



# Catalogue of the species of plant rust fungi (Uredinales) of Brazil

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### Introduction

The purpose of this catalogue is to record all of the species of plant rust fungi that are known to occur in Brazil and to provide several sorts of information that may help scientists and students to identify and to give the currently correct names to the species. The catalogue is a revision and an expansion of our original "Index of the rust fungi (Uredinales) of Brazil" (Hennen, J. F., M. M. Hennen, and M. B. Figueiredo, 1982). The catalogue includes various kinds of corrections to the original work, and includes the following new information: 1. species that have been determined to occur in Brazil since the publication of the Index. 2. Data for the TYPE specimen for each species name, including synonyms, are recorded where it was possible to determine from the literature. We have not tried to determine the location (herbarium) where the type specimens are located. 3. Anamorph names are separated from teleomorph names as required by the International Code of Botanical Nomenclature (ICBN). For both anamorph and teleomorph synonyms, the symbol ( $\equiv$ ) is placed in front of synonyms to indicate a nomenclatural synonym, i. e. names with the same type specimen; the symbol ( $\approx$ ) is placed in front of other names to indicate a taxonomic synonym, i. e. names with different type specimens. 4. A partly newly developed system of symbols is given for what is thought to be the life cycle for most of the accepted species. This notation is put in bold in a parentheses placed just after the information about the accepted name of the rust species. The ontogenic system for the meaning of terms for life cycle stages is used. These symbols are explained later. 5. Geographic range outside of Brazil. 6. Descriptive and other taxonomic information is included for most genera and species, and 7. Species of special economic importance are indicated.

For those species which we have new Brazilian State records, and for those species that are included in this work but were not recorded in the original Index, we include citations of voucher specimens if available. We have not included all of the citations of the numerous voucher specimens that were cited in the original Index.

We have been unable to confirm the identification of hosts for those cited from the literature. All host identifications are reported as our best preliminary effort. We believe that they are probably correct for nearly all families and genera. We have consulted The Missouri Botanical Garden's data base Tropicos and The New York Botanical Garden's database for updating names and authors of names for many host species.

Laundon (1965A) listed 289 names that had been proposed for genera of rust fungi. Many of these are considered synonyms of other genera or are no longer in use for various technical reasons. Cummins and Hiratsuka (2003), the most recent critical revisionary work, included 120 holomorph and 13 anamorph rust genera for the World. We include in this catalogue 56 holomorph and 9 anamorph genera for Brazil and nearly 800 species. We believe that the information in this Catalogue will form a bases for all future work on the taxonomy of rusts of Brazil, and will be especially helpful to scientists and students who do not have extensive library and herbarium resources easily available.

### Genera of rusts in Brazil

Compared to many other fungi, the Uredinales have more morphological and developmental traits that are useful for their classification. Worldwide, Cummins and Hiratsuka (2003) included 120 teleomorph and 13 anamorph genera as sufficiently different to be recognized. At least 45 (38 %) teleomorph and 10 (77 %) anamorph genera have been recorded from Brazil.,

Although Cummins and Hiratsuka (2003) included a key for separating genera of rusts, their key begins by separating the genera into families. Thus, their key is more useful for classification than for identification of rust genera.

#### A list of genera and the number of species of rusts reported from Brazil

Names in red were not included in the original index.

Names in pink were in the original index but are not in this Catalogue.

Genus	Number of rust species		
	1985	2003	change in number
Achrotelium	0	1	+1
Aecidium(An)	88	68	-20
Aeciure(An)	0	1	+1
Anthomyces	1	1	0
Aplopsora	0	1	+1
Apra	1	1	0

Arthuria	1	2	+1
Batistopsora	0	1	+1
Botryorhiza	1	1	0
Calidion(An)	1	1	0
Canasta (An)	0	1	+1
Catenulopsora	0	2	+2
Centrifuga	0	1	+1
Cerradoa	1	1	0
Cerotelium	2	9	+7
Chaconia	4	7	+3
Chrysocyclus	2	2	0
Cionothrix	2	2	0
Cladoma (An)	0	1	+1
Coleosporium	4	6	+2
Crossopsora	6	10	+4
Cumminsella	1	1	0
Dasyspora	1	1	0
Desmella	1	1	0
Diabole	1	1	0
Dicheirinia	4	8	+4
Didymopsora	4	4	0
Dietelia	1	1	0
Diorchidiella	1	2	+1
Diorchidium	2	4	+2
Dipyxis	1	1	0
Endophyllum	3	4	+1
Frommea	1	0	-1
Frommeella	0	1	+1
Hemileia	3	1	-2
Intrapes (An)(Leptinia)	1	1	0
Kimuromyces	0	1	+1
Kuehneola	3	1	-2
Kweilingia	0	1	+1
Leptinia	1	2	+1
Maravalia	1	8	+7
Melampsora	7	7	0
Milesia(An)	0	1	+1
Mimema	0	1	+1
Olivea	2	3	+1
Pelastoma	0	1	+1
Phakopsora	13	28	+15
Phragmidiella	0	1	+1
Phragmidium	3	2	-1
Physopella	4	0	-4
Porotenus	2	4	+2
Prospodium	23	31	+8
Puccinia	274	264	-10
Pucciniastrum	2	3	+1
Puccinosira	2	2	0
Ravenelia	29	41	+12
Scopella	5	0	0
Skierka	3	3	0
Sorataea	2	3	+1
Sphaerophragmium	3	2	-1
Sphenospora	4	5	+1
Spumula	0	4	+4

Synnoma (An)			
Tegillum	1	0	-1
Thirumalachariella	1	0	-1
Tranzschelia	1	1	0
Triactella	1	0	-1
Uncol	0	1	+1
Uredinopsis	1	1	0
Uredo(An)	105	70	-35
Uromyces	103	107	+4
Uromycladium	0	1	+1
Uropyxis	2	1	-1
<u>Ypsilospora</u>	<u>0</u>	<u>1</u>	<u>+1</u>

Total holomorph genera 1985/ 49 ; 2003/57      2003/745 species  
 Total anamorph genera 1985/ 4 ; 2003/9  
 Genera new to Brazil 2003 - 16 (11 teleomorph, 5 anamorph)

**Rust Genera with most species:**

	<u>Teleomorphs</u>	<u>Anamorphs</u>	
<i>Puccinia</i>	264	<i>Uredo</i>	70
<i>Uromyces</i>	107	<i>Aecidium</i>	68
<i>Ravenelia</i>	41		
<i>Prospodium</i>	31		
<i>Phakopsora</i>	28		
<i>Crossopsora</i>	10		
<i>Cerotelium</i>	9		
<i>Maravalia</i>	8		
<i>Dicheirinia</i>	8		
<i>Chaconia</i>	7		
<i>Melampsora</i>	7		
<i>Coleosporium</i>	6		
<i>Sphenospora</i>	5		
<i>Didymopsora</i>	4		
<i>Diorchidium</i>	4		
Endophyllum	4		
<i>Porotenus</i>	4		
<i>Spumula</i>	4		



## A CATALOGUE OF THE RUST SPECIES (UREDINALES) OF BRAZIL

### Arrangement and notations of species

1. All generic and species names (binomials of holomorphs, anamorphs, nomenclatural synonyms, and taxonomic synonyms) that have been applied to rusts reported from Brazil are arranged in alphabetical order.
2. Accepted names of holomorph species, when first listed, are in all **BOLD CAPS**, followed by the family name spelled out, not abbreviated, of the person who first published the species name, bibliographic citation where name was published, information about the TYPE specimen, including host name and authority, country of origin in **bold**, more specific location in country, date of collection, and *in italic*, collector and collectors number if available, or *s.n.* indicating that a number is not available. Also after each accepted species entry, a group of symbols is presented that represents some important morphological traits and a "best guess, hypothesis, or first approximation" about the life cycle of that species. See explanation about these symbols above.

For example:

**ACHROTELIUM LUCUMAE** Cummins, Mycologia 48: 601. 1956. TYPE on *Lucuma nervosa* A. DeCandolle, Sapotaceae, from **The United States of America**, Florida: Dade Co., Homestead, 7 Feb 1939, *Geo. Ruehle s.n.* (**0/Ipe,IIpe/III**).

Anamorph

*Uredo lucumae* Arthur & Johnston, Mem. Torrey Bot. Club 17: 169. 1918. TYPE on *Lucuma nervosa* A. DeCandolle from **Cuba**, Santiago de las Vegas, 25 June 1915, *J. R. Johnston s.n.* *Uredo lucumae* is the name for both the aecial and the uredinial anamorphs.  
 ≡ *Uraecium lucumae* (Arthur & Johnston) Arthur, Bull. Torrey Bot. Club 60: 467. 1933.  
 ≡ *Achrotelium lucumae* (Arthur & Johnston) Cummins, Bull. Torrey Bot. Club 67: 70. 1940. (based on an anamorph).

3. Unaccepted names, mostly synonyms, of holomorph species are in *italic*, *not caps*, *not bold* with a symbol of "≡" for nomenclatural synonyms, and a symbol of "=" for taxonomic synonyms.
4. Accepted names of anamorph species are in all **bold italic**, *not caps* for example ***Uredo lucumae***. See below.
5. Unaccepted names, synonyms, of anamorph species are in *italic*, *not all caps*, *not bold* with the symbols as shown above for nomenclatural and taxonomic synonyms.  
for example:

***Uredo lucumae*** Arthur & Johnston, Mem. Torrey Bot. Club 17: 169. 1918. TYPE on *Lucuma nervosa* A. DeCandolle from **Cuba**, Santiago de las Vegas, 25 June 1915, *J. R. Johnston s.n.* *Uredo lucumae* is the name for both the aecial and the uredinial anamorphs.  
 ≡ *Uraecium lucumae* (Arthur & Johnston) Arthur, Bull. Torrey Bot. Club 60: 467. 1933.  
 ≡ *Achrotelium lucumae* (Arthur & Johnston) Cummins, Bull. Torrey Bot. Club 67: 70. 1940. (based on an anamorph).

6. Genera and data about the genera are listed separately alphabetically at the beginning of a group of species or species.
7. Host names of records from Brazil when first listed are in **bold italic**.
8. If available, data about type specimens are included immediately after nearly all names: including host name, country of origin in **bold**, more specific location in country, date of collection, and *in italic*, collector and collectors number if available, or *s.n.* indicating that a number is not available. See number 2 above.

**ACHROTELIUM** H. Sydow in H. Sydow & Petrak,  
 Ann. Mycol., Berlin, 26: 425. 1928. TYPE SPECIES, *Achrotelium ichnocarpi* H. Sydow, on *Ichnocarpus volubilis*, Apocynaceae, from the **Philippines**. (?Chaconiaceae).

Spermogonia Group VI (type 7). Aecia subepidermal in origin, erumpent, powdery, aeciospores borne singly on pedicels, walls echinulate, pores obscure or scattered.. Uredinia similar to the aecia but not associated with spermogonia. Telia subepidermal in origin, erumpent; teliospores (probasidial cells), pedicellate, one-celled, borne sympodially, several to a sporogenous cell wall thin, pale or colorless. Mature probasidial cells transformed with little or no change in size or aspect directly into four celled metabasidia

(“internal germination” in older literature), each metabasidial cell produces a sterigma with one basidiospore (Cummins and Hiratsuka, 2003).

Only the one species listed below has been reported in the Americas. Four other species have been reported from tropical Asia. Cummins and Hiratsuka (2003) reported seven species.

*Achrotelium lucumae* (Arthur & Johnston) Cummins, see *Uredo lucumae* Arthur & Johnston  
(**ACHROTELIUM LUCUMAE** Cummins).

**ACHROTELIUM LUCUMAE** Cummins, Mycologia 48: 601. 1956. TYPE on *Lucuma nervosa* A. DeCandolle, Sapotaceae, from **The United States of America**, Florida: Dade Co., Homestead, 7 Feb 1939, *Geo. Ruehle s.n.* (**0/Ipe,IIpe/III**).

Anamorph

*Uredo lucumae* Arthur & Johnston, Mem. Torrey Bot. Club 17: 169. 1918. TYPE on *Lucuma nervosa* A. DeCandolle from **Cuba**, Santiago de las Vegas, 25 June 1915, *J. R. Johnston s.n.* *Uredo lucumae* is the name for both the aecial and the uredinial anamorphs.  
≡ *Uraecium lucumae* (Arthur & Johnston) Arthur, Bull. Torrey Bot. Club 60: 467. 1933.  
≡ *Achrotelium lucumae* (Arthur & Johnston) Cummins, Bull. Torrey Bot. Club 67: 70. 1940. (based on an anamorph).

On Sapotaceae

*Pouteria macrophylla* (Lamarck) Eyma [*Richardella macrophylla* (Lamarck) Aublet], Amapá (Sotão, 1994: 39); Maranhão (AL 85-114, 9925), Pará (Sotão, 2001).

*Achrotelium lucumae* has been reported also from the Bahamas.

Spermogonia and aecia. Aeciospores and urediniospores borne on pedicels, 32-47 x 28-39 µm, globoid or broadly ellipsoid, wall bilaminate, the inner layer ca 2 µm thick, cinnamon brown, outer layer hygroscopic, 4-6 µm thick, pale yellow to colorless, strongly and uniformly echinulate, germ pores 2-4, scattered; teliospores 66-99 x 12-15 µm, cylindrical, rounded at the apex, narrowed at the base, wall 2-4.5 µm thick, colorless, smooth, pedicel 50-60 µm long, colorless, persistent.

The anamorph name, *Uredo lucumae*, applies to both the aecia and uredinia because they are alike in morphology. Arthur (1933) transferred *Uredo lucumae* to *Uraecium* because spermogonia were present in the type. Arthur used the genus *Uraecium* for anamorph species that had spermogonia intimately associated with other sori with pedicellate spores without regard to any other traits.

*Aecidiella* J. B. Ellis & F. D. Kelsey,

Bull. Torrey Bot. Club 24: 208. 1897. TYPE SPECIES: *Aecidiella triumfettae* Ellis & Kelsey, see **Puccinosira** and **Puccinosira pallidula** (Spegazzini) Lagerheim.

*Aecidiella triumfettae* Ellis & Kelsey, see **Puccinosira pallidula** (Spegazzini) Lagerheim.

*Aecidiolum* F. Unger,

*Die Exantheme der Pflanzen*, p.301. 1833 TYPE SPECIES: *Aecidiolum exanthematum* Unger (? *Uromyces pisi* DeCandolle) Otth on *Euphorbia cyparissias* (Euphorbiaceae) from Germany. This name has been used for spermogonia of rusts but names are no longer applied to spermogonia (Laundon, 1965).

*Aecidiolum eregerontis* Spegazzini, see **Puccinia cyperii** Arthur.

**AECIDIUM** Persoon:Persoon (anamorph),

Syn. Meth. Fung., p. 204, 1801. LECTOTYPE SPECIES, *Aecidium berberidis* Persoon: Persoon, chosen by Clements and Shear, 1931 in The Genera of Fungi.

The anamorph genus *Aecidium* is one of the easiest to identify. The sori are usually described as “cupulate” (cup-like) with a well developed tubular or cylindrical peridium composed of one layer of proximally, slightly overlapping (imbricate) cells that originate from a ring of parental cells that surrounds the sporogenous cells at the base of the sorus. The peridial cell walls are not pigmented, the inner facing wall surfaces are usually verrucose, and the outer facing walls are usually smooth or nearly so. As a young sorus grows its apex is covered by the peridium which breaks through the epidermis of the host. After emerging from the host the apical cells of the peridium split open releasing the spores. The sides of the peridium often

split lengthwise to form recurved pieces that give a “star-like” appearance when viewed from above. However, the length that a sorus may attain after it emerges from the host is often determined by environmental factors such as humidity and rainfall. Under dry, still conditions the cylinders may attain one to several mm in length. The base of the sorus is lined with a hymenial layer composed of tightly packed, somewhat elongated sporogenous cells. Each sporogenous cell produces a row, or “chain” of spores that often remains intact for some length. The older spores at the distal ends of the chains come apart and are disseminated by wind. Usually near the base of the sorus fragile intercalary cells are located between the spores. These soon disintegrate and are not present in the upper parts of the rows. Spore walls are variously sculptured but most commonly evenly finely verrucose or at least with some verrucae. The verrucae are usually loosely attached to the spore wall and easily come off. In many species refractive granules of various sizes, larger than the verrucae, make up part of the sculpture pattern. In some species the sculpture may be in bands around the spores. Spores germinate with a mycelial germ tube, not a metabasidium.

Although the genus *Aecidium* is easily identified, the species are often difficult to separate because few morphological traits have been found. The correct identification of the host is usually essential for identifying species of *Aecidium*. More recently variations in spore wall and peridial wall sculpture patterns have been found to be useful for characterizing some species. Each species of *Aecidium* may be a part of a holomorphic species and has the possibility of functioning as aecia, uredinia, or both. In the interesting short cycled teleomorphic genus *Endophyllum*, its telia have the morphology of *Aecidium*, but the spores are teliospores (probasidia) that germinate by producing metabasidia and basidiospores.

There are many published reports of experimental inoculations that connect species of *Aecidium* as aecial stages of holomorphic species, most commonly species of *Puccinia* and *Uromyces*. In these reports, often the *Aecidium* species is not named, its morphological traits not described, and voucher specimens of the experimental material may not have been saved. Additional inoculations that confirm putative connections of these anamorphs with teleomorphs have seldom been reported. In many cases, however, there is no doubt that the *Aecidium* species functions as the aecial stage of the rust species.

*Aecidium* species may also function as uredinia. When a collection of an *Aecidium* species without intimately associated spermogonia is made in the field, the infection is probably uredinial. Some good examples of this kind of uredinia are those that occur in at least six species of *Puccinia* on *Ipomoea* species (Convolvulaceae) in neotropical areas. Thus, in some rust species the aecial stage and the uredinial stage may be identical in morphology, both belonging to the same species of *Aecidium*.

If spermogonia are intimately associated with *Aecidium* sori, these sori are usually assumed to be an aecial stage. But if the spores germinate with a metabasidium, the genus is *Endophyllum*. Spermogonia may be present or absent in *Endophyllum*. If spermogonia are absent and the spores do not germinate with a metabasidium, these sori may be either aecial or uredinial in function.

Because of the similarity of the words *Aecidium* (the name of a morphologically identified anamorph genus) and aecium (the name of a position or stage in a life cycle, and the name of the sori produced by that stage), there has been confusion about the use of these terms (Hennen & Hennen., 2001).

Arthur (1924) reported that *Aecidium* is a "form genus" that he defined as "Species whose life-cycle is not known, or is not readily assumed from related forms...These genera do not represent the whole cycle of development, and are not based upon type species" Later, he abandoned this usage presumably in favor of using *Aecidium* as a anamorph genus in the modern sense.

#### Key to help identify anamorph genera of Phakopsoraceae, Uredinales (Buriticá, 1994)

Note: In Botanical terminology **sessile** means no or **nearly** no stalk. In fungi the word pedicel is used for a stalk. In mature anamorph sori of rusts, pedicels may or may not be obvious. Even though they are not obvious in mature sori, these sori may have had spores with a very small intercalary cell between the developing spore and the sporogenous cell. These may function as disjunctive cells and have the same location as pedicels. For routine identification purposes, it is usually better to use the descriptive term sessile for these sori because no pedicels may be readily observable in the mature sori.

- |  |                  |
|--|------------------|
| 1. Spores pedicellate  | 2                |
| 1. Spores sessile or in vertical rows without pedicels               | 3                |
| 2. Sori with peripheral paraphyses                                   | <i>Macabuna</i>  |
| 2. Sori with peridia   | <i>Peridipes</i> |
| 3. Spores verrucose  | 4                |
| 3. Spores echinulate   | 5                |
| 4. Sori with cellular peridia, short to long cylindrical, cyathiform | <i>Aecidium</i>  |

4. Sori without or only poorly developed cellular peridium	<i>Caeoma</i>
5. Spores in vertical rows, with prominent intercalary cells	<i>Aeciure</i>
5. Spores sessile, not in vertical rows	6.
6. Sori without sterile peripheral structures	<i>Uredendo</i>
6. Sori with sterile peripheral structures	7
7. Sori with long, laterally united, peripheral paraphyses mimicing a palisade	<i>Uredostilbe</i>
7. Not as above	8
8. Paraphyses peripheral, curved, without nearly covering the sorus	<i>Physopella</i>
8. Paraphyses peripheral, or peridium nearly covering the sorus	9
9. Sori with cellular or hyphoid peridium	<i>Milesia</i>
9. Sori with paraphyses arching over the sorus leaving a pore-like opening, the paraphyses surmounting a short ring of hyphoid tissue	<i>Malupa</i>

**Key to help identify anamorph genera of Uredinales (modified from Cummins and Hiratsuka, 2003)**

1. Spores produced on pedicels or sessile	2
1. Spores produced in vertical rows without pedicels	7
2. Sorus with no fungal bounding structure (may have intermixed paraphyses)	3
2. Sorus with fungal bounding structure	4
3. Sorus subepidermal or subcuticular	<i>Uredo</i>
3. Sorus suprastomatal	<i>Wardia</i>
4. Sorus with peripheral paraphyses	5
4. Sorus with peridium	6
5. Sorus with peripheral paraphyses united basally	<i>Malupa</i>
5. Sorus with peripheral paraphyses not united basally	<i>Calidion</i>
6. Sorus covered by dome-shaped peridium	<i>Milesia</i>
6. Sorus surrounded by laterally fused palisade-like compact peridium	<i>Uredostilbe</i>
7. Intercalary cells absent	8
7. Intercalary cells present	9
8. Spores intermixed with sterile elater-like hyphae	<i>Elateraecium</i>
8. No intermixed sterile elater-like hyphae	<i>Petersonia</i> ( <i>Caeoma</i> IV and V of Sato and Sato, 1985)
9. Peridium and paraphyses absent	<i>Caeoma</i> ( <i>Caeoma</i> I, II, III of Sato and Sato, 1985).
9. Peridium or paraphyses present	
10. Peripheral paraphyses present	<i>Lecythea</i>
10. Peridium present	11
11. Sorus cup shaped to cylindrical, peridial cells usually short	<i>Aecidium</i>
11. Sorus elongated to blister-like, peridial cells usually long	12
12. Sorus usually blister-like, with single to multilayered peridium	<i>Peridermium</i>
12. Sorus more or less cylindrical, perium well-developed, tending to shred longitudinally at maturity	<i>Roestelia</i>

*Aecidium aegiphilae* P. Hennings, Hedwigia Beiblatt 38(70). 1899. On: *Aegiphila* sp., Verbenaceae, Santa Catarina (Hennings, 1899A: (70). Not a rust (P. Sydow & H. Sydow., 1923: 316).

*Aecidium agnesium* (H. Sydow) Hennen et. al., *comb. nov.* See *Aecidium distinguendum* P. Sydow & H. Sydow (**PUCCINIA PUTA** H. S. Jackson & Holway).

**AECIDIUM ALTERNANTHERAE** H. S. Jackson & Holway in Jackson, Mycologia 19: 56. 1926.  
TYPE on *Alternanthera moquinii* (Webb) Dusen, **Brazil**, Minas Geraes: Belo Horizonte, 26 Nov. 1921, *Holway*-1338. **(0/I,??);or ?(0/-,-/IIIendo).**

On Amaranthaceae:

*Alternanthera moquinii* (Webb ex Moquin-Tandon) Dusen, Minas Gerais (Jackson, 1927: 56;

Laundon, 1965: 5).

*Aecidium alternantherae* has been reported only from Brazil: two specimens from Minas Gerais.

Spermogonia on the adaxial side of leaves, few in small groups, globoid or depressed globoid, 75-85  $\mu\text{m}$  high x 80-110  $\mu\text{m}$  wide, ostiolar filaments absent. Aecia mostly on the adaxial side of leaves in small groups on slightly discolored spots, 0.2-0.4 mm across, peridium membranous, thin, inconspicuous, colorless, erose at margin, peridial cells in face view 30-45 x 22-30  $\mu\text{m}$ , irregularly polyhedral, wall thin, colorless, without evident markings; aeciospores 28-40 x 23-28  $\mu\text{m}$ , globoid or ellipsoid, wall 2-2.5  $\mu\text{m}$  thick, very finely verrucose.

*Aecidium alternantherae* might be an *Endophyllum*. The thin, membranous, inconspicuous cellular peridium with smooth cell walls characterizes the species (Jackson, 1927).

**AECIDIUM AMAZONENSE** P. Hennings, Hedwigia 43: 169. 1904. TYPE on *Guatteria* sp., **Peru**, Iquitos, Rio Amazonas, July 1902, *Ule-3193*. (**0/I,??**).

On Annonaceae

*Guatteria schomburgkiana* Martius, Pará (Albuquerque, 1971: 147).

*Guatteria* sp., Amazonas (Hennings, 1904B: 170).

*Aecidium amazonense* has been reported only from Peru and Brazil.

Spermogonia on adaxial side of leaves, 140-200  $\mu\text{m}$  diam., few, scattered or loosely grouped, almost black. Aecia on round or irregular, brown or blackish-brown spots 0.5-5 cm across on abaxial side of leaves, aecial sori short cylindrical, yellowish, with a recurved, lacerate margin; peridial cells 28-42 x 20-26  $\mu\text{m}$ , round, oblong, or polyhedral in face view, walls 3-4  $\mu\text{m}$  thick, the outer facing wall non-striate, the inner densely verrucose; aeciospores 22-26 x 19-22  $\mu\text{m}$ , angular globose to ovoid; wall ca 2  $\mu\text{m}$  thick, pigmented golden-yellow on about one third to one half of the spore wall, the rest colorless, pigmented part very finely verrucose, the colorless part strongly verrucose with 3-4 large refractive granules plus one or two smaller ones.

#### Key to help identify *Aecidium* species on *Guatteria*, Annonaceae, in Neotropics

Six of the eleven species of *Aecidium* that have been named on genera of Annonaceae in the Neotropics have been reported on *Guatteria* spp. For practical identification at present we believe it is best to recognize only two species on *Guatteria*, *Ae. amazonense* and *Ae. guatteriae*. If all six of these species were to be recognized they would be impossible to distinguish between. They all cause large blackish, somewhat thickened leaf spots in which spermogonia are adaxial and *Aecidium* sori are abaxial and sunken into the slightly hypertrophied blackish leaf spot.

*Ae. amazonensis* can be identified by its non-striate outer facing walls of its peridial cells, and its spore wall sculptured pattern. In spores in the type specimen about one third to one half of the spore wall is pigmented golden-yellow, the rest is colorless. The pigmented part is very finely verrucose, the colorless part is strongly verrucose. Three to four large refractive granules occur plus one or two smaller ones.

*Aecidium guatteriae*, which includes the other species, peridial cells are reported as striate on the outer facing walls and verrucose on the inner walls. The spore walls are only minutely densely verrucose in bands around the spores, numerous larger refractive granules within the bands, wall smooth outside the bands (fide Hennen, *Ule-3220*).

The sizes that have been reported for the peridial cells and spores all overlap so these measurements cannot be used to identify the species. The reported spore wall sculpture intergrades.

We consider the following names as synonyms of *Ae. guatteriae*: *Aecidium marayense* P. Hennings, on *Guatteria* sp., **Brazil**, Rio Juruá, Marary, September 1900, *Ule-3086*; *Aecidium rionegrense* P. Hennings, on *Guatteria* sp. from **Brazil**, Amazonas: Manaus, July 1900, *Ule-2782*; *Aecidium huallagense* P. Hennings, on *Guatteria alutacea* Diels from **Peru** *Ule-3219* and *3220*; and *Aecidium uredinoidis* P. Hennings, on *Guatteria* sp. originally reported erroneously as on Sapindaceae, from **Brazil**, Amazonas: Rio Jurua, Jurua-miry, *E. Ule*.

*Aecidium xylopieae* produces large witch's brooms on its *Xylopiea* spp. hosts but the spores and peridia of *Aecidium xylopieae* are also very similar to those of *Aecidium guatteriae*.

The identity and relationships of these anamorphs will remain uncertain until their connection to other life cycle stages are determined.

*Aecidium annonaceicola* P. Hennings, see **AECIDIUM ANNONAE** P. Hennings.

**AECIDIUM ANNONAE** P. Hennings, Hedwigia 34: 100. 1895 (as "*anonae*"). TYPE on *Annona* sp. from **Brazil**, Goiás: Meiaponte, Oct. 1892, *Ule-1919*. (0/I,?/?).

= *Aecidium annonaceicola* P. Hennings, Hedwigia 34: 101. 1895. TYPE on *Annona* sp. from **Brazil**, Goiás: Meiaponte, Oct 1892, *Ule-1915*.

On Annonaceae:

**Annona** sp., Goiás (Hennings, 1895A: 100 ;Hennings, 1895A: 101).

*Aecidium annonae* has been reported only from Brazil.

Spermogonia abundant, evenly and rather closely distributed, yellowish-brown at first then darker, 120-160 µm in diameter. Aecia on the abaxial side of leaves, rather evenly and densely distributed on blackish, more or less indeterminate spots or on more or less the whole leaf surface that becomes blackish; peridial cells 24-28 x 17-22 µm, subrhomboid to angular ellipsoid, firmly united, the outer facing wall 4-6 µm thick, smooth, inner wall 3-4 µm thick, verrucose; aeciospores 16-23 x 13-18 µm, angular globose, ovoid or ellipsoid, wall 1-1.5 µm thick, densely and minutely verruculose, subcolorless (Sydow, P. & H. Sydow, 1923).

*Aecidium anthericicola* Arthur, see **UROMYCES ERAGROSTIDIS** Tracy.

*Aecidium aphelandrae* P. Hennings, see **AECIDIUM CEPHALANTHI-PERUVIANI** P. Hennings.

*Aecidium australe* Spegazzini (not Berkeley, 1843), see **PUCCINIA CYPERI** Arthur.

*Aecidium asclepiadis* Kunze, see **UROMYCES ASCLEPIADIS** Cooke.

**AECIDIUM BACCHARIDIS** Dietel, Hedwigia 36: 33. 1897. TYPE on *Baccharis* sp., Compositae, from **Brazil**, Santa Catarina: Serra Geral, Jan 1891, *Ule-1704*. (?/?;Hcv/?).

*Aecidium baccharidis* has been reported only from the type.

Spermogonia not reported. Sori on yellowish to brownish spots on abaxial side of leaves, peridium slightly exerted, peridial cells 25-35 x 17-24 µm, subquadric, rectangular to rhomboid, outer wall 7-9 µm thick, striate, interior wall 3-4 µm thick, verrucose; spores 20-26 x 18-23 µm, angularly globoid to ellipsoid, wall 1.5-2 µm thick, densely and minutely verrucose, subcolorless (P. Sydow & H. Sydow, 1923).

Perhaps the sori of *Aecidium baccharidis* function as uredinia because no spermogonia have been reported. Lindquist (1958) did not include this name in his monographic study of rusts on *Baccharis*. New collections are needed to determine if this rust still occurs in Brazil

*Aecidium basanacanthae* P. Hennings, see **AECIDIUM RANDIAE** P. Hennings.

*Aecidium bonariense* Spegazzini, see **PUCCINIA MACROPODA** Spegazzini.

**AECIDIUM BORRERIICOLA** H. S. Jackson & Holway in Jackson, Mycologia 24: 96. 1932. TYPE on *Galianthe angustifolia* (Chamisso & Schlechtendahl) E. L. Cabral [reported originally as ≡ *Borreria angustifolia* Chamisso & Schlechtendahl] (Rubiaceae) from **Brazil**, São Paulo: Campos do Jordão, 30 Apr 1922, *Holway-1794*. (0/I,?/?).

*Aecidium borreriicola* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia on both sides of leaves, but mostly on adaxial side, deep seated, crowded on discolored spots, periphyses prominent. Aecia loosely scattered over areas 0.5-1.5 cm across on discolored spots, , the sori 0.15-0.2 mm across, cupulate or short columnar, (larger and coarser than those of *Aecidium holwayi*), whitish, peridial cells 28-32 x 18-20 µm, rhomboid, outer facing wall 4-6 µm thick, smooth, inner facing wall 3-4 µm thick, coarsely verrucose-rugose; aeciospores 17-22 x 12.5-22 µm, ellipsoid to oblong; wall ca 1 µm thick on sides, up to 6 µm apically, delicately and closely verrucose, colorless (Jackson, 1932).

**AECIDIUM BRASILIENSE** Dietel, Hedwigia 36: 35. 1897. LECTOTYPE on *Cordia* sp., from Brazil,

Rio de Janeiro, Serra dos Orgãos, Dec 1891, *Ule-1813*. (**0/I,??**).

On Boraginaceae:

*Cordia cylindrostachya* Roemer & Schults, Rio de Janeiro (Sydow, 1907: 355).

*Cordia discolor* Chamisso, Rio de Janeiro (Jackson, 1931: 500).

*Cordia ecalyculata* Velloso, Minas Gerais (Thurston, 1940: 291).

*Cordia macrophylla* Linnaeus, Rio de Janeiro (Hennings, 1904A: 80).

*Cordia obscura* Chamisso, Rio de Janeiro (Jackson, 1931: 500).

*Cordia trichotoma* Velloso, Paraíba (Viégas, 1945: 74; IAC-3822).

*Cordia* sp. Rio Acre (Sydow, 191671), Rio de Janeiro (Dietel, 1897: 35; Dietel, 1899: 258; Jackson, 1931: 500; IAC-4829).

*Aecidium brasiliense* has been reported only from Brazil but see *Uromyces seteraia-italicae* for a discussion about a supposed teleomorph connection.

Spermogonia not reported. Peridial cells 25-38 x 18-25 µm, outer wall 6-8 µm thick, striate, inner wall ca 4 µm thick, verrucose, spores 20-27 x 18-23 µm, subglobose to ellipsoid and angulate, wall more or less evenly ca 1 µm thick, densely and minutely verrucose, subcolorless (Sydow, 1923).

*Aecidium cordiae*, also on *Cordia* spp. in Brazil, has spores 26-38 x 20-26 µm, with walls 1.5-2 µm thick at sides, and 5-8 µm thick above.

Dale (1955) named *Aecidium trinitense* on *Cordia bicolor* A. DeCandolle from Trinidad, which is similar to *Aecidium brasiliense* but differs by having peridial cells with outer walls smooth, the inner walls verrucose-tuberculate, spores 18-26 x 15-20 µm, with walls 1 µm thick at sides 2-4 µm thick above, finely verrucose, and colorless.

*Aecidium bulbifaciens* Neger, see *Aecidium circumscribens* Neger (**UROMYCES CIRCUMSCRIPTUS** Neger).

*Aecidium byrsonimae* Kern & Kellerman, see **AECIDIUM BYRSONIMATIS** P. Hennings.

*Aecidium byrsonimaticola* P. Hennings, see **AECIDIUM BYRSONIMATIS** P. Hennings.

**AECIDIUM BYRSONIMATIS** P. Hennings, Hedwigia 34: 101. 1895. LECTOTYPE on *Byrsonima* sp. from **Brazil**, Goiás, Maranhão, Sept. 1892, *E. Ule-1924*. (**0/I,??**).

= *Aecidium byrsonimaticola* P. Hennings, Hedwigia 34: 322. 1895. TYPE on *Byrsonima* sp. from **Brazil**, Goiás, *Ule-2150*.

= *Endophyllum singulare* Dietel & Holway, in Holway, Bot. Gaz. (Crawfordsville) 31: 336. 1901. TYPE on *Byrsonima* sp. (recorded mistakenly as "ericaceous plant") from **Mexico**, Jalisco, *M. E. Jones s. n.*

≡ *Aecidium singulare* (Dietel & Holway) Arthur, Amer. J. Bot. 5: 540. 1918. TYPE same as for *Endophyllum singulare*.

≡ *Aecidium byrsonimae* Kern & Kellerman, J. Mycol. 13: 24. 1907. TYPE on *Byrsonima crassifolia* (Linnaeus) Humboldt, Bonpland & Kunth from **Guatemala**, Dept. Baja Verapaz, Sierra de las Minas, 10 Mar 1905, *Kellerman-4325*.

On Malpighiaceae:

*Byrsonima crassifolia* (Linnaeus) DeCandolle, São Marcos, Rio Branco (Sydow, 1916: 71).

*Byrsonima sericea* DeCandolle, Rio de Janeiro (Dietel, 1899: 257).

*Byrsonima* sp., Amazonas (Hennings, 1904B: 168), Goiás, Maranhão (Hennings, 1895A: 101; 1895B: 322), Pará (Hennings, 1909: 101).

*Aecidium byrsonimatis* has been reported also from Venezuela, Trinidad, Central America and Mexico.

Spermogonia densely and equally distributed on both sides of leaves and stems on deformed, systemically infected shoots, subcuticular, at first yellow-brown, finally chestnut-brown. Aecia scattered among the spermogonia, cylindrical, sometimes up to 1-3 mm high, white; peridial cells firmly united in regular rows, 36-65 x 20-30 µm, rhomboid, outer facing wall 3-4 µm thick, smooth, inner facing wall 5-7 µm thick, coarsely verrucose; aeciospores 28-55 x 22-35 µm, angular ovoid, ellipsoid, or oblong, often apiculate, wall 2-3.5 µm thick at sides, often thicker at the base, apex usually greatly thickened 5-24 µm, yellowish-brown (P. Sydow & H. Sydow, 1923).

*Aecidium byrsonimatis* is almost certainly the aecial anamorph of *Crossospora byrsonimatis*, although no experimental inoculations have been reported.

**AECIDIUM CALOSPORUM** Juel, Bih. K. Svenska Vet.-Akad. Handl. 23: 22. 1897. TYPE on *Diospyros* sp., aff. *D. hispida* A.DeCandolle from **Brazil**, Mato Grosso: Cuiabá, cerrado, 7 Aug ("7/8") 1894, G. A. Malme s.n. (**O/I,?!/?**).

On Ebenaceae:

*Diospyros hispida* A. DeCandolle, Mato Grosso (Juel, 1897: 22), São Paulo (IAC 4337; IBI-10819).

*Diospyros liosmoides* A. C. Smith, Amazonas (PUR-F15183).

*Diospyros* sp., Goiás (IBI-13313), Mato Grosso do Sul (IBI-14321), São Paulo (IBI-16499), Tocantines (IBI-13298).

*Aecidium calosporum* has been reported only from Brazil.

Spermogonia in dense, small, shiny groups on indefinite, circular spots 3-7 mm across on adaxial side of leaves. Aecia densely crowded on the abaxial side of leaves, cylindrical, whitish; peridial cells 34-44 x 18-24 µm, firmly united in regular rows, wall more or less evenly thickened 7-10 µm; aeciospores 28-30 µm across, subglobose, wall 1.5 µm thick, yellow, evenly and densely covered with elongated, needle-like spines 2-3 µm long.

Unlike many species of *Aecidium*, *Aecidium calosporum* is easily identified because of the numerous closely packed, needle-like spines on the walls of the spores.

#### Key to help identify *Aecidium* species on *Diospyros*, Ebenaceae, in Neotropics

At least 13 species of *Aecidium* have been reported on *Diospyros* species in the tropical regions of the world: Asia-7; Africa-2; South America-4; three of these from Brazil. The Sydows (1923) divided six species known then into two groups:

1. Sori deeply embedded in a black, crust-like or stroma-like layer composed of host and fungal tissue.

Originally included four species from Asia, later Dale placed *Aecidium carbonaceum* from Trinidad in this group and reported the similarity of *Ae. carbonaceum* to *Ae. diospyri-hispidi* Viégas. We consider *Ae. diospyri-hispidi* as a synonym of *Aecidium muelleri* Thurston and therefore place the latter in this group.

2. Sori not as above.

Originally included one species from Asia, one from Africa, and *Aecidium ulei* from Brazil.

*Aecidium calystegiae* Desm., see **Puccinia convolvuli** Castagne.

*Aecidium cardiospermophillum* Spegazzini, see **Aecidium serjaniae** P. Hennings.

**AECIDIUM CEPHALANTHI-PERUVIANA** P. Hennings, Hedwigia 43: 167. 1904. TYPE on *Cephalanthus peruvianus* (Rubiaceae) from **Peru**, Tarapoto, Sept. 1902, Ule- 3167. (**O/Icv,?!/?**). = *Aecidium aphelandrae* P. Hennings, Hedwigia 44: 58. 1905. TYPE on *Cephalanthus* sp. (Mistakenly reported on *Aphelandra* sp., Acanthaceae. Host identified as *Cephalanthus peruvianus* by Sydow, 1924.) from **Peru**, Rio Amazonas, Tarapoto, Dec. 1902, Ule s.n..

On Rubiaceae:

*Cephalanthus* sp., Peru, Rio Amazonas (Hennings, 1904: 167; 1905: 58).

Rust species collected by Ule in Peru along the Amazon River are to be expected in nearby Brazil.

*Aecidium cestri* Montagne, see **Uromyces cestri** Montagne.

**AECIDIUM CHRYSANTHUM** H. Sydow & P. Sydow, Ann. Mycol. 14: 71. 1916. TYPE on *Boussingaultia* sp., Basellaceae, from **Brazil**, Rio Acre, Alto Xapury, Oct 1911, Ule-3428. (**O/I,?!/?**). *Aecidium chrysanthum* has been reported only from the type.

Spores are variable in size, 24-42 x 15-25 µm, ovoid, ellipsoid, piriform to oblong, wall 1.5-2 µm thick, densely verruculose, and golden-yellow to yellow-brown (The Sydows, 1923).

Joerstad (1956: 454) named *Aecidium ulluci* on *Ullucus* sp., another host species in the Basellaceae, from Bolivia, which had smaller spores with colorless walls.



**AECIDIUM CHUQUIRAGUAE** H. S. Jackson & Holway in Jackson, Mycologia 24: 183. 1932. TYPE on *Chuquiragua* sp. from **Brazil**, São Paulo: Campos do Jordão, 20 Apr. 1922, *Holway-1743*. (0/I,?/?).

On Compositae:

*Chuquiragua* sp., São Paulo (Jackson, 1932: 183; Viégas, 1945: 74; I AC-3572).

*Aecidium chuquiraguae* has been reported only from Brazil.

Spermogonia on the adaxial side of leaves, prominent, numerous in loose groups on discolored spots, 180-120 µm high x 100-134 µm broad, globoid, ellipsoid to oblong, with a loose fascicle of periphyses to about 45 µm high. Aecia confluent in loose groups on the abaxial side of leaves in areas ca 1-2 cm across, yellowish; peridium short cylindrical, peridial cells 30-36 x 14-16 µm, broadly rhomboidal, imbricated, outer facing wall 2-3.5 µm thick, smooth, inner facing wall 2-3 µm thick, verrucose-rugose; aeciospores 28-36 x 22-26 µm, subgloboid to ellipsoid, wall 1.5-2 µm thick around sides, 7-15 µm thick above, colorless, prominently verrucose (Jackson, 1932).

A trait that helps to identify the species is the very thick wall at one end of the spores (Jackson, 1932).

**AECIDIUM CIRCINATUM** Winter, Hedwigia 23: 168. 1884. TYPE on *Jacaranda* sp. from **Brazil**, Santa Catarina: São Francisco, January 1889, *Ule-24*. (?I,?/?).

On Bignoniaceae:

*Jacaranda* sp.; Minas Gerais (Thurston, 1940: 291, the host published as *Stenolobium* sp.).

Santa Catarina (Winter, 1884: 168; Pazschke, 1892: 94; Hennings, 1896: 257), São Paulo (*Puttemans-2358*).

*Aecidium circinatum* has been reported only from Brazil.

Spermogonia unknown. Aecia mostly on the abaxial side of leaves, rarely on the primary veins and petioles, on circular or irregular brownish-purple spots 2-10 mm across; sori short cylindrical, up to 0.5 mm high, whitish with laciniate, reflexed margins; peridial cells firmly united, 25-42 x 16-25 µm, outer facing wall 4-7 µm thick, smooth, inner facing wall 2.5-4 µm thick, sinuate- or striate-verrucose; aeciospores 27-42 x 18-26 µm, oblong or cubical, often rectangular; wall 2 µm thick, usually much thickened at the apex 5-10 µm, nearly colorless (H. Sydow & P. Sydow, 1923).

Winter (1884) published the host of the type specimen as an unidentified Bignoniaceae. Pazschke (1892) determined that the host was *Jacaranda* sp.. If Thurston's (1940) identification of the rust on his specimen from Minas Gerais is correct, the host must surely be *Jacaranda* sp., not *Stenolobium*.

The differences that have been reported between the three species of *Aecidium* on *Jacaranda* from Brazil are shown below (modified from the Sydows, 1924).

#### Key to help identify *Aecidium* species on *Jacaranda* from Brazil, Bignoniaceae

1. Spore walls thickened apically (4-)5-10 µm, lateral walls (1-)2 µm thick, spores 25-42 x 18-25(-32) µm.  
*Aecidium circinatum*.
1. Spore walls usually not thickened apically, walls mostly 1-1.5 µm thick, spores (14-)16-20(-25) x (12-)14-18(-20) µm 2
  2. Sori mainly on stems and petioles, spores mostly oblong, 17-25 x 12-17 µm  
*Aecidium puttemansianum*.
  2. Sori mainly on leaflet blades, spores mostly 16-20 x 14-18.  
*Aecidium jacarandae*.

We considered *Ae. puttemansianum* and *Ae. jacarandae* as one taxon because the differences reported between them do not hold up. Compression of spores within a sorus may result in quadangular more elongate spores. Infections are not restricted to leaflet blades in *Ae. jacarandae*. We have collections that include small stem galls, petiole infections, and leaflet blade infections in the same material.

*Aecidium circumscribens* Neger, see **UROMYCES CIRCUMSCRIPTUS** Neger.

*Aecidium circumscriptum* Schweinitz, see **ENDOPHYLLUM CIRCUMSCRIPTUM** Whetzel & Olive.

*Aecidium cissi* Winter, see **ENDOPHYLLUM CIRCUMSCRIPTUM** Whetzel & Olive.

*Aecidium cnidoscoli* P. Hennings, see **UROMYCES CNIDOSCOLI** P. Hennings.

*Aecidium convolvulinum* Spegazzini, see **PUCINIA CRASSIPES** Berkeley & Curtis.

*Aecidium convolvulinum* Schweinitz, not a rust.

**AECIDIUM CORDIAE** P. Hennings in Sintenis et al., Bot. Jahrb. Syst. 17: 491. 1893. TYPE on *Cordia bullata* Linnaeus from **Santo Domingo (Haiti)**, date not reported, *Ehrenberg s.n.* (**0/I,?/?**).  
= *Aecidium cordiophilum* Spegazzini, Rev. Argentina Bot. 1: 95. 1925. TYPE on *Cordia ulmifolia* from **Argentina**, Salta: Sierra Santa Bárbara, Jan 1906, ? *Spegazzini s.n.*

On Boraginaceae:

*Cordia cylindrostachya* Roemer & Schultes, Brazil (Sydow, Mon. Ured. 4: 120. 1924).

*Cordia curassavica* Roemer & Schultes, Rio de Janeiro (PUR-F9264), Minas Gerais (Jackson, 1931: 500).

*Cordia urticifolia* Chamisso, Rio de Janeiro (Jackson, 1931: 500), Santa Catarina (Hennings, 1896: 256).

*Aecidium cordiae* has been reported also from Argentina, Venezuela, Trinidad, and Haiti.

Peridial cells 22-30 x 17-23  $\mu\text{m}$ , outer wall 6-8  $\mu\text{m}$  thick, striate, inner wall 3-4  $\mu\text{m}$  thick, verrucose, aeciospores 26-38 x 20-26  $\mu\text{m}$ , angular-globose to ovoid, wall 1.5-2  $\mu\text{m}$  thick at sides, 5-8  $\mu\text{m}$  thick above, closely and finely verrucose, colorless (The Sydows, 1923).

*Aecidium brasiliense*, also on *Cordia* sp. from Brazil, has spores 20-27 x 18-23  $\mu\text{m}$ , subglobose to ellipsoid and angulate, wall more or less evenly ca 1  $\mu\text{m}$  thick, densely and minutely verrucose, nearly colorless.

**AECIDIUM CORNU-CERVI** P. Hennings, Hedwigia 43: 168. 1904. TYPE on *Dalechampia* sp. from **Brazil**, Amazonas: Rio Juruá, Marary and Bom Fim, Sept and Nov 1900, *Ule-3080*. (**?/I,?/?**).

On Euphorbiaceae:

*Dalechampia* sp. Amazonas (Hennings, 1904B: 168).

*Plukenetia* sp., Pará (IBI-16058).

*Aecidium cornu-cervi* has been reported only from Brazil.

Spermogonia, uredinia, and telia unknown. Aecia on deformed branches transformed into xylaria-shaped horns, up to 10 cm long, densely immersed over the whole surface; 0.25 - 0.35 mm diam., peridium margin white, lacerate; peridial cells 25-35 x 16-0  $\mu\text{m}$ ; aeciospores 15-19 x 12-16  $\mu\text{m}$ , subcuboid, cylindrical, ovoid or oblong; wall 1  $\mu\text{m}$  thick, densely and minutely verrucose, subhyaline.

Hennings (1904B) included an illustration of *Aecidium cornu-cervi* showing a large witches' broom with many deformed branchlets up to 10 cm long with numerous scattered sori. The branchlets resembled fruiting structures of some species of the Ascomycete genus *Xylaria*. Another collection, IBI-16058, is from Ilha Marajó, Pará and the host identified as *Plukenetia* sp., a high climbing woody vine.

*Aecidium crotalariicola* P. Hennings, see *Malupa vignae* (Bresadola) Ono, Buriticá & Hennen [**PHAKOPSORA MEIBOMIAE** (Arthur) Arthur].

*Aecidium crotonopsidis* Burrill, Bot. Gaz. (Crawfordsville) 9: 190. 1884.

= *Aecidium splendens* Winter, Hedwigia 24: 256. 1885. TYPE on *Croton monanthogynus* Michaux, Euphorbiaceae, from The United States of America, Missouri: Perryville, date not reported, *C. H. Demetrio-sn.*

Hennings (1896: 257) misidentified a collection on *Croton* sp., Euphorbiaceae, from Santa Catarina, *Ule-952* as *Aecidium splendens* Winter, a synonym of *Aecidium crotonopsidis*. This identification is incorrect because Cummins (1971) reported that *Aecidium crotonopsidis* is an anamorph of *Uromyces graminicola* Burrill whose uredinia and telia occur on *Panicum* spp. and has been reported only in North America. We have not been able to reidentify the *Ule* specimen (*Ule-952*).

**AECIDIUM CYTTARIOIDES** P. Hennings (as "*cyattaroides*"), Hedwigia 43: 170. 1904. TYPE on Acanthaceae from **Brazil**, Amazonas: Rio Juruá, Marari, Sept. 1900, *Ule*-2819. (?/I,?/?).

On Acanthaceae:

**Gen. undetermined**, Amazonas (Hennings, 1904B: 170).

*Aecidium cyttarioides* has been reported only from the type.

Spermogonia unknown. Aecia on rough, ovoidal to variously tubercular, hard galls, 1-2 cm in diameter, that break through the bark on twigs; sori cupulate to more or less honeycombed, peridium immersed, brownish, peridial cells 22-26 x 16-18  $\mu\text{m}$ , oblong, or rounded-polygonal, about 30  $\mu\text{m}$  across, wall reticulate; aeciospores 10-14 x 8-12  $\mu\text{m}$ , angularly subglobose, wall ca 1  $\mu\text{m}$  thick, densely minutely verrucose, may appear smooth, colorless or pale yellowish (Sydow, H. & P., 1924; Laundon, 1964).

Hennings (1904) reported that the host of *Aecidium cyttarioides* is a climbing Acanthaceae vine and the rust induces galls on stems and twigs that resemble those induced by a species of the Ascomycete genus *Cyttaria* on *Nothofagus* in southern Chile. The specific epithet was misspelled in the original publication as "cyattarioides".

*Aecidium dalechampiae* P. Hennings, Hedwigia Beiblatt 38: (70). 1899. TYPE on *Dalechampia ficifolia* from

**Brazil**, Santa Catarina: São Francisco, Aug. 1884, *Ule*-210 and *Dalechampia* sp June 1885, *E. Ule*-461 (LECTOTYPE).

The Sydows (1923) reported that the description given by Hennings is completely worthless because the sori are all destroyed by *Tubercularina*.

**AECIDIUM DALECHAMPIICOLA** P. Hennings, Hedwigia 43: 80. 1904. TYPE on *Dalechampia* sp., Euphorbiaceae, from **Brazil**, Rio de Janeiro: Rio de Janeiro, Museum park, May 1900, *Ule*-1098. (?/I,?/?).

*Aecidium dalechampiicola* has been reported also from Venezuela, Belize, and Mexico. Only the type collection has been reported from Brazil.

Spermogonia unknown. Sori densely grouped on brown spots 1-4 mm across on the abaxial side of leaves; peridial cells 22-28 x 13-16  $\mu\text{m}$ , outer wall 3-5  $\mu\text{m}$  thick, striate to almost smooth, inner wall 2-3  $\mu\text{m}$  thick, verruculose, spores 17-20 x 13-16  $\mu\text{m}$ , sub globose or ellipsoid, wall 1  $\mu\text{m}$  thick, densely and minutely verruculose, colorless (The Sydows, 1923).

*Aecidium desmium* Berkeley & Broome, see **PHAKOPSORA GOSSYPII** (Lagerheim) N. Hiratsuka f.

*Aecidium desmodii* P. Hennings, see **UROMYCES ORBICULARIS** Dietel.

*Aecidium dichondrae* Hariot, see **PUCCINIA DICHONDRAE** Montagne.

*Aecidium dichondrae* Neger, see **PUCCINIA DICHONDRAE** Montagne.

*Aecidium diospyri-hispidae* Viégas, see **AECIDIUM MUELLERI** Thurston.

*Aecidium distinguendum* P. Sydow & H. Sydow, see **PUCCINIA PUTA** H. S. Jackson & Holway.

**AECIDIUM DOMINGENSIS** Kern & Ciferri, Mycologia 22: 116. 1930. TYPE on *Baccharis myrsinites* (Lamarck) Persoon from **Dominican Republic**, Santiago: Diego de Ocampo, Aug 1929, *R. Ciferri*-2524. (0/Icv,?/?) or (0/Icv,Icv/?).

On Compositae:

**Baccharis** sp., Minas Gerais (Viégas & Teixeira, 1945: 51).

*Aecidium domingensis* has been reported from Santo Domingo and Brazil.

Because no peridia are reported for this species, this name should be transferred to *Caeoma*, if the lack of a peridium is confirmed. Lindquist (1958) did not include this name in his monograph of rusts on *Baccharis*.

Spermogonia mostly on the abaxial side of leaves in small orbicular groups, punctiform, globoid or ovate, 150-175 µm in diameter. Aecia mostly on abxial side of leaves in orbicular groups 2-4 mm across surrounding the spermogonia, sori 0.3-0.4 mm across, long covered by the overarching epidermis; aeciospores 42-52 x 24-31 µm, ovoid, sometimes pyriform, often angular and narrowed above and below; wall 1.5-2 µm thick, sometimes thicker above 3-4 µm, sparsely echinulate-verucose, colorless (Kern & Ciferri, 1930).

*Aecidium dugettiae* P. Hariot, see **AECIDIUM DUGUETIAE** P. Hariot.

**AECIDIUM DUGUETIAE** Hariot, Bull. Soc. Myc. France 31: 57. 1915 (as "*Aecidium dugettiae*"). TYPE on *Duguetia* sp. (as "*Dugettia*"), Annonaceae, from **Brazil**, Pará: Belém, Oct 1913, *F. Vincens s.n.* (**0/I,??**).

On Annonaceae

**Duguetia furfuracea** (Saint Hilaire) Bentham & Hooker, Goiás (IBI-16674), São Paulo (IBI-16213).

*Aecidium dugettiae* has been reported only from Brazil. It is very similar to *Dietelia dugettiae*, which also has been reported only from Brazil. *Dietelia dugettiae* produces leaf galls, *Aecidium dugettiae* has been reported to form only leaf spots. Without spore germination evidence, and there is none up to now, it may not be possible to distinguish between these two taxa. Spores of both species have well developed refractive granules.

Spermogonia on the adaxial side of leaves. Aecia on irregular brown spots on the abaxial side of leaves, sometimes covering almost the entire leaf, peridial cells oblong-polygonal, firmly united, smooth, spores 16-26 x 18 µm, globoid, wall thin, smooth, nearly colorless. (Sydow, P. & H. Sydow, 1923).

*Aecidium ebenaceum* Montagne, Syll. Crypt. Number 1151, p. 312, 1856. TYPE on Ebenaceae, genus undetermined, from **Brazil**, Amazonas: Rio Negro, *Richard Spruce-(?1938) or s. n.* (**0?/?/?**). *Aecidium ebenaceum* has been reported only from the type. The Sydows (1924: 149).reported that perhaps only spermogonia are present and that this species cannot be recognized because there is no adequate description and the location of the type is unknown.

*Aecidium elongatum* Spegazzini, see **PUCCINIA VERBENIPHILA** Lindquist.

*Aecidium erigeronatum* Schweinitz, see **PUCCINIA DIOICAE** P. Magnus.

*Aecidium erigerontis* Kern & Whetzel, see **PUCCINIA CYPERI** Arthur.

*Aecidium eriosemais* P. Hennings, Hedwigia 34: 103. 1895. Not a rust (Sydow, 1923: 339).

**AECIDIUM EUPATORII** Dietel, Hedwigia 38: 258. 1899. TYPE on *Eupatorium* sp. from **Brazil**, Rio de Janeiro, Jan 1896, *Ule-2129*. (**?/I,??/?**).

On Compositae:

***Eupatorium pallescens*** DeCandolle, Mata Atlântica, Rio Grande do Sul (Joerstad, 1956: 462).

***Eupatorium*** sp., Rio de Janeiro (Dietel, 1899: 258).

*Aecidium eupatorii* has been reported only from Brazil.

Spermogonia unknown. Sori on abaxial side of leaves on large circular, yellowish spots, spots reddish-brown above, and on stems, causing distortions, outer facing walls of peridial cells 4-9 µm thick, smooth, inner facing walls 5-6 µm, verrucose, aeciospores 20-26 x 14-23 µm or 23-32 x 17-26 µm, very variable, globoid, polyhedral or oblong, wall 1-1.5 µm thick, very minutely and densely verrucose, even, colorless (H. Sydow & P. Sydow, 1924; Joerstad, 1956).

*Aecidium euphorbiae* Gmelin in Linnaeus, Syst. Nat. 2: 1473. 1791, *nomen illegit.*, a pre Persoon name. On Euphorbiaceae, *Euphorbia* sp., Rio de Janeiro, (Hennings, 1904A: 80). Hennings' report probably refers to **UROMYCES EUPHORBIAE** Cooke & Peck..

*Aecidium expansum* Dietel, see **PUCCINIA MIKANIAE** H. S. Jackson & Holway.

*Aecidium glaziovii* P. Hennings, see **Puccinia psidii** Winter.

**AECIDIUM GLECHONIS** Spegazzini, Anal. Mus. Nac. Hist. Nat. Buenos Aires 23: 34. 1912. TYPE on *Glechon thymoides* Spreng. from **Argentina**, Misiones: Bompland, Sept 1920, *Spegazzini s.n.* (**0?/I,?/?**),

On Labiatae:

*Glechon myrtoides* Saint-Hilaire., Paraná, (Joerstad, 1959: 69).

*Aecidium glechonis* has been reported only from Argentina and Brazil.

Spermogonia on adaxial side of leaves on small leaf spots, aecia on the abaxial side of leaves on the same spots, also on irregular tumors, peridium poorly developed, peridial cells rhomboid or irregular elliptical-rhomboid; aeciospores 28-31 x 24-28 (Lindquist, 1982), 29-39 x 23-28 µm (Joerstad, 1959), ellipsoid or polyhedral, wall 2-2.5 µm thick, with large verrucae.

Joerstad (1959) reported that Spegazzini states that *Aecidium glechonis* may belong with *Puccinia glechonis* Spegazzini whose type was collected on the same host and locality as the type for the *Aecidium glechonis*. *Puccinia glechonis* has not been reported from Brazil.

**AECIDIUM GOYAZENSE** P. Hennings, Hedwigia 34: 101. 1895. TYPE on *Loranthus* sp. from **Brazil**, Goiás: Serra dos Pyreneos, Aug. 1892, *Ule-1909*. (**?/Icv,?/?**).

On Loranthaceae:

*Loranthus* sp. Goiás (Hennings, 1895A: 101).

*Phthirusa ovata* (Pohl) Eichler, Dist. Fed. (IBI-13208).

*Aecidium goyazense* has been reported also from Venezuela on *Struthanthus dichotrianthus* Eichler (Kern, F. 1938. Additions to the Uredinales of Venezuela. Mycologia 30: 53). Hennings (1895) reported the Brazilian host as *Loranthus* sp. but the Sydows (1923) recorded it as *Phthirusa ovata*.

Sori on hard galls up to 3 cm across on leaves and stems, peridium up to 2.5 mm long, cylindrical, whitish, outer peridial cell walls 8-10 µm thick, striate, inner walls 3-4 µm thick, densely, minutely verrucose, aeciospores 24-34 x 20-25 µm, angularly globose, ovoid to ellipsoid, wall 2-2.5 µm thick, finely verrucose (P. Sydow & H. Sydow, 1923).

#### Key to help identify unconnected species of *Aecidium* on Loranthaceae in Neotropica

1. Sori on galls up to 3 cm across on leaves and stems, outer facing peridial walls striate, aeciospores 25-40 x 20-25 µm, walls uniformly 2-2.5(-3) µm thick, finely verrucose.

*Aecidium goyazense*, *Aecidium loranthi*

1. Sori not on galls, on circular hypotrophied leaf areas 3-5 mm across

*Aecidium struthanthi*

*Aecidium graminellum* Spegazzini, see **Puccinia graminella** Dietel & Holway.

**AECIDIUM GUAREAE** P. Hennings, Hedwigia 43: 168. 1904. TYPE on Meliaceae (a lectotype must be chosen from the four specimens, including *E. Ule-2677*, originally cited by Hennings mistakenly as on Sterculiaceae) from **Brazil**, (**?0/I,?/?**).

On Meliaceae:

*Guarea* sp., Amazonas, ? Pará (Hennings, 1904B: 168; 1905: 59).

*Aecidium guareae* has been reported only from the original specimens cited by Hennings.

Spermogonia unsure. Aecia on much deformed, systemically infected stem-systems, sori short-cylindric, peridial cells firmly united, 25-32 x 20-24 µm, subquadric to rhomboid; spores 20-26 x 18-22 µm, mostly angular subglobose, wall 1 µm thick, minutely verrucose. (Sydow P. & H. Sydow, 1923; Batista, A C. et al., 1966).

A drawing of one spore published by Batista et al. (1966) shows the apical wall thickened.

**AECIDIUM GUATTERIAE** Dietel, Hedwigia 36: 34. 1897. TYPE on *Gutteria* sp. from **Brazil**, Minas Gerais: Ouro Preto, *Ule-1830*. (**0/I,?/?**).

= *Aecidium marayense* P. Hennings, Hedwigia 43: 170. 1904. TYPE on *Gutteria* sp., **Brazil**, Rio Juruá, Marary, September 1900, *Ule-3086*.

- = *Aecidium rionegrense* P. Hennings, Hedwigia 43: 166. 1904. LECTOTYPE (chosen here) on *Guatteria* sp. from **Brazil**, Amazonas: Manaus, July 1900, *Ule-2782*.  
 = *Aecidium huallagense* P. Hennings, Hedwigia 43: 170. 1904. TYPE on *Guatteria alutacea* Diels from **Peru**, Oct 1902, *Ule-3219* and 3220.  
 = *Aecidium uredinoidis* P. Hennings, Hedwigia 44: 58. 1905. TYPE on *Guatteria* sp. fide the Sydows, (1923: 180-181), originally reported erroneously as on Sapindaceae, from **Brazil**, Amazonas: Rio Jurua, Jurua-miry, *E. Ule-s.n.*

On Annonaceae (as *Aecidium guatteriae*):

*Guatteria psilopus* Martius, Rio de Janeiro (Dietel, 1899: 259).

*Guatteria* sp., Minas Gerais (Dietel, 1897: 34), Pará (Hennings, 1909: 101).

On Annonaceae (as *Aecidium rionegrense*).

*Guatteria schomburgkiana* Martius, Amazonas (Hennings, 1904B: 166).

*Aecidium guatteriae* has been reported only from Brazil and Peru.

Spermogonia on adaxial side of leaves, numerous, at first brown then black in little whitish spots. Aecia on abaxial side, in irregular groups, short cylindrical, on swollen, black or almost black spots 2-3 cm or more across; peridial cells 30-40 x 18-26  $\mu\text{m}$ , mostly isodiametric, loosely united, walls 3-4  $\mu\text{m}$  thick, outer wall striate, inner densely verrucose; aeciospores 17-25 x 16-19  $\mu\text{m}$ , angular globoid or ellipsoid, wall 1(-1.5)  $\mu\text{m}$  thick, minutely verrucose, pale yellow (P. Sydow & H. Sydow, 1923). Aeciospores 15-16 x 12-13  $\mu\text{m}$ , globoid, walls uniformly mostly less than 1  $\mu\text{m}$  thick, verrucae in bands around the spores, numerous larger refractive granules within the bands, wall smooth outside the bands (fide Hennen, *Ule-3220*).

See *Aecidium amazonense* for discussion of species of *Aecidium* on *Guatteria*.

*Aecidium guttatum* Kunze, see **ENDOPHYLLUM CIRCUMSCRIPTUM** Whetzel & Olive.

*Aecidium hibisciatum* Schweinitz, see **PUCCINIA SCHEDONNARDI** Kellerman & Swingle.

*Aecidium hieronymi* Spegazzini, see **RAVENELIA HIERONYMI** Spegazzini.

**AECIDIUM HOLWAYI** H. S. Jackson, Mycologia 24: 97. 1932. TYPE on *Spermacoce latifolia* Aublet [= *Borreria latifolia* (Aubl.) Schumann] from **Brazil**, São Paulo: Santo Amaro, 27 May 1922, *Holway-1893*. (0/I,?/?).

On Rubiaceae:

*Spermacoce latifolia* Aublet ( $\equiv$  *Borreria latifolia* (Aubl.) Schumann), São Paulo (Jackson, 1932: 97).

*Aecidium holwayi* has been reported only from the type and one other collection from **Brazil**, São Paulo: Mandaque, 25 May 1922, *Holway-1670*.

Spermogonia on both sides of leaves, in the center of discolored spots or scattered between the aecia. Aecia on abaxial side of leaves, loosely scattered on discolored spots 1-1.5 cm across, infections not systemic; peridium cylindrical, peridial cells 28-32 x 18-21  $\mu\text{m}$ , outer facing wall 5-7  $\mu\text{m}$  thick, smooth, inner facing wall 2-3  $\mu\text{m}$  thick, minutely verrucose-rugose; aeciospores, 15-18 x 11-13  $\mu\text{m}$ , globoid to broadly ellipsoid, wall less than 1  $\mu\text{m}$  thick, not thickened apically, almost imperceptibly verrucose, colorless (Jackson, 1932).

These traits separate *Aecidium holwayi* from *Aecidium borrerii*.

*Aecidium huallagense* P. Hennings, Hedwigia 43: 170. 1904. Reported from Peru on *Guatteria*. See under *Ae. guatteriae* for discussion.

*Aecidium hyperici-frondose* Schweinitz, see **UROMYCES TRIQUETRUS** Cooke.

*Aecidium hyptidis* P. Hennings, see **PUCCINIA GIBERTII** Spegazzini.

**AECIDIUM INVALLATUM** P. Hennings, Hedwigia 34: 102. 1895. TYPE on *Mollinedia* sp., Monimiaceae, from **Brazil**, Goiás: Goiás, Jan. 1893, *Ule-2000*. (0/I,?/?).

*Aecidium invallatum* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil and the identification of the host requires confirmation.

Spermogonia on the adaxial side of leaves on orbicular discolored spots 0.5-1 cm across, aecia on abaxial side of leaves in crowded groups to 1 cm across, peridium cupulate, peridial cells 32-40 x 17-26  $\mu\text{m}$ , irregularly rhomboid, outer facing wall 5-8  $\mu\text{m}$  thick, inner facing wall ca 3  $\mu\text{m}$  thick, densely verrucose; aeciospores subglobose to ellipsoid, wall 1-1.5  $\mu\text{m}$  thick, densely and minutely verrucose, yellowish (P. Sydow & H. Sydow, 1923).

*Aecidium ipomoeae* Spegazzini, see **Puccinia crassipes** Berkeley & Curtis.

*Aecidium ipomoeae-panduranae* Schweinitz, Syn. Fg. Carol., Schr. Nat. Ges. Leipzig 1: 69. 1822 (and *Caeoma convolvulatum* Schweinitz, Trans. Am. Phil. Soc. II. 4: 292, and *Aecidium convolvulinum* Schweinitz, l.c. 309. 1832.) . These names are based on *Albugo* sp., not rust. See **Puccinia crassipes** Berkeley & Curtis.

**AECIDIUM IQUITOSENSE** P. Hennings, Hedwigia 43: 166. 1904. TYPE on *Psychotria* sp. from **Peru**, Iquitos, July 1902, *Ule-3194*. (?/I,?/?).  
On Rubiaceae.

*Psychotria* sp., Peru, Iquitos (Hennings, 1904B), Rio Acre (Sydow, 1916: 71).

*Aecidium iquitosense* has been reported from nearby Bolivia and Peru and is to be expected from Brazil. Reports from India and Sri Lanka need to be confirmed.

Spermogonia unknown. Sori mostly on locally systemically infected, slightly thickened areas of petioles and peduncles, deep seated, cylindrical; peridial cells 35-50 x 22-26  $\mu\text{m}$ , oblong, rather loosely united, outer wall smooth, inner wall verrucose with obvious rounded warts; spores 21-26 x 19-23  $\mu\text{m}$ , angular globose, lateral wall 1.5-2  $\mu\text{m}$ , apical wall usually thickened up to 7  $\mu\text{m}$ , densely verrucose, almost colorless (P. Sydow & H. Sydow, 1923).

*Aecidium psychotriae*, the only other species of *Aecidium* reported from the Americas on *Psychotria*, does not produce systemic infections, its spores are a little larger, 25-35 x 24-29  $\mu\text{m}$ , lateral walls 2-3  $\mu\text{m}$ , and apical walls to 12  $\mu\text{m}$  thick.

**AECIDIUM JACARANDAE** P. Hennings, Hedwigia Beiblatt 38: (130). 1899. TYPE on *Jacaranda* sp. from **Brazil**, Rio de Janeiro: Teresopolis, Jan. 1897, *Ule-2796*. (0/Icv,?/?).  
= *Aecidium puttemansianum* P. Hennings, Hedwigia 48: 3. 1908. TYPE on *Jacaranda* sp. from **Brazil**, São Paulo: Serra da Cantareira, March [?]1903, *Puttemans-676*.

On Bignoniaceae

*Jacaranda* sp., Rio de Janeiro (Hennings, 1898), São Paulo (Hennings, 1908: 3; *Puttemans* 2378, IBI-14963).

*Aecidium jacarandae* has been reported only from Brazil.

Spermogonia type 4. Aecia on abaxial side of leaves, on brownish spots to about 1 cm diam., often largely confluent, densely crowded, peridium white, lacerate at the apex, incurved; peridial cells firmly united, 24-34 x 17-22  $\mu\text{m}$ ; aeciospores 16-20 x 14-18  $\mu\text{m}$ , angular globose or ellipsoid, wall 1-1.5  $\mu\text{m}$  thick, densely and minutely verrucose, nearly colorless.

See **AECIDIUM CIRCINATUM** Winter for a comparison of species of *Aecidium* on *Jacaranda*.

**AECIDIUM JURUENSE** P. Hennings, Hedwigia 43: 169. 1904. TYPE on *Unonopsis polyphleba* Diels, Annonaceae, from **Brazil**, Amazonas: Rio Juruá, Juruá-Miri, June 1901, *Ule-3087*. (0/Icv,?/?).  
*Aecidium juruense* has been reported only from the type.

Spermogonia on the adaxial side of leaves, numerous, dark brown; aecia on the abaxial side of leaves, densely grouped on large, dark, thickened spots up to 6 cm across, peridial cells 25-34 x 16-20  $\mu\text{m}$ , usually oblong, firmly united in regular rows, wall thin; aeciospores 16-19 x 15-17  $\mu\text{m}$ , globose, subglobose, to broadly ellipsoid, wall about 1  $\mu\text{m}$  thick at sides, 3-6  $\mu\text{m}$  above, minutely verrucose, subcolorless (P. Sydow & H. Sydow, 1923).

The apically thickened aeciospores help to identify *Aecidium juruense*.

*Aecidium jussiaeae* Spegazzini, see **Puccinia jussieuae** Spegazzini.

**AECIDIUM KIEHLIANUM** Viégas, *Bragantia* 5: 76. 1945. TYPE on *Senecio erisithalifolius* Schultz-Bipontius, Compositae, from Brazil, São Paulo: Mun. de Cunha, Serra, 8 Dec 1938, *J. Kiehl s.n.* (IAC 2661). (?/I,??).

*Aecidium kiehlianum* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia unknown. Aecia globoid, mostly on the abaxial side of leaves, scattered in groups; peridial cells polyhedral, 42-48 x 22-24 x 30 x 40 µm, outer facing wall 6 µm thick, smooth, inner facing wall 4 µm thick, reticulate; aeciospores 22-32 µm, globoid, wall 1.5-2 µm thick, minutely verrucose, colorless (Viégas, 1945).

See *Aecidium senecionis-acanthifolii* Dietel for note about similarities to that species.

**AECIDIUM LANTANAE** Mayor, *Mem. Soc. Neuchatel. Sci. Nat.* 5: 567. 1913. TYPE on *Lantana hispida* Humboldt, Bonpland & Kunth from **Colombia**, Antioquia: near Angelópolis, 20 Aug 1910, *Mayor-213*. (0/Icv,??).

On Verbenaceae:

*Lantana camara* Linnaeus, Rio de Janeiro (Viégas, 1945: 164; IAC 4817).

*Lantana lilacena* Desfontaines, Minas Gerais, Rio de Janeiro (Jackson, 1932: 63).

*Aecidium lantanae* has been reported also from Ecuador, Colombia, and Central America.

Spermogonia on the abaxial side of leaves, subepidermal in origin, numerous in groups; aecia surrounding the spermogonia, peridial cells 23-36 x 16-18 µm, outer wall smooth, inner wall verrucose; aeciospores 16-18 x 18-21 µm, globoid, often angular by pressure, wall minutely verrucose, with irregular smooth spots, colorless (Viégas, 1945).

Arthur (1924) included *Aecidium lantanae* as a synonym of *Aecidium verbenae* Spegazzini but we follow Jackson (1934) and Viégas (1945) who considered these as two separate taxa. *Aecidium spagazzinianum* Saccardo & Trotter is a new name for *Aecidium verbenae* which is now considered as an anamorph of *Puccinia verbeniphila* Lindquist. Spermogonia have not been reported for *Aecidium spagazzinianum* whose sori often occur with telia, suggesting that these *Aecidium* sori function as uredinia.

*Aecidium lathyrinum* Spegazzini, see **UROMYCES LATHYRINUS** Spegazzini.

*Aecidium leveilleum* P Magnus, see **PUCINIA MEYERI-ALBERTI** P. Magnus

**AECIDIUM LINDAVIANUM** P. Sydow & H. Sydow, *Mon. Ured.* 4: 120. 1923. TYPE on *Cordia nodosa* from **Peru**, Yurimaguas, Aug 1902, *Ule-3242*. (0/Icv,??).

On Boraginaceae:

*Cordia alba* (Jacquin) Roemer & Schultes, Minas Gerais (Thurston, 1940: 291).

*Aecidium lindavianum* has been reported only from Peru and Brazil.

Spermogonia on the adaxial side of leaves. Aecia on the abaxial side of leaves, in circular groups on brownish leaf spots 1-2 cm across; short cylindrical, peridial cells firmly joined, 23-28 x 18-22 µm irregularly rhomboid, outer facing walls 3-4 µm thick, smooth to nearly smooth, inner facing walls 2-3 µm thick, minutely verruculose; aeciospores 17-20 x 15-17 µm, wall more or less evenly 1 µm thick minutely verrucose, colorless (P. Sydow & H. Sydow, 1923).

Thurston (1940) identified his collection from Vicosá, Minas Gerais as *Aecidium lindavianum* because its spores were "quite small", 18-21 x 15-16 µm, which is smaller than spores of *Aecidium cordiae* (26-38 x 20-26 µm), or *Aecidium brasiliense* (20-27 x 18-23 µm).

**AECIDIUM LIPPIAE-SIDOIDIS** H. Sydow & P. Sydow, *Oesterr. Bot. Z.* 52: 183. 1902. TYPE on *Lippia sidoidis*, Verbenaceae, from **Brazil**, place and date not determined, *Sello s.n.* (?Icv,??).

*Aecidium lippiae-sidoidis* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia unknown. Aecia on the abaxial side of leaves in groups on yellowish leaf spots 2-4 mm across, yellowish, peridial cells firmly joined, 18-26 x 16-20 µm, rhomboid; aeciospores 16-22 x 15-18 µm, angularly globoid or ellipsoid; wall 1-1.5 µm thick, densely and finely verrucose, subcolorless. (P. Sydow & H. Sydow, 1923).



**AECIDIUM LORANTHI** Thuemen, De fungis enterianis observationis, p.99-102, in Lorentz, Veg. Norde. Prov. Entre-Rios, p. 101. 1878. TYPE on *Loranthus uruguayensis* H. & A. from **Argentina**, Santa Candidas, Dec 1875, collector uncertain, perhaps *Lorentz. (?/I,???)*.

On Loranthaceae:

*Loranthus* sp., Santa Catarina (Hennings, 1895C: 338).

*Phoradendron* sp., Santa Catarina (Hennings, 1896: 257).

*Aecidium loranthi* has been reported also from Argentina and Guatemala.

Spermogonia unknown. Aecia subglobose to hemispherical, on large galls up to 1.5 cm in diameter on stems, peridial cells outer facing walls 12 to 14  $\mu\text{m}$  thick, striate, inner facing walls 3.5-5  $\mu\text{m}$  thick, with large verrucae; aeciospores 25-40 x 17-25  $\mu\text{m}$ , subglobose to ellipsoid, wall 2.5-3  $\mu\text{m}$  thick, verrucose (Lindquist, 1982)

*Aecidium loranthi* is very similar to *Aecidium bulbifaciens* Neger from Chile. Lindquist (1982) placed *Aecidium bulbifaciens* as an anamorph of *Uromyces circumscriptus*. See *Aecidium goyazensis* for comparison.

**AECIDIUM MABEAE** Thurston, Mycologia 32: 291. 1940. TYPE on *Mabea brasiliensis* Mueller-Aargau, from **Brazil**, Minas Gerais: Viçosa, 1 April 1933, *Mueller-438. (0/Icv,???)*.

On Euphorbiaceae:

*Mabea brasiliensis* Mueller-Aargau, Minas Gerais (Thurston, 1940: 291; IBI-13173).

*Aecidium mabeae* has been reported only from Brazil.

Spermogonia on the adaxial side of leaves, in small groups about 1 mm across, aecia on the abaxial side of leaves on discolored leaf spots 2-5 mm across, cupulate; peridial cells 36-32  $\mu\text{m}$  long, rhomboid, ends slightly overlapping, outer facing wall about 3  $\mu\text{m}$  thick, smooth, inner wall 4-6  $\mu\text{m}$  thick striate to tuberculate-verrucose; aeciospores 27-35 x 20-26  $\mu\text{m}$ , broadly ellipsoid to oblong, wall 1.5-2  $\mu\text{m}$  thick at sides, 5-7  $\mu\text{m}$  thick above, prominently verrucose, colorless (Thurston, 1940).

See also *Aecidium maprouneae* var. *maprouneae* which also has spores with the apical wall thickened.

**AECIDIUM MAPROUNEAE** P. Hennings var. **MAPROUNEAE**, Hedwigia 42: 168. 1904. TYPE on *Maprounea* sp. from **Peru**, Iquitos: Rio Amazonas, July 1902, *Ule-3195. (0/I,???)*.

On Euphorbiaceae

*Maprounea guianensis* Aubl., Amapá (Hennen & Sotão: Fitopat. Bras. 22: 444-446. 1997; IBI 89-17, 90-28).

*Aecidium maprouneae* var. *maprouneae* has been reported only from Brazil and Peru.

Sori on hypertrophied leaf spots 2-5(-10) mm in diameter; spermogonia type 4, on the adaxial side of leaves; aecia hypophyllous, peridial cells 24-31 x 13-22  $\mu\text{m}$ , irregularly rhomboid, outer wall 4-7  $\mu\text{m}$  thick, smooth, inner wall about 3  $\mu\text{m}$  thick, verrucose; aeciospores 22-29(-31) x 15-18(-20)  $\mu\text{m}$ , oblong to ellipsoid, often angular, side wall about 1  $\mu\text{m}$  thick, apical wall (4-)9(-11)  $\mu\text{m}$ , densely verrucose, without refractive granules (Hennen & Sotão, 1997).

*Aecidium maprouneae* var. *maprouneae* needs to be compared more carefully with *Aecidium mabeae*.

**AECIDIUM MAPROUNEAE** P. Hennings var. **NONCRASSATUM** Hennen & Sotão, Fitopat. Bras. 22: 444-446. 1997. TYPE on *Maprounea* sp., Euphorbiaceae, from **Brazil**, Amapá: Vila de Maruanum, ca 15 km NW of Macapá, 27 Dec 1989, *Hennen & Sotão-89-171. (0/I,???)*.

*Aecidium maprouneae* var. *noncrassatum* has been reported only from the type.

*Aecidium maprouneae* var. *noncrassatum* differs from *A. m.* var. *maprouneae* mainly because the aeciospores are not thickened apically (Hennen and Sotão, 1997).

*Aecidium marayense* P. Hennings, see **AECIDIUM AMAZONENSE** P. Hennings.

**AECIDIUM MATTOGROSSENSE** Juel, Bih. K. Svenska Vet.-Akad. Handl. 23: 22. 1897. TYPE on a large leaved Rubiaceae, perhaps *Sickingia* sp. in primary forest, from **Brazil**, Mato Grosso: Santa Cruz da Barra, ? 2 March 1894 ("2/3 1894"), *C. Lindman-B513. (0/I,???)*.

*Aecidium mattogrossense* has been reported only from the type.

Spermogonia on both sides of leaves but mainly on the adaxial side, 80-110  $\mu$ , across, moderately numerous in each group; aecia on the abaxial side of leaves, cupulate, crowded on fuscous circular spots 6-12 mm across; peridial cells 30-44 x 22-26  $\mu$ m, firmly united; aeciospores 27-33 x 22-26  $\mu$ m, globose, subglobose to ovoid, wall 1.5  $\mu$ m thick, strongly verrucose, nearly colorless (Sydow, P & H. Sydow, 1913).

**AECIDIUM MEIAPONTENSE** P. Hennings, Hedwigia 34: 321. 1895. TYPE on undetermined

Acanthaceae from **Brazil**, Goiás: Meiaponte, Nov. 1892, *Ule-1984*. (0/I,?/?).

*Aecidium meiapontense* has been reported only from the type.

Spermogonia on the abaxial side of leaves, 80-90  $\mu$ m across, few grouped in the center of light colored spots. Aecia loosely grouped on abaxial side of leaves around the spermogonia, spots about 1 cm across, cupulate, peridium whitish, peridial cells firmly united, 23-28 x 15-19  $\mu$ m, subrhomboid, outer facing wall 7-9  $\mu$ m thick, smooth, inner facing wall 3  $\mu$ m thick, verrucose; aeciospores 16-22 x 15-17  $\mu$ m, subglobose to ellipsoid, wall 1  $\mu$ m, densely and minutely verrucose, subhyaline (Sydow, P. & H., 1923; Laundon, 1963).

The description is inadequate to determine any relationship of this rust (Laundon, 1963).

**AECIDIUM MELANANTHI** P. Hennings, Hedwigia Beiblatt 41: (62). 1902. TYPE on *Melananthus dipyrenodis* Walpers, Solanaceae, originally reported mistakenly as Verbenaceae, from **Brazil**, Rio de Janeiro, Pico da Gavea, 20 June 1897, *Ule-s.n.* (?/Icv,?/?).

*Aecidium melananthi* has been reported only from the type.

Spermogonia unknown. Aecia evenly and densely covering the whole surface of somewhat deformed branchlets and leaves; short cylindrical; peridial cells 24-30 x 18-23  $\mu$ m, firmly united; aeciospores 18-24 x 14-17  $\mu$ m, angular globoid or ellipsoid, wall 1-1.5  $\mu$ m thick, minutely verrucose, sub-colorless (H. Sydow & P. Sydow, 1923).

*Aecidium mexicanum* Dietel & Holway, see **UROMYCES COMMELINAE** Cooke.

**AECIDIUM MICROSPORUM** Dietel, Hedwigia 36: 34. 1897. TYPE on *Aster divaricatus* Linnaeus, Compositae, from **Brazil**, Santa Caterina, Serra Geral, April 1891, *Ule-1055*. (0/Icv,?/?).

*Aecidium microsporum* has been reported only from the type.

Spermogonia in loose groups on both sides of leaves. Aecia mostly on the abaxial side of leaves on small distinct spots in small to medium groups; peridial cells 23-28 x 17-22  $\mu$ m, subrhomboid to polygonal, outer facing wall 7-11  $\mu$ m thick, striate, inner facing wall 3-4  $\mu$ m thick, verrucose; aeciospores 12-18 x 10-16  $\mu$ m, angular globoid or ellipsoid; wall 1  $\mu$ m thick, densely and minutely verrucose, sub-colorless (P. Sydow & H. Sydow, 1923).

*Aecidium mikaniae* P. Hennings, see **Puccinia MIKANIAE** H. S. Jackson & Holway.

**AECIDIUM MINIMUM** H. S. Jackson & Holway in Jackson, Mycologia 24: 121. 1932. TYPE on *Stevia urticaefolia* Thunberg, Compositae, from **Brazil**, Minas Gerais: Ouro Preto, 6 Dec 1921, *Holway-1366*. (0/Icv,?/?).

*Aecidium minimum* has been reported from one other collection from Bolivia.

Spermogonia deeply immersed on both sides of leaves in dense groups on discolored leaf spots. Aecia on the abaxial side of leaves in dense groups 5-8 mm across, these on purplish leaf spots; peridium short cylindrical or cupulate, peridial cells 28-34 x 12-16  $\mu$ m, broadly rhomboid; outer facing wall 2.5-4  $\mu$ m thick, smooth; inner facing wall 2-2.5  $\mu$ m thick, prominently verrucose; aeciospores 12-15  $\mu$ m across, subglobose, wall 1  $\mu$ m thick, finely verrucose, colorless (Jackson, 1932).

Jackson (1932) speculated that *Aecidium minimum* might belong to the heteroecious species *Puccinia eleocharidis* Arthur with uredinia and telia on Cyperaceae.

**AECIDIUM MIRYENSE** P. Hennings, Hedwigia 43: 169. 1904. TYPE on *Guarea* sp. Meliaceae, from **Brazil**, Rio Juruá, Juruá-Miri, June 1901, *Ule-2678*. (0/Icv,?/?).

*Aecidium miryense* has been reported only from the type.

Spermogonia on the adaxial side of leaves, numerous, blackish. Aecia densely and more or less evenly grouped on the abaxial side of leaves on large, yellow-brown, irregular, not or slightly thickened, leaf

spots 1-3 cm long; cupulate, peridial cells 19-27 x 16-18  $\mu\text{m}$ , subrhomboid, firmly joined, outer facing wall 2-2.5  $\mu\text{m}$  thick, smooth, inner facing wall 0.5-2  $\mu\text{m}$  thick, minutely verrucose, aeciospores 14-19 x 12-14  $\mu\text{m}$ , subglobose to ellipsoid, wall about 1  $\mu\text{m}$  thick, minutely verrucose to punctate, sub-colorless (Sydow, P. & H. Sydow, 1923)..

**AECIDIUM MOMORDICAE** Juel, Bihang K. Svenska Vet.-Akad. Handl. 23: 21. 1897. TYPE on *Momordica* sp., Cucurbitaceae, from **Brazil**, Mato Grosso: Palmeiras, 4 Jan 1894, C. A. M. Lindman s.n. (0/Icv,??/??).

*Aecidium momordicae* has been reported only from the type.

Spermogonia on the adaxial side of leaves, not numerous, honey-yellow. Aecia loosely grouped on the abaxial side of leaves on indefinite yellowish spots, cupulate or short cylindrical, peridial cells 30-46 x 18-25  $\mu\text{m}$ , firmly united, imbricated, outer facing wall 6-8  $\mu\text{m}$  thick, striate, inner facing wall 4-6  $\mu\text{m}$  thick, densely and coarsely verrucose; aeciospores 23-27 x 18-23  $\mu\text{m}$ , globose, subglobose, or ellipsoid, wall 1.5  $\mu\text{m}$  thick, densely verrucose, sub-colorless (Sydow, P. & H. Sydow, 1923).

**AECIDIUM MUELLERI** Thurston, Mycologia 32: 292. 1940. TYPE on *Diospyros* sp. (mistakenly reported originally as *Nectandra amara* Nees, Lauraceae) from **Brazil**, Minas Gerais: Viçosa, 3 Dec 1929, Mueller-39. (0/Icv,??/??).

= *Aecidium diospyri-hispidae* Viégas, Bragantia 5: 75. 1945. TYPE on *Diospyros hispida* A.

DeCandolle from **Brazil**, Minas Gerais: Belo Horizonte, Fazenda Baleia, 19 Jan 1943, A. P. Viégas & H. M. Barreto s.n.

On Ebenaceae:

*Diospyros hispida*, Minas Gerais (Thurston, 1940: 292; Viégas, 1945: 75; IAC-4143), São Paulo (IBI-12056).

*Aecidium muelleri* is known only from Brazil from the reports listed above

Spermogonia on discolored spots on the adaxial side of leaves, in groups (2-)5-7(-10) mm across; becoming blackish, subepidermal in origin, not deeply embedded, 100-130  $\mu\text{m}$  high x 200-300  $\mu\text{m}$  wide, conical, periphyses not seen. Aecia on discolored blackish spots the abaxial side of leaves, in circular groups 2-8 mm across, 0.2-0.3 mm across, cylindrical, erect, peridium whitish, peridial cells 28-32 to 40-50  $\mu\text{m}$  long x 15-20  $\mu\text{m}$  wide, rhomboid, polygonal in face view, sub imbricate, outer facing wall 3-4  $\mu\text{m}$  thick smooth, inner facing wall 5-6  $\mu\text{m}$  thick, tuberculate-verrucose, aeciospores 16-23 x (13-)15-16(-20)  $\mu\text{m}$ , broadly ellipsoid to angularly globoid, wall evenly ca 1  $\mu\text{m}$  thick, minutely verrucose (Thurston, 1940; Viégas, 1945).

Viégas (1945) reported that the outer facing peridial cell walls were beaked distally, the beak overlapping the adjacent cell.

See *Aecidium calosporum* for comparisons of *Aecidium* species on *Diospyros*.

**AECIDIUM NECTANDRAE** H. S. Jackson & Holway in Jackson, Mycologia 23: 102.1931. TYPE on *Nectandra oppositifolia* Nees from **Brazil**, Belo Horizonte, 26 Nov. 1921, Holway-1339. (0/Icv,??/??).

On Lauraceae

*Nectandra* sp., MinasGerais (Jackson, 1931: 102), Sao Paulo (? IBI-12396).

*Aecidium nectandrae* has been reported only from the type and questionably from the collection cited above.

Spermogonia scattered on discolored spots on the adaxial side of leaves, very large, 170-210  $\mu\text{m}$  across, globoid, deep seated, arising from below the palisade layer, finally rupturing the epidermis with ostiole as broad as the spermogonium. Aecia on the abaxial side of leaves, numerous, scattered on discolored spots 1-3 cm across; peridium short cylindrical, firm; peridial cells 18-20  $\mu\text{m}$  long by 15-20  $\mu\text{m}$  wide, rhombic in cross section, outer facing wall 1.5-2.5  $\mu\text{m}$  thick, smooth, inner facing wall 2-3  $\mu\text{m}$  thick, roughly tuberculate; aeciospores 23-28 x 16-20  $\mu\text{m}$ , ellipsoid to short cylindrical, wall finely and prominently verrucose, apical wall 3.5-5.5  $\mu\text{m}$  thick (Jackson, 1931).

*Aecidium obsoletum* Spegazzini, see **Puccinia cyperii** Arthur.

**AECIDIUM OCHRACEUM** Spegazzini, Revista Argentina Hist. Nat. 1: 401. 1891. TYPE on

*Tabernaemontana australis* from **Paraguay**, near Villa Morra, month not reported, 1893, *J. D. Anisitz-141. (?/Icv,?!?)*.

On Apocynaceae:

*Tabernaemontana amygdalifolia* Jacquin, Rio de Janeiro (Jackson, 1931: 492).

*Tabernaemontana* sp., Brazil (Sydow, 1924: 138); Minas Gerais (IAC-5269), São Paulo (IBI-14819).

*Aecidium ochraceum* has been reported only from Paraguay and Brazil.

Spermogonia unknown. Aecia on the abaxial side of leaves, on round, yellowish to brownish spots 0.5-1.5 cm across, densely concentrically grouped; cupulate, peridial cells firmly united, 24-30 x 18-20  $\mu\text{m}$ , rhomboid, wall 2.5-4  $\mu\text{m}$  thick, outer facing wall minutely striate, inner facing wall striate verrucose; aeciospores 24-28 x 21-24  $\mu\text{m}$ , ellipsoid to ovoid, often angular; wall 2-2.5  $\mu\text{m}$  thick on sides, 10-12  $\mu\text{m}$  thick at top, verrucose, more noticeable above (Lindquist, 1982).

Lindquist (1982) illustrated the spores of *Aecidium ochraceum* showing walls verrucose with the apical walls greatly thickened and more noticeably verrucose. These traits together with the identification of the host help to identify this species.

*Aecidium oxalidis* Thuemen, see **Puccinia SORGHII** Schweinitz.

**AECIDIUM PACHYCEPHALUM** Dietel, Hedwigia 36: 34. 1897. TYPE on *Baccharis megapotamica* Sprengel, Compositae, from **Brazil**, Santa Catarina, Serra Geral, Jan 1891, *Ule-1054. (?!?,Icv?!?)*.

*Aecidium pachycephalum* has been reported only from the type.

Spermogonia unknown. Infections systemic, sori cupulate, whitish, evenly, densely scattered on stems and singly on leaves; peridial cells firmly united but falling away, 25-35 x 18-25  $\mu\text{m}$ , rectangular to irregularly rhomboid, outer facing wall 2.5-3  $\mu\text{m}$  thick, smooth, inner facing wall about 7  $\mu\text{m}$  thick, strongly and coarsely verrucose; spores catenulate, 23-29 x 17-23  $\mu\text{m}$ , polyhedric, subglobose to ovoid; wall 1-1.5  $\mu\text{m}$  thick at sides, 7-14  $\mu\text{m}$  thick apically, densely verrucose, sub-colorless (Sydow, P. & H. Sydow, 1923).

Because spermogonia are unknown, we assume the name applies to uredinia. The systemic infections and the apically thickened spores help identify *Aecidium pachycephalum*.

*Aecidium pampeanum* Spegazzini, see **Puccinia PAMPEANA** Spegazzini.

*Aecidium passifloricola* P. Hennings, see **Puccinia SCLERIAE** (Pazschke) Arthur.

*Aecidium peiresciae* P. Hennings, see **Uromyces PERESKIAE** Dietel.

*Aecidium peireskiae* P. Hennings see **Uromyces PERESKIAE** Dietel.

*Aecidium pereskiae* P. Hennings, see **Uromyces PERESKIAE** Dietel.

*Aecidium pereskiae* H. S. Jackson & Holway see **Uromyces PERESKIAE** Dietel.

**AECIDIUM PIPTOCARPHAE** P. Hennings, Hedwigia 48: 3. 1908. TYPE on *Piptocarpha* *cfr.* *axillaris* from **Brazil**, São Paulo: Serra da Cantareira, July 1905, *Puttemans-1324. (0/Icv,?!?)*.

On Compositae:

*Piptocarpha axillaris* Baker, São Paulo (Hennings, 1908: 3; P. Sydow & H. Sydow, 1923:52).

*Aecidium piptocarphae* has been reported only from the type and is an anamorph of either *Puccinia piptocarphae* P. Hennings or *Puccinia seorsa* H. S. Jackson & Holway.

Spermogonia on yellow brown spots 4-6 mm across the adaxial side of leaves, sori yellow-brown at first becoming dark later; aecia in groups of 2-8 on the abaxial side of leaves below the spermogonia, 1.5-2.5 mm long, cylindrical, yellowish, lacerate; peridial cells 38-65 x 15-25  $\mu\text{m}$ , irregularly rhomboid, outer facing wall 1.5-3  $\mu\text{m}$  thick, smooth, inner facing wall 3-4  $\mu\text{m}$  thick, densely verrucose; aeciospores 27-40 x 20-27  $\mu\text{m}$ , ellipsoid, wall 1.5-2  $\mu\text{m}$  thick, densely verrucose, verucae easily displaced (the Sydows, 1923).

**AECIDIUM POSOQUERIAE** Dietel, Ann. Mycol. 6: 98. 1908. TYPE on *Posoqueria latifolia* (Rudge)

Roemer & Schultes, Rubiaceae, from **Brazil**, Pará: Marco, Dec 1907, *Baker-80*. (**0/Icv,?/?**).  
*Aecidium posoqueriae* has been reported only from the type.

Spermogonia on adaxial side of leaves. Aecia on the abaxial side of leaves and petioles in large brown effused spots, several cms. long and varying width, mostly along veins and around stems, finally becoming dry, peridial cells overlapping in fairly regular rows, outer wall very slightly striate, inner wall verrucose, aeciospores 25-38 x 20-26  $\mu\text{m}$ , subglobose, ellipsoid, ovoid or oblong, wall 1.5-2  $\mu\text{m}$  thick on sides, 6-17  $\mu\text{m}$  thick above, subcolorless, densely verrucose (P. Sydow & H. Sydow, 1923).

Batista et al. (1966), in addition to the information above, reported peridial cells 35-45 x 24-32  $\mu\text{m}$ , outer facing wall 12-16  $\mu\text{m}$  thick, pregueada.

The apically thickened walls of the aeciospores help to identify *Aecidium posoqueriae*.

Compare *Aecidium iquitosense* reported as on *Psychotria* sp.

**AECIDIUM PRATAE** H. S. Jackson & Holway in Jackson, Mycologia 19: 57. 1927. TYPE on  
Amaranthaceae, genus undetermined from **Brazil**, São Paulo: Prata, 9 Apr. 1922, *Holway-1716*.  
(**?/Icv,?/?**).

*Aecidium pratae* has been reported only from the type.

Spermogonia unknown. Aecia a few in small groups 1.5-4 mm across on the abaxial side of leaves; short cylindrical, yellowish; peridial cells 26-32 x 16-20  $\mu\text{m}$ , rectangular, ends abutted, outer facing wall 6-8  $\mu\text{m}$  thick, transversely striate and finely verrucose, inner walls 2.5-3  $\mu\text{m}$  thick, coarsely tuberculate-verrucose, aeciospores 18-23 x 16-20  $\mu\text{m}$ , globoid or broadly ellipsoid, wall about 1  $\mu\text{m}$  thick, very minutely verrucose, appearing smooth.

*Aecidium pratae* is not connected to *Puccinia mogiphanis* and has larger spores than *Aecidium bonariense* (*Puccinia macropoda* Spegazzini), which are 16-18 x 14-16  $\mu\text{m}$  (Jackson, 1927).

**AECIDIUM PSYCHOTRIAE** P. Hennings, Hedwigia 43: 166. 1904. TYPE on *Psychotria* sp. from  
**Peru**, Cerro de Isco, March 1903, *Ule-3230*. (**?/Icv,?/?**).

On Rubiaceae.

*Psychotria* sp., Roraima (Sydow, 1916: 72).

*Aecidium psychotriae* has been reported also from Venezuela.

Spermogonia unknown. Host not deformed, sori on orangish or yellow-brown spots on abaxial side of leaves, in small somewhat circular groups, deep seated, cupulate, peridial cells 30-50 x 28-35  $\mu\text{m}$ , angular, outer facing wall smooth, inner facing wall verrucose, colorless; spores 25-34 x 24-29  $\mu\text{m}$ , wall 2-3  $\mu\text{m}$  thick laterally, thickened at the apex up to 12  $\mu\text{m}$ , subcolorless, densely verrucose with large verrucae (P. Sydow & H. Sydow, 1923).

See *Aecidium iquitosense* for a comparison to the only other species of *Aecidium* reported on *Psychotria* in the Americas.

*Aecidium pusillum* Dietel, see **AECIDIUM VERNONIAE** P. Hennings.

*Aecidium puttemansianum* P. Hennings, see **AECIDIUM JACARANDAE** P. Hennings.

**AECIDIUM RANDIAE** P. Hennings, Hedwigia 35: 259. 1896. LECTOTYPE on *Basanacantha*  
sp. (reported originally as *Randia* sp.) from **Brazil**, Santa Catarina, Tubarão, *Ule--1211*. (**0/I,?/?**).  
= *Aecidium basanacanthae* P. Hennings, Hedwigia 43: 166. 1904. TYPE on *Basanacantha* sp.  
from **Brazil**, Rio Juruá, Marary, Sept. 1900, *E. Ule-2683*. (**0/Icv,?/?**).

On Rubiaceae:

*Basanacantha* sp., Amazonas (Hennings, 1904B: 166); Minas Gerais, Rio de Janeiro, Santa Catarina (Hennings, 1896: 259 as *Randia* sp.).

*Aecidium randiae* has been reported only from Brazil.

Spermogonia on adaxial side of leaves, numerous, in blackish-brown spots. Aecia on abaxial side of leaves on flat or hemispheric galls 3-10 mm across or mostly up to 2 cm long, these hard, mostly drying black or gray, sori numerous over the surface of the gall, deeply immersed, cupulate, peridial cells mostly 50-60  $\mu\text{m}$  long, spores 20-28 x 18-26  $\mu\text{m}$ , subglobose, ovoid or ellipsoid (Sydow, P. & H. Sydow, 1923).

Hennings published the name *Aecidium basanacanthae* in 1904 to be used for *Aecidium randiae* published in 1896 in which he mistakenly reported the host as *Randia*. It should have been *Basanacantha*.

However, the Code does not permit this kind of name change. *Aecidium basanacanthae* is a synonym of *Ae. randiae* as shown above.

? **AECIDIUM RANUNCULI** Schweinitz, Schriften Natur. Ges. Leipzig 1: 67. 1822. TYPE on *Ranunculus abortivus* from **The United States of America**, probably Pennsylvania: Bethlehem, other data not available.

On Ranunculaceae:

*Ranunculus bonariensis* Poiré, Rio de Janeiro (Pazschke, 1896: 52).

We believe that the rust was misidentified by Pazschke. Arthur (1918, 1920) and Cummins (1971) reported that *Aecidium ranunculi* is an aecial stage of *Puccinia eatoniae* Arthur, a rust of the grass genus *Sphenopholis*, known only in North America.

Photos of the Ule specimen (number 2093, = 114) in HBG on which Pazschke's report was based shows *Ranunculus* leaves with numerous, closely arranged *Aecidium* sp. sori indicating a systemic infection. Ule made another collection of *Aecidium* sp on *Ranunculus* sp. from Brazil that is also systemic, and was identified as *Aecidium ranunculi*: number 1029 on *R. flegelliformis* from Santa Catarina: Tubarão, August 1890. All collections of *Aecidium* on *Ranunculus* from Brazil still need to be identified.

**AECIDIUM RICKII** P. Sydow & H. Sydow., Mon. Ured. 4: 201. 1923. TYPE on *Zanthoxylum hiemalis* Saint Hilaire from Brazil (Theissen, *Dec. fung. bras.* 191). (**0/Icv,?!?**).

On Rutaceae:

*Zanthoxylum hiemalis* Saint Hilaire, Brazil (The Sydows, 1923: 201).

*Zanthoxylum* sp., Amapá (Sotão-92-101); Rio de Janeiro (Jackson, 1931: 364).

*Aecidium rickii* has been reported only from Brazil.

Spermogonia on adaxial side of leaves, in groups, numerous, shiny. Aecia on abaxial side of leaves, densely crowded in round or irregular groups 4-10 mm across, finally occurring over the whole or a large portion of the leaf, rarely on stems, cupulate; peridial cells 25-35 x 18-22 µm, irregularly rhomboid, the outer facing cell walls striate, 3-5 µm thick, inner facing walls verrucose, ca 3 µm thick; aeciospores 20-26 x 17-21 µm, subglobose, ovoid or oblong, often angular, wall 1-1.5 µm thick at sides, 6-14 µm thick at apex, verrucose, subcolorless (P. Sydow & H. Sydow, 1923).

The apically thickened spores help to identify *Aecidium rickii*. Four other species of *Aecidium* have been reported on *Zanthoxylum* spp. throughout the world: *Aecidium zanthoxyli-schinifolii* Dietel from Japan, *Aecidium spissum* Sydow from India and Burma with its peridium very poorly developed and is thus *Caecoma*-like, *Aecidium xanthoxyli* Peck from North America, which is an aecial stage of the heteroecious rust *Puccinia andropogonis*, and *Aecidium xanthoxylinum* Spegazzini from Paraguay and Brazil, reported to be characterized by small aeciospores 16-18 µm in diameter with colorless and smooth walls. We doubt that the spore walls of *Aecidium xanthoxylinum* are truly smooth.

*Aecidium rionegrense* P. Hennings, see **AECIDIUM GUATTERIAE** P. Hennings.

*Aecidium rivinae* Berkeley & Curtis, see **PUCGINIA RAUNKAERII** Ferdinansen & Winge.

**AECIDIUM SANTANENSE** Lindquist, Revista Fac. Agron. (La Plata) 39: 144. 1963. TYPE on *Vernonia squarrosa* Lessing [= *Lessingianthus plantaginoides* (Kuntze) H. Robinson], Compositae, from **Brazil**, Rio Grande do Sul: Porto Alegre, Municipio de Santana, 14 April, 1962, *Costa-Neto* (LPS-30620). (**?/Icv,?!?**).

*Aecidium santanense* has been reported only from the type collection.

Spermogonia unknown. Sori on stems in linear series parallel to the length of the stem on small, abnormal enlargements; peridium cylindrical; peridial cells rectangular, outer facing walls smooth, inner facing walls verrucose; spores 19-26 x 15-21 µm, angularly globoid or ellipsoid, wall evenly 1.5-2 µm thick, finely verrucose, colorless (Lindquist, 1982).

Two other species of *Aecidium* have been reported on *Vernonia* in South America. Their sori are on leaves and not in linear series on abnormal enlargements on stems. *Aecidium tarapotense* P. Hennings, known only from its type from Tarapoto, Peru, has comparatively large aeciospores 30-40 x 20-30 µm, walls ca 2 µm thick, strongly and densely verrucose with large round verrucae and with rhomboidal peridial cells 35-42 x 18-24 µm. *Aecidium vernoniae*, reported only from Brazil, has somewhat smaller aeciospores 24-38

x 20-30 µm, walls 1.5-2 µm thick, subcolorless, verrucose, and with elongated peridial cells 42-70 x 18-24 µm.

**AECIDIUM SENECTIONIS-ACANTHIFOLII** Dietel in Neger, Ofvers, K. Vetensk. Akad. Forh. .56: 748. 1899. TYPE on *Senecio acanthifolii* from **Argentina**, Tierra del Fuego, Rio Azopardo, 29 Feb 1896, P. Dusén-142. (?/Icv,?!/?).

On Compositae:

*Senecio bonariensis* Hooker & Arnott, Rio Grande do Sul (Lindquist & Costa Neto, 1967: 63).

*Aecidium senecionis-acanthifolii* has been reported with certainty only from Argentina, although there is the above report from Brazil and another from Bolivia.

Spermogonia questionable. Aecia on orbicular discolored spots on the abaxial side of leaves, cupulate; peridial cells very loose, subrhomboid, outer facing wall 4-7 µm thick, striate, inner facing wall 3-4 µm thick, verrucose; aeciospores 26-32 x 23-26 µm, ovoid to narrowly ellipsoid, wall 1.5-2 µm thick, densely, obviously, and evenly verrucose.

*Aecidium kiehlianum* Viégas on *Senecio erisithalifolius* Schultz from São Paulo (Viégas, 1945: 76) is morphologically similar (Joerstad, 1956: 473).

**AECIDIUM SERJANIAE** P. Hennings, Hedwigia 35: 258. 1896. TYPE on *Serjania fulva* Gr. from **Argentina**, Sierra de Tucumán, Feb. 1874, G. Hieronymus & Lorentz. (0/Icv,?!/?).

= *Aecidium serjaniae* Spegazzini, Rev. Argent. Bot. 1: 100-101. 1925. Type on *Serjania glabrata* Humboldt, Bonpland & Kunth (reported originally as *Serjania fulva* Griseb) from **Argentina**, Jujuy: Ledesma, March 1906, Spegazzini-s.n.

= *Aecidium cardiospermophillum* Spegazzini, An. Mus. Nac. Buenos Aires 19: (ser. 3, v. 12): 320. 1909. Type on *Cardiospermum coryndum* Linnaeus from **Argentina**, Jujuy, Jan 1906, Spegazzini-s.n.

On Sapindaceae.

*Serjania* sp., São Paulo (Sydow, 1907: 355).

*Aecidium serjaniae* has been reported also from Venezuela and on *Cardiospermum* and *Urvillea* from Argentina.

Spermogonia on the adaxial side of leaves. Aecia on large or small discolored spots on the abaxial side of leaves, cylindrical, to 1 mm high, whitish, peridial cells rhomboid, outer facing wall smooth, inner facing wall striate-verrucose; aeciospores 15-20 x 12-16 µm, ellipsoid to polyhedric, wall 1.5 µm thick, faintly verrucose (Lindquist, 1982).

*Aecidium serjaniae* P. Hennings requires a neotype because the Sydows (1923) reported that the original material used by Hennings no longer had any rust on it.

Kern (1938) suggested that *Aecidium serjaniae* is part of the life cycle of an unknown heteroecious species that gave rise to the very common short cycled *Puccinia arechavaletae*.

*Aecidium serjaniae* Spegazzini, see **AECIDIUM SERJANIAE** P. Hennings.

*Aecidium singulare* (Dietel & Holway) Arthur, see **AECIDIUM BYRSONIMATIS** P. Hennings.

*Aecidium smilacinum* Lindquist, Rev. Fac. Agron. 41: 121. 1966. TYPE on *Smilax campestris* Grisebach, Liliaceae, from **Uruguay**, Dept Tacuarembó: Gruta de los Cuervos, 3 Jan 1960, Garcia Zorrón-2021; a new name is needed because it is not *Aecidium smilacinum* Tranzschel, Conspectus Uredinalium U. R. S. S., p. 140, 1939 on *Smilax oldhami* Miq. from Russia. (0/Icv,?!/?).

On Liliaceae

*Smilax campestris* Grisebach, Rio Grande do Sul (Lindquist, 1966: 121).

*Aecidium smilacinum* Lindquist is known only from the two specimens cited above.

Spermogonia in groups in the center of dead spots on the adaxial side of leaves, aecia in circles on the abaxial side of leaves opposite the spermogonia, whitish, peridial cells imbricated, rhomboid, exterior facing walls smooth, interior facing walls verrucose-striate, spores 21-28 x 19-22 µm, ellipsoid to ovoid, wall 1-1.5 µm thick, colorless, verrucose (Lindquist, 1982).

*Aecidium solani-argentei* P. Hennings, see **DIDYMOPSIS SOLANI-ARGENTEI** (P.Hennings)

Dietel.

*Aecidium solaninum* Spegazzini, see **PUCINIA ARAUACANA** Dietel & Neger.

*Aecidium solaninum* Spegazzini var. *laevis* Spegazzini, see *Aecidium solaninum* Spegazzini (**PUCINIA ARAUACANA** Dietel & Neger).

*Aecidium solaniphillum* Spegazzini, see **PUCINIA SUBSTRIATA** Ellis & Bartholomew.

*Aecidium spegazzinianum* Saccardo & Trotter, see **PUCINIA VERBENIPHILA** Lindquist.

*Aecidium spegazzinii* De Toni in Saccardo, see **PUCINIA CYPERI** Arthur.

*Aecidium splendens* Winter, see *Aecidium crotonopsidis* Burrill.

*Aecidium stachytarphetae* P. Hennings, see **ENDOPHYLLUM -STACHYTARPHETAE** Whetzel & Olive.

**AECIDIUM STEVIAE** P. Hennings, Hedwigia Beiblatt 38: (71). 1899. TYPE on *Stevia urticifolia* Thunberg (Compositae) from **Brazil**, Rio de Janeiro: Serra do Itatiaia, March 1894, *E. Ule-2085*. (**0/Icv,??**).

*Aecidium steviae* has been reported only from the type collection.

Spermogonia few in a group in the center of brown spots on both sides or only on the adaxil side of the leaves. Aecia on irregular to circular, rufidulous to purplish spots 4-8 mm across, mostly in circular groups, on the abaxial side of leaves; cupulate, peridial cells loosely united, 30-40 x 20-30  $\mu$ m, rectangular to polyhedral, outer facing wall 6-9  $\mu$ m thick, striate, inner facing wall 3  $\mu$ m thick, verrucose; aeciospores 24-35 x 18-25  $\mu$ m, angular-globoid, ovoid or ellipsoid; wall 1-1.5  $\mu$ m thick, minutely verrucose, nearly colorless (P. Sydow & H. Sydow, 1923).

**AECIDIUM STRUTHANTHI** H. S. Jackson & Holway in Jackson, Mycologia 19: 53 1927. TYPE on *Struthanthus marginatus* (Desrousseau) Blume from **Brazil**, Rio de Janeiro: Terezopolis, 30 Sept. 1921, *Holway-1177*. (**?/Icv,??**).

On Loranthaceae.

*Struthanthus marginatus* (Desrousseau) Blume, Rio de Janeiro (Jackson, 1927: 53).

Spermogonia unknown. Aecia in groups on more or less circular hypertrophied areas 3-5 mm across on both sides of leaves but mostly on the abaxial side; peridium cylindrical, rather firm, erose, golden yellow; peridial cells 22-38 x 14-18  $\mu$ m, oblong or narrowly rhomboidal, outer facing wall 4-7  $\mu$ m thick, strongly transversely striate, inner facing wall 1.5-2.5  $\mu$ m thick, finely and closely verrucose-rugose; aeciospores 26-34 x 18-20  $\mu$ m, irregularly globoid or ellipsoid, wall 2.5-3  $\mu$ m thick, very finely and closely verrucose, appearing smooth, pale golden yellow.

See *Aecidium goyazensis* for comparison.

? *Aecidium superficiale* Karsten & Roumeguère, Rev. Mycol. (Toulouse) 23: 78. 1890. TYPE on undetermined host from **Vietnam**, Ououlu (Tonkin), "autumn" 1887-1889, *B. Balansa*.

Rick's exciccata (1911:184 on ? Sterculiaceae: *Melochia* sp. or Tiliaceae *Triumfetta* sp.) that recorded *Aecidium superficiale* in Brazil is without doubt based on a misidentification of the rust

*Aecidium talini* Spegazzini, see **PUCINIA LEPTOCHLOAE** Arthur & Fromme

**AECIDIUM TOURNEFORTIAE** P. Hennings, Hedwigia 34: 338. 1895. TYPE on *Tournefortia* sp. from **Brazil**, Santa Caterina: Blumenau, Nov 1891, *A. Moeller s. n.* (**0/I,??**).

On Boraginaceae:

*Tournefortia glaberima* Salzmann, São Paulo (Hennings, 1902D: 296, *Puttemans-345*).

*Tournefortia paniculata* Chamisso, São Paulo (Viégas, 1945: 77; IBI-2234, IAC-276).



*Tournefortia salicifolia* (Gardner) DeCandolle, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 137).

*Tournefortia* sp., Maranhão (IBI-15626), Minas Gerais (Thurston, 1940, IBI-4632), Paraná (IBI-12152), Rio de Janeiro (IBI-13204), Santa Catarina (Hennings, 1895C: 388), São Paulo (Sydow, 1907: 355; Viégas, 1945: 77, IAC-1367).

*Aecidium tournefortiae* has been reported also from Argentina, Colombia, Venezuela, Central America, and The West Indies. Viégas (1945) was first to report spermogonia for this rust.

Spermogonia on both sides of leaves, in small groups 1-4 mm diam.; aecia on abaxial side of leaves, loosely grouped or in circles on dark-colored spots 0.5-1.5 cm across, cupulate, peridium pale yellow, peridial cells 23-27 x 15-19  $\mu\text{m}$ , rhomboidal, slightly overlapping or abutted, the outer wall 3-5  $\mu\text{m}$  thick, minutely verrucose or transversely striate, the inner wall 2-3  $\mu\text{m}$  thick, closely verrucose, the markings often uniting and becoming rugose; aeciospores 17-24 x 13-19  $\mu\text{m}$ , globoid or ellipsoid, wall evenly 1(-1.5)  $\mu\text{m}$  thick, very closely and finely verrucose (Arthur, 1924).

*Aecidium trichoclinae* P. Hennings, see **UROMYCES TRICHOCLINES** P. Hennings.

*Aecidium triumfettae* P. Hennings, see **PUCINIOSIRA PALLIDULA** (Spegazzini) Lagerheim.

**AECIDIUM TUBIFORME** Dietel & Neger, Bot. Jahrb. Syst. 27: 13. 1899. TYPE on *Berberis buxifolia* Lamarck from **Chile**, specimen not cited. (0/I,??).

On Berberidaceae:

*Berberis* sp., Rio de Janeiro (Dietel, 1899: 258).

*Aecidium tubiforme* has been reported also from Argentina and Chile.

Spermogonia mostly on the adaxial side of leaves, in small groups, reddish yellow at first, becoming almost black. Aecia mostly on the adaxial side of leaves, in small groups of 2-10, also solitary, 0.8-1 mm long, tubiform, whitish; peridial cells firmly united, 30-40 x 23-27  $\mu\text{m}$ , outer facing wall 8-13  $\mu\text{m}$  thick, striate, inner facing wall 3-4  $\mu\text{m}$  thick, verrucose; aeciospores 21-27 x 18-22  $\mu\text{m}$ , subglobose, angular or ellipsoid, wall 1.5-2  $\mu\text{m}$  thick, densely and finely verrucose, nearly colorless. (Sydow, P. & H. Sydow, 1923).

*Aecidium tubulosum* Patouillard & Gaillard, see **PUCINIA SUBSTRIATA** Ellis & Bartholomew.

*Aecidium tucumanense* Spegazzini, see **PUCINIA GIBERTII** Spegazzini.

*Aecidium tweedianum* Spegazzini, see **UROMYCES INDURATUS** H. Sydow & P. Sydow & Holway.

*Aecidium uleanum* Pazschke, see **PUCINIA SUBSTRIATA** Ellis & Bartholomew var. **SUBSTRIATA**.

**AECIDIUM ULEI** P. Hennings, Hedwigia 43: 167. 1904. TYPE on *Diospyros* sp. from **Brazil**, Rio Jurua, Marari, and Santa Clara, Sept and Oct. 1900, *Ule*-2689, 3081, and 3071 (a lectotype needs to be chosen). (0/I,??).

On Ebenaceae.

*Diospyros* sp., Amazonas (Hennings, 1904B: 167).

*Aecidium ulei* has been reported with certainty only from Brazil. A report from Ethiopia seems to be a missidentification.

Spermogonia on adaxial side of leaves, numerous in groups, very black. Aecia scattered in circular or irregular groups on brownish or darker spots 0.5-2 cm across on abaxial side of leaves; short cylindrical, surrounded by the blackened epidermis; peridial cells 25-32 x 17-20  $\mu\text{m}$ , 4-6 angled, firmly united, overlapping, upper part densely verrucose; aeciospores 18-25 x 14-18  $\mu\text{m}$ , irregular, angular-globose, ellipsoid or oblong; wall evenly 1  $\mu\text{m}$  thick, minutely verrucose, nearly colorless (P. Sydow & H. Sydow, 1923).

See *Aecidium calosporum* for comparisons of *Aecidium* species on *Diospyros*.

*Aecidium uredinoidis* P. Hennings, see **AECIDIUM GUATTERIAE** Dietel.

**AECIDIUM USTERIANUM** Spegazzini, Revista Mus. La Plata 15: 10. 1908. TYPE on undetermined genus of ? Menispermaceae from **Brazil**, São Paulo: São Paulo, São Paulo Botanical Garden, *Usterianum*. (?/Icv,?!/?).

*Aecidium usterianum* has been reported only from the type. New collections are required to determine the nature of this species.

Spermogonia unknown. Aecia usually on pale indeterminate spots on the abaxial side of leaves, cupulate-cylindrical, whitish; peridial cells 25-35 x 20-30 µm, ovoid to rhomboid, walls very thick, densely verrucose with large verrucae; spores 20-40 µm in diameter, globoid to angular-globoid, wall thin, smooth, colorless (P. Sydow & H. Sydow, 1923).

The Sydows (1923) modified the original description reporting that the spore walls were smooth. This is probably a mistake!

*Aecidium verbenae* Spegazzini, see *Aecidium spegazzinianum* Saccardo & Trotter (**PUCCINIA VERBENIPHILA** Lindquist).

*Aecidium verbenicola* Spegazzini, see *Aecidium spegazzinianum* Saccardo & Trotter (**PUCCINIA VERBENIPHILA** Lindquist).

*Aecidium verbeniphilum* Spegazzini, see *Aecidium spegazzinianum* Saccardo & Trotter (**PUCCINIA VERBENIPHILA** Lindquist).

**AECIDIUM VERNONIAE** P. Hennings, Hedwigia 35: 262. 1896. TYPE on *Vernonia* sp., from **Brazil**, Rio de Janeiro: Corcovado, July 1887, *Ule*-655. (?/Icv,?!/?).  
= *Aecidium pusillum* Dietel, Hedwigia 36: 34. 1897. TYPE on *Vernonia* sp. (reported originally as an unidentified Monimiaceae) from **Brazil**, Rio de Janeiro, Nov 1891, *Ule*-1821. Host identification corrected by the Sydows (1923).

On Compositae:

*Vernonia* sp., Rio de Janeiro (Hennings, 1896: 262; Dietel, 1897: 34; Dietel, 1899: 258).

*Aecidium vernoniae* has been reported only from Brazil. See *Aecidium santenense* Lindquist for a comparison with that species.

Spermogonia, uredinia, and telia unknown. Aecia in irregular groups on adaxial, or rarely single on abaxial, side of leaves, in center of brownish, indeterminate spots 4-8 mm across, sometimes in rows along veins, cupulate to short cylindrical; peridial cells 42-70 x 18-24 µm; spores 24-38 x 18-28 µm, ovoid to ellipsoid, wall 1.5-2 µm thick, densely verrucose with large verrucae, nearly colorless (Sydow, P. & H. Sydow, 1923).

*Aecidium vernoniae-mollis* Mayor, see **COLEOSPORIUM VERNONIAE** Berkeley & Curtis.

**AECIDIUM VINNULUM** H. S. Jackson & Holway in Jackson, Mycologia 23: 360. 1931. TYPE on *Byrsonima intermedia* Jusseu from **Brazil**, São Paulo: Guarulhos, 30 Jan 1922, *Holway*-1511. (0/Icv,?!/?).

On Malpighiaceae

*Byrsonima coccolobifolia* Humboldt, Bonpland & Kunth, São Paulo (IBI-13378, -13381).

*Byrsonima intermedia* Jussieu, Minas Gerais (IBI-13668, São Paulo (Jackson, 1931: 360; IBI-13365, -14417, -14708, -14985, -15571).

*Byrsonima fagifolia* Niedenzu, Goiás (IBI-13320, -13331).

*Byrsonima spicata*, Pará (IBI-13250).

*Byrsonima* sp., Maranhão (IBI-s.n.).

*Aecidium vinnulum* has been reported also questionably from Mexico.

Spermogonia in small groups in the center of spots on adaxial side of leaves opposite the aecia, subcuticular or intraepidermal in origin, flattened or broadly conical with ostiolar periphyses. Aecia in groups on discolored spots 8-12 mm across on the abaxial side of leaves; cupulate, small; peridial cells 28-36 x 14-16 µm, rhomboid in side view, considerably overlapping, outer facing wall 5-6 µm thick, smooth, inner facing wall 3-5 µm thick, finely verrucose; aeciospores 20-24 x 16-18 µm, somewhat angular, broadly ellipsoid, wall 1 µm or less thick, finely and inconspicuously verrucose (Jackson, 1931).

Jackson (1931) suggested that *Aecidium vinnulum* might belong to the life cycle of a *Crossopora* species. But our observations of this *Aecidium* species at Horto Florestal of Mogi-Mirim, São Paulo over several years revealed no connections to any other life cycle stage. Because of the presence of spermogonia, these observations suggest that it is an *Endophyllum* but no spore germination has been seen.

*Aecidium wittmackianum* P. Hennings, see **UROMYCES INDURATUS** Sydow & Holway.

**AECIDIUM WULFFIAE** P. Hennings, Hedwigia 43: 166. 1904. TYPE on *Wulffia* sp., Compositae, from **Brazil**, Amazonas: Rio Juruá, Juruá-Miri, Sept. 1901, *Ule-2686*. (?/?!/?/?)

*Aecidium wulffiae* has been reported only from the type. New collections are required to determine the traits of this species.

Spermogonia unknown. Aecia in dense circular or irregular groups on yellowish spots 3-5 mm across on abaxial side of leaves, cupulate; peridium poorly developed, peridial cells not seen, aeciospores 17-24 x 15-19 µm, subglobose to ellipsoid, wall 1 µm thick, ? nearly smooth, nearly colorless (P. Sydow & H. Sydow, 1923). The description requires improvement because only poor material was available to the Sydows (Monogr. Ured. 4: 66. 1923).

*Aecidium xanthoxyli* Peck, Bot. Gaz. (Crawfordsville) 6: 275. 1881. TYPE on *Zanthoxylum americanum* (Rutaceae) from **The United States of America**, Iowa, Decora, date not recorded, *Holway-s. n.* On Rutaceae.

*Zanthoxylum* sp., Brazil, Santa Catarina, Tubarão, Feb 1889, *Ule-1207* (Hennings, 1896: 257).

This record is a misidentification because *Ae. xanthoxyli* Peck has been reported as an aecial anamorph of *Puccinia andropogonis* Schweinitz and only in The United States of America (Arthur, 1934, p.122). Cummins (1971) considers *Ae. xanthoxyli* Peck as a synonym of *Aecidium pentastemonis* Schweinitz, an aecial stage of *Puccinia andropogonis* Schweinitz. Perhaps this collection is *Aecidium rickii*.

**AECIDIUM XANTHOXYLINUM** Spegazzini, Revista Argentina Hist. Nat. 1: 400. TYPE on *Zanthoxylum* sp. from **Paraguay**, Paraguari, Oct 1881, *Balansa-3565*. (?/I,?!/?)

On Rutaceae:

*Dictyoloma peruviana* Planchon, Minas Gerais (Thurston, 1940: 292).

*Zanthoxylum* sp. (previously spelled *Xanthoxylum*), Minas Gerais (Thurston, 1940: 292;76-576); Rio de Janeiro (Dietel, 1899: 257; Jackson, 1931: 364). São Paulo (IBI-13858).

*Aecidium xanthoxylinum* has been reported only from Paraguay and Brazil.

Spermogonia unknown. Aecia densely grouped in concentric circles on reddish spots 5-6 mm across on abaxial or on both sides of leaves, peridial cells 25-30 x 20-25 µm, rhomboidal, aeciospores 16-18 µm in diameter, globose, often angular, wall ?smooth, colorless (P. Sydow & H. Sydow, 1924).

The spores of *Aecidium xanthoxylinum* lack the apically thick spore wall and are much smaller than those of *Aecidium rickii*, the only other species of *Aecidium* that has been reported on *Zanthoxylum* in Latin America. We doubt that the spore walls of *Aecidium xanthoxylinum* are truly smooth. Lindquist (1982) reported that he found no specimens of this species in the Spegazzini herbarium in La Plata.

See *Aecidium rickii* for comments on other species of *Aecidium* on *Zanthoxylum*.

**AECIDIUM XYLOPIAE** P. Hennings, Hedwigia 34: 100. 1895. TYPE on *Xylopi* sp. from **Brazil**, Goiás: Catalão, July 1892, *Ule-1921*. (0/Icv,?!/?)

On Annonaceae.

*Xylopi aromatica* (Lamarck) Martius, Goiás (IBI-16671), São Paulo (IBI-12600).

*Xylopi grandiflora* Saint-Hilaire, São Paulo (Sydow, 1907: 355).

*Xylopi* sp., Goiás (Hennings, 1895: 100, IBI-16671), Maranhão (IBI-13297), Mato Grosso (IBI-16758), Minas Gerais (IBI-12658), São Paulo (IBI-12619), Tocantins (IBI-13297), São Paulo (IBI-16889).

In the Western Hemisphere *Aecidium xylopi* has been reported only from Brazil.. Infections become locally systemic and produce large witches' brooms. Vionnot-Bourgin (1953) reported this species

from the Ivory Coast in Africa but he did not report the characteristic witches' brooms nor the bands of verrucae or refractive granules on the walls of the aeciospores in those collections.

Sori on large witches' brooms up to 75 cm long, the infected leaves greatly reduced and thickened, discolored, and distorted; spermogonia on the adaxial side of leaves, numerous, evenly and densely distributed over the surface of the leaves; aecia on the abaxial side of leaves, densely and evenly covering the whole surface of the leaves, cupulate; peridial cells 22-28 x 17-20  $\mu\text{m}$ , ellipsoid to regularly pentagonal, firmly united, arranged in almost regular series, outer wall 4-6  $\mu\text{m}$  thick, irregularly striately, and minutely verrucose, inner wall 2-2.5  $\mu\text{m}$  thick, minutely verruculose; aeciospores 15-19 x 13-16  $\mu\text{m}$ , globose, angular globose or broadly ellipsoid, wall 1  $\mu\text{m}$  thick, subcolorless, irregularly densely and minutely verruculose in sinuous narrow, irregular bands, the bands with several large refractive granules, wall smooth in areas between the bands (P. Sydow & H. Sydow, 1923; and our own observations).

The peridial cells and spores of *Aecidium xylopiæ* are very similar to those of *Aecidium guatteriae* but somewhat smaller.

**AECIURE** Buriticá & Hennen (anamorph),

Rev. Acad. Colomb. Cienc. 19: 49. 1994. TYPE SPECIES, *Aeciure crotonis* (P. Hennings) Buriticá & Hennen. Rev. Acad. Colombiana Cienc. 19: 49. 1994 ( $\equiv$  *Uredo crotonis* P. Hennings, Hedwigia 34: 99. 1895. TYPE on *Croton* sp. from **Brazil**, Minas Gerais, Uberaba, June 1892, *Ule-1922*).

Sori lack peridia, spores in vertical rows, with evanescent intercalary cells near the base of the sorus, spores with echinulate walls.

The echinulate spore walls differentiate *Aeciure* from *Caeoma*.

**AECIURE CROTONIS** (P. Hennings) Buriticá & Hennen, see **ARTHURIA CATENULATA** H. S. Jackson & Holway.

**ALLODUS** (Berkeley & Curtis) Arthur,

Result. Sci. Congr. Bot. Vienne p. 345. 1906. See Laundon (1965A) for details about the type species.

Orton (1916) and Arthur (1921) used this genus for nearly 50 species that were formerly placed in *Puccinia*.. Arthur (1906) proposed that *Allodus* be based on a confusing mixture of variations in the morphological and ontogenic concepts of life cycles. In ontogenic terminology the species are long cycled and autoecous, both the uredinia and aecia, when known, have the morphology of the anamorph genus *Aecidium*. Aecia can be identified in herbarium specimens only if spermogonia are present. In morphologic terminology the species have no uredinia. Teliospores are two-celled like *Puccinia*. *Uromycopsis* is exactly parallel to *Allodus* except its teliospores are one-celled as in *Uromyces*. Later, Arthur abandoned the use of *Allodus* and *Uromycopsis*. Most of the species of *Allodus* are now placed in *Puccinia* and those of *Uromycopsis* in *Uromyces*.

*Allodus crassipes* (Berkeley & Curtis) Arthur, see **PUCCINIA CRASSIPES** Berkeley & Curtis.

*Allodus graminella* (Spegazzini) Arthur, see **PUCCINIA GRAMINELLA** Dietel & Holway.

**Alveolaria** Lagerheim,

Ber. Dtsch. Bot. Ges. 9: 346-347. 1891 (issued 1892). TYPE SPECIES *Alveolaria cordiae* Lagerheim on *Cordia* sp., Boraginaceae, from **Ecuador**.

The genus *Alveolaria* includes only two species that occur on Boraginaceae in the Andes Mountain area of South America.

*Alveolaria duguetiae* Viégas, see **DIETELIA DUGUETIAE** (Thurston) Buriticá & Hennen.

**Angiopsora** Mains,

Mycologia 26: 126. 1934. TYPE SPECIES, *Angiopsora lenticularis* Mains on *Lasciacis ruscifolia* (Gramineae) from Ecuador. A synonym of *Phakopsora*, Phakopsoraceae.

*Angiopsora cameliae* (Mayor) Mains, see **PHAKOPSORA CAMELIAE** (Arthur) Buriticá.

*Angiopsora compressa* (Arthur & Holway) Mains, see **PHAKOPSORA COMPRESSA** (Arthur & Holway) Buriticá & Hennen.

*Angiopsora divina* (H. Sydow) Mains, see **KWEILINGIA DIVINA** (H. Sydow) Buriticá.

*Angiopsora phakopsoroides* (Arthur & Mains) Mains, see **PHAKOPSORA PHAKOPSOROIDES** (Arthur & Mains) Buriticá & Hennen

#### **ANTHOMYCES** Dietel,

Hedwigia 38: 253. 1899. TYPE SPECIES, *Anthomyces brasiliensis* Dietel on Leguminosae from Brazil. See below.

*Anthomyces* has been reported only from the type species and the type collection listed below. The genus seems to be close to *Dicheirinia* and is placed in the Raveneliaceae.

*Anthomyces* and most genera in the Raveneliaceae have teliospores with sterile intercalary cells. These are usually thin-walled and in some species difficult to observe. They are most highly developed in the genus *Kernkampella* which is specialized on several genera of the Euphorbiaceae and is most diverse in India. Only one species, *K. appendiculata* on *Phyllanthus* sp., occurs in the Western Hemisphere but it has not yet been found in Brazil. *Kernkampella* is included in *Ravenelia* by some authors.

**ANTHOMYCES BRASILIENSIS** Dietel, Hedwigia 38: 253. 1899. TYPE on Leguminosae not identified, from **Brazil**, Rio de Janeiro, Nov 1896, *Ule-2284*. (?!?,II/III).

*Anthomyces brasiliensis* has been reported only from the type.

The teliospores of this species have unihyphal pedicels. Each pedicel has three to several distal, obvious, intercalary cells united to each other laterally. Each intercalary cell subtends a narrowly ellipsoid probasidial cell, these also united to each other laterally. The thin walls of the probasidial cells are lightly pigmented, smooth, and each probably germinates without dormancy to produce a well differentiated metabasidium.

#### **APLOPSORA** Mains,

Amer. J. Bot. 8: 442. 1921. TYPE SPECIES, *Aplopsora nyssae* Mains Amer. J. Bot. 8: 442. 1921. On *Nyssa aquatica* Linnaeus, Nyssaceae, from the **United States of America**, Mississippi: Jackson, 12 Nov 1888, *S. M. Tracy-1200*. Chaconiaceae (Cummins, G. B. and Y. Hiratsuka, 2003).

Spermogonia and aecia unknown. Uredinia subepidermal in origin, slightly or strongly erumpent. Telia subepidermal in origin, exposed, composed of one layer, of colorless, thin-walled, sessile probasidial cells, or sometimes in the central part of a sorus vertical rows of two or three cells; probasidia germinate without dormancy to produce differentiated metabasidia.

In addition to the type, two other species are known in North America: *A. dicentrae* (Mains & Anderson) Buriticá & Hennen ( $\equiv$  *Cerotelium dicentrae* Mains & Anderson), a heteroecious species that produces spermogonia and telia on *Dicentra* spp., Fumariaceae, and uredinia and telia on *Laportea* sp., Urticaceae, and *Aplopsora tanakae* (Ito) Buriticá & Hennen on *Amphicarpa* sp., Leguminosae, reported also from Japan. *Aplopsora lonicerae* Tranzschel is reported from Far East, Russia, and Manchuria.

**APLOPSORA HENNENII** J. Dianese & L. T. P. Santos, Mycol. Res. 99: 915. 1995. TYPE on *Qualea multiflora* from Brazil, Minas Gerais. (?!?,IIpe/III).

= *Aplopsora qualeae* Buriticá & Hennen, Rev. Acad. Colombia Cienc. 22: 332. 1998. TYPE on *Qualea* sp. from Brazil, São Paulo: Mogi-mirim, Horto Florestal, 16 Sept 1976, *J. F. Hennen & M. B. Figueiredo-76-390*.

Anamorph

*Macabuna qualeae* Buriticá & Hennen, Rev. Acad. Colombia Cienc. 22: 332. 1998. TYPE on *Qualea* sp. from **Brazil**, São Paulo: Mogi-mirim, Horto Florestal, 16 Sept 1976, *J. F. Hennen & M. B. Figueiredo-76-390*.

On Vochysiaceae

*Qualea* sp., Federal District, Goiás, Minas Gerais, São Paulo (Buriticá, 1998: 332).

*Aplopsora hennenii* has been reported only from Brazil.

Spermogonia and aecia unknown, Uredinia on the abaxial side of leaves, often scattered over large areas, or single or in groups of 2-5, dark cinnamon brown, subepidermal in origin, erumpent, powdery, paraphyses peripheral, numerous, 25-35 x 6-9 µm, incurved, wall thickened on outer facing side and apically 3-6 µm, smooth, yellowish; urediniospores pedicellate, 18-22 x 11-15 µm, reniform to ellipsoid, wall 0.5-1 µm thick, echinulate on the convex side, with a smooth area on the concave side, cinnamon-brown; germ pores obscure, probably 2 subequatorial on the smooth side. Telia on the abaxial side of the leaves around the uredinia, subepidermal in origin, later exposed, waxy, colorless to yellowish, spores sessile, 14-22 x 6-10 µm, ellipsoid, in one layer, central spores with 1 or 2 cells in a row, wall very thin, colorless, often allready germinated (Buriticá, P and J. Hennen, 1998).

*Aplopsora hennenii* can be identified by the brown, powdery, anamorph sori that are surrounded by numerous incurved paraphyses that usually have thickened outer walls, pedicellate urediniospores that are reniform, with evenly echinulate walls except for a smooth area on the concave surface, and probably two subequatorial pores that are often obscure.

This is the only rust species reported on the Vochysiaceae.

*Aplopsora qualeae* Buriticá & Hennen, see **APLOPSORA HENNENII** Dianese et al.

#### **APRA** Hennen and Freire,

*Mycologia* 71: 1054. 1979. TYPE SPECIES, *Apra bispora* Hennen and Freire on *Mimosa micrantha* Bentham from Brazil. Only the type species has been reported. Raveneliaceae.

The teliospores of the genus *Apra* have unihyphal pedicels. Each pedicel has two distal intercalary cells united to each other laterally. Each intercalary cell subtends one probasidial cell. The two probasidial cells are not united to each other. The walls of the probasidial cells are pigmented and each has a germ pore toward its base near the intercalary cell. Metasidia have not been seen but they are doubtless well differentiated from the probasidial cell when it germinates. The aecia and uredinia are morphologically identical and belong to the anamorph genus *Aecidium*. The aecia can be identified as such only when spermogonia are intimately associated with the sori.

**APRA BISPORA** Hennen & F. O. Freire, *Mycologia* 71: 1054. 1979. TYPE on *Mimosa micrantha* Bentham from **Brazil**, Pará: 23 km W of Altamira on transamazon highway to Itaituba, 25 Oct 1977, Freire & Cardoso s.n. (**O/Icv,IIcv/III**).

On Leguminosae:

*Mimosa micrantha* Bentham, Pará (Hennen & Freire, 1979: 1054).

*Mimosa guilandinae*. var. *duckei* (Huber) Barnaby, Amapá (Sotão, 1994).

*Mimosa rufescens* Bentham, Pará (Hennen & Freire, 1979).

*Mimosa guilandinae* var. *spruceana* Bentham, Pará (IBI-16023).

*Mimosa* sp., Amapá (Sotão, 1994), Amazonas (IBI-17348), Pará (*Sotão et al.* 97-343).

*Apra bispora* has been reported also from Bolivia and Colombia. The hosts are weedy, densely and sharply spiny, scandent shrubs, abundant in local places along road cuts through the rainforest.

Spermogonia on the adaxial side of leaves, subcuticular, type 7. Aecia on the abaxial side of leaves, grouped in somewhat swollen spots, deeply seated, the peridium erumpent, aeciospores catenulate, 21-26 x 20-23 µm, more or less globoid, wall 1 µm thick except 2-5 µm thick apically, finely verrucose with intermixed larger granules except at the apex and base which with a smooth area, colorless, pores often obscure, (4-)6 in the equatorial zone. Uredinia when produced probably like the aecia but unaccompanied by spermogonia. Telia on the adaxial side of leaves in small groups, often concentric, subepidermal in origin becoming erumpent, blackish-brown, teliospores composed of two free probasidial cells, each with a proximal intercalary cell, both intercalary cells are attached to a single hyphal pedicel. Probasidial cells (32-)34-40(-43) x 17-19 µm thick laterally, 4-5.5(-6) µm thick apically, clear chestnut-brown, obscurely verrucose, germ pore 1, basal, just below attachment to intercalary cell, pedicel colorless, thin-walled usually breaking before the apical cells.

A few collections have only *Aecidium* sp. sori but without spermogonia or telia. These are probably uredinia. The sori are morphologically identical to the aecia of the other *Apra* collections that have spermogonia and telia. Without experimental inoculations with basidiospores that would provide evidence

that aecia may develop without spermogonia, or without spore germination evidence that the spores might be teliospores of *Endophyllum sp.*, it is impossible to be certain that they are uredinia.

***Argomycetella* H. Sydow,**

Ann. Mycol. 23: 313. 1925. TYPE SPECIES *Argomycetella pura* H. Sydow.

The genus *Argomycetella* is no longer in use and is regarded as a synonym of *Uromyces*.

*Argomycetella dolichosporus* (Dietel & Holway) H. Sydow, see **UROMYCES DOLICHOSPORUS**  
Dietel & Holway.

*Argomycetella pura* H. Sydow, see **UROMYCES PURUS** (H. Sydow) Cummins.

***Argotelium* Arthur,**

Result. Sci. Congr. internat. Bot., Vienne. 1905: 343. 1906. TYPE SPECIES *Argotelium hyptidis* (Tracy & Earle) Arthur (≡ *Uredo hyptidis* Curtis), this designated by Laundon (1975).

The genus *Argotelium* is no longer in use and is regarded as a synonym of *Puccinia*.

*Argotelium hyptidis* (Tracy & Earle) Arthur, see **PUCGINIA GIBERTII**.

**ARTHURIA H. S. Jackson,**

Mycologia 23: 463. 1931. TYPE SPECIES, *Arthuria catenulata* H. S. Jackson & Holway on *Croton* sp. (Euphorbiaceae) from Brazil. Phakopsoraceae. See below.

All sori without peridia or paraphyses. Aecia and uredinia essentially alike, powdery; aecio- and urediniospores borne in vertical rows, intercalary cells evident but evanescent, walls echinulate. Telia somewhat waxy, teliospores one-celled, borne in short vertical rows of two to five, walls thin, colorless, smooth. Germination without dormancy, metabasidia well differentiated.

Besides the two species listed below, *Arthuria micra* Buriticá & Hennen was reported from Mexico, and *Arthuria columbiana* (Kern) Cummins from Trinidad, Venezuela, Colombia, and Ecuador (Buriticá, 1998). All species of *Arthuria* from the neotropics parasitize *Croton* spp., Euphorbiaceae. Four other species are known from tropical Asia, three on *Glochidion* sp., Euphorbiaceae, and one on Asclepiadaceae.

Buriticá (1994) established the anamorph genus *Aeciure* for sori with morphology similar to those anamorphs of *Arthuria* species on *Croton*. It differs from *Caecoma* because the spores are echinulate, not verrucose.

**ARTHURIA CATENULATA** H. S. Jackson & Holway in Jackson, Mycologia 23: 464. 1931. TYPE on *Croton* sp. from **Brazil**, Rio de Janeiro: Paineiras, 17 Aug. 1921, *Holway-1046*. (**O/Ice,IIce/III**).  
Anamorph

***Aeciure crotonis*** (P. Hennings) Buriticá & Hennen, Rev. Acad. Colombiana Cienc. 19: 49. 1994.

≡ *Uredo crotonis* P. Hennings, Hedwigia 34: 99. 1895. TYPE on *Croton* sp. from

**Brazil**, Minas Gerais, Uberaba, June 1892, *Ule-1922*. This name is for both aecia and uredinia.

On Euphorbiaceae.

***Croton celtidifolius*** Baillon, Rio de Janeiro, (IBI-1646), São Paulo (Jackson, 1931: 464).

***Croton*** sp., Goiás, Minas Gerais (IBI-15881), Rio de Janeiro, São Paulo (Hennings, 1895: 99; Buriticá, 1998: 327; IBI-13759).

*Arthuria catenulata* has been reported only from Brazil.

Spermogonia chiefly epiphyllous, sometimes amphigenous, subcuticular, conspicuous, gregarious in small groups of three to eight, punctiform, flattened -hemisphaeric or occasionally conic, often confluent, 38-50 µm high by 75-100 µm broad. Aecia chiefly hypophyllous, occasionally amphigenous, rounded or irregular, 0.3-0.8 mm. across, occurring singly opposite the spermogonia or in groups, and then often confluent and circinating about the spermogonia, early naked, pulverulent, golden or light cinnamon brown, ruptured epidermis conspicuous; without peridia or paraphyses, aeciospores in vertical rows, obovate or ellipsoid, 26-38 x 18-25 µm; wall colorless, 2-3 µm thick, sparsely and prominently echinulate, the pores obscure, perhaps 4, equatorial. Uredinia hypophyllous, like the aecia in appearance and structure, scattered or gregarious, often with a large central sorus surrounded by an encircling group of smaller sori; urediniospores

like the aeciospores. Telia hypophyllous, scattered or gregarious, often with a large central sorus 0.6-1 mm. in diameter, surrounded by an encircling group of smaller sori, possibly developing in old uredinia, waxy or semi-waxy, at first golden-brown, becoming whitish on germination; teliospores in vertical rows, rows composed of 3-8 spores, slightly constricted at the septa, teliospores somewhat barrel shaped, 20-25 by 25-35  $\mu\text{m}$ , adhering, germinating at once and in succession from apex to base of row; wall thin, 1-1.5  $\mu\text{m}$ , colorless, smooth; metabasidium stout, composed of four cells, basidiospores oblong, 18 -20 x 11-13  $\mu\text{m}$  (Jackson, 1931).

There is no essential morphological difference between the aecia and uredinia or between the spores of the two stages. Both belong to the anamorph genus *Aeciure*.

**ARTHURIA DEMICYCLA.** Buriticá & Hennen in Buriticá, Rev. Acad. Colombiana Cienc. 22: 327. 1998. TYPE on *Croton* sp., Euphorbiaceae, from **Brazil**, São Paulo: Campos do Jordão, 5 Nov 1976, J. F. & M.M. Hennen-76-561. (0/Ice,-/IIIcs).

Anamorph

*Aeciure demicycla* Buriticá & Hennen in Buriticá, Rev. Acad. Colombiana Cienc. 22: 327. 1998. TYPE same as for the teleomorph. This anamorph functions as aecia. *Arthuria demicycla*, reported only from the type, is characterized by its lack of uredinia.

**BATISTOPSORA** Dianese, Medeiros & Santos, Fitopatol. Brazil. 18(3): 437. 1993. TYPE SPECIES, *B. crucis-filii*, listed below.

Spermogonia subepidermal in origin [Group VI(type5), Cummins & Hiratsuka, 2003]. Aecia immature, not described. Anamorph sori with long peripheral, palisade-like paraphyses, these adherent or united laterally to form a cylinder, within which the spores accumulate and emerge. Telia waxy to brown crustose in appearance, composed of several layers of thin-walled loosely or non adherent, single celled teliospores that are arranged in vertical rows, walls thin, not or lightly pigmented.

The cylindrical palisade of paraphyses around the uredinia help to identify the genus, and is the basic trait for recognizing the anamorph genus *Uredostilbe*.

Dianese et al. (1993) found spermogonia that they identified as type 5 [Group VI(type5), Cummins & Hiratsuka, 2003] and aecia too immature to describe. They placed the genus in the Phakopsoraceae, very close to *Phakopsora*.

In addition to *Batistopsora crucis-filii* listed below, one other species has been reported, *Batistopsora pistila* Buriticá & Hennen on *Annona nolosericca* from Honduras and Panama (Buriticá, 1999).

**BATISTOPSORA CRUCIS-FILII** Dianese, Medeiros & Santos, Fitopatol. Brasil 18(3): 7. 1993. TYPE on *Annona tomentosa* Fries from **Brazil**, Minas Gerais: Paracatú, 6 June 1993, J. C. Dianese. (0/I?,IIse/III).

Anamorph

*Uredostilbe crucis-filii* Buriticá, Rev. Acad. Colombia. Cienc. 23(87): 272. 1999. TYPE same as for *Batistopsora crucis-filii* Dianese et al.

On Annonaceae

*Annona aff. crassifolia* Martius, Minas Gerais (Buriticá, 1999: 273).

*Annona glaucophylla* Fries, Goiás (Buriticá, 1999: 273).

*Annona tomentosa* Fries, Minas Gerais, (Dianese et al., 1993:437).

*Annona* sp., Goiás (IBI-16682), Mato Grosso (IBI-16704), Mato Grosso do Sul (IBI-14330), Minas Gerais (IBI-15962), São Paulo (IBI-16893)(Buriticá, 1999: 273).

*Batistopsora crucis-filii* has been reported only from Brazil.

Spermogonia subepidermal in origin, 100-150  $\mu\text{m}$  wide, 75-115  $\mu\text{m}$  high in center [Group VI(type5), Cummins & Hiratsuka, 2003]. Aecia immature, not described. Uredinia on abaxial side of leaves, subepidermal in origin, whitish to pale yellowish, paraphyses peripheral, (40-)75-80 x 7-12  $\mu\text{m}$ , flat-cylindrical, tips rounded, somewhat capitate, walls pale yellowish, coherent laterally to form a cylindrical palisade-like enclosure; urediniospores sessile, (17-)20-24(-26) x (12-)16-18  $\mu\text{m}$ , ellipsoid to globoid, truncate at base, wall uniformly 1  $\mu\text{m}$  thick, finely, densely echinulate, pale yellowish, germ pores obscure. Telia subepidermal in origin, around the uredinia or scattered singly on the abaxial side of leaves, 140-160  $\mu\text{m}$  wide x 70-80  $\mu\text{m}$  high, lenticular, waxy, yellowish; teliospores (8-12) 14-18 x (5-)8-10  $\mu\text{m}$ , cubical to



short cylindric, in vertical rows of 3-4(-5) spores, wall uniformly 1-2  $\mu\text{m}$  thick, nearly colorless (Dianese et al., 1993; Buriticá, 1999).

***Bitzea* Mains,**

Mycologia 31: 38. 1939. TYPE SPECIES *Maravalia ingae* H. Sydow Mycologia 17: 257. 1925.

*Bitzea* is a synonym of *Chaconia* (Cummins & Hiratsuka, 1983).

*Bitzea ingae* (Sydow) Mains, see **CHACONIA INGAE** (H. Sydow) Cummins.

**BOTRYORHIZA** H. H. Whetzel & E. W. Olive in Olive & Whetzel,

Amer. J. Bot. 4: 47. 1917. TYPE SPECIES, *Botryorhiza hippocrateae* Whetzel & Olive, see below. Family uncertain.

*Botryorhiza* is characterized by its tightly packed, yellow-orange telia that are subepidermal in origin, erumpent, with one-celled, pedicellate teliospores that have walls that are colorless and uniformly thin. No germ pore occurs in the teliospores. Metabasidia develop by apical elongation from a distal, nipple-like protrusion of the probasidial cell. The genus is especially characterized by haustoria that are irregularly globoid and lobed or botryose. The botryose haustoria suggest a close relation to *Centrifuga*, that also infects *Hippocratea* sp. and other genera of Celastraceae.

**BOTRYORHIZA HIPPOCRATEAE** Whetzel & Olive in Olive & Whetzel, Am. Jour. Bot. 4: 47. 1917.

TYPE on *Hippocratea volubilis* Linnaeus from **Puerto Rico**, date and location not reported, *Whetzel & Olive-87. (-I-, -III).*

On Hippocrateaceae (included in the family Celastraceae by some authors):

***Hippocratea volubilis*** Linnaeus, São Paulo (IBI-13371).

*Botryorhiza hippocrateae* has been reported also from several Caribbean islands.

Spermatogonia, aecia, and uredinia unknown, but see notes below. Telia mostly on abaxial side of leaves, sometimes on both sides or on stems, usually from a localized mycelium, sometimes from a systemic mycelium on deformed young shoots, subepidermal in origin, erumpent, yellowish when young, without a peridium or paraphyses, teliospores (probasidia) 13-14 x 18-24  $\mu\text{m}$ , ovoid with a rounded apical protuberance, born as single cells at end of pedicel-like hyphae but often from a complex branching system of sporogenous hyphae, wall thin, colorless, metabasidium develops without dormancy by elongation from the apical protuberance (Olive and Whetzel, 1917; our observations).

***Bubakia* J. C. Arthur,**

Result. sci. Congr. internat. Bot. Wien 1905, p. 338, 1906. TYPE SPECIES *Melampospora crotonis* Burrill, Bot. Gaz. (Crawfordsville) (Crawfordsville) 9: 189. 1884, on *Croton* sp. (Euphorbiaceae) from the United States of America.

*Bubakia* is a synonym of *Phakopsora* (Cummins & Hiratsuka, 1983), Phakopsoraceae.

*Bubakia argentinensis* (Spegazzini) H. S. Jackson & Holway, see **PHAKOPSORA ARGENTINENSIS** (Spegazzini) Arthur.

*Bubakia crotonis* (Burrill) Arthur, see **PHAKOPSORA CROTONIS** (Burrill) Arthur.

*Bubakia erythroxylois* Cummins, see **PHAKOPSORA ERYTHROXYLONIS** (Cummins) Kern.

*Bubakia ulei* (Sydow) H. S. Jackson & Holway, see **PHAKOPSORA ULEI** (H. Sydow & P. Sydow) Buriticá & Hennen.

**BULLARIA** DeCandolle,

Fl. Fr. 2: 226. 1805. See Laundon (1965A) for details about the type species.

Arthur proposed that *Bullaria* should be based on a confusing mixture of variations in the morphological and ontogenic concepts of life cycles. In ontogenic terminology the species are long cycled

and autoecous, both the uredinia and aecia when known, have the morphology of anamorph genera with pedicellate spores. In morphologic terminology the species have no aecia. Teliospores are two-celled. Arthur (1922) used this genus for nearly 70 species that were formerly placed in *Puccinia*. Later, Arthur abandoned the use of *Bullaria* and it is not used any more. Most of the species are now placed in *Puccinia*.

***Caeoma*** Link, (anamorph)

Mag. Ges. naturf. Freunde 3: 5. 1809. LECTOTYPE SPECIES has not been chosen. The name must be conserved (Laundon, 198X). An anamorph genus.

The use of *Caeoma* as an anamorph genus name has been confusing because traditionally it was restricted to aecial anamorphs, even though some uredinial anamorphs such as the uredinia of *Coleosporium* fit exactly the morphological concept of *Caeoma*. The genus rarely has been used for rusts from Brazil. It is characterized morphologically by sori that lack a peridium and that have a more or less flattened hymenium that produces catenulate spores. In some species the spores do not remain in columns but become irregularly arranged. In these species the spores are pushed out of the top of the sori and where they appear as a small mass.

*Aeciure* differs from *Caeoma* because *Aeciure* has echinulate spores.

Arthur (1924) reported that *Caeoma* is a "form genus" that he defined as "Species whose life-cycle is not known, or is not readily assumed from related forms...These genera do not represent the whole cycle of development, and are not based upon type species" Later, he abandoned this usage presumably in favor of using *Caeoma* as an anamorph genus in its modern sense.

*Caeoma anthurii* Hariot, see **UREDIO ANTHURII** (Hariot) Saccardo.

*Caeoma eugeniarum* Link, see **PUCINIA PSIDII** Winter.

*Caeoma hydrocotyles* Link, see **PUCINIA HYDROCOTYLES** Cooke.

*Caeoma mbatobiensis* Spegazzini, see **DESMELLA ANEMIAE** H. Sydow & P. Sydow,

*Caeoma negerianum* Dietel, see **PUCINIA HENNINGSII** Dietel.

*Caeoma pavoniae* Dietel, Hedwigia 36: 36. 1897. TYPE on *Pavonia* sp., Malvaceae, from **Brazil**, Rio de Janeiro, Dec 1893, *Ule-2045*. The placement of this species in *Caeoma* is questionable because the spores may be pedicellate, not catenulate.

*Caeoma superficialis* Spegazzini, see **DESMELLA ANEMIAE** H. Sydow & P. Sydow.

? *Caeoma theissenii* (H.) Sydow in Theissen, Ann. Mycol. 8: 452. 1910. *Nomen confusum*.

Reported to be on *Dalechampia* sp., Euphorbiaceae, from Rio Grande do Sul (Theissen, 1910: 452). This specimen is a species of *Coleosporium* fide P. & H. Sydow, 1924: 378 and the host is probably misidentified because no other species of *Coleosporium* has been reported on *Dalechampia*.

*Caeomurus cestri* (Montagne) Kuntze, see **UROMYCES CESTRI** Montagne.

**CALIDION** H. Sydow & P. Sydow

(anamorph of **UNCOL** Buriticá & P. A. Rodriguez),

Ann. Mycol. Berlin 16: 242. 1919. TYPE SPECIES *Uredo lindsaeae* P. Hennings, Hedwigia 43: 165. 1904.

The anamorph genus *Calidion* was established for a rust species that produces sori with well developed peripheral paraphyses and has been reported from a few collections on ferns in Amazonia. It is characterized by its sori that have three well defined zones, two within a substomatal chamber and one suprastomatal zone. Within the substomatal chamber there is a basal pseudoparenchymatous layer about ten cells deep and a middle layer of a palisade of irregularly cylindrical sporogenous cells. Suprastomatically there is an upper zone composed of a circle of numerous, dorsally thick-walled, peripheral paraphyses that enclose the maturing spores that have emerged from the sporogenous cell layer. The sori appear to be on the leaf

surface but they are not truly suprastomatal because the epidermis is partially broken around the sori. Superficially the sori of *Calidion* resemble sori of *Desmella*, but the sori of *Desmella* are truly suprastomatal and they do not have paraphyses.

Two species have been published, *C. lindsaeae* and *C. dumontiae*. Buriticá and Rodriguez (2000) published a connection between *Calidion dumontiae* Buriticá from Colombia and a new teleomorph genus, *Uncol* Buriticá & P. A. Rodriguez. *Uncol* is characterized by its suprastomatal telial sori that are morphologically similar to those of *Calidion*, and teliospores that are catenulate, and develop as sessile, blastic single cells. Buriticá & P. A. Rodriguez emphasize that other genera of rusts in which the telial sori are suprastomatal have pedicellate teliospores.

**CALIDION LINDSAEAE** (P. Hennings) H. Sydow & P. Sydow Ann. Mycol. Berlin 16: 242. 1919.  
(anamorph of **UNCOL** Buriticá & P. A. Rodriguez),

≡ *Uredo lindsaeae* P. Hennings, Hedwigia 43: 165. 1904. TYPE on *Lindsaea ulei* Hieronymus  
(Pteridophyta) from **Brazil**, Amazonas: Rio Juruá, Juruá-Mirim, Aug 1901, *Ule*-2998.

Sori hypophyllous, more or less densely scattered or sometimes in groups, round, 120 - 220 µm across, light to dark cinnamon-brown, surrounded by numerous, conspicuous, compact, pigmented, tubular to tubular-barrel shaped, mostly incurved paraphyses, 35-100 x 10-4 µm, which are free from each other but 2-6 originate from a single, hyaline, thin-walled, stalk-cell 40-60 µm long. Most of the paraphyses develop from the same place on the stalk-cell and spread out finger-like. A septum is between each paraphysis and the stalk-cell. Paraphyses with a very thick out wall, a lumen often not seen. The barrel-shaped paraphyses are thickened only at the apex up to 14 µm. Spores are globoid, ovoid, to ellipsoid, 20-32 x 18-25 µm; wall 1-1.5 µm thick, moderately to thickly echinulate, echinulae stout or fine; without visible germ-pores.

The Sydows (1924) returned this species to *Uredo*, but we recognize it as an anamorphic genus characterized by its elongated paraphyses stalk cells and well-developed, thick-walled paraphyses.

### *Calidion lindsaeae*

Sori hypophyllous, more or less densely scattered or sometimes in groups, round, 120 - 220 µm across, light to dark cinnamon-brown, surrounded by numerous, conspicuous, compact, pigmented, tubular to tubular-barrel shaped, mostly incurved paraphyses, 35 - 100 x 10 -14 µm, which are free from each other but 2 - 6 originate from a single, hyaline, thin-walled, stalk-cell 40 - 60 µm long. Most of the paraphyses develop from the same place on the stalk-cell and spread out finger-like. A septum is between each paraphysis and the stalk-cell. Paraphyses with a very thick out wall, a lumen often not seen. The barrel-shaped paraphyses are thickened only at the apex up to 14 µm. Spores are globoid, ovoid, to ellipsoid, 20 -32 x 18 - 25 µm; wall 1 - 1.5 µm thick, moderately to thickly echinulate, echinulae stout or fine; without visible germ-pores.

The Sydows (1924) returned this species to *Uredo*, but we recognize it as an anamorphic genus characterized by its elongated paraphyses stalk cells and well-developed, thick-walled paraphyses.

*Calyptospora* J. Kuhn,

Hedwigia 8: 81. 1869. TYPE SPECIES, *Calyptospora goeppertianum* Kuhn on *Vaccinium vitis-idaea* (Ericaceae) from Poland.

*Calyptospora goeppertiana* Kuehn, see **PUCCINIASTRUM GOEPPERTIANUM** (Kuehn) Kleban.

### **CATENULOPSORA** B. B. Mundkur,

Ann. Bot., London, N. S. 7: 216. 1943. TYPE SPECIES, *Catenulopsora flacourtiiae* Mundkur & Thirumalachar on *Flacourtia sepiaria* (Flacourtiaceae) from India.

= *Newinia* Thaug, Mycologia 45: 702. 1973. TYPE SPECIES *Newinia heterophragmae* Thaug  
on *Heterophragma sulfurum* Kuntze (Bignoniaceae) from Burma.

Spermogonia type IV where known. Anamorph sori with peripherical paraphyses, spores pedicellate. Telia with teliospores produced in laterally free vertical rows from sporogenous basal cells, these sometimes resembling a pedicel. (Buriticá, 1998)

Cummins and Hiratsuka, 2003, placed *Catenulopsora* as a synonym of *Kuehneola*, but Buriticá and Hennen (1994) and Buriticá (1999) recognized it as a separate genus. In addition to the two species below, Buriticá recorded 9 other species from the Old World Tropics of Africa, India, Burma, Thailand, and The Philippines in an unpublished list.

**CATENULOPSORA HENNENEAE** Buriticá, Rev. Acad. Cienc. 23: 429. 1999. TYPE on *Pouteria* sp., Sapotaceae, from **Brazil**, Minas Gerais: N. of São Gortado, 16 Jun 1988, *J. F. Hennen & Y. Ono-88-243* (??,IIse/III).

Anamorph

***Macabuna henneneae*** Buriticá, Rev. Acad. Cienc. 23: 429. 1999. TYPE on *Pouteria* sp., Sapotaceae, from **Brazil**, Minas Gerais: N. of São Gortado, 16 Jun 1988, *J. F. Hennen & Y. Ono-88-243*.

On Sapotaceae

***Pouteria*** sp., Minas Gerais, São Paulo (Buriticá, 1999: 429).

*Catenulopsora henneneae* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, subepidermal in origin, erumpent, brown, pulverulent, hymenium flat; paraphyses peripheral, 26-40 x 5-9 µm, curved, branched, 1-2 septate, dorsally thickened to 4 µm, wall yellow, paraphyses in hymenium flexuous. Urediniospores 26-32 x 18-24 µm, obovoid, reniform, wall 2-3 µm thick, uniformly and minutely echinulate, yellow brown, germ pore 2-4, scattered. Telia not seen, teliospores in uredinia 12-16 x 14-18 µm, ovoid to cuboid, lobed above, in vertical rows of 5-7 spores; wall, evenly ca 1 µm thick, yellow-brown, smooth; germination without dormancy (Buriticá, 1999: 23).

**CATENULOPSORA PRAELONGA** (Spegazzini) Buriticá, Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales 19: 465. 1995. (??,IIpe/III).

≡ *Rostrupia praelonga* Spegazzini, Contr. Estud. Fl. Sierra Ventana, p. 83, number 387. 1896.

TYPE on *Pavonia polymorpha* A. St. Hilaire, Malvaceae, from **Argentina**, Cordoba, Sierra de Ventana, specific location, date, and collector not reported.

= *Kuehneola malvicola* Arthur, N. Am Flora 7: 187. 1912. TYPE, a Lectotype must be chosen from the specimens with telia that Arthur examined. Arthur (1912) described telia and teliospores but published the name as a transfer from *Uredo*. This is recorded below under anamorph but Cummins & Stevenson (on page 128 of "A check list of North American rust fungi (Uredinales)", U. S. D. A. Plant Disease Reporter, supplement 240; pages 109-193, 1956) treated it as a teleomorph name attributable to Arthur alone but they did not choose a lectotype.

Anamorph

***Macabuna malvicola*** (Spegazzini) Buriticá, Rev. Acad. Colombiana Cienc. 19 (74): 464. 1995.

≡ *Uredo malvicola* Spegazzini, Anal. Soc. Ci. Argentina 17: 124. 1884. TYPE on *Abutilon* sp. from **Paraguay**, Cerro Hu near Paraguari, April 1883, *B. Balansa-3887*.

= *Uredo hibisci* Sydow, Hedwigia Beiblatt 40: (128). 1901. TYPE on *Hibiscus syriacus* L. from **United States of America**, Louisiana: St. Martinsville, date not recorded. *A. B. Langlois* s. n., (Ellis, N. Amer. Fungi, number 2408 as "*Uredo* of *Uromyces syriacus* Cooke").

≡ *Kuehneola malvicola* (Spegazzini) Arthur, N. Amer. Flora 7: 187. 1912. Based on *Uredo malvicola* Spegazzini, an anamorph name but see above under teleomorph synonyms.

≡ *Cerotelium malvicolum* (Spegazzini) Dietel in Englar, Nat. Pfl. Fam. II. 6: 57. 1928. Based on *Uredo malvicola* Spegazzini, an anamorph name.

On Malvaceae.

: ***Hibiscus mutabilis*** Linnaeus, Minas Gerais (Viégas, 1945: 3; IAC-3968), Rio de Janeiro (Viégas, 1945: 3; IAC-3683), São Paulo (*Puttemans-1940, -1972*).

***Hibiscus syriacus*** Linnaeus, Sao Paulo (Viégas. 1945: 3).

***Malvastrum*** sp., Rio de Janeiro (PUR-F18290).

***Malvaviscus*** sp., Rio de Janeiro (Jackson, 1931: 478).

***Pavonia brasiliensis*** Sprengel, Minas Gerais (IBI-13195), São Paulo (IBI-18104).

*Pavonia communis* Saint-Hilaire, Rio de Janeiro (IBI-12827).

*Pavonia hexaphylla* (S. Moore) A. Krapovickas, São Paulo (IBNI-16189).

*Pavonia sepium* Saint-Hilaire, Rio de Janeiro (Jackson, 1931: 478).

*Pavonia speciosa* Humboldt, Bonpland & Kunth, São Paulo (Jackson, 1931: 478; IBI-1648).

*Pavonia spinifex* Cavanilles, Minas Gerais (Thurston, 1940: 293), São Paulo (Jackson, 1931: 478; IBI-12573).

*Pavonia* sp., São Paulo (IBI-12096).

*Catenulopsora praelonga* has been reported also from Argentina, Paraguay, Central America, the Caribbean Islands, some southern states in the United States of America, and the Philippines. It has been reported most frequently by the name *Kuehneola malvicola*.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, often numerous, scattered, subepidermal in origin, blister-like, then erumpent, 0.2-1 mm across, varying in size on different hosts, hymenium flat, remaining below the epidermis, pulverulent, cinnamon-brown; paraphyses peripheral, few, not reaching above the spore mass, 45-60 x 9-13  $\mu\text{m}$  cylindrical, often slightly curved, wall uniformly ca 1  $\mu\text{m}$  or less thin, colorless, smooth; urediniospores 20-28 x 16-22  $\mu\text{m}$ , ellipsoid to broadly obovoid or globlid; wall 1-1.5  $\mu\text{m}$  thick, golden-yellow, finely, closely echinulate, pores 2-3, more or less around or slightly above the equator. Telia on the abaxial side of leaves, few, scattered, pulvinate, dark cinnamon-brown, latter gray-white by germination, teliospores 77-150 x 15-19  $\mu\text{m}$ , cylindrical, rounded above, tapering below, slightly constricted at septa, composed of rows of 6-10 probasidial cells, these 14-22 x 12-18  $\mu\text{m}$ , wall more or less uniformly 1-1.5  $\mu\text{m}$  thick, light golden yellow, germ pore 1 in each cell, near the distal edge of the cell, pedicel not produced (Arthur, 1912, Buriticá, 199).

#### CEROTELIUM J. C. Arthur,

Bull. Torrey Bot. Club 33: 30. 1906. (as "*Cerotelium*") TYPE SPECIES *Cerotelium canavaliae* Arthur on *Canavalia ensiformis* (Leguminosae) from Puerto Rico.

Telia subepidermal in origin, erumpent, hemispherical to lenticular, surrounded by irregular hyphoid tissue; probasidial cells (teliospores) one-celled, produced one after another from hymenium of teliosporogenous cells in a basal layer, teliospores usually not, or only temporarily, adherent in rows, thus mostly irregularly arranged in the upper part of the sorus; usually waxy when young, intercalary cells absent; mature spores in upper part of sorus with thin, unpigmented walls, germinate without dormancy and collapse, thus forming an irregular mass of collapsed pro- and metabasidial cells and basidiospores at the top of the sori.

Anamorphs belong to the genera *Malupa*, *Physopella*, and *Uredendo*. Spermogonia are unknown for all Neotropical species but have been reported to be in group VI, type 7 (Cummins & Hiratsuka, 2003) for at least one Paletropical species. Family Phakopsoraceae (Buriticá, 1999).

At least 10 species of *Cerotelium* have been reported from the Old World, All of the other 10 species of *Cerotelium* reported from the Neotropics, except *Cerotelium canavaliae* on *Canavalia* sp., Leguminosae, from the Antilles, have been reported from Brazil (Buriticá, 1999).

#### Key to help identify species of *Cerotelium* in the Neotropics (modified from Buriticá, 1999)

1. Only telia and teliospores present 2.
1. Anamorphs produced 3.
  2. Telial hymenium flat, teliospores embedded in a gelatinous matrix, on Annonaceae, *Xylopia* *Cerotelium xylopii* Buriticá & Hennen.
  2. Telial hymenium concave, teliospores without a gelatinous matrix, on Onagraceae, *Ludwigia* sp. *Cerotelium mariae* Buriticá & Hennen.
3. Anamorph without peripheral structures (*Uredendo*), on Rubiaceae, *Randia*. *Cerotelium figueiredae* Buriticá & Hennen.
3. Anamorph with peripheral structures (*Milesia* or *Physopella*) 4.
  4. Anamorph in *Milesia* 5.
  4. Anamorph in *Physopella* 6.
5. Telia deeply embedded in the host tissue, hymenium concave, on Leguminosae, *Canavalia*. From Puerto Rico, unknown in Brazil *Cerotelium canavaliae* Arthur.

5. Telia subepidermal, hymenium flat, on Caryocaraceae, *Caryocar*.  
*Cerotelium giacomettii* Dianese et al.
6. Paraphyses in *Physopella* septate 7.  
6. Paraphyses in *Physopella* not septate 8.
7. On Lecythidaceae, *Eschweilera* *Cerotelium nuxae* Buriticá & Hennen.  
7. On Moraceae, *Ficus* *Cerotelium ficicola* Buriticá & Hennen.  
8. Peripheral paraphyses thickened dorsally, on Rubiaceae, *Sabicea*  
*Cerotelium sabiceae* Buriticá & Hennen.  
8. Peripheral paraphyses not thickened dorsally 9.
9. Anamorph (*Physopella*) hymenium concave, telia small, cup-like, on Polygonaceae, *Coccoloba*  
*Cerotelium coccolobae* Buriticá & Hennen.  
9. Anamorph (*Physopella*) hymenium flat, telia evident, erumpent, becoming dark and irregular, on  
Marantaceae *Cerotelium rectangulata* Buriticá & Hennen

*Cerotelium bignoniacearum* Dale, see **PHRAGMIDIELLA BIGNONIACEARUM** (Dale) Buriticá & Hennen.

**CEROTELIUM COCCOLOBAE** Buriticá & Hennen in Buriticá, Rev. Acad. Colombia Cienc. 23: 421. 1999. TYPE on *Coccoloba* sp. from **Brazil**, Mato Grosso do Sul: Coxim, Iate Clube Rioverde, 18 April 1983, *J.F. Hennen, M.M. Hennen & R. Antunes-83-224* (IBI-14376). (?!?, IIse/III).

Anamorph

*Physopella coccolobae* (Hennings) Buriticá & Hennen, Rev. Acad. Colombia Cienc. 23: 421. 1999.

≡ *Uredo coccolobae* Hennings, Hedwigia 35: 253. 1896. TYPE on *Coccoloba populifolia* Weddell from **Brazil**, Rio de Janeiro, Sept 1887, *Ule-728*.

On Polygonaceae.

*Coccoloba populifolia* Weddell, Rio de Janeiro (Hennings, 1896: 253; PUR-F8870).

*Coccoloba* sp., Mato Grosso do Sul (the type cited above), Rio Acre (Sydow, H. & P., 1916, as *Uredo coccolobae*); **Peru**, Seringal, S. Francisco, Rio Acre (Sydow, 1916: 72). *Cerotelium coccolobae* has been reported only from Brazil and Peru.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves. usually in circular groups, yellowish to pale cinnamon-brown, originating deep within host tissue, erumpent, ruptured epidermis noticeable, hymenium concave, paraphyses peripheral and in the hymenium, 26-43 x 6-11 µm, cylindrical, flexuous, wall evenly 1-1.5 µm thick, colorless; urediniospores sessile, 20-24 x 15-18 µm, obovoid to ellipsoid, wall uniformly 1-1.5 µm thick, with numerous, closely placed echinulae, yellowish to pale cinnamon-brown, germ pores obscure, apparently more than 3, scattered. Telia on abaxial side of leaves, in groups in or around the uredinia, cupulate at first, later irregularly 3-lobed, growth determinate, with 3-5 layers of spores, waxy at first, turning whitish by formation of metabasidia and basidiospores; teliospores 17-21 x 14-16 µm, ellipsoid to cylindrical, originating one after the other, cohering in vertical rows in central part of sorus, not cohering in lateral part and becoming irregularly arranged, wall uniformly 1 µm thick, colorless, germinating without dormancy.

The lobed telia aid in identifying this species.

*Malupa uvifera* (Sydow) Buriticá & Hennen (≡ *Uredo uvifera* Sydow), whose teleomorph is unknown, is another anamorph that infects *Coccoloba uvifera* (Linnaeus) Jacquin in the West Indies and Venezuela (reported as *Uredo coccolobae* on *Coccoloba uvifera* by Kern, F. D. et al., 1934: 293).

*Cerotelium desmium* (Berkeley & Broome) Arthur, see **PHAKOPSORA GOSSYPHII** (Lagerheim) N. Hiratsuka f.

*Cerotelium fici* (Cast.) Arthur see **PHAKOPSORA NISHIDANA** Ito.

*Cerotelium fici* (Butler) Arthur

Although Butler published *Kuehneola fici* Butler on *Ficus glomerata* as a new combination, "*Kuehneola fici* (Cast.) Butler", from the basionym *Uredo fici* Cast., he included a description of an anamorph and a teleomorph. Because of the inclusion of a reference to a teleomorph specimen and a teleomorph

description, the name is treated as a new species attributed to Butler alone. We believe this rust, which is known only from India, is properly placed as *Cerotelium fici* (Butler) Arthur but with the concept of *Cerotelium* as defined by Buriticá and Hennen (199x). Neither *Kuehneola fici* Butler nor *Cerotelium fici* (Butler) Arthur apply to the common fig rust, *Phakopsora nishidana* S. Ito, which is widely distributed on cultivated fig, *Ficus carica*. See *Phakopsora nishidana* for other notes.

**CEROTELIUM FICICOLA** Buriticá & Hennen in Buriticá, Rev. Acad. Colomb. 23: 417. 1999. TYPE on *Ficus* sp. from **Trinidad**, North Coast Road, 27 Jan 1952, R. E. D. Baker-2482. (??,IIse/III).  
Anamorph

*Physopella ficicola* (Spegazzini) Buriticá & Hennen in Buriticá, Rev. Acad. Colomb. 23: 417. 1999.

≡ *Uredo ficicola* Spegazzini, An. Soc. Cient. Argentina 17: 120. 1883. TYPE on *Ficus* sp. from **Paraguay**, Cordillera de Peribebuy, July 1883, B. Balansa-3881.

= *Uredo ficina* Juel, Bih. Kongl. Svenska Vet.-Akad. Handl. 23: 25. 1897. TYPE on *Ficus* sp. from **Paraguay**: San Antonio, July 1893, Lindman-80.

≡ *Physopella ficina* (Juel) Arthur, N. Am. Fl. 7: 103. 1907.

= *Uredo fici* var. *guarapaensis* Spegazzini, An. Soc. Cient. Argentina 17(3): 120. 1884. TYPE on *Ficus ibapohy* Martius from **Paraguay**, near Guarapi, May 1881, Balansa-4122.

On Moraceae

*Ficus ibapohy* Martius, São Paulo (Jackson, 1927: 52; Briticá, 1999: 418; IBI-1647).

*Cerotelium ficicola* has been reported also from Paraguay, Ecuador, The West Indies, and Central America.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves, scattered, cinnamon-brown, subepidermal in origin, ruptured epidermis noticeable; paraphyses peripheral, 35-39 x 7-10 µm, curved, septate, wall thickened on the concave side to 4 µm, yellow, urediniospores sessile, 24-30 x 18-23 µm, ellipsoid to globoid, wall uniformly 1-1.5 µm thick, with sharp, prominent echinulae, pale yellow, germ pores 3-5, scattered. Telia on the abaxial side of leaves, scattered, subepidermal in origin, hemispherical, with 4-6 layers of spores irregularly arranged, waxy at first, later whitish by germination; teliospores 24-31 x 11-15 µm, irregular in shape, from cuboid to ellipsoid, wall uniformly less than 1 µm thick, colorless, germinating without dormancy (Buriticá, 1999: 417).

The globoid urediniospores with cinnamon-brown, prominently echinulate walls with sharp pointed spines and evident 3-5 scattered germ pores, aid in identification of this species.

Using the name *Uredo ficina* Juel, Laundon (1971) reported the anamorph of this species on seven species of *Ficus* and from Brazil, Paraguay, Trinidad, Guatemala, and Puerto Rico. His reports from Florida and Michigan in The United States of America are mistakes. This rust does not occur on the commonly cultivated edible fig, *Ficus carica*.

**CEROTELIUM FIGUEIREDEAE** Buriticá & Hennen in Buriticá, Rev. Acad. Colombia Cienc. 23: 419. 1999. TYPE on *Randia* sp. from **Brazil**, São Paulo: near Conchal, Fazenda Campinha, 27 June 1988, J. F. Hennen, R. M. Lopez-Franco & A. A. de Carvalho, Jr.-88-355. (??,II/III).

Anamorph

*Uredendo figueiredeae* Buriticá & Hennen in Buriticá, Rev. Acad. Colombia Cienc. 23: 419. 1999. TYPE same as for the teleomorph.

On Rubiaceae

*Randia* sp., São Paulo (Buriticá, 1999: 419, IBI-16466).

*Cerotelium figueiredeae* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, but mostly on the adaxial side, scattered, whitish to yellowish, subepidermal in origin, erumpent, hymenium flat, growth indeterminate; paraphyses 21-35 x 9-11 µm, intrasoral, wall uniformly 1-2 µm thick, colorless; urediniospores sessile, 20-24(-29) x 16-19 µm, obovoid to ellipsoid; wall uniformly about 1 µm thick, yellowish to pale cinnamon-brown, echinulate, spines prominent and abundant, germ pores obscure. Telia on the abaxial side of leaves, around or in the uredinia, waxy, hemispherical, cinnamon-brown, becoming whitish by germination, hymenium flat, growth indeterminate, teliospores 17-23 x 11-13 µm, irregularly arranged, 2-4 spores deep; wall 1 µm thick, colorless, germination without dormancy.

**CEROTELIUM GIACOMETTII** J. C. Dianese, Santos, & Medeiros in J. C. Dianese et al., Fitopatol. Bras. 18: 444. 1993. TYPE on *Caryocar brasiliense* Cambessades from **Brazil**, Minas Gerais: Buritis, 31 May 1993, *Dianese-4008*. (?!?,**IIse/III**).

On Caryocaraceae

*Caryocar brasiliense* Cambessades, Minas Gerais (Dianese et al., 1993: 444; Buriticá, 1999: 420; IBI-15963), São Paulo (Buriticá, 1999: 420; IBI-14292).

*Cerotelium giacomettii*, the only rust known on the family Caryocaraceae, has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves in groups on chlorotic spots, sori subepicermal in origin, opening by a pore, round in outline, yellowish to cinnamon-brown, hymenium flat; peridium hyphoid; spores sessile, 29-33(-37) x 19-22 µm, ellipsoid; wall uniformly 1.5-3 µm thick, yellowish, with small scattered spines, germ pores obscure. Telia like the uredinia but waxy, becoming whitish by germination, hemispheric to columnar, erumpent, growth determinate, hymenium flat, teliospores 26-30(-33) x 9-11(-14) µm, obovoid to ellipsoid, free from each other, in 2-4 layers, irregularly arrange in the upper part of the sorus but sometimes a few remaining in vertical rows in the base; wall uniformly 0.5 µm thick, colorless, germination without dormancy (Dianese et al., 1993: 444).

Hennings (1904: 162) mistakenly reported an Ule specimen from Peru as *Uredo uberabensis*. The host of this Peru specimen is probably *Byrsonima* sp. (Malpighiaceae) and the rust is not *Milesia uberabensis* (≡ *Uredo uberabensis*).

*Cerotelium holwayi* H. S. Jackson, see **PHRAGMIDIELLA HOLWAYI** (H. S. Jackson) Buriticá.

**CEROTELIUM MARIAE** Buriticá & Hennen in Buriticá, Rev. Acad. Colombia Cienc. 23: 418. 1999.

TYPE on *Ludwigia* sp., Onagraceae, from **Brazil**, Santa Catarina: 10 km N junction of highway to Union on highway to Torres, 2 Dec 1976, *J. Hennen & Mary M. Hennen-76-764*. (?!?,**II/III**).

*Cerotelium mariae* has been reported only from the type.

Spermogonia, aecia, and uredinia unknown. Telia on both sides of leaves, mostly on the abaxial side. in circular groups on well defined discolored leaf spots, sori subepidermal in origin, erumpent, open, hemispheric, waxy, yellowish to orangish, growth determinate, coalescent, hymenium intraepidermal, concave; teliospores 18-30 x 7-14 µm, cuboid to oblong-ellipsoid, wall 0.5-1 µm thick, colorless to yellowish, distal spores with apical walls irregularly 3-4 µm thick, spores in 4-6 layers, irregularly arranged in distal part of sorus, in more or less regular vertical rows in the lower part.

*Cerotelium malvicola* (Spegazzini) Dietel, see **CATENULOPSORA PRAELONGA** (Spegazzini) Buriticá & Hennen.

*Cerotelium minutum* Arthur, see **PHRAGMIDIELLA MINUTA** (Arthur) Buriticá & Hennen.

**CEROTELIUM NUXAE** Buriticá & Hennen in Buriticá, Rev. Acad. Colombia Cienc. 23: 421. 1999.

TYPE on *Eschweilera jaranae* (Hubbard) Ducke, Lecythidaceae, from **Brazil**, Pará: Belém, Black Biological Forest Preserve, 27 Nov 1977, *J.F. Hennen & Mary M. Hennen-77-285*. (?!?,**IIe/III**).

Anamorph

*Physopella jaranae* (Albuquerque) Buriticá & Hennen in Buriticá, Rev. Acad. Colombia Cienc. 23: 421. 1999.

≡ *Uredo jaranae* Albuquerque, Pesq. Agrop. Brasil Ser, Agron. 6: 141. 1971. TYPE on *Eschweilera jaranae* (Hubbard) Ducke, Lecythidaceae, from **Brazil**, Pará: Belém, 27 Jan 1962, *Albuquerque s.n.*

*Cerotelium nuxae* has been reported only from the two specimens cited above from Brazil on Lecythidaceae.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, mostly on the abaxial side, in circular groups on yellowish chlorotic spots, subepidermal in origin, erumpent, ruptured epidermis noticeable, hymenium flat and subepidermal when young, latter deep in host tissue and concave, paraphyses 24-40 x 12-20 µm, peripheral and intra soral, septate, cylindrical, capitate, numerous, wall 3-6 µm thick apically, colorless; urediniospores pseudopedicelate, 24-40 x 16-24 µm, reniform to ellipsoid, wall 0.5 µm thick,



echinulate, pale cinnamon-brown, germ pores 2-3, supraequatorial. Telia on the abaxial side of leaves, around the uredinia, erumpent, hemispheric, waxy, whitish to yellowish, determinate growth, with 4-6 layers of spores, hymenium subepidermal, concave, teliospores originate in vertical rows, latter irregularly arranged, free, ellipsoid to obovoid, 15-18 x 8-12  $\mu\text{m}$ , wall uniformly 0.5  $\mu\text{m}$  thick, colorless or pale yellowish.

The straight, capitate, septate paraphyses, and the reniform spores with wide, short pseudopedicels (disjunctive cells) aid in identifying *Cerotelium nuxae*. The anamorph spores probably develop one after another through the remains of the pseudopedicel of the previous spore.

*Cerotelium piperinum* Sydow, see *Malupa piperinum* (Sydow) Buriticá & Hennen (**CROSSOPSORA PIPERIS**).

**CEROTELIUM RECTANGULATA** Buriticá & Hennen in Buriticá, Rev. Acad. Colombia Cienc. 23: 423. 1999. TYPE on Marantaceae, unidentified genus, (*?Ischnosiphon abciquus* (Ruage) Koernicke) from **Brazil**, Pará: east of Belém, plantation of EMBRAPA, ca 5 km from headquarters building, 24 Nov 1977, *J.F. Hennen, M.M. Hennen & F.G. Albuquerque-77-263. (?!?, IIse/III)*.

Anamorph

*Physopella rectangulata* (Albuquerque) Buriticá & Hennen in Buriticá, Rev. Acad. Colombia Cienc. 23: 423. 1999.

≡ *Uredo rectangulata* F.G. Albuquerque (as "retanulata"), Pesq. Agropec. Brasil, Ser. Agron. 6: 142. 1971. TYPE on ? *Heliconia psitocorum* Linnaeus, from **Brazil**, Pará: Belém, 17 May 1962, *F.G. Albuquerque-872*.

On Marantaceae

*Ischnosiphon* sp., Pará (IBI-13269).

**Genus undetermined**, Amapá (IBI-16022).

*Cerotelium rectangulata* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves on angular discolored spots delimited by veins, subepidermal in origin, erumpent, ruptured epidermis evident, cinnamon-brown, hymenium concave when young, latter flat and raised above the leaf surface, paraphyses 20-30 x 9-12  $\mu\text{m}$ , peripheral, curved, wall uniformly 1-2  $\mu\text{m}$  thick, yellowish; urediniospores sessile, 21-26 x 19-23  $\mu\text{m}$ , globose to ovoid, wall uniformly 0.5  $\mu\text{m}$  thick, finely echinulate, colorless, germ pores obscure. Telia on abaxial side of leaves, around the uredinia, erumpent, hemispheric, waxy, pale brown, hymenium concave, growth determinate, coalescent to form irregular dark masses when old, teliospores 9-15 x 8-10  $\mu\text{m}$ , globose, ovoid to ellipsoid, in 2-3 irregular layers in a gelatinous matrix, often arranged one below the other appearing as two-celled, wall uniformly very thin, smooth, hyaline, germinate without dormancy to form a mixture of metabasidia, basidiospores and old probasidial cells.

Urediniospores were not common on our collections. Most of the telia on our specimens were old, dark blackish, and irregularly warty in small yellowish, angular leaf spots delimited by the leaf veins. Very young telia are required to determine the structure of the sorus.

**CEROTELIUM SABICEAE** Buriticá & Hennen in Buriticá, Rev. Acad. Colombia Cienc. Rev. Acad. Colombia Cienc. 23: 419. 1999. TYPE on *Sabicea villosa* Willdenow from **Brazil**, São Paulo: near Mongaguá, 22 Aug 1979, *J. F. Hennen, M. M. Hennen & M. B. Figueiredo-79-276* (IBI-13749). (*?!?, IIse/III*).

Anamorph

*Physopella sabiceicola* (Arthur) Buriticá & Hennen in Buriticá. TYPE on *Sabicea hirsuta* Humboldt, Bonpland & Kunth from **Puerto Rico**, Mayaguez, 2 Nov 1913, *F. L. Stevens-1047*.

On Rubiaceae

*Sabicea villosa* Willdenow, São Paulo (Buriticá, 1999: 419, IBI-13748).

*Cerotelium sabiceae* has been reported also from Trinidad.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, subepidermal in origin, open at first by a pore, later widely open and raised, yellowish, hymenium flat, paraphyses 24-38 x 10-15  $\mu\text{m}$ , curved, peripheral united at base, wall 2-4  $\mu\text{m}$  thick at apex and on outer side, thinner on inner side, yellowish, not overarching the sorus at maturity, also some free in the sorus; urediniospores sessile, 20-26 x 17-20  $\mu\text{m}$  obovoid to ellipsoid, wall 0.5-1  $\mu\text{m}$  thick, minutely and finely echinulate, colorless to yellowish, germ pores

obscure. Telia on the abaxial side of leaves around the uredinia, waxy, hemispheric, determinate growth, covered at first by the epidermis, later erumpent, colorless to pale cinnamon-brown, hymenium flat, teliospores 14-21 x 10-16 µm, wall 1 µm thick, colorless, in 3-6 layers, free in vertical rows.

Traits that differentiate the two *Cerotelium* species on Rubiaceae are: the anamorph sori of *C. sabaceae* have the morphology of *Physopella* while the anamorph sori of *C. figueiredeae* have the morphology of *Uredendo*.

**CEROTELIUM XYLOPIAE** Buriticá & Hennen in Buriticá, Acad. Colombia Cienc. Rev. Acad.

Colombia Cienc. 23: 417. 1999. TYPE on *Xylopi* sp. from **Brazil**, Federal District: Aguas Emendadas National Park, 18 Oct 1976, *J.F. Hennen & Mary M. Hennen-76-492. (-/-, -/III).*

On Annonaceae

*Xylopi* sp., Federal District (IBI-12456), Goiás (IBI-13349).

*Cerotelium xylopi* has been reported only from Brazil.

Spermogonia, aecia, and uredinia unknown. Basidial sori on abaxial side of leaves in groups of 3-12 on yellowish spots up to 1.5 cm across, or without leaf discoloration, sori 0.2-0.5 mm across, dome shaped, yellowish, gelatinous when young, blackish at maturity, hymenium flat, darkly pigmented at maturity, probasidial cells produced in vertical rows but not adherent, (17-)24-36(-41) x 11-)12-16(-23) µm, irregularly broadly ellipsoid, oblong, ovoid, pyriform, or globoid, rounded to broadly papillate above, rounded to obtuse or truncate below, becoming irregularly arranged 3-5 cells deep in a gelatinous matrix, wall usually less than 0.5 µm thick, colorless, smooth, without germ pores, elongating apically without dormancy to produce metabasidia and globoid basidiospores (10-)13 µm diameter (Buriticá, 1999).

**CERRADOA** Hennen & Ono,

*Mycologia* 70: 570. 1978. TYPE SPECIES *Cerradoa palmaea* Hennen & Ono.

See the description of the species below.

Sori suprastomatal, chestnut-brown, urediniospore echinulate, teliospores with two laterally joined probasidial cells, septum vertical, each cell with one apical pore next to septum. Only one species has been reported.

Cummins and Hiratsuka (1983, 2003) placed this genus as a synonym of *Edythea*. The telia of these two genera are morphologically very similar. *Edythea* occurs on *Berberis* spp. (Berberidaceae) in the Andean region of South America (Buriticá, 19xx). We consider *Cerradoa* as a distinct genus from *Edythea*.

**CERRADOA PALMAEA** Hennen & Ono, *Mycologia* 70: 570. 1978. TYPE on ? *Attalea ceraensis*

Barbosa Rodrigues from **Brazil**, Federal District: Parque Nacional Aguas Emendadas, Aug 1976, *J. Hennen, M. M. Hennen, Y. Ono & P. Herringer* 76-247A. (??, II/III).

Areaceae (Palmae)

*Attalea ceraensis* Barbosa Rodrigues, Federal District (Hennen & Ono, 1978: 570; IBI-12671).

The identification of this host requires confirmation.

**Gen.undetermined**, Bahia (IBI-13616); Goiás (IBI-13324), Maranhão (IBI-13233), Minas Gerais (IBI-15333), Pará (*Sotão et al.-S97-636*, Museu Goeldi); São Paulo (IBI-13715).

*Cerradoa palmaea* has been reported from Brazil and also from Colombia.

Spermogonia and aecia unknown. Uredinia mostly on adaxial side of leaves, scattered or in loose groups, 0.3-1 mm wide, powdery, chestnut-brown; urediniospores 28-30 x 28-33 µm, globoid; wall 3-3.5 µm thick, 2-layered, echinulate, spines 2.5-3.5 µm apart, germ pores 2, equatorial. Telia similar to the uredinia, teliospores 25-30 x 30-35 µm, flattened globoid, two-celled, septum mostly vertical, wall (5-)5-7(-8) µm distally, (2.5-)4(-5) at sides, 2-layered, chestnut-brown, smooth, germ pores 1 in each cell next to septum; pedicel 4-5 µm wide next to spore, (10-)15-25(-30) µm long, sporogenous cells irregularly globoid, 4-10 µm wide.

*Cerradoa palmaea* was the first rust to be reported on the large, tropical, monocotyledenous family Areaceae. Later another rust was reported: *Uredo crusa* J. Hennen & J. McCain on an unidentified palm from Mexico and *Chamaedorea* sp. and *Geonoma* from Guatemala (Hennen & McCain, 1993).

**CHACONIA** Juel,

*Bih. svensk. Vetensk Akad. Handl.* 23: 12. 1897. TYPE SPECIES *Chaconia alutacea* Juel on *Pithecellobium divaricatum* (reported originally as *Calliandra* sp.), Leguminosae, from Paraguay.

*Chaconia* is characterized by teliospores that are composed of one probasidial cell with very thin, colorless, smooth walls. Teliospores are sessile, laterally free, and are borne in small groups on laterally free teliosporogenous cells. These probasidia develop metabasidia and basidiospores without dormancy by apical elongation. No germ pore has been reported.

**CHACONIA ALUTACEA** Juel, Bih. Till K. Svenska Vet.-Akad. Handl. 23: 12. 1897. TYPE on *Pithecellobium divaricatum* (Borg.) Bentham from **Paraguay**, Gran Chaco near Asuncion, 15 July 1893, C. A. M. Lindman. The host was reported by Juel mistakenly as *Calliandra* sp. but was identified by Vestergrén in his *Exsiccati (Micro. rar. sel. 755)* as *Pithecellobium divaricatum*. **(0/I,?/III)**.

= *Uromyces albescens* H. Sydow & P. Sydow, Ann. Mycol. 14: 66. 1916. TYPE on *Pithecellobium glomeratum* Bentham from **Peru**, Seringal Auristela, Rio Acre, July 1911, Ule-3500.

= *Maravalia albescens* (H. Sydow & P. Sydow) Dietel, Ann. Mycol. 22: 270. 1924. TYPE same as for *U. albescens* H. Sydow & P. Sydow.

On Leguminosae:

***Pithecellobium glomeratum*** Bentham, **Peru**, Rio Acre (Sydow, 1916: 66).

*Chaconia alutacea* Juel is the type species for the genus *Chaconia*. Silveira's (1951) report of *Chaconia alutacea* from Brazil requires confirmation. It is to be expected because of the close proximity of known locations in Peru and Paraguay.

Spermogonia amphigenous, subcuticular, lenticular to hemispherical, 60-70 µm across, 20-24 µm high. Aecia hypophyllous, in small groups on somewhat hypertrophied lesions opposite the spermogonia, subepidermal in origin, erumpent; aeciospores pedicellate, obovoid to ellipsoid, 20-26 x 16-20 µm, wall ca. 1 µm thick, cinnamon-brown, echinulate, germination pores not seen. Uredinia unknown. Basidiosori hypophyllous, 0.3-0.8 µm diam, scattered or in small groups, subepidermal, erumpent; probasidia clavate to cylindrical, 40-70 x 10-18 µm, walls thin, hyaline; metabasidia formed by continuous apical elongation of probasidia.

Spermogonia and aecia are known only from Belize.

**CHACONIA BRASILIENSIS** Ono & Hennen, Trans. Mycol. Soc. Japan 24: 382. 1983 (1984). TYPE on *Stryphnodendron* sp. from **Brazil**, São Paulo: near Conchal, Fazenda Campinimha, 16 Sept 1976, J. F. Hennen & M. B. Figueiredo-76-404, IBI-12601. **(?/? ,II/III)**.

On Leguminosae:

***Stryphnodendron adstringens*** (Martius) Coville, Federal District (IBI-12448).

***Stryphnodendron barbatimam*** (Velloso) Martius, Federal District (Ono & Hennen, 1983: 382).

***Stryphnodendron cristalinae*** Heringer, Federal District (Ono & Hennen, 1983: 382).

***Stryphnodendron*** sp., Federal District, Goiás (Ono & Hennen, 1983: 382, IBI-16696), Mato Grosso (IBI-16708), Minas Gerais (Ono & Hennen, 1983: 382), Pará (Pará/97-297, Pará/98-117), São Paulo (Ono & Hennen, 1983: 382).

*Chaconia brasiliensis* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia mostly on the abaxial side of leaflets, 0.2-0.5 mm diam., scattered or in groups, subepidermal in origin, erumpent, powdery, cinnamon-brown; without paraphyses; urediniospores pedicellate, 23-38 x 18-25 µm, subglobose, asymmetrical obovoid to ellipsoid, wall ca. 1.5 µm thick, echinulate, cinnamon-to golden-brown, germ pores 6 (5-7), scattered. Basidiosori similar to the uredinia but compact, and waxy, probasidia 47-67 x 9-14(-16) µm, cylindrical, wall very thin, colorless, basidiospores 10-13 x 7-10 µm.

*Chaconia erythroxyli* (Viégas) Viégas, see **MARAVALIA ERYTHROXYLI** (Viégas) Ono & Hennen.

**CHACONIA INGAE** (H. Sydow) Cummins, Mycologia 48: 602. 1956. **(0/Ipver,IIpver/III)**.

= *Maravalia ingae* H. Sydow, Mycologia 17: 257. 1925. (Nov 1925). TYPE on *Inga* sp. from **British Guiana**, Vreedn Hoor, 8 Jan 1922, Stevens-715 (only telia described).

= *Bitzea ingae* (H. Sydow) Mains, Mycologia 31: 38. 1939.

= ?*Maravalia utriculata* H. Sydow, Ann. Mycol. 23: 314. 1925. (Dec 1925). TYPE on *Inga* sp. from **Costa Rica**, San José: La Caja, 6 Jan 1925, H. Sydow-279.

#### Anamorph

- Uredo excipulata* H. Sydow & P. Sydow, Ann. Mycol. 2: 35. 1904. TYPE on *Inga inicuil* Chamisso & Schlechtendahl from **Mexico**, Pringle. The Sydows described spermogonia and aecia. This anamorph name is for both aecia and uredinia.
- = *Uromyces ingicola* P. Hennings, Hedwigia 43: 157. 1904. TYPE on *Inga* sp from **Brazil**, Amazonas: Rio Jurá, Juruá-Miry, June 1901, Ule-2929. (Hennings missidentified urediniospores as teliospores).
- = *Uromyces ingicola* P. Hennings, Hedwigia 48: 1. 1909. TYPE on *Inga* sp. from **Brazil**, São Paulo: São Paulo, Feb 1903, Puttemans-646. (Hennings mistakenly published the same name twice, each with a different type specimen).
- = *Uromyces porcensis* Mayor, Mem. Soc. Neuchâteloise. Sci. Nat. 5: 459. 1913. TYPE on *Inga cf. ingoides* (Rich.) Willdenow from **Colombia**, Antioquia: Andes Centrales, road from Cisneros to Medellín, 31 July 1910, E. Mayor-311. (Mayor described spermogonia and aeciospores, not teliospores).
- = *Ravenelia whetzeli* Arthur, Mycologia 9: 64. 1917. TYPE on *Inga vera* Willdenow from **Puerto Rico**, Mayaguez: La Jagua, 28 March 1916, Whetzel & Olive-206. (Arthur described only spermogonia and aecia).
- = *Uromyces ingaeiphilus* Spegazzini, Revista Argentina Bot. 1: 140. 1925. TYPE on *Inga edulis* Martius from **Argentina**, Misiones: Puerto Iguazú, Nov 1923, J. F. Molfino s.n. (Spegazzini missidentified urediniospores as teliospores).
- = *Uredo mogi-mirim* Viégas, Bragantia 5: 85. 1945. TYPE on *Inga* sp. from **Brazil**, São Paulo: Mogi-Mirim, Faz. Spina, 17 Dec 1940, A. R. Campos-16.

#### On Leguminosae:

- Inga edulis* Martius, Minas Gerais (Thurston, 1940: 292; IBI-9443), Pará (Albuquerque, 1971: 147; IAN-584), Paraíba (IBI-15530), São Paulo (Viégas, 1945: 85; IAC-4026; IBI-5448).
- Inga* sp., Amapá (IBI-16047), Amazonas (Hennings, 1904B: 157), Minas Gerais (IBI-14934), Rio de Janeiro (IBI-1724), São Paulo (Hennings, 1908: 1; IBI-1723).

*Chaconia ingae* has been reported from Argentina to Mexico on various species of *Inga*, but all of these reports cannot be confirmed because anamorphs have been confused with those of *Ypsilospora tuemensis* (Hernández & Hennen, 2003). All collections composed of galls with finely echinulate spores belong to *Ypsilospora tuemensis*. Collections on leaves with little or no galls and spore walls striate-reticulate belong to *Chaconia*.

Spermogonia on both sides of leaves, subcuticular in origin, lenticular to hemispherical. Aecia on hypertrophied lesions, deep seated in host mesophyll tissues, erumpent; aeciospores pedicelate, (20-)24-48(-55) x 14-26(-30) µm, obovoid to ellipsoid, short clavate or irregular, narrowed toward the base; walls 2-4 µm thick at sides, 2-5 µm at apex, 3-9 µm at base, with prominent longitudinal ridges, often reticulate with less pronounced cross ridges, cinnamon-brown, pores 3-4, equatorial. Uredinia and urediniospores like the aecia and aeciospores but without spermogonia. Basidiosori on abaxial side of leaves, scattered or loosely grouped, often confluent, subepidermal in origin, early erumpent; probasidia 70-140 x 12-20 µm, clavate to cylindrical, walls thin, colorless, metabasidia formed by apical elongation of the probasidia, basidiospores 9-10 x 7-8 µm, obovoid (Ono & Hennen, 1983; Hernández & Hennen, 2003).

The aecio- and urediniospores of *Chaconia ingae* are morphologically the same and both belong to the anamorph taxon *Uredo excipulata*. Although both are variable in size and wall thickness, each has identical, very characteristic, but sometimes faint, striate-reticulate wall sculpture. These anamorph spores have been mistaken as teliospores of *Uromyces* and as anamorph spores of *Ravenelia* as shown by the synonymy listed above. Teliospores (probasidia) are grouped on sporogenous cells, sessile, and laterally free.

Ono & Hennen (1983) mistakenly included *Uromyces ingae* Lagerheim ex Arthur (Mycologia 9: 65. 1917) as a synonym of *Chaconia ingae*, but that name was never officially established.

See *Ypsilospora tuemensis* Hernández & Hennen. for anamorph names that have been listed sometimes as synonyms of *Chaconia ingae*.

**CHACONIA MAPROUNEAE** (Viégas) Ono & Hennen (as “*maprouniae*”) in Hennen & Figueiredo, Mycologia 73: 350-355. 1981. (??,II/III).

= *Coleosporium maprouneae* Viégas, Bragantia 5: 5. 1945. TYPE on *Maprounea brasiliensis*

Saint-Hilaire from **Brazil**, Minas Gerais, Tumulo de Lund, Lagoa Santa, 8 April 1936, P. Krug & G. P. Viégas-1509.

Anamorph

*Uredo maprouneae* P. Hennings, Hedwigia 43: 163. 1904. LECTOTYPE on *Maprounea guianensis* Aubl. from **Peru**, Tarapoto, Sept 1902, *Ule-3247*. Lectotype chosen here.

On Euphorbiaceae:

*Maprounea brasiliensis* Saint-Hilaire, Amapá (Hennen & Sotão, 1997: 446); Federal District (IBI-12444), Minas Gerais (Viégas, 1945: 5; IBI-12697), Mato Grosso (IBI-16711), Pará (*Sotão et al.*-S98-36A), São Paulo (IBI-12702).

*Chaconia maprouneae* has been reported also from Bolivia, Peru, and Trinidad.

Spermogonia and aecia unknown. Uredinia 0.2-1.0 mm across, on the abaxial side of leaves, scattered or densely aggregated, subepidermal in origin, erumpent, urediniospores pedicellate, 26-31(-35) x 18-25(-27)  $\mu\text{m}$ , asymmetrically obovoid to pyriform, wall 1-1.5  $\mu\text{m}$  thick, echinulate, pale to yellowish brown, pores 5-6 supraequatorial or somewhat scattered in the upper half of the spore. Basidiosori on the abaxial side of leaves, 0.1-0.3 mm diameter, scattered or in small groups, intermixed in the uredinia, subepidermal in origin, erumpent, probasidia 27-41 x (4-)6-10  $\mu\text{m}$ , cylindric, wall thin, colorless, metabasidia formed by elongation of the probasidia, basidiospores 7-8 x 6-7  $\mu\text{m}$  obovoid to pyriform. (Ono and Hennen, 1983).

Jackson (1931) mistakenly made the new combination *Bubakia ulei* (H. Sydow & P. Sydow) H. S. Jackson & Holway in Jackson, Mycologia 23: 446. 1931. The host specimen that led Jackson to make this combination was misidentified as on "*Phyllanthus brasiliensis* (Aubl.) Rusby" from Bolivia, Nor Yungas: Coroico, 11 June 1920, *Holway-734*. The correct identification of the host is *Maprounea brasiliensis* and the rust is an anamorph of *Chaconia maprouneae*.

*Bubakia ulei* (H. Sydow & P. Sydow) H. S. Jackson & Holway in Jackson, Mycologia 23: 446. 1931.

*Uredo Phyllanthi* P. Henn. Hedwigia 35: 249. 1896.

*Schroeteriaster Ulei* Sydow, Ann. Myc. 14: 70. 1916.

On *Phyllanthus brasiliensis* (Aubl.) Rusby. Coroico, Nor Yungas, Bolivia, June 11, 1920, 734.

The collection consists of uredinia only but seems to agree with the *description* given by Sydow, who assigns *Uredo Phyllanthi* P. Henn. as a synonym. Arthur's record of the latter from Trinidad (Thaxter 31) is an error. This specimen is the uredinial stage of a *Ravenelia*, probably *R. appendiculata* Lagerh. & Diet..

*Chaconia erythroxyli* (Viégas) Viégas, see **MARAVALIA ERYTHROXYLI** Ono & Hennen.

#### **CHRYSOCYCLUS** H. Sydow,

Ann. Mycol. Berlin 23: 322. December 1925. LECTOTYPE SPECIES, *Chrysocyclus cestri* (Dietel & P. Hennings) H. Sydow ( $\equiv$  *Puccinia cestri* Dietel & P. Hennings) on *Cestrum* sp. (Solanaceae) from **Brazil**. Chosen by Laundon, 1965A.

= *Holwayella* H. S. Jackson, Mycologia 18: 49. January 1926. TYPE SPECIES, *Holwayella mikaniae* (Arthur) H. S. Jackson [ $\equiv$  *Chrysopsora mikaniae* Arthur and *Chrysocyclus mikaniae* (Arthur) H. Sydow].

*Chrysocyclus* produces only spermogonia and telia. The telia form one or more bright yellow, waxy rings around the centrally located spermogonia. When very immature, teliospores are two-celled and pedicellate, resembling very narrow, thin-, pale-, smooth-walled *Puccinia* teliospores. As each probasidial cell matures it elongates apically to form a metabasidium, each with four basidiospores. Jackson (1926) described this as follows: "The upper cell gradually elongates and the lower cell simultaneously develops at one side in like manner, giving the structure a shape like a mitten in which the thumb is as large as the hand portion, both being cylindric. When fully mature the contents concentrate in the upper portion of each branch, leaving the lower portion empty and collapsed".

Only three species are known: the two listed below and *Chrysocyclus senecionis* Davidson on *Senecio* sp., Compositae, from Venezuela (Davidson, 1932).

**CHRYSOCYCLUS CESTRI** (Dietel & P. Hennings) H. Sydow, Ann. Mycol. 23: 32. 1925. This is the lectotype species of the genus *Chrysocyclus* H. Sydow. **(0/-./III)**.

≡ *Puccinia cestri* Dietel & P. Hennings, Hedwigia 41: 295. 1902. TYPE on *Cestrum* sp. from **Brazil**, São Paulo, Serra da Cantareira, May, Nov. 1900, *Puttemans-180*, & -365 (a lectotype needs to be chosen).

≡ *Chrysopsora cestri* (Dietel & P. Hennings) Arthur, Bull. Torrey Bot. Club 51: 53. 1924.

On Solanaceae:

*Cestrum viridiflorum* Hooker, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 137).

*Cestrum* sp., Rio de Janeiro (Jackson, 1932: 80), São Paulo (Dietel & P. Hennings, 1902: 295; Jackson, 1932: 80).

*Chrysocyclus cestri* has been reported also from Argentina, Bolivia, Ecuador, Venezuela, The West Indies, and Central America.

The large, bright yellow, telial sori in rings are characteristic of the species. The sori of older infections may be target-like with several concentric rings.

The genus is in effect a micro-Puccinia in which the sori are waxy and there is no cessation of development between the formation of the teliospore initial and the time when the basidiospores are developed.

The first collection of this interesting species of which we have any knowledge was made by Lagerheim, June 1891, at Pichencha, Ecuador. This collection is marked *Puccinia magnifica* Lagerh., but the name seems never to have been published.

In 1924 Arthur transferred the species to *Chrysopsora*. During the year 1923, H. S. Jackson made a study of this species together with *C. mikaniae* Arth., and came to the conclusion that Arthur had misinterpreted their morphology. Jackson published a preliminary note (Mycologia 18: 48-49. Jan. 1, 1926) in which the genus *Holwayella* was proposed, with *C. Mikaniae* as the type, to accommodate these two species. Almost simultaneously, but technically one day previously, Sydow published the genus *Chrysocyclus* with the above species as the type (Jackson, 1931).

*Didymopsora solani* Dietel was reported to be on *Solanum* sp. but the host is probably *Cestrum* sp. and the rust is probably *Chrysocyclus cestri*. To determine this with certainty the type specimen needs to be examined.

**CHRYSOCYCLUS MIKANIAE** (Arthur) H. Sydow, Ann. Mycol. 23: 324. 31 December 1925. TYPE same as for *Chrysopsora mikaniae* Arthur. **(0/III)**.

≡ *Chrysopsora mikaniae* Arthur, Bull. Torrey Bot. Club 51: 54. 1924. TYPE on *Mikania buddleiaefolia* DeCandolle from **Brazil**, Rio de Janeiro, Theresopolis, 28 September 1921, E. W. D. & Mary M. Holway-1159.

≡ *Holwayella mikaniae* (Arthur) H. S. Jackson, Mycologia 18: 49. 1 January 1926. TYPE same as for *Chrysopsora mikaniae* Arthur.

On Compositae:

*Mikania buddleiaefolia* DeCandolle, Rio de Janeiro (Jackson, 1932: 121).

*Mikania lindbergii* Baker, São Paulo (Jackson, 1932: 121).

*Mikania* sp., Rio Grande do Sul (PUR-F18883).

*Chrysocyclus mikaniae* has been reported also from Bolivia, Ecuador, and Venezuela.

Spermogonia on the adaxial side of leaves, in small groups. Aecia and uredinia lacking. Telia on the abaxial side of leaves opposite the spermogonia, 0.3-1 mm long, erumpent, ruptured epidermis conspicuous, waxy at first, reddish or golden yellow, turning greyish white by germination, arranged in circles 2.5-4 mm across that surrounds the area of the epiphyllous spermogonia; teliospores 2-celled, before germination (50-)54-63(-80) x (11-)13-16  $\mu$ m, cylindrical, rounded at both ends, not constricted at septum, the distal probasidial cell elongating first, the proximal cell a little later, the spore becoming mitten shaped by elongation of the two cells, wall uniformly thin 1  $\mu$ m or less, smooth, colorless, pedicel about as thick and long as the spore, fragile.

The teliospores germinate without dormancy by elongation and transformation of the probasidia into metabasidia (Cummins, 1978).

#### **Comparisons to help identify rusts on *Mikania* in the Neotropics**

1. Sori *Aecidium*-like, cupulate, peridiate, spores 1-celled in vertical rows (catenulate) with intercalary cells at least near base of sori. 2.
1. Sori not *Aecidium*-like, spores 1- or 2-celled 4.
  2. Sori cupulate or in waxy or horny columns, peridia not strong, intercalary cells evident

- DIETELIA PORTORICENSIS (0/-,-/III).**
2. Sori cupulate, powdery, peridia well developed, interclary cells evanescent 3.
3. Spores with large refractive granules **Puccinia Mikaniae (?/?,IIcv/III).**  
**Uromyces Mikaniae (?/?,IIcv/III).**  
**Aecidium spp.**
3. Spores without refractive granules
4. Sori in circles, bright orange-red at first, turning gray by germination, without paraphyses **Chrysocyclus Mikaniae (0/-,-/III).**
4. Sori usually not in circles, pale brown or blackish brown, 5.
5. Sori powdery, brownish, spores echinulate, 1-celled (urediniospores), or verrucose, 2-celled (teliospores) **Puccinia Granchacoensis (?/?,IIpe/III).**
5. Sori not powdery, blackish, spores smooth (teliospores) 6.
6. Telia loculate, locules surrounded by dark brown paraphyses, teliospores one celled. **Uromyces Mikaniae (?/?,IIcv/III)..**
6. Telia loculate or not, then pulvinate, compact, teliospores mostly 2-celled. 7.
7. Telia loculate locules surrounded by dark brown paraphyses **Puccinia Mikaniae (?/?,IIcv/III).**
7. Telia not loculate, pulvinate, often crowded in groups, without paraphyses 8.
8. Teliospore apical walls 3.5-6.5 μm thick **Puccinia Mikaniifolia (0?/-,-/III).**
- 8 Teliospore apical walls 2.5-3.5(-4) μm thick **Puccinia Spegazzinii(-/-,-/III).**

#### *Chrysomyxa*

*Chrysomyxa bambusae* Teng, see **KWEILINGIA**.

#### *Chrysopsora* Lagerheim,

Ber. deutsch. bot. Ges. 9: 345. 1892. TYPE species *Chrysopsora gynoxidis* on *Gynoxis* sp. (Compositae) from Ecuador.

*Chrysopsora* has been reported only from the type species.

*Chrysopsora cestri* Arthur, see **CHRYSOCYCLUS CESTRI** (Dietel & P. Hennings) H. Sydow.

*Chrysopsora mikaniae* Arthur, see **CHRYSOCYCLUS MIKANIAE** (Arthur) H. Sydow.

#### **CIONOTHRIX** Arthur,

N. Am. Flora 7: 124. 1907. TYPE SPECIES: *Cionothrix praelonga* (Winter) Arthur (≡ *Cronartium praelongum* Winter), on *Eupatorium* sp., Compositae, from Brazil. See below.

Spermogonia subepidermal, flask-shaped to globoid with ostiolar filaments. Aecia and uredinia not produced. Telia subepidermal in origin, deep-seated, bulbous with numerous short, hyphoid, slightly curved ostiolar paraphyses; teliospores 1-celled, without intercalary cells, becoming erumpent and strongly adherent in hair-like columns. Metabasidia external.

The spores are produced asynchronously from a concave hymenium. Because of the asynchronous spore origins, rows of spores are not maintained but the spores appear somewhat randomly arranged in the extruded columns. The long, brown hair-like telia, that may be up to at least 2 mm long, help identify *Cionothrix*. Telia are easily seen with the unaided eye but even better with a 10X hand lens. The teliospores germinate without dormancy to produce metabasidia and basidiospores.

Buriticá and Hennen (1980) include three species in *Cionothrix*, the two listed below and *C. basicrassa* Buriticá & Hennen on *Eupatorium* sp. from Mexico.

Kern et al. (1938) and Joerstad (1956) did not recognize *Cionothrix* as a separate genus but suggested that is a microcyclic form of *Cronartium*.

#### **CIONOTHRIX PRAELONGA** (Winter) Arthur, N. Amer. Fl. 7: 124. 1907. **(0/III).**

≡ *Cronartium praelongum* Winter in Rabenhorst, Hedwigia 26: 24. 1887. TYPE on *Eupatorium* sp., (?*Chromolaena odorata* (L.) R. M. King & H. Robinson, ≡ *E. odoratum* L., reported originally as an unidentified Compositae) from **Brazil**, Santa Catarina: São Francisco, May 1885, *Ule-73*.

On Compositae:

*Eupatorium dichotomum* Schultz-Bipontius, Santa Catarina (Pazschke, 1892:95).

*Eupatorium* sp., Minas Gerais (Jackson, 1932: 122; IBI-12775), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 140; Buriticá & Hennen, 1980: 21), Roraima (Sydow, 1916: 70), Santa Catarina (Winter, 1887: 24), São Paulo (Jackson, 1932: 122; Buriticá & Hennen, 1980: 21; IBI-13133).

*Cionothrix praelonga* has been reported also from Argentina to Mexico on about 10 species of *Eupatorium*. *C. usneoides* is almost identical except its telia are arranged much more densely.

Spermogonia on adaxial side of leaves, in small groups of 2-6, flask-shaped, 90-100 µm across, honey-yellow fading to whitish. Aecia and uredinia lacking. Telia crowded on yellow spots on abaxial side of leaves in small groups 1-2 mm across; telial column 2-3 mm long, 50-75 µm wide, filiform, slender, flexuous, pale yellowish, deeply seated, the basal region wide but narrowed to a neck region, flask shape; paraphyses abundant, upwardly directed, cylindrical, thick walled, colorless, mostly 4-7 µm wide, these joined below; teliospores (24-)28-34(-40) x (12-)16-20(-24) µm, mostly narrowly ovoid or ellipsoid, initially catenulate but not remaining in rows, without obvious intercalary cells, wall 1 µm thick, colorless (Cummins, 1978; Buriticá & Hennen, 1980).

*Chromolaena odorata* (≡ *Eupatorium odoratum*), a native in the Neotropics, has been reported as an extremely aggressive, invasive, alien weed that has been given many local common names in tropical areas of Africa, Asia, and the Pacific Islands. In a survey of parts of South America to find native fungal pathogens as possible biological control agents for this weed, Barreto and Evans (1994) found *Cionothrix praelonga* on *Chromolaena odorata* in Colombia but not in Brazil. Perhaps the type specimen and some of the unidentified hosts reported above as *Eupatorium* sp. are *Chromolaena odorata*.

**CIONOTHRIX USNEOIDES** (P. Hennings) H. Sydow & P. Sydow, Ann. Mycol. 16: 243. 1918. **(0/III)**.

≡ *Cronartium usneoides* P. Hennings, Hedwigia 34: 95. 1895. TYPE on *Conyza* sp. from **Brazil**, Goiás: Meiaponte, August 1892, *Ule-1912*.

On Compositae:

*Conyza* sp., Goiás (Hennings, 1895: 95; Buriticá & Hennen, 1980: 21).

*Cionothrix usneoides* has been reported only from Brazil. *C. praelonga* is almost identical except its telia are arranged much less dense.

#### **COLEOSPORIUM** J. H. Lévillé,

Ann. Sci. nat., sér. 3, 8: 373. 1847. LECTOTYPE SPECIES *Coleosporium rhinanthacearum* Kickx on *Rhinanthus serotinus* (Scrophulariaceae) from Belgium. Chosen by J. C. Arthur, 1906.

Spermogonia and aecia on leaves (needles) of *Pinus* spp. Uredinia blister-like, without a peridium, not cupulate, urediniospores catenulate. These are traits of the anamorph genus *Caeoma*, not *Aecidium* or *Uredo*. For this reason, we use the genus *Caeoma* for the uredinia of *Coleosporium*.

The basidio sori of *Coleosporium* are composed mostly of one or sometimes two layers of more or less cylindrical, thin-walled, colorless probasidial cells. A probasidial cell of *Coleosporium* becomes transformed into a metabasidium as karyogamy, meiosis, and basidiospore formation occur. There is little or no change in the shape and size of the probasidial cell as it becomes the metabasidium. Basidiospores are formed at the tips of sterigmata of various lengths, those from the proximal cells longer than those from the distal cells.

*Coleosporium* is a large genus of around 80 species in the Northern Hemisphere. They are nearly all heteroecious with spermogonia and aecia on leaves (needles) of *Pinus* spp. Spermogonia and aecia have never been reported in South America. Six species are known from Brazil only in the uredinial and telial stages. Three of these species are on genera of Compositae, another on *Plumeria* sp., Apocynaceae, one on *Ipomoea* spp., Convolvulaceae, and one is reported on *Clematis*, Ranunculaceae.

*Coleosporium brasiliense* Dietel, see **PUCCINIA MEDELLINENSIS** Mayor.

**COLEOSPORIUM CLEMATIDIS** Barclay, J. Asiatic Soc. Bengal, pt. 2, Nat. Hist. 59: 89. 1890. TYPE



on *Clematis montana* from **India**, Simla: a specific specimen not cited, *Barclay-s.n.* A lectotype needs to be chosen. **(0/I ≅ II/III)**.

= *Coleosporium pulsatillae* Tanaka, 1890 (not Leveille),

= *Coleosporium clematidis-apiifoliae* S. Ito, 1038 (not Dietel).

Anamorph

*Caecoma clematidis* Thuemen, Mycotheca univ. no. 539. 1876. Anamorph name only for uredinia.

On Ranunculaceae:

*Clematis* sp., São Paulo (Jackson, 1927: 63).

*Coleosporium clematidis* has been reported from Africa, Australia, India to China, the maritime provinces of Siberia, Japan, and the Philippines.

Spermogonia and aecia on *Pinus* species in Asia. Uredinia (*Caecoma clematidis*) yellow; urediniospores 20-36(-44) x 12-22(-28) μm, ellipsoid, oblong-ellipsoid or broadly ellipsoid, wall verrucose, often with a reticulum-like spot, number of verrucae per 100 μm square 21-50, verrucae 0.5-1.8(-2) μm broad, 0.8-1.8(-2) μm high. Telia scattered, occasionally in circular groups, orange-red; mature metabasidia in two layers; one celled probasidia 80-132 x 15-25 μm excluding gelatinous apical layer, metabasidia after becoming 4-celled 57-92 x 15-26 μm, with a long sterile cell at base; basidiospores 20-27(-29) x 12-16(-18) μm, ellipsoid (Hiratsuka, N., et al., 1992).

The Brazilian collection (Jackson, 1927), which has only urediniospores, is the only one reported from the Western Hemisphere. New collections are needed to determine if this rust still occurs in Brazil.

*Coleosporium elephantopodis* Thuemen, see **COLEOSPORIUM VERNONIAE** Berkeley & Curtis.

**COLEOSPORIUM IPOMOEAE** Burrill [as "(Schw.) Burrill"], Parasit. Fungi of Illinois, pt. 1 in Bull. Illinois

State Lab. Nat. Hist. 2: 217. 1885. TYPE on *Ipomoea pandurata* Linnaeus from **The United States of America**, North Carolina: Salem, date not recorded, *Schweinitz*. **(0/Icv ≅ IIcv/III)**.

= *Coleosporium fischeri* Mayor, Mem. Soc. Neuchatel. Sci. Nat. 5: 550. 1913. LECTOTYPE on *Ipomoea angulata* Lamarck [as "*Quamoclit angulata* (Lam.) Bojer"] from **Colombia**, Cundinamarca, Pres de Villeta, 9 Oct 1910, *Mayor-286*.

Synanamorphs

Uredinia:

*Caecoma ipomoea* Link in Willdenow, Sp. Pl. 6(2): 14. 1822. TYPE same as for *Coleosporium ipomoeae* Burrill.

≅ *Uredo ipomoeae* Schweinitz, Schrift. Naturf. Ges. Leipzig 1: 70. 1822. TYPE same as for *Coleosporium ipomoeae* Burrill.

= *Coleosporium guaraniticum* Spegazzini, Anales Soc. Cient. Argent. 17: 95. 1884. TYPE on *Ipomoea gossypoides* from **Paraguay**, Paraguari, date?, collector?. Only uredinia described.

= *Uredo ipomoeae-pentaphyllae* P. Hennings, Hedwigia 35: 252. 1896. TYPE on *Ipomoea pentaphylla* from **Brazil**, Rio de Janeiro, May 1887, *Ule-712*.

= *Aecidium dominicanum* Gonzales, Fragosa, & Ciferri, Bol. Real. Soc. Espan. Hist. Nat. Madrid 26: 249. 1926. TYPE on *Ipomoea* sp. from **The Dominican Republic**, near Haina, date not reported, *Ciferri s. n.* Only uredinia described.

= *Uredo vicosiana* Thurston, Mycologia 32: 306. 1940. TYPE on *Ipomoea* sp. (host misidentified originally as *Cleome spinosa* Jacquin, Capparidaceae) from **Brazil**, Minas Gerais, Viçosa, 4 Feb 1934, A. S. *Mueller-689*.

Aecia:

*Peridermium ipomoeae* Hedgecock & Hunt, Mycologia 9: 239. 1917 TYPE on *Pinus echinata* Miller from **The United States of America**, Georgia: East Point, 26 April 1916, *Hedgecock-22217*. Not reported from South America.

On Convolvulaceae:

*Ipomoea acuminata* Roemer & Schultes, Rio de Janeiro (Jackson, 1931: 495).

*Ipomoea batatas* Lamarck, São Paulo (Viégas, 1945: 5).

*Ipomoea cairica* Sweet, Minas Gerais (Thurston, 1940: 293).

*Ipomoea glabra* Choisy, Pará (Albuquerque, 1971: 147; IAN-686), São Paulo (Jackson, 1931: 495).

*Ipomoea pentaphylla* Jacquin, Rio de Janeiro (Hennings, 1896: 252).

*Ipomoea* sp., Amapá (IBI-16607), Minas Gerais (Thurston 1940: 306, IBI-14455), Piauí (IBI-15482),

Rio Grande do Sul (IBI-17420), Rio de Janeiro (Jackson, 1931: 495).

*Coleosporium ipomoeae*, the only species of *Coleosporium* known on *Ipomoea* spp., has been reported in the Americas from Argentina to The United States of America on at least 25 species of *Ipomoea* and on several closely related genera such as *Operculina*, *Pharbitis*, *Quamoclit*, *Riva*, and *Thyella*. The species seems to survive over most of its range by repeated infections from urediniospore.

Spermogonia on both sides of needles, on somewhat discolored spots. Aecia with the spermogonia, the peridium flattened laterally; aeciospores catenulate, 22-27 x 17-20 µm, ovoid or ellipsoid,; wall 2 -3 µm thick, colorless, strongly verrucose. Spermogonia and aecia are known on leaves of *Pinus* spp. only from the Southeastern U. S. A.

Uredinia on abaxial side of leaves, widely scattered, or somewhat clustered, 0.25-1 mm across, blister-like, not cupulate, without a peridium, orange-yellow fading to white, erumpent, ruptured epidermis usually conspicuous; urediniospores catenulate, 18-27 x 13-21 µm, ellipsoid, more or less angular and irregular; wall 1-1.5 µm thick, closely and noticeably verrucose, colorless. Telia on abaxial side of leaves, widely scattered, often confluent, pulvinate, 0.5 mm. or less across, deep reddish-orange fading to pale-yellow; teliospores 19-23 x 60-80 µm, apical wall swelling to 20-40 µm above, oblong, or slightly clavate, rounded or obtuse at both ends, contents orange-yellow fading to colorless (Arthur, 1934).

Uredinia have traits of the anamorph genus *Caecoma*, not *Aecidium* or *Uredo*. For this reason, we use the anamorph genus *Caecoma* for the uredinia of this rust (Arthur, 1934).

Various species of *Aecidium* which do have sori that are cupulate with a well developed peridium are also commonly collected in the neotropics on *Ipomoea* spp. These are anamorphs of *Puccinia* spp.

*Coleosporium maprouneae* (P. Hennings) Viégas, see **CHACONIA MAPROUNEAE**(Viégas) Ono & Hennen.

*Coleosporium pallidulum* Spegazzini, see **PUCINIOSIRA PALLIDULA** (Spegazzini) Lagerheim.

**COLEOSPORIUM PLUMERIAE** Patouillard (as “*plumierae*”), Bull. Soc. Mycol.France 18: 178. 1902.

TYPE on *Plumeria alba* from **Guadalupe** date?, R. P. Duss-s.n.. (?/?? ≠ IIcv/III).

Anamorph

*Uredo domingensis* Berkeley, Ann. Mag. Nat. Hist. (2 ser.) 9: 200. 1852. TYPE on *Plumeria* sp. (reported originally as on an unknown plant), from **Santo Domingo**, date and collector not reported (?). Literature not available. The host was identified by Arthur (1918: 329). This name needs to be transferred to an appropriate anamorph genus.

= *Uredo plumeriicola* P. Hennings, Hedwigia 43: 161. 1904. TYPE on *Plumeria* sp. from **Peru**, Huallaga, Jan 1903, *Ule*-3239.

≡ *Coleosporium domingensis* (Berkeley) Arthur, Amer. J. Bot. 5: 329. 1918. Based on uredinia.

On Apocynaceae:

*Plumeria rubra* Linnaeus, Goiás (PUR-89640), Minas Gerais (PUR-F87201), São Paulo (PUR-87388).

*Plumeria* sp. Amapá (IBI-16077), Amazonas (IBI-15644), Bahia (IBI-17724), Ceará (IBI-17123), Maranhão (IBI-17112), Minas Gerais (IBI-14456), Pernambuco (IBI-94-159) Piauí (IBI-15483), Rio de Janeiro (IBI-16878). São Paulo (IBI-14039).

*Coleosporium plumeriae* is widespread on *Plumeria* spp. in the Neotropics. There are records also from isalands in Hawaii and Micronesia.

Uredinia on abaxial side of leaves, scattered, 0.3-0.5 mm across, soon naked, ruptured epidermis inconspicuous, powdery, orange yellow when fresh; urediniospores produced catenulately, 26-37 x 19-24 µm, broadly ellipsoid to obovoid; wall 1.5-2 µm thick, verrucose, tubercles 3-5 µm across, coarse, low, easily deciduous. Basidial sori 0.1-0.3 mm across, on abaxial side of leaves, scattered among the uredinia or alone, shiny waxy, bright reddish-orange when fresh, basidia 26-33 x 10-13 µm, rounded or obtuse at both ends, apical wall swelling to 10-20 µm.

*Plumeria* spp., the uredinial and telial host species of *Coleosporium plumeriae*, were introduced into Brazil from their native home in Central America and the islands in the Caribbean. *Plumeria* spp. are used widely in Brazil and many other tropical countries as ornamental shrubs or small trees. Several colors of flowers are produced. On trees that are heavily infected with rust, the lower leaf surfaces are bright orange because of the numerous rust sori. These severe infections may cause premature leaf fall that reduces plant growth.

The urediniospores of this rust germinate easily and quickly and are useful in teaching about rust biology.

*Coleosporium senecionis* Kickx, see **COLEOSPORIUM TUSSILAGINIS** (Persoon) Lèveillé.

**COLEOSPORIUM TUSSILAGINIS** (Persoon) Lèveillé, in Orbigny, Dict. Univ. Hist. Nat., 12: 786.

1849. (O/Icv  $\approx$  IIcv/III).

This bibliographic citation is from Hylander, *et al.*, (1953). Laundon, (1967) reported the author and place of publication as “Berkeley, Outline rit. Fungology p. 333, 1860”.

$\equiv$  *Uredo tussilaginis* Persoon, Syn. Meth. Fung. p. 218, 1801. TYPE on *Tussilago farfara*

Linnaeus, from Europe. Hylander, *et al.*, (1953) report that the type contains telia.

$=$  *Coleosporium senecionis* Kickx, Flora Flandres 2: 53. 1867. LECTOTYPE on *Senecio vulgaris* Linnaeus, Belgium, Flanders, designate by Hylander *et al.* (1953).

Other teleomorph synonyms based on European or North American specimens,

too numerous to record here, are reported by Arthur (1907), Hylander *et al.* (1953), Kaneko, 1981, Lindquist (1982), and others.

Anamorphs

Spermatogonial and aecial anamorphs occur on *Pinus* spp. in northern Eurasia and perhaps North America and have been named several times. Probably the aecial anamorph name with priority is *Peridermium pini* Willdenow. Spermatogonia and aecia are unknown in South America.

Uredinial anamorphs have been given several names. Perhaps the uredinial anamorph name with priority is *Uredo tussilaginis* Persoon as cited above. To have priority for both the teleomorph name and the anamorph name, Persoon's publication of the name *Uredo tussilaginis* must contain descriptive information about both the telia and uredinia.

On Compositae:

*Calendula officinalis* Linnaeus, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 139).

*Emilia sonchifolia* ., Minas Gerais (76-582/IBI 12755), Rio de Janeiro (IBI 13069), São Paulo (IBI 12003;).

*Senecio bonariensis* Hooker & Arnott, Rio Grande do Sul (75-215/12193); São Paulo (PUR-F17804).

*Senecio brasiliensis* Lessing, Minas Gerais (IBI-14572), Paraná (Jackson, 1932: Rio Grande do Sul (IBI 14147), Rio de Janeiro (Jackson, 1932: 178; Viégas, 1945: 5), Rio Grande do Sul (PUR-F759), São Paulo (Jackson, 1932: 178; Viégas, 1945: 5; IBI-565; 75-103/12091).

*Senecio crassiflorus* DeCandolle, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 139; IBI 12192).

*Senecio grandis* Gardner, Rio de Janeiro (Jackson, 1932: 178).

*Senecio hastatus* Bongard, Rio de Janeiro (PUR-F774), São Paulo (Jackson, 1932: 178).

*Senecio pulicaris* Baker, Rio Grande do Sul (Lindquist & Costa Neto, 1967: 63).

*Senecio selloi* (Sprengel) DeCandolle, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 139).

*Senecio* sp., Paraná (IBI-17377), Rio de Janeiro (Jackson, 1932: 178), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 139), São Paulo (Jackson, 1932: 178; Viégas, 1945: 5).

Hylander *et al.* (1953) determined that *Coleosporium senecionis* plus at least seven other

*Coleosporium* names should be considered as synonyms of *C. tussilaginis* because the species could not be separated by morphology. Cummins (1978) continued to use *C. senecionis* Kickx as the name for this rust on *Senecio* without comment about *C. tussilaginis*. Kaneko (1981) in his very detailed study of *Coleosporium* followed Hylander *et al.* and used the name *Coleosporium tussilaginis* as the name of a species complex.

The dikaryotic stage of this rust has been reported on at least four vascular plant families and ten genera in the Northern Hemisphere.

update Jan 2000

**COLEOSPORIUM VERNONIAE** Berkeley & Curtis in Berkeley, *Grevillia* 3: 57. 1874. TYPE on *Vernonia* sp., Compositae, from **The United States of America**, date not reported, Alabama, *Beaumont-s.n.* (0/Icv<sup>z</sup> IIcv/III).

= *Coleosporium elephantopodis* Thuemen, Mycol. Univ. No. 953. 1878. TYPE on *Elephantopus tomentosus* Linnaeus, Compositae, from **The United States of America**, North Carolina, locality, date of collection, and collector's name not available. Telia are present in the type specimen and were described by Thuemen, thus the name is to be ascribed to Thuemen alone and not as a transfer from *Uredo elephantopus* Schweinitz as has been done in the past (Cummins, 1962).

Anamorph

*Uredo elephantopodis* Schweinitz, Schrift. Nat. Ges. Leipzig 1: 70. 1822. Type same as for *Coleosporium elephantopodis* Thuemen reported above.

= *Uredo elephantopodis* P. Hennings, *Hedwigia* 35: 253. 1896. TYPE on *Elephantopus scaber* L. from **Brazil**, Santa Catarina: São Francisco, 1884, *Ule-6*. Not that of Petch.

= *Aecidium vernoniae-mollis* Mayor, Mem. Soc. neuchatel. Sc. nat. 5:570. 1913. TYPE on *Vernonia mollis* Kunth [= *Lepidaploa canescens* (Kunth) H. Robinson] from **Colombia**, Antioquia, 9 Sept 1910, *Mayor-172*. (fide The Sydows, 1923: 307).

On Compositae:

*Elephantopus angustifolius* Swartz São Paulo(Jackson, 1932: 103; Viégas, 1945: 83; IAC-2861; IBI 15008).

*Elephantopus mollis* Humboldt, Bonpland & Kunth, Amapá (IBI-1606), Maranhão (IBI-15613), Minas Gerais (Thurston, 1940: 293; IBI-12774), Pará (Albuquerque, 1971: 147), Rio de Janeiro (PUR-F707), Santa Catarina (PUR-F706), São Paulo(Jackson, 1932: 103; IBI-12319).

*Elephantopus scaber* L., Rio de Janeiro (Dietel, 1899: 254; Sydow, 1907: 355; Viégas, 1945: 4), Rio Grande do Sul (Lindquist & Costa Neto, 1967: 63), Santa Catarina (Hennings, 1896: 253).

*Elephantopus* sp., Minas Gerais (PUR-F18874), Mato Grosso (IBI-16733), Pará (IBI-13248), Rio de Janeiro (Jackson, 1932: 103), RioGrande do Sul (PUR-F18872), São Paulo (Sydow, 1907: 355; Jackson, 1932: 103).

*Coleosporium vernoniae* is widespread in the Americas on *Elephantopus* spp. and on *Vernonia* in North America. Records of hosts have also been reported as *Orthopappus* sp. and *Pseudelephantopus* sp. These genera are often recognized as closely related to *Elephantopus*.

Spermogonia mostly on the upper leaf surface, in 1 or 2 rows. Aecia on both surfaces, large and conspicuous, flattened laterally (*Peridermium* sp., known only in the SE United States of America on *Pinus* spp.), Uredinia on both leaf surfaces or usually only on the abaxial surface, yellow when fresh but nearly white when old and dry; urediniospores catenulate, (17-)20-26(-30) x (14-)16-20(-22) µm mostly ellipsoid or broadly so, nearly uniformly verrucose with rods or ridges mostly 1.5-2 µm high, these commonly united in irregular or pseudoreticulate patterns, the wall minus verrucae about 1 µm thick, colorless. Telia (basidiosori) on the abaxial side, early exposed, hard when dry about orange color or paler, mostly 2 or 3 basidia deep but the basidia not catenulate, (44-)50-66(-70) x (16-)18-22(-24) µm, cylindrical or elongately clavate, mostly transversely septate but some collections commonly have some cruciately septate basidia the apical gelatinous layer (20-)25-35(-40) µm thick; basidiospores (few seen) 20-26 x 12-14 µm oblong ellipsoid or slightly allantoid (Cummins, 1978).

#### *Cronartium* E. Fries,

Obs. Myc. 1: 220. 1815. TYPE SPECIES *Cronartium asclepiadeum* Fries on an undetermined species of Asclepiadaceae from Europe.

*Cronartium*, a heteroecious genus of the Northern Hemisphere, does not occur in Brazil. Its spermogonia and aecia are on galls on stems and cones of *Pinus* species. Uredinia and telia are on various dicotyledonous hosts. One or two short cycle species are known on *Pinus* spp. in the Northern Hemisphere. They have the morphology of the aecia of their parental long cycle species and produce similar stem galls. These are placed in the genus *Endocronartium*. If accidentally introduced into Brazil, perhaps they could produce an important disease in *Pinus* plantations.

*Cronartium byrsonimatis* P. Hennings, see **CROSSOPSORA BYRSONIMATIS** (P. Hennings) R.S. Peterson.

*Cronartium egenulum* Sydow, Ann. Mycol. 10: 405. 1912. Not a rust, but abnormal epidermal hairs.

*Cronartium notatum* Arthur & J.R. Johnston, see **CROSSOPSORA NOTATA** (Arthur & J.R. Johnston) Arthur.

*Cronartium praelongum* Winter, see **CIONOTHRIX PRAELONGA** (Winter) Arthur.

*Cronartium uleanum* Sydow, see **CROSSOPSORA ULEANA** (H. Sydow & P. Sydow) R.S. Peterson.

*Cronartium usneoides* P. Hennings, see **CIONOTHRIX USNEOIDES** (P. Hennings) Sydow.

**CROSSOPSORA** H. Sydow & P. Sydow,

Ann. Mycol., Berlin, 16: 243. 1919. TYPE SPECIES, *Crossopsora zizyphi* (H. Sydow & E. J. Butler) H. Sydow & P. Sydow ( $\equiv$  *Cronartium zizyphi* H. Sydow & Butler) on *Zizyphus oenopilia* and *Z. rugosa*, Rhamnaceae, from India. Phakopsoraceae.

Spermogonia subcuticular, Group VI (type 7). Aecia subepidermal, opening by a pore-like rupture of the epidermis, without peridium, *Caeoma*-type, aeciospores in vertical rows, echinulate. Uredinia subepidermal in origin, erumpent, usually with septate and basally united paraphyses, *Malupa*-type; urediniospores borne singly, echinulate, pores scattered but obscure. Telia subepidermal in origin, erumpent with strongly adherent teliospores produced from closely adhering teliosporeogenous cells that results in long, brown, hair-like telial columns. Each teliospore has one lateral germpore.

Nine species of *Crossopsora* have been reported from the Old World. Buritica (1999) reported 11 more species in the Neotropics, including four new species and two new unconnected anamorph species that probably belong to new species of *Crossopsora*.

**Key to help identify species of *Crossopsora* in the Neotropics on Apocynaceae**

1. Anamorph soral paraphyses straight, mostly more than 100  $\mu$ m long
  - Malupa condilocarpi* (H. S. Jackson & Holway) Buriticá & Hennen. (Brazil).
1. Anamorph soral paraphyses incurved, usually less than 100  $\mu$ m long                    2
  2. Telial paraphyses mostly more than 80  $\mu$ m long
    - Crossopsora angusta* Joerstad (Brazil).
  2. Telial paraphyses mostly less than 80  $\mu$ m long
    - Crossopsora stevensii* H. Sydow (Colombia, Trinidad, Guyana, Guatemala),

**On Asclepiadaceae**

1. Uredinial sori with abundant, septate intrasoral paraphyses; telial paraphyses peripheral, straight, and long
  - Crossopsora asclepiadaceae* Buriticá & Hennen (Brazil).
1. Uredinial sori without intrasoral paraphyses, telial paraphyses straight and short.
  - Crossopsora mateleae* Dale (Brazil, Trinidad, Central America).

**On Bignoniaceae**

1. On *Xylophragma* sp. Minas Gerais
  - Crossopsora crassa* Buriticá & Hennen (Brazil).

**On Bixaceae**

1. On *Bixa*, anamorph paraphyses incurved
  - Crossopsora bixae* Buriticá (Brazil, Colombia).

**On Leguminosae**

1. On *Hymenaea*, anamorph in *Peridipes*
  - Crossopsora hymenaeae* Dianese et al. (Neotropics)

**On Malpighiaceae**

1. On *Byrsonima*, uredinia paraphyses short, spore walls with irregular, elongated verrucae, and smooth areas  
*Crossopsora notata* (Arthur & Johnson) Arthur (Neotropica).
1. On *Byrsonima*, uredinia paraphyses long and thick, spore wall uniformly echinulate  
*Crossopsora byrsonimatis* (P. Hennings) R. Peterson (Neotropica) .

#### On Piperaceae

1. On *Piper*, anamorph paraphyses hyaline, flexuous  
*Crossopsora piperis* R. Berndt et al.  
*Malupa piperium* (H. Sydow) Buriticá & Hennen (Brazil, Ecuador).

#### On Solanaceae

1. On *Cyphomandra* and *Solanum*, anamorph with long, thin paraphyses  
*Crossopsora uleana* (H. & P. Sydow) R. Peterson (Brazil, Ecuador, Colombia).

#### On Vitaceae

1. On *Cissus*, anamorph in *Physopella*  
*Crossopsora wilsoniana* (Arthur) Arthur (Northern S America, C America, West Indies).

**CROSSOPSORA ANGUSTA** Joerstad, Arkiv. Bot. Ser. 2, 3: 448. 1956. TYPE on *Echites sulphurea* Velloso from **Brazil**, Mato Grosso: Cuiabá, 19 June 1922, *Malme sn. (?!?,Ipe/III)*.

Anamorph

*Malupa joerstadiae* Buriticá & Hennen in Buriticá, Rev. Acad. Colomb. Cienc. 23: 411. 1999.  
TYPE on *Echites* sp. from **Brazil**, São Paulo: Luís Antonio, Horto Florestal, 8 July 1983, *J. F. Hennen et al. (IBI-14677)*.

On Apocynaceae:

*Echites sulphurea* Velloso, Mato Grosso (Joerstad, 1956: 448).  
? *Echites* sp., São Paulo (Buriticá, 1999: 411; IBI-14676).  
*Crossopsora angusta* has been reported only from Brazil.

Spermatogonia and aecia unknown. Uredinia on abaxial side of leaves, subepidermal in origin, erumpent by a small pore, pale yellowish, hymenium concave; paraphyses peripheral, 27-32 x 5-9 µm, incurved, outer wall 4-6 µm thick, yellowish, inner wall thinner; urediniospores 26-30(-36) x 19-24 µm, ellipsoid, wall uniformly 1-1.5 µm thick, finely echinulate, yellowish, germ pores 4-5, more or less equatorial. Telia in small groups on spots up to 2 mm across on abaxial side of leaves, telia in the form of filiform rods up to 2 mm long and 30-44 µm across, dark brown; paraphyses peripheral, 80-150 x 3-5 µm, straight, outer wall 2-3 µm thick, yellowish; teliospores 23-45 x 7-10 µm (fide Joerstad), 40-56 x 5-8 µm (fide Buriticá), in rows, the rows grouped into rods 5-6 spores across, spore walls evenly 1-1.5 µm thick, germ pore 1, in the upper end of the spore (Joerstad, 1956; Buriticá, 1999).

Joerstad (1956) described only telia for *Crossopsora angusta* and reported that it was very similar to *Crossopsora stevensii* H. Sydow from Guyana and Trinidad. Buriticá (1999) first described an anamorph of *Crossopsora angusta* and reported the two species could be identified by the length of the peripheral paraphyses in the uredinia: those of *Crossopsora angusta* are 80 µm long while those of *C. stevensii* are less than 80 µm long. An unconnected anamorph, *Malupa condylocarpi*, also from Brazil, has paraphyses 100 µm or more long.

**CROSSOPSORA ASCLEPIADIACEAE** Buriticá & Hennen in Buriticá, Rev. Acad. Colomb. Cienc. 23: 408. 1999. TYPE on undetermined Asclepiadaceae genus, from **Brazil**, Bahía: ca 20 km. N of Victoria de Conquista, 9 Mar 1984, *J. F. Hennen & M.M. Hennen-84-227. (?!?,Ipe/III)*.

Anamorph

*Malupa peckoltiae* (Sydow) Buriticá & Hennen in Buriticá, Rev. Acad. Colomb. Cienc. 23: 409. 1999.  
= *Uredo peckoltiae* Sydow, Ann. Mycol. 1: 332. 1903. TYPE on *Peckoltia pedalis* Fournier, Asclepiadaceae, from **Brazil**: Goiás, place and date?, *Gardner s.n.*  
= *Uredo apocynaceae* Hennings, Hedwigia 48: 3. 1908. TYPE on *Cyathostelma* sp., from **Brazil**, São Paulo: Serra de Cantareira, Mar 1903, *Puttemans-694*.

On Asclepiadaceae

*Cyathostelma* sp., São Paulo (Sydow, 1903: 332; as *Uredo apocynaceae*).  
*Peckoltia pedalis* Fournier, Goiás (Sydow, 1903: 332; as *Uredo peckoltiae*)

*Schubertia grandiflora* Martius, Pará (*Albuquerque-779*, reported as *Crossopsora mateleae* Dale, Albuquerque, 1971).

**Undetermined genus**, Bahia (IBI-13467); Minas Gerais (IBI-16429, -16432).

*Crossopsora asclepiadaceae* has been reported from Brazil and perhaps Cuba. Joerstad (1956) reported *Uredo peckoltiae* from Cuba on *Poecilopsis oblongata* (Grisebeck) Sclotchendahl, Asclepiadaceae, which may be an anamorph of *Crossopsora asclepiadaceae*.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, single or in circular groups, subepidermal in origin, 0.1-0.3 mm across, opening by a pore, hymenium concave, paraphyses united below, 36-60 x 6-9 µm, numerous, peripheral, straight to curved, wall, to 4 µm thick dorsally, and up to 12 µm thick apically, yellowish; *Malupa*-spores 27-32(-45) x 20-23(-26) µm, variable in size and shape, globose, obovoid, ellipsoid to broadly ellipsoid, wall uniformly 1-1.5 µm thick, uniformly and finely echinulate, pores 2-4, more or less equatorial or obscure; telia on the abaxial side of leaves, filiform, dark brown, paraphyses 30-50 x 6-8 µm, peripheral, slightly curved, wall up to 4 µm thick, yellowish; teliospores in vertical rows, the rows stuck together forming columns 7-8 spores across, teliospores 30-36 x 8-12 µm, oblong, wall uniformly ca 1 µm thick, yellowish, pore below the equatorial region, germination without dormancy.

**CROSSOPSORA BIXAE** Buriticá, Caldasia 12: 166. 1978. TYPE on *Bixa orellana* Linnaeus from **Colombia**, Meta: 26 km from San Juan de Arama to Vista Hermosa, 10 Jan 1976, *P. Buriticá-76-056*. (??,II/III).

Anamorph

*Malupa bixae* (Arthur) Buriticá, Rev. I. C. N. E. Medellin 5: 188. 1994.

≡ *Uredo bixae* Arthur, Mycologia 7: 327. 1915. TYPE on *Bixa orellana* Linnaeus from **Puerto Rico**, Adjuntas, 2 Mar 1913, *F. L. Stevens-462*.

On Bixaceae:

*Bixa orellana* Linnaeus, Amazonas (*J.F. & M.M. Hennen-s.n.*, 1982), Pará (PUR-F18712).

Buriticá (1999) recorded *Crossopsora bixae* also from Colombia, and Puerto Rico.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, mostly on abaxial side, scattered or in small groups, subepidermal in origin, opening by a small pore; paraphyses peripheral, 38-44 x 7-9 µm, slightly curved, elevated on hyphoid tissue, wall 5-8 µm thick dorsally, yellowish; urediniospores 30-34 x 23-26 µm, obovoid to ellipsoid, wall evenly 1 µm thick, yellowish, echinulate, germ pores 5(-6), equatorial or ? 2 and supraequatorial. Telia as the uredinia but teliospores adherent in filiform columns 2-3 mm long x 40-50 µm across, brownish; teliospores 35-45 x 8-11 µm, rectangular, wall 0.5-1 µm thick, smooth, yellowish, germ pore 1, equatorial.

A coloring agent (annatto) from the seeds of *Bixa orellana* has been used since prehistoric times in the Amazonian regions of South America.

**CROSSOPSORA BYRSONIMATIS** (P. Hennings) R.S. Peterson, Rept. Tottori Mycol. Inst. Japan 10: 210. 1973. (0/Ice, Ipe/III).

≡ *Cronartium byrsonimatis* P. Hennings, Hedwigia 48: 2. 1908. TYPE on *Byrsonima coccolobifolia* Humboldt, Bonpland & Kunth from **Brazil**, São Paulo: Morro Pellado, July 1904, *Puttemans-1140*.

Synanamorphs

**AECIDIUM BYRSONIMATIS** P. Hennings, Hedwigia 34: 101. 1895. LECTOTYPE on *Byrsonima* sp. from **Brazil**, Goiás, Maranhão, Sept. 1892, *E. Ule-1924*. (0/I,??).

= *Aecidium byrsonimaticola* P. Hennings, Hedwigia 34: 322. 1895. TYPE on *Byrsonima* sp. from **Brazil**, Goiás, *Ule-2150*.

= *Endophyllum singulare* Dietel & Holway, in Holway, Bot. Gaz. (Crawfordsville) 31: 336. 1901. TYPE on *Byrsonima* sp. (recorded mistakenly as "ericaceous plant") from **Mexico**, Jalisco, *M. E. Jones s. n.*

≡ *Aecidium singulare* (Dietel & Holway) Arthur, Amer. J. Bot. 5: 540. 1918. TYPE same as for *Endophyllum singulare*.

≡ *Aecidium byrsonimae* Kern & Kellerman, J. Mycol. 13: 24. 1907. TYPE on *Byrsonima crassifolia* (Linnaeus) Humboldt, Bonpland & Kunth from **Guatemala**, Dept. Baja Verapaz, Sierra de las Minas, 10 Mar 1905, *Kellerman-4325*.

On Malpighiaceae:

*Byrsonima crassifolia* (Linnaeus) DeCandolle, São Marcos, Rio Branco (Sydow, 1916:

71).

*Byrsonima sericea* DeCandolle, Rio de Janeiro (Dietel, 1899: 257).*Byrsonima* sp., Amazonas (Hennings, 1904B: 168), Goiás, Maranhão (Hennings, 1895A: 101; 1895B: 322), Pará (Hennings, 1909: 101).*Aecidium byrsonimatis* has been reported also from Venezuela, Trinidad, Central America and Mexico.

Spermogonia densely and equally distributed on both sides of leaves and stems on deformed, systemically infected shoots, subcuticular, at first yellow-brown, finally chestnut-brown. Aecia scattered among the spermogonia, cylindrical, sometimes up to 1-3 mm high, white; peridial cells firmly united in regular rows, 36-65 x 20-30  $\mu\text{m}$ , rhomboid, outer facing wall 3-4  $\mu\text{m}$  thick, smooth, inner facing wall 5-7  $\mu\text{m}$  thick, coarsely verrucose; aeciospores 28-55 x 22-35  $\mu\text{m}$ , angular ovoid, ellipsoid, or oblong, often apiculate, wall 2-3.5  $\mu\text{m}$  thick at sides, often thicker at the base, apex usually greatly thickened 5-24  $\mu\text{m}$ , yellowish-brown (P. Sydow & H. Sydow, 1923).

*Aecidium byrsonimatis* is almost certainly the aecial anamorph of *Crossopsora byrsonimatis*, although no experimental inoculations have been reported.

***Malupa notata*** (Arthur) Buriticá in Buriticá & Pardo-Cardona, Rev. Acad. Colombiana Cienc. 20: 219. 1996. . We have reidentified the host of *Uredo alibertiae* P. Hennings as *Byrsonima* sp., Malpighiaceae, and the rust as an anamorph of a *Crossopsora*. The host was originally misidentified as *Alibertia elliptica*, Rubiaceae (P. Hennings. 1896. Hedwigia 3: 254). If *Uredo alibertiae* turns out to be an anamorph *C. byrsonimatis*, then *Uredo alibertiae* would have nomenclatural priority over *U. notata* Arthur.

≡ *Uredo notata* Arthur, Mycologia 9: 89. 1917. TYPE on *Byrsonima crassifolia* (Linnaeus) DeCandolle from **Puerto Rico**, Mayaguez, 7 Mar 1916. Whetzel & Olive.

= *Uredo amicososa* Arthur, Bull Torrey Bot. Club 45: 121. 1919. TYPE on *Byrsonima crassifolia* from **Puerto Rico**, Mayaguez, 29 Mar 1917. H. E. Thomas-264. The host was mistakenly reported originally as *Chrysophyllum cainito* Linnaeus, Sapotaceae.

On Malpighiaceae:

*Byrsonima affinis* H. Anderson, Minas Gerais (IBI-12632A).*Byrsonima coccolobifolia* Humboldt, Bonpland & Kunth, Minas Gerais (IBI-12643), São Paulo (Hennings, 1908: 2, IBI-15050).*Byrsonima crassifolia* Humboldt, Bonpland & Kunth, Pará (IBI-13242).*Byrsonima densa*, Maranhão (IBI-15625).*Byrsonima fagifolia*, Minas Gerais (IBI-12779).*Byrsonima intermedia* Jussieu, Mato Grosso do Sul (IBI-13343), Minas Gerais (IBI-12801), Sao Paulo (IBI-12559).*Byrsonima pachyphylla*, Goiás (IBI-13665).*Byrsonima* sp., Amapá (IBI-16083), Mato Grosso (IBI-16751), Minas Gerais (IBI-14495), Para (IBI-16039), São Paulo (IBI-12596).*Crossopsora byrsonimatis* has been reported from southern Brazil to Mexico.**CROSSOPSORA CRASSA** Buriticá & Hennen in Buriticá, Rev. Acad. Colomb. Cienc. 23: 411. 1999.TYPE on *Xylophragma myriantha* (Chamisso) Sprague from **Brazil**, Minas Gerais: S W of Leopoldina on highway to Juis de Fora, 14 Nov 1976, J. F. Hennen & M. M. Hennen-76-648 (IBI-12821). (??,II/III).

Anamorph

***Malupa crassa*** Buriticá & Hennen in Rev. Acad. Colomb. Cienc. 23: 411. 1999. TYPE same as for *Crossopsora crassa*.

On Bignoniaceae

*Xylophragma myriantha* (Chamisso) Sprague, Goiás (IBI-13226), Minas Gerais (IBI-12809, -12821, -12812), (Buriticá, 1999: 412).*Crossopsora crassa* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia scattered or in groups of 2 to 5 on abaxial side of leaves, subepidermal in origin, hymenium semiconcave, deeply immersed, crater-form; paraphyses 30-35 9-12  $\mu\text{m}$ , peripheral, raise up by hyphoid tissue, branched, septate, curved; wall irregularly thickened, dorsally and



apically to ca 6  $\mu\text{m}$ , the inner wall less; urediniospores 31-39 x 18-23  $\mu\text{m}$ , obovoid, wall 0.5-1.0  $\mu\text{m}$  thick, occasionally 1-2 at the apex, finely echinulate, germ pores 2, one at the apex, one at the base. Telia on the abaxial side of leaves, scattered singly or in small groups, subepidermal in origin, surrounded by hyphoid tissue, hymenium flat; teliospores in laterally united, long rows, that form columns or hair-like filaments 5-6 spores across (40-45  $\mu\text{m}$  wide) and up to 1 mm long; teliospores 35-45 x 9-11  $\mu\text{m}$ , cuboid to rectangular, walls cinnamon-brown, outer facing wall ca 2  $\mu\text{m}$  thick, inner facing wall 1  $\mu\text{m}$  thick, germ pore 1, in outer facing wall, germination without dormancy (Buriticá, 1999).

**CROSSOPSORA HYMENAEAE** Dianese, Buriticá, & Hennen, *Fitopatol. bras.* 19: 589. 1994. TYPE on *Hymenaea stigonocarpa* Martius from **Brazil**, Goiás: between Rialma and Rianópolis, 16 July 1979, J. F. Hennen & M. M. Hennen-79-178 (IBI-13654). (?/?,IIpe/III).  
 = *Crossopsora hymenaeae* Buriticá & Hennen in Buriticá & Pardo-Cardono, *Rev. Acad. Colombiana Cienc.* 20: 213. 1996. TYPE same as for *Crossopsora hymenaeae* Dianese, Buriticá & Hennen.

Anamorph

*Peridipes hymenaeae* (Mayor) Buriticá & Hennen in Buriticá & Pardo-Cardono, *Rev. Acad. Colombiana Cienc.* 20: 213. 1996,  
 = *Uredo hymenaeae* Mayor, *Mem. Soc. Neuchatal Sci. Nat.* 5: 586. 1913. TYPE on *Hymenaea* sp from **Colombia**, Antioquia: between Sabaletas and Titiribí, 15 Sept. 1910, *E. Mayor-149*.

On Leguminosae:

*Hymenaea stigonocarpa* Martius, *Distr. Fed., Mato Grosso* (IBI-16721; Dianese et al., 1994).

*Hymenaea* sp., Goiás (IBI-16659), Mato Grosso do Sul, Minas Gerais (IBI-16368; Dianese et al., 1994), São Paulo (IBI-14699).

*Peridipes hymenaeae*, as *Uredo hymenaeae*, an anamorph of *Crossopsora hymenaeae*, has been reported also from Colombia, Central America, The West Indies, and Mexico.

Spermogonia and aecia unknown. Uredinia 0.3-0.7mm across, on the abaxial side of leaves, scattered or in loose groups on brownish spots, subepidermal in origin, opening by an irregular central pore in the overarching epidermis, powdery, dark cinnamon-brown, peridium hyphoid, paraphyses in hymenium 40-48 x 9-12(-17)  $\mu\text{m}$ , cylindrical, flexuous, wall thin, occasionally 2-3  $\mu\text{m}$  thick at apex; urediniospores (26-)29-33(-39) x (13-)16-17(-20)  $\mu\text{m}$ , obovoid or ellipsoid, wall 1  $\mu\text{m}$  at sides, 2-4  $\mu\text{m}$  thick at apex, moderately echinulate, pores (2-)3-4, superequatorial. Telia scattered on the abaxial side of leaflets, subepiermal in origin, erumpent as filiform columns, or mostly developing in old uredinia, dark brown, teliospores in groups of rows united to form a colum, individual spores 26-32 x 7-10  $\mu\text{m}$ , rectangular, wall ca 1  $\mu\text{m}$  thick, cinnamon-brown, those on the outside minutely roughened, germ pore 1, near the end of the spore (Buriticá et al., 1996).

**CROSSOPSORA MATELEAE** Dale, *Commonw. Mycol. Inst. Mycol. Papers* 59: 4. 1955. TYPE on *Matelea viridifolia* (Meyer) Woods from **Trinidad**: River State, Diego Martin, 4 Mar 1947, *W. T. Dale-1335*. (?/?,II/III).

On Asclepiadaceae:

*Oxypetalum appendiculatum* Martius, *Sao Paulo* (de Carvalho, 2001: 74; IBI-18337).

*Crossopsora mateleae* has been reported also from The West Indies and Central America, and on *Gonolobus*, *Macrosepis*, and *Matelea*.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, in groups, cinnamon-brown; supepidermal in origin, opening by a pore, hymenium concave, without intrasoral paraphyses, peripehral paraphyses 25-58 x 8-9  $\mu\text{m}$ , dorsal wall up to 5  $\mu\text{m}$  thick; urediniospores 29-33(-37) x 20-33  $\mu\text{m}$ , angular, ellipsoid to broadly ellipsoid, wall uniformly 1  $\mu\text{m}$  thick, finely echinulate, cinnamon-brown; germ pores 3-5, more or less equatorial. Telia on the abaxial side of leaves, scattered singly, filiform, dark coffee-brown; paraphyses 21-35 x 6-9  $\mu\text{m}$ , peripheral, straight, wall to 5  $\mu\text{m}$  thick, yellowish; teliospores 40-55 6-9  $\mu\text{m}$ , rectangular, in long vertical rows, wall uniformly 1  $\mu\text{m}$  thick, yellowish, germ pore 1, below the equator, germination without dormancy; teliospores coherent in long columns 5-7 spores across (Dale, 1955).

**CROSSOPSORA NOTATA** (Arthur & J.R. Johnston) Arthur, *N. Amer. Flora* 7: 695. 1925.

= *Cronartium notatum* Arthur & J.R. Johnston, *Mem. Torrey Bot. Club.* 17: 114.1918. TYPE

on *Byrsonema crassifolia* (Linnaeus) deCandolle from **Cuba**, Las Tunas, 29 Mar 1916, J. R. Johnston. (??,II/III).

Anamorph

*Malupa miuma* Buriticá, Rev. Acad. Colombia Cienc. 23: 414. 1999. TYPE same as for *Cronartium notatum* listed above.

On Malpighiaceae:

*Byrsonima coccllobifolia* Humboldt, Bonpland & Kunth, Minas Gerais, Federal District (Buriticá, 1999: 415).

*Byrsonima coriacea* DeCandolle, Pará (Albuquerque, 1971: 147; IAN-492).

*Byrsonima crassifolia* Humboldt, Bonpland & Kunth, Pará (Albuquerque, 1971: 147).

*Byrsonima intermedia* Jussieu, São Paulo (Jackson, 1931: 361). Mato Grosso do Sul (Buriticá, 1999: 415).

*Byrsonima rotunda* Grisebach, Federal District (Buriticá, 1999: 415).

*Byrsonima* sp., Pará (IAC-8232). Sao Paulo, Minas Gerais (Buriticá, 1999: 415).

*Crossopsora notata* has been reported also from Cuba and perhaps Central America.

Spermogonia and aecia unknown. Uredinia scattered singly or occasionally in small groups, pale cinnamon-brown, subepidermal in origin, opening by a slit, hymenium concave, paraphyses peripheral, 25-35  $\mu\text{m}$ , straight, rarely curved, then 58-65 x 10-12  $\mu\text{m}$ , wall 6-8  $\mu\text{m}$  thick, yellowish; urediniospores 42-46 x 27-34  $\mu\text{m}$ , obovoid to ellipsoid, wall 3-4  $\mu\text{m}$  thick, occasionally 6-8  $\mu\text{m}$  thick in apex, yellowish, prominently, irregularly verrucose, verrucae in irregular groups and in lines with smooth areas, germ pores 2-3(-4), supraequatorial. Telia on the abaxial side of leaves, scattered singly, paraphyses peripheral, 25-35  $\mu\text{m}$  long, subtended by hyphoid tissue surrounding the sorus; teliospores adherent laterally and end to end in long rows forming filiform, hair-like, coffee-brown columns, 5-8 spores across, individual spores 55-65 x 30-36  $\mu\text{m}$ , rectangular to ellipsoid, outer facing walls 4-6  $\mu\text{m}$  thick, yellowish, smooth, germ pore 1, near the apical end of spore; germination without dormancy.

*Crossopsora opposita* Sydow, see **CROSSOPSORA ULEANA** (H. Sydow & P. Sydow) R.S. Peterson.

**CROSSOPSORA PIPERIS** Berndt, R., F. Freire, and C. N. Bastos, Mycotaxon 83: 266. 2002. TYPE on *Piper hostmannianum* from **Brazil**.

Anamorph

*Malupa piperinum* (Sydow) Buriticá & Hennen, Rev. Acad. Colomb. Cienc. 23: 412. 1999.

≡ *Cerotelium piperinum* Sydow, Ann. Mycol. 37: 318. 1939. TYPE on *Piper* sp. cf.

*pastasani* Diels (Piperaceae), from **Ecuador**, Napo-Pastaza, 21 Feb 1937, Sydow-883. Telia not described.

≡ *Uredo piperinum* (Sydow) Berndt, R., F. Freire, and C. N. Bastos, Mycotaxon 83: 266. 2002.

On Piperaceae

*Piper hostmannianum*

*Piper* sp., Rio de Janeiro (Buriticá & Hennen, 1999: 412: *Puttemans-1959*).

We found a few telia of *Crossopsora* in Puttemans' specimen but not enough for a good type.

Hopefully a new collection with sufficient telia will be found so that this anamorph species can be placed in *Crossopsora*.

**CROSSOPSORA ULEANA** (H. Sydow & P. Sydow) R.S. Peterson, Rept. Tottori Mycol. Inst.(Japan) 10: 221. 1973. (??,IIse/III).

≡ *Cronartium uleanum* H. Sydow & P. Sydow, Ann. Mycol. 14: 70. 1916. TYPE on

*Cyphomandra* sp., Solanaceae, from **Peru** (probably currently **Brazil**), Rio Acre, Seringal Auristella, May 1911, Ule-3422.

= *Crossopsora opposita* Sydow, Ann. Mycol. 37: 319. 1939. TYPE on *Solanum theobromophyllum* Bitter (?= *Solanum anceps* Ruiz & Pavon) from **Ecuador**, Tungurahua: near Banõs, Hacienda San Antonio, 12 Jan 1938, H. Sydow-717.

Anamorph

*Malupa montesina* Buriticá, Rev. Acad. Colombia Cienc. 23: 415. 1999. TYPE same as for *Cronartium uleana* given above.

On Solanaceae:

*Cyphomandra* sp., Rio Acre (Sydow, 1916A: 70).

*Crossopora uleana* has been reported also on *Solanum* and from Peru, Colombia and Ecuador.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, mostly on abaxial side, in circular groups, subepidermal in origin, deeply embedded, opening by a pore; paraphyses peripheral, 28-70 x 7-11  $\mu\text{m}$ , wall irregularly thickened 2-4  $\mu\text{m}$ , yellowish; urediniospores sessile, 26-30 x 19-24  $\mu\text{m}$ , obovoid to ellipsoid, wall 1-1.5  $\mu\text{m}$  thick, uniformly echinulate, yellowish, germ pores probably 3, supraequatorial. Telia by the uredinia, hymenium flat to slightly concave, originating deep in host tissue; paraphyses 80-110 x 5-8  $\mu\text{m}$ , flexuous, wall 2-4  $\mu\text{m}$  thick, yellowish, peripheral at the opening of the sorus originating from hyphoid tissue below; teliospores in long linear rows, forming filiform columns 1-3 mm long, 10 teliospores across, teliospores 60-80 x 6-8  $\mu\text{m}$ , linear, wall more or less uniformly less than 1  $\mu\text{m}$  thick, cinnamon-brown, germ pore 1, supraequatorial.

The long, narrow teliospores aid in identifying *Crossopora uleana*.

We include this record from an area reported originally to be in Peru close to Brazil but the current border probably puts the collection site in Brazil. New collections are needed to determine if this rust occurs in Brazil.

### *Ctenoderma*

*Ctenoderma cristatum* (Spegazzini) H. Sydow & P. Sydow, see **SKIERKA CRISTATA** Mains.

### **CUMMINSIELLA** Arthur,

Bull. Torrey Bot. Club 60: 475. 1933. TYPE SPECIES, *Uropyxis sanguinea* Arthur on *Mahonia* sp. (Berberidaceae) from **The United States of America**. See McCain & Hennen (1982) for a monograph of the species of *Cumminsiella*. Family Pucciniaceae.

Spermogonia subepidermal, Group V (type 4). Aecia with *Aecidium* morphology, subepidermal in origin, erumpent, with peridium, aeciospores catenulate, verrucose. Uredinia subepidermal in origin, with or without paraphyses, urediniospores borne singly on pedicels, walls echinulate or verrucose, pores mostly zonate. Telia subepidermal in origin, erumpent, teliospores 2-celled, borne singly on pedicels, wall pigmented, often bilaminar, the surface variously sculptured, germ pore 2 in each cell, metabasidia external.

Eight species have been reported, all on *Mahonia* or *Berberis* {Berberidaceae}, all autoecious and macrocyclic, and all native to North and South America.

**CUMMINSIELLA SANTA** McCain & Hennen, Systematic Bot. 7: 49. 1982. TYPE on *Berberis* sp., Berberidaceae, from **Brazil**, Santa Catarina: ca 60 km S of Lajes on highway 116, 27 Nov 1976, J. Hennen & M. Hennen-76-739, IBI-12913. (??,IIpe/III).

*Cumminsiella santa* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia, aecia, and uredinia not reported. Urediniospores mixed in telia, 23-26 x 14-18  $\mu\text{m}$ , obovoid, wall ca 1  $\mu\text{m}$  thick, verrucose, colorless to pale cinnamon-brown, pores 3-4, equatorial. Telia mostly on abaxial side of leaves, scattered, 0.3-0.5 mm across, blackish-brown, teliospores 24-29 x 23-25  $\mu\text{m}$ , broadly ellipsoid, broadly rounded above and below, slightly constricted at the septum, wall (1-)1.5-2  $\mu\text{m}$  thick, but 2.5-4  $\mu\text{m}$  thick over pores, chestnut-brown, two layered, outer layer minutely verrucose, pores 2 in each cell, opposite, next to the septum in each cell, pedicel 25-80  $\mu\text{m}$  long, 4-5  $\mu\text{m}$  wide near spore, wider and thicker walled distally, then thinner-walled and verrucose towards the base. not collapsing laterally. (McCain and Hennen, 1982).

*Cumminsiella santa* differs from the seven other species of *Cumminsiella* because of the near absence of teliospore surface roughness and its relatively thin-walled urediniospores. Only two other species have been reported from South America, *Cumminsiella antarctica* and *C. stolpiana*. Both of these have been reported only from far south in Argentina and Chile. Unlike the other six species these have pedicels that swell greatly in liquid mounts.

### *Cystingophora* Arthur,

N. Amer. Flora 7: 131. 1907. TYPE: *Cystingophora hieronymi* (Spegazzini) Arthur ( $\equiv$  *Ravenelia hieronymi* Spegazzini).

Arthur proposed the genus *Cystingophora* for species of *Ravenelia* that have an *Aecidium* anamorph but it is no longer used as a genus.

*Cystingophora hieronymi* (Spegazzini) Arthur, see **RAVENELIA HIERONYMI** Spegazzini.

*Dasturella divina* (H. Sydow) Mundkur & Kheswala, see **KWEILINGIA DIVINA** (H. Sydow) Buriticá.

**DASYSPORA** Berkeley & Curtis,

J. Philadelphia Acad. Sci. ser. 2; 2: 281. 1853. TYPE SPECIES: *Dasyspora gregaria* (Kunze) P. Hennings (*D. foveolata* Berkeley & Curtis).

Spermogonia subepidermal, type 5. Aecia and uredinia unknown, probably not produced. Telia subepidermal in origin, erumpent; spores 2-celled by horizontal septum, borne singly on pedicels, wall pigmented, beset with rod-like verrucae, germ pore 1 in each cell, metabasidium external.

*Dasyspora gregaria* occurs in the American tropics on *Xylopia* spp. (Annonaceae). *Dasyspora* differs from *Puccinia* in the type of spermogonium. The reported "hyphoid" aecium is an alga (Hennen and Figueiredo, 1981).

**DASYSPORA GREGARIA** (G. Kunze) P. Hennings, Hedwigia 35: 231. 1896. **(0/-,-/III),(-/-,-/III).**

=*Puccinia gregaria* G. Kuntze in Weigelt exsicc., 1827 (?), date of issue uncertain. Type: On *Xylopia* sp. (Annonaceae), Surinam, Weigelt s.n. (Holotype B, n.v., isotypes issued in Weigelt's exsicc. by Kunze, PUR, NY, etc.).

=*Dasyspora foveolata* Berkeley & Curtis, J. Acad. Nat. Sci. Philadelphia II. 2: 281. 1853.

Type: a duplicate of the Weigelt specimen listed above for *P. xylopieae* G. Kuntze but separated from the original collection by Schweinitz (Holotype K, isotypes PH, PUR).

[*Aecidium foveolatum* Berkeley & Curtis as "Schweinitz MSS", J. Acad. Nat. Sci. Philadelphia II. 2: 281. 1853, nom. ambig. Type. same as listed above for *D. foveolata*. The name probably applies to an associated alga, *Stomatochroon* sp.]

=*Puccinia compacta* Thuemen, Flora 1875. 364. Type. An isotype of *P. gregaria* G. Kuntze but with erroneous label. Not *P. compacta* Berkeley, 1855.

=*Puccinia winteri* Pазschke, Hedwigia 29: 158. 1890. Type. On *Xylopia* sp. Brazil: Rio De Janeiro, Aug 1887, Ule 98 (Holotype, B, n.v., isotypes issued as Pазschke Fungi europaei et extraeuropaei, cent. 37, no. 3662. n.v.).

=*Puccinia foveolata* (Berkeley & Curtis) P. Hennings, Hedwigia 34: 95. 1895.

*Oidium parasiticum* Kunze in ex P. Hennings, Hedwigia 35: 231. 1896, probably applies to an associated alga, *Stomatochroon* sp.

=*Dicaeoma winteri* (Pазschke) O. Kuntze, Rev. Gen. 3<sup>3</sup>: 471. 1898.

*Dasyspora gregaria* has been reported as widespread in the Neotropics

Spermogonia when produced epiphyllous in small groups. Aecia and uredinia not produced. Telia hypophyllous grouped opposite the spermogonia, or alone, blackish brown, pulvinate becoming pulverulent, spores (27-)30-34(-37) x (19-)22-24(-28) μm, oblong, wall 1.5-2(-2.5) μm thick, closely tuberculate in the mid-region with the tubercles discrete or united in various patterns, beset basally and apically with rod-like (3-)5-6(-8) μm long processes furcated apically in short branches at least in part, chestnut-brown, pores not seen, pedicel slender, thin-walled, colorless, to 40 μm long, or often broken much shorter.

On Annonaceae:

*Xylopia aromatica* (Lamarck) Martius, Apiaí (IBI-17075, 90-32Goiás (PUR-F8700), Mato Grosso (PUR-F18202; Hennen & Figueiredo, Mycologia 1981: 350), São Paulo (IBI-17201).

*Xylopia frutescens* Aub., Pernambuco (IBI-15546).

*Xylopia grandiflora* Saint-Hilaire, Mato Grosso (Joerstad, 1956: 448), Rio de Janeiro (Hennings, 1896: 230), São Paulo (Viégas, 1945: 27; Joerstad, 1956: 448; IAC-3328).

*Xylopia ocrantha* Martius, Bahia (Viégas, 1945: 27; IAC-3039; IBI-2272).

*Xylopia* sp., Amapá (IBI-15994), Amazonas (IBI-17349), Apiaí (IBI-15944), Federal District (IBI-12672), Goiás (PUR-F18771), Maranhão (PUR-F18774), Mato Grosso do Sul (IBI-14323), Minas Gerais (IBI-1587), Pará (IBI-13625), Pernambuco (Batista & Bezerra, 1960: 8; IBI-15586), São Paulo (IAC-3188; IBI-15769).

*Dasyscypha gregaria* is a common rust on Neotropical species of *Xylopia*. Even phanerogamic herbarium specimens have yielded a number of *Dasyscypha gregaria* specimens. Only about half of the telial sori are associated with spermogonia within a population. This may indicate heterogeneity in self fertility and sterility.

Hennen & Figueiredo (1981) discovered that a bright yellow orange zoosporangial stage of an alga, *Stomatocroon* sp, that is often associated with sori of this rust, has been mistakenly reported at various times to be an aecial or uredinial anamorph of this species. This alga was thought at one time to be a hyphoid aecium.. The symbiotic relationship between these two organisms is unknown. Close relatives of this alga have been mistaken for fungi several times (Reynolds, 198?).

Although germination pores are not visible in the teliospores, we have seen a metabasidium emerging from each end of spores indicating that one apical pore occurs in the upper probasidial cell and one basal pore is in the lower cell next to the pedicel.

This species could be placed in *Puccinia* but because of the unique teliospore wall sculpture of coarse tubercles around the sides that merge into larger bifurcated processes at each end of the teliospores, we keep it as a separate genus.

#### *Dendroecia* Arthur,

Result. Sci. Congr. Bot. Vienne p. 340. 1906. TYPE SPECIES: *Dendroecia farlowiana* Dietel Arthur (= *Ravenelia farlowiana* Dietel).

Arthur proposed *Dendroecia* for short cycled species of *Ravenelia* but it is no longer in use.

*Dendroecia lysilomae* (Arthur) Arthur, see **RAVENELIA LYSILOMAE** Arthur var. **LYSILOMAE**.

#### **DESMELLA** H. Sydow & P. Sydow,

Ann Mycol. (Berlin) 16: 241. 1919. TYPE SPECIES *Desmella anemiae* H. Sydow & P. Sydow, on *Anemia tomentosa* from Brazil. See below.

See description of *Desmella anemiae* below.

*Desmella*, for which we believe only one species is known, *D. anemiae*, occurs only in the Neotropics and recently was reported from Hawaii. It has been found on about 21 different genera of ferns. The genus is characterized by producing sori that originate in substomatal chambers of the host leaflets (pinnae). Sporogenous cells are formed that emerge through the stomata and produce uredinio- and teliospores suprastomataly. Several special haustorial hyphae extend from the substomatal sorus and terminate as well developed haustoria within epidermal cells on the adaxial side of the leaf opposite the sorus. The teliospores are two-celled by a vertical to oblique septum and with colorless walls that are thickened distally.. Spermogonia and aecia are unknown.

These very simple thalli of *Desmella* that consist only of one sorus and a few specialized haustorial hyphae resemble the very similar simple thalli of certain *Hemileia* species in India.

**DESMELLA ANEMIAE** H. Sydow & P. Sydow (as “ANEIMIAE”), Ann. Mycol. 16: 241. 1918.

LECTOTYPE on *Anemia tomentosa* var. *fulva* (Schizaeaceae) from **Brazil**, Santa Catarina: Tubarão, *Ule-515*. Lectotype chosen here. (??,II/III).

Anamorph

*Caeoma mbatobiensis* Spegazzini, Anal. Soc. Cient. Argentina 17: 96. 1884. TYPE on ?*Pteris* sp., from **Paraguay**, near Mbatobi, July 1883, *B. Balansa-3866*. This anamorph species needs to be transferred to *Wardia*, another anamorph genus.

= *Caeoma superficiale* Spegazzini, Anal. Soc. Cient. Argentina 17: 96. 1884. TYPE on *Blechnum* sp. from **Paraguay**, near Mbatobi, July 1883, *B. Balansa-3882*.

= *Uredo gymnogrammes* P. Hennings, Hedwigia 34: 337. 1895. TYPE on *Gymnogramma* sp. from **Brazil**, Santa Catarina, ?date?, *Alfr. Moeler-s.n.*

= *Uredo anemiae* P. Hennings, Hedwigia 35: 255. 1896. LECTOTYPE, the same as for *Desmella anemiae* H. Sydow & P. Sydow.

= *Uredo blechnicola* P.Hennings, Hedwigia 43: 165. 1904. TYPE on *Blechnum voluble* from **Brazil**, Rio Jura, Juruá-Mirim, August 1901, *Ule-3141*.

= *Uredo nephrolepidis* Dietel, Mem. Soc. neuchâteloise Sci. nat. 5: 576. 1913. TYPE on

- Nephrolepis pendula* Raddi. from **Colombia**, Antioquia: from Angelopolis to Guaca, 12 Sept, 1910, *Mayor-151*.  
 = *Desmella gymnogrammes* H. Sydow & P. Sydow, Ann. Mycol. 16: 242. 1918. TYPE, see *Uredo gymnogrammes* above, telia not described.  
 = *Desmella mbatobiense* H & P. Sydow, Ann. Mycol. 16: 241. 1918. TYPE, see *Caecoma mbatobiensis* above, telia not described.  
 = *Desmella superficialis* H. Sydow & P. Sydow, Ann. Mycol. 16: 242. 1919. TYPE, see *Caecoma superficiale* above, telia not described.  
 = *Desmella superficialis* Kern in Stevenson, Fungi of Puerto Rico, Contr. Reed Herb. P. 264. 1975. TYPE, see *Caecoma superficiale* above, telia not described. On Pteridophytes: Schizaeaceae, Blechnaceae, and Thelypteridaceae (Polypodiaceae): *Anemia fulva* (Cavanilles) Swartz (Schizaeaceae), São Paulo (Jackson, 1926: 140).

On ferns

- Anemia tomentosa* Swartz, Santa Catarina (PUR-F1240).  
*Anemia* sp., Minas Gerais (Thurston, 1940: 293), Rio de Janeiro (Maublanc & Rangel, 1915: 15), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 112).  
*Blechnum* sp. (Blechnaceae), Amazonas (Hennings, 1904: 165).  
*Gymnogramma* sp. (Polypodiaceae), Santa Catarina (Hennings, 1895: 337).  
*Nephrolepis* sp., São Paulo (IBI-13823).  
*Polypodium* sp. Mato Grosso (IBI-16767), Minas Gerais (IBI-14578), São Paulo (IBI-).  
*Thelypteris* sp., (*Cyclosorus dentata* (Forsk.) Ching (Polypodiaceae, Thelypteridaceae),) Minas Gerais (IBI-14465), São Paulo (IBI-12103).  
**Genus undetermined**, Amapá (IBI-16030), Ceará (IBI-17134).

We treat *Desmella* as having only one species that is wide ranging in the Neotropics from Argentina to Mexico with a wide host range of various ferns. It has also been reported from Hawaii and has been found on cultivated ornamental ferns in São Paulo State.

Spermatogonia and aecia unknown. Sori originate in abaxial substomatal chambers, a small group of sporogenous cells emerge from substomatal chambers squeeze through the stomata and produce uredinio- and teliospores suprastomataly. Several special haustorial hyphae extend from the substomatal sorus and terminate in well developed haustoria within adaxial epidermal cells opposite the sorus. Urediniospores (19-)24(-27), mostly globose; wall ca 1-2  $\mu\text{m}$  thick, evenly echinulate, colorless; pores obscure. Teliospores two-celled by a vertical to oblique septum, (18-)20(-23)  $\mu\text{m}$  high x (21-)25(-28)  $\mu\text{m}$  wide, walls ranging from ca 1.5  $\mu\text{m}$  thick at base and sides to 7  $\mu\text{m}$  thick distally, smooth, colorless to pale yellowish.

The synonyms listed above were segregated originally because of different hosts or slight differences in anamorph spore size, spore wall thickness, visibility of germ pores, and echination. These differences are most likely due to variations in spore ages. Because of the way spores are produced on the suprastomatal sori, spores of different ages may be placed in microscopic preparations. It may be difficult to determine if the spores being described are mature.

We use the spelling of the specific epithet here that conforms with the conserved spelling of the host genus *Anemia*. In most previous reports the spelling has been *D. aneimiae*.

#### **DIABOLE** Arthur,

Bull. Torrey Bot. Club 49:149. 1922. TYPE SPECIES *Diabole cubensis* (Arthur) Arthur, ( $\equiv$  *Uromycladium cubense* Arthur & J. R. Johnston). Family Raveneliaceae.

Spermatogonia subcuticular, type 7. Aecia and uredinia unknown. Telia subcuticular in origin, erumpent, blackish brown, powdery; teliospores with a single pedicel that usually bears two or three distal intercalary cells, two laterally free probasidial cells are attached distally to each intercalary cell; thus each teliospore pedicel has four or six, laterally free probasidial cells, germ pores uncertain, perhaps in a basal pale area of each spore, germination unknown but the metabasidium undoubtedly external. The probasidial cells have a unique "velvety" kind of sculpture.

The type species, the only one known, has been reported from Cuba, Central America, Mexico, Brazil, and introduced elsewhere on *Mimosa* spp. (Leguminosae). *Diabole* is one of a few genera that have subcuticular telia. The genus presumably is related to *Ravenelia* or *Dicheirinia*, or perhaps *Uromycladium* where Arthur first placed it.

**DIABOLE CUBENSIS** (Arthur & J. R. Johnston) Arthur, Bull. Torrey Bot. Club 49: 194. 1922.

(0/-,-/III).

≡ *Uromycladium cubense* Arthur & J. R. Johnston, Mem. Torrey Bot. Club. 17: 119. 1918.

TYPE on *Mimosa pigra* L. (*nom. conserv.*) from **Cuba**, Cienfuegos, Santa Clara, 6 Nov 1915, *Johnston-191*)

On Leguminosae:

*Mimosa pigra* L. (reported as *Acacia cavenia* Benth), Mato Grosso (Joerstad, 1959: 73).

*Diabole cubensis* has been reported also from Cuba, Mexico, and Central America only on *Mimosa* sp. We believe the host of the Brazil record reported by Joerstad (1959) is *Mimosa pigra sensu lat.*, not *Acacia cavenia*.

Spermogonia on the adaxial side of leaves, subcuticular, few in a group, type 7. Aecia and uredinia unknown, doubtless not produced. Telia mostly on the abaxial side of leaves, subcuticular in origin, erumpent, blackish brown, pulverent, teliospores composed of single probasidial cells 15-20 µm diam, usually slightly wider than high, borne in pairs on a common, brownish, short intercalary cell on the pedicel, typically 2 or 3 pairs of intercalary cells on each pedicel, often seen in mounts as radially arranged clusters; wall in upper 2/3 or 3/4 of probasidial cells 1.5-2 µm thick, chestnut-brown and verrucose, verrucae small, discrete or merging in short series, wall in basal part of cell 0.5-1 µm thick, pale and smooth, pores obscure but probably 2 or 3 at the juncture of the pale and chestnut-brown areas of cell wall.

The correct nomenclature of the *Mimosa* host species has been confusing. Barneby (1991), in the most thorough, modern monograph of the genus *Mimosa*, revised the species complex that includes *M. pigra*. He included eight taxa in six species in the complex, one of which was the weedy species that is widespread through the tropics and has been reported as the host of *Diabole cubensis*. In accordance with the rule of priority and typification of plant names in the ICBN, Barneby found that the name *Mimosa pilgra* L. could not be applied to the widespread weedy species and that *Mimosa pellita* Humboldt & Bonpland ex Willdenow was the correct name. But because the name *Mimosa pilgra* L. had been used widely for the weedy species, under the rules of the ICBN, it was conserved in 1994 with a conserved type specimen from Mozambique and deposited in Kew.

The conservation of the name *Mimosa pilgra* L was important because much research has been published using this name for the widespread weedy species. In an effort to find methods of biological control, *Diabole cubensis* has been one of the fungi for this purpose.

*cubensis* has been researched as a possible biological control agent for its hosts because these *Mimosa* taxa have become very aggressive weeds in various parts of the Americas, Southeast Asia, Australia, and Africa.

But, It is difficult to know the most up to date names for the hosts.

#### *Dicaeoma* S. F. Gray,

Nat. Arr. Brit. Pl. 1: 541. 1821. LECTOTYPE SPECIES chosen by Arthur, 1906 is *Dicaeoma persicariae* Gray, a nom. nov. for *Puccinia polygoni-amphibii* Persoon, a heteroecious species with uredinia and telia on *Polygonum amphibium* (Polygonaceae) from Europe.

Most species of *Dicaeoma* are now placed as synonyms of *Puccinia*. Arthur (1920) used *Dicaeoma*, based on a confusing mixture of the variations in the morphological and ontogenic concepts of life cycles, for nearly 270 species that were formerly placed in *Puccinia*. Ontogenically they are long cycled and heteroecious, morphologically the aecia belong to *Aecidium* and the uredinia belong to various anamorph genera with pedicellate spores. Later, Arthur abandoned the use of this genus and it is not used any more.

We have not included all of the many names of *Dicaeoma* that may be synonyms of rust species that occur in Brazil.

*Dicaeoma appendiculata* (Winter) Kuntze, see **PROSPIDIUM APPENDICULATUM** (Winter) Arthur var **APPENDICULATUM**.

*Dicaeoma cannae* (Winter) Arthur, see *Uredo cannae* Winter (**Puccinia thaliae** Dietel).

*Dicaeoma claviformis* (Lagerheim) Kuntze, see **Puccinia claviformis** Lagerheim.

*Dicaeoma cressae* (Lagerheim) Kuntze, see **Puccinia tuyutensis** Spegazzini.

*Dicaeoma fuirenicola* Arthur, see *Uredo fuirencae* P. Hennings (**PUCGINIA FUIRENICOLA** Kern)

*Dicaeoma hyptidis-mutabilis* (Mayor) Arthur, see **PUCGINIA HYPTIDIS-MUTABILIS** Mayor.

*Dicaeoma insititium* (Arthur) Arthur, see **PUCGINIA INSITITIUM** Arthur.

*Dicaeoma leonotidis* Arthur, see **PUCGINIA LEONOTIDICOLA** P. Hennings.

*Dicaeoma medellinense* Arthur, see **PUCGINIA MEDELLINENSIS** Mayor.

*Dicaeoma minutum* (Diétel) Arthur, see **PUCGINIA MINUTA** Diétel.

*Dicaeoma ormosiae* (Arthur) Arthur, see **DICHEIRINIA ORMOSIAE** (Arthur) Cummins.

*Dicaeoma pampeana* (Spegazzini) Kuntze, see **PUCGINIA PAMPEANA** Spegazzini.

*Dicaeoma phakopsoroides* (Arthur & Mains) Arthur & Fromme, see **PHAKOPSORA PHAKOPSOROIDES** (Arthur & Mains) Buriticá & Hennen.

*Dicaeoma paranahybae* (P. Hennings) O. Kuntze, see **PUCGINIA PARANAHYBAE** P. Hennings.

*Dicaeoma pluchaea* Arthur & Jackson, see **PUCGINIA OCELLIFERA** Cummins.

*Dicaeoma pluchaeae* (Sydow) Arthur & Jackson, see **PUCGINIA OCELLIFERA** Cummins.

*Dicaeoma polygoni-amphibii* Arthur, see **PUCGINIA POLYGONI-AMPHIBII** Persoon.

*Dicaeoma prosperum* (Arthur) Arthur, see **PUCGINIA FARINACEA** Long.

*Dicaeoma scleriae* (Pazschke) Arthur, see **PUCGINIA SCLERIAE** (Pazschke) Arthur.

*Dicaeoma tuyutensis* (Spegazzini) Kuntze, see **PUCGINIA TUYUTENSIS** Spegazzini.

#### **DICHEIRINIA** Arthur,

N. Amer. Flora 7: 147. 1907. TYPE SPECIES *Dicheirinia binata* (Berkeley & Curtis) Arthur ( $\equiv$  *Triphragmium binatum* Berkeley), see below. Family Raveneliaceae

Spermogonia subcuticular, type 7. Aecia subepidermal in origin, erumpent; aeciospores borne single on pedicels. Uredinia subepidermal in origin, erumpent, similar to the aecia but without spermogonia, mostly with peripheral paraphyses which often are branched and "fancy"; urediniospores borne singly on pedicels as the aeciospores, pores equatorial or basal. Telia subepidermal in origin, erumpent; teliospores with 2-4-probasidial cells separated by vertical septa, walls pigmented, mostly ornamented with block-like warts or spines, the pedicel with 1 apical intercalary cell for each probasidial cell, these laterally united, germ pore or slit 1 in each cell, metabasidium external.

All of the fifteen species that are known occur on Leguminosae. *Dicheirinia canariensis* Urries on *Cytisus proliferi* from the Canary Islands, *D. maderensis* H. B. Gjaerum on *Teline maderensis* from Madeira, *D. trispora* on *Abrus precatorius* from Maritius, and *D. viennotii* Huguenin on *Albizia* sp. from New Caledonia are the only species reported outside of the Neotropics. Seven species are known for Brazil. See Cummins (1935 and 1940) for other species from the Neotropics.

#### **Key to help identify *Dicheirinia* spp. based on urediniospores**

1. Uredinia unknown or not produced, microcyclic, only spermogonia and telia: (*D. archeri*, *D. manaosensis*, *D. quadrispora*, *D. spinulosa*, *D. superba*. See key based on telia).
1. Urediniospores produced



2. Urediniospores equatorially three lobed, 1 pore in each lobe (see *Ravenelia bakeriana* also). *D. guianensis* (on *Lonchocarpus*).
2. Urediniospores not lobed
  3. Urediniospores with 3 equatorial germ pores...*D. binata* (on *Erythrina* & *D. antunes* (on *Ormosia*).
  3. Urediniospores with 1 basal germ pore next to hilum
    4. Urediniospores (24-)29-34(-37) x (20-)23-26(-28)  $\mu\text{m}$ , wall echinulate with a smooth spot near base. *D. ormosiae* (on *Ormosia*).
    4. Urediniospores (18-)22-28(-30) x (15-)18-23(-25)  $\mu\text{m}$ , wall echinulate without a noticeable smooth spot near base.*D. uleana* (on *Ormosia*).

**Key to help identify *Dicheirinia* spp. based on telia and paraphyses**

Add *D. mirable* (H. Sydow) Hennen & Cummins, and *D. manaosensis* under both number ones!

1. Teliospores with mostly two- or one probasidial cells.
  2. Teliospore pedicel with one intercalary cell, paraphyses "cauliflower-like" ....  
*D. ormosia* (on *Ormosia*).
  2. Teliospore pedicel with two intercalary cells when two probasidial, paraphyses not "cauliflower-like."
    3. Paraphyses very few, if present clavate-capitate, often *Puccinia*-like, without urediniospores, short-cycled with spermogonia  
*D. manaosensis* (on *Lonchocarpus*, *Derris*).
    3. Paraphyses terminating in an irregular knob or fist-like head, teliospore sculpture digitate  
*D. binata* (on *Erythrina*).
    3. Paraphyses not as above, teliospore sculpture cubical, or bead-like
      4. Paraphyses straight cylindrical 30-50 x 8-10  $\mu\text{m}$ .  
*D. suberba* (on *Piptadenia*).
      4. Paraphyses otherwise
        5. Paraphyses clavate-capitate, often *Uromyces*-like.  
*D. archeri* (on *Lonchocarpus*).
        5. Paraphyses incurved-cylindrical to worm-like, thick-walled leaving a narrow irregular lumen on inner side
          6. Paraphyses 11-18 x to 170  $\mu\text{m}$  long, urediniospores angularly obovoid or more or less triangular, wall more or less evenly thickened, germ pore 1, basal.  
*D. uleana* (on *Ormosia*).
          6. Paraphyses x to 250  $\mu\text{m}$  long, urediniospores mostly spherical, wall closely echinulate with two or three thinner areas associated probably with 2 or 3 supraequatorial germ pores  
*D. antunes* sp nov (on *Ormosia*).
  1. Teliospores mostly with three or four probasidial cells.
    7. Teliospores mostly four celled, echinulate, telia without paraphyses.
      8. Teliospores 20-23(-24)  $\mu\text{m}$  high x 28-32(-34) wide, becoming smooth basally  
*D. quadrispora* (on *Acacia*)
      8. Teliospores 20-32(-36)  $\mu\text{m}$  high x 26-42(-48)  $\mu\text{m}$  wide, echinulate below  
*D. spinulosa* (on ???).
    7. Teliospores mostly three-celled.
      9. Paraphyses numerous, clavate-capitate, often *Puccinia*-like, urediniospores often present.  
*D. guianensis* (on *Lonchocarpus*).
      9. Paraphyses very few, if present clavate-capitate, often *Puccinia*-like, without urediniospores, short-cycled with spermogonia  
*D. manaosensis* (on *Lonchocarpus* & *Derris*).

**DICHEIRINIA ARCHERI** Cummins, Bull. Torrey Bot. Club 64: 42. 1937. TYPE on *Lonchocarpus nicou* De Candolle, Scotelweg, Surinam, 2 Nov 1934, W. A. Archer H-256. (0/-, -/III).  
On Leguminosae

**Derris** sp., Amazonas (Rezende, 1999).

**Lonchocarpus** sp., Amazonas (IBI-14119).

*Dicheirinia archeri* has been reported also from Colombia, Peru, and Venezuela.

Spermogonia mostly on the abaxial side of leaves and on rachis in hypertroped areas. Aecia and uredinia not produced. Telia around and among the spermogonia, deep-seated, dark brown, paraphyses peripheral, basally united, septate, the terminal cell clavate or capitate, colorless or usually brown, thickened 3-10  $\mu\text{m}$  at apex and often *Uromyces*-like; teliospores 2 celled (very rarely 3 celled) by vertical septum (30-35-42(-44)  $\mu\text{m}$  high, (38-)40-50(-53)  $\mu\text{m}$  wide with septum in view, wall 1.5-2(-3)  $\mu\text{m}$  thick except slightly thicker above, chestnut-brown, often or usually smooth basally, densely sculptured above with variously shaped and sized tuberculate or cubical processes (1.5-)2-4(-6)  $\mu\text{m}$  thick, paler than the wall proper and forming a corona-like layer, pore or slit 1 in each cell wall at apex next to the septum but obscured by the sculpture, pedicel simple below, colorless or yellowish, usually broken just below the 2 distal intercalary cells.

Considerable variation occurs mainly in spore size. Apparently, some of the host plants are of commercial importance, hence get moved about (rust and all). Perhaps a variety or varieties could be distinguished if more collections were available.

**DICHEIRINIA BINATA** (Berkeley & Curtis) Arthur, N. Amer. Flora 7: 147. 1907. **(0/Ipe,IIpe/III).**

$\equiv$  *Triphragmium binatum* Berkeley & Curtis, Proc. Amer. Acad. Sci. 4: 125. 1859 (1860). TYPE on *Erythrina* sp, reported originally as "leaves of unknown plant", from **Nicaragua**, date not reported, *C. Wright s.n.*

$\equiv$  *Diorchidium binatum* (Berkeley & Curtis) De-Toni in Saccardo, Sylloge Fungorum 7:736. 1888.

Anamorph

***Lecythea pezizaeformis*** Berkeley & Curtis, Proc. Amer. Acad. Sci. 4: 127. 1859 (1860). TYPE same collection as for *Triphragmium binatum* Berkeley & Curtis. This name needs to be transferred to an appropriate anamorph genus.

$\equiv$  [*Uredo pezizaeformis* (Berkeley & Curtis) De-Toni in Saccardo, Sylloge Fungorum 7: 736. 1888, nom. nov. for *Lecythea pezizaeformis*].

= *Uredo cabreriana* Kern & Kellerman, J. Mycol. 13: 25. 1907. TYPE on *Erythrina glauca* Wildenow from **Guatemala**, Dept. Izabel, Livingston, 18 Jan 1905, *Kellerman-5465*. The host was reported mistakenly as *Buettneria lateralis* (Sterculiaceae) in the original publication.

*Dicheirinia binata* has been reported on *Erythrina crista-galli* Linnaeus, *E. glauca* Wildenow, and *E. umbrosa* Humboldt, Bonpland & Kunth, Leguminosae, from Central America, Islands in the Caribbean, Trinidad, Venezuela, and Colombia. It has not yet been reported from Brazil but is to be expected.

Spermogonia on distorted or gall-like growths on both sides of leaves and petioles. Aecia becoming confluent around the spermogonia, brown, with few or many paraphyses, spores as the urediniospores. Uredinia mostly on the abaxial side of leaves, brown, with numerous, colorless, refractive, irregularly knob-like paraphyses to 30  $\mu\text{m}$  wide, solid or near so in the head, urediniospores (28-)32-35(-38) x (22-)25-29(-31)  $\mu\text{m}$ , asymmetrical, obovoid as usually seen but more or less reniform or with one flat side when turned "on edge", wall (2.5-)3-3.5(-4)  $\mu\text{m}$  thick at sides, often thicker apically, echinulate, pores 3(4), equatorial. Telia as the uredinia except blackish brown, spores 2-celled, (30-)33-38(42)  $\mu\text{m}$  high, (38-)45-55(-60)  $\mu\text{m}$  wide when both cells show fully, wall (1.5-)2-3  $\mu\text{m}$  thick at sides, 4-6  $\mu\text{m}$  thick apically, chestnut-brown, with numerous simple or branched projections to 9  $\mu\text{m}$  long and 6  $\mu\text{m}$  wide at base; pedicel colorless, to 50  $\mu\text{m}$  long, usually broken near intercalary cells, the 2 intercalary cells distinct.

Spermogonial and aecial infections occur on greatly swollen, distorted, or gall-like growths on young tissues.

**DICHEIRINIA GUIANENSIS** Cummins, Bull. Torrey Bot. Club 64: 39-40. 1937. TYPE on

*Lonchocarpus nicou* De Candolle, from **British Guiana**, Bonisiki Landing, Arawan River, N. W. District, , 16 July 1934, *W. A. Archer H-248* (orig. publ. date 7 July and coll. no. H-256 erroneous). **(0/Ipe,IIpe/III).**

On Leguminosae

***Derris galabrescens*** (Bentham) Mael., Pará, (10 Oct 1978, *O. Freire s.n.*).

*Lonchocarpus* sp., Amazonas (Krukoff-7690).

*Dicheirinia guianensis* has been reported also from Colombia and British Guiana.

Spermogonia on both sides of leaves, closely grouped in slightly hypertrophied areas. Aecia around and among the spermogonia, brown, deeply seated, with abundant verrucose, capitate, peripheral paraphyses united basally, septate and resembling teliospores of *Puccinia* because the apical cell is thick-walled and chestnut-brown apically, aeciospores pedicellate, 40-47(-50)  $\mu\text{m}$  high, (29-)33-43(-47)  $\mu\text{m}$  wide, variable in appearance depending on the orientation but strongly 3-lobed equatorially, rounded apically and narrowed basally (with reference to hilum), wall uniformly 2.5-2  $\mu\text{m}$  thick, chestnut-brown, echinulate, pores 3 with 1 in each equatorial lobe. Uredinia on the abaxial side of leaves, scattered with little or no hypertrophy, otherwise and the urediniospores as in aecia. Telia first among aecia, later scattered as the uredinia, teliospores 3-celled, (30-)35-44  $\mu\text{m}$  high, 35-42(-44)  $\mu\text{m}$  wide, variable in shape depending upon orientation of spores, the central cell usually higher in placement than the two lateral cells, wall 2-2.5  $\mu\text{m}$  thick or slightly thicker apically, dark chestnut-brown, conspicuously adorned especially apically with rounded or cubical tubercles in varying number and arrangements, pores obscure, probably 1 in each cell apically at the inner angles, pedicel simple basally, colorless, with 3 distal intercalary cells, 1 for each probasidial cell.

The inconspicuous low, rounded verrucae on the paraphyses were not reported before. The urediniospores and paraphyses are almost identical to those of *Ravenelia bakeriana*.

**DICHEIRINIA MANAOSENSIS** (P. Hennings) Cummins, Mycologia 27: 158. 1935. (0/-, -/III).

≡ *Diorchidium manaosense* P. Hennings, Hedwigia 43: 159. 1904. TYPE on *Lonchocarpus rariflorus* Martius from **Brazil**, Amazonas: Manaus, Rio Negro, August 1900, *Ule-3113*. (B; probable isotypes *Ule*, *Mycotheca brasiliensis* No. 11). 1904.

On Leguminosae

*Lonchocarpus rariflorus* Martius, Amazonas (Hennings, 1904B: 159; Cummins, 1935: 158).

*Lonchocarpus* sp., Roraima (*Prance-9639*).

*Dicheirinia manaosensis* has been reported also from Colombia and French Guiana.

Spermogonia closely grouped in hypertrophied areas of leaf blades, veins, midrib, and peduncles, subcuticular. Aecia and uredinia not produced. Telia on both sides of leaves, among and around the spermogonia, brown, mostly on the abaxial side of leaves, subepidermal in origin, deeply seated, with a few peripheral paraphyses the apical cell of which is thick-walled and like *Puccinia* teliospores, teliospores mostly 3-celled (occasionally 2-celled) by vertical septa, (38-)44-55(-65)  $\mu\text{m}$  high, (36-)40-55(-59)  $\mu\text{m}$  wide, varying in appearance depending on the orientation of the spore; wall 1.5-2  $\mu\text{m}$  thick or somewhat thicker at apex, chestnut-brown, conspicuously sculptured, especially apically with variously shaped tubercles or plaques to 8  $\mu\text{m}$  thick, pores or germ slits obscure, probably apical at the inner angles but obscured by the sculpture; pedicels simple below, usually broken below the intercalary cells, with 2-3 distal intercalary cells next to the probasidial cells.

Cummins (1935) reported that probasidial cells ("teliospores") are "borne 3 (rarely 2) on a pedicel" but we observed that teliospores in the one slide that we made from the type had mostly 2 probasidial cells.

**DICHEIRINIA ORMOSIAE** (Arthur) Cummins, Mycologia 27: 155. 1935. (?/?, IIpe/III).

≡ *Puccinia ormosiae* Arthur, Mycologia 9: 78. 1917. TYPE on *Ormosia krugii* Urban from

**Puerto Rico**: El Yunque, 14 April 1916, *Whetzel & Olive-276*.

≡ *Dicaeoma ormosiae* (Arthur) Arthur, N. Am. Fl. 7: 391. 1920.

On Leguminosae:

*Ormosia nobilis* Tulasne, Pará (IBI-13284).

*Dicheirinia ormosiae* has been reported also from Puerto Rico and Santo Domingo.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, subepidermal in origin becoming erumpent, scattered, discrete, with a conspicuous rim of whitish, peripheral paraphyses around a brown center, paraphyses with a thick stalk much branched apically, botryoid, the ultimate branchlets short columnar, colorless, the whole structure somewhat as a piece of cauliflower head, urediniospores (24-)29-34(-37) x (20-)23-26(-28)  $\mu\text{m}$ , obovoid with the pore face view, triangular with the pore lateral, wall (2-)2-2.5(-3)  $\mu\text{m}$  thick, dark cinnamon- or chestnut-brown, echinulate but smooth in an area near the base, pore 1, next to the hilum. Telia as the uredinia, teliospores 2-(rarely 3)-celled by vertical septum, (25-)28-33(-35)  $\mu\text{m}$  high, (27-)33-40(-42)  $\mu\text{m}$  with septum face view, wall 2.5-3  $\mu\text{m}$  thick, chestnut-brown, closely ornamented with rounded or irregular, pale brown tubercles 3-4  $\mu\text{m}$  thick, pore 1 in each cell in apex next to the septum,

obscured by ornamentation, pedicel colorless, 1- septate about 6-8  $\mu\text{m}$  below hilum thus forming a single intercalary cell, the lower part deciduous and very fragile.

*Dicheirinia ormosiae* differs from all other species of the genus in having a single intercalary cell bearing a 2-celled teliospore.

*Dicheirinia solenioides* Cummins, see **DICHEIRINIA ULEANA** Hennen & Cummins.

**DICHEIRINIA SUPERBA** H. S. Jackson & Holway in Jackson, Mycologia 23: 333. 1931. TYPE on *Piptadenia* sp., mistakenly reported originally as *Inga* sp., **Brazil**, Rio de Janeiro: Petropolis, 20 Oct 1921. *E.W. D. Holway-1234. (0/-,-/III).*

On Leguminosae:

*Piptadenia* sp., Rio de Janeiro (Jackson, 1931: 333; Cummins, 1935: 158), São Paulo (IBI-18100, 98-533).

*Dicheirinia superba* has been reported only from Brazil from the three collections reported above.

Spermogonia and telia usually locally systemic on distorted young shoots forming small witches' brooms and on leaves, on both sides of leaflets, petioles, or stems, spermogonia usually displaced by developing, very powdery, blackish telia. Aecia and uredinia not produced. Telial paraphyses 30-50 x 8-10  $\mu\text{m}$ , peripheral, palisade-like, irregularly cylindrical, rounded above, 0, 1, 2 septate; wall 0.5-1  $\mu\text{m}$  thick, some unilaterally 1.5-2  $\mu\text{m}$  thick, colorless; teliospores mostly two-celled, (20-)22-25  $\mu\text{m}$  high x (23-)26-28(-30)  $\mu\text{m}$  wide; walls 1-1.5(-2)  $\mu\text{m}$  thick, chestnut-brown, adorned with cubical or irregularly shaped plaque-like tubercles, 1-2(-3)  $\mu\text{m}$  high, these in short linear series or randomly arranged, most abundant apically, and sometimes lacking basally, germ slits apical next to the vertical septum, intercalary cells 2, one proximal to each probasidial cell, pedicel thin-walled, fragile, breaking shortly below the intercalary cells.

#### **DIDYMOPSISORA** Dietel,

Hedwigia 38: 254. 1899. LECTOTYPE SPECIES *Didymopsisora solani-argentei* (P. Hennings) Dietel. See below. Family Puccinosiriaceae.

Spermogonia in small groups, globose or flask shaped, with ostiolar periphyses. Telia often form in a circle around spermogonia, subepidermal in origin, deep seated, erumpent, arising from a mycelium-lined cavity, without peridia, forming short or more or less long columns; teliospores two celled, catenulate, with or without intercalary cells between the teliospores, one germ pore per cell or pores obscure, spores usually become disoriented and irregularly arranged as the mature sori. This disorientation may disguise the two-celled trait of the teliospores in mature sori.

*Didymopsisora* is a genus of six species, all from the neotropics except one from Africa. Like other genera of the Puccinosiriaceae, *Didymopsisora* is considered as polyphyletic, its species probably being short cycle derivatives of various long cycle species of *Puccinia* that parasitized several host families. But no one has yet suggested a putative parental species for any *Didymopsisora*.

Theoretically, in the process of short cycling, the telia of *Didymopsisora* have followed a pathway in which some traits of the parental telia and aecia are combined. The teliospores are two-celled and the telia often lack peridia as in the parental telia, but the teliospores also are catenulate and have intercalary cells as in the parental aecia (Buriticá, & Hennen, 1980).

#### **Key to help identify species of *Didymopsisora***

1. Teliospores yellow-brown
  2. Teliospores 21-30 x 17-27  $\mu\text{m}$ 
    1. *D. paraguayensis*.  
On *Barnadesia* sp., Compositae, from **Paraguay**.
    2. Teliospores 50-65 x 23-28  $\mu\text{m}$ 
      2. *D. chquiraguae*.  
On *Chuquiraga* sp., Compositae, from **Brazil**.
1. Teliospores colorless
  3. Teliospores irregularly verrucose
    3. *D. solani-argentei*.  
On *Solanum* sp., Solanaceae, from **Brazil**.
  3. Teliospores smooth
    4. Teliospores 18-32 x 9-14  $\mu\text{m}$ 
      4. *D. triumfettae*.  
On *Triumfetta* sp., Tiliaceae, from **Brazil**.

4. Teliospores 30-35 x 19-22  $\mu\text{m}$  5. *D. solani*.  
Probably *Chrysocyclus cestri* on *Cestrum* sp., Solanaceae, from **Brazil**.  
4. Teliospores 30-45 x 19-22  $\mu\text{m}$  6. *D. africana*.  
On *Dissotis* sp., Melastomataceae, **Africa**.

**DIDYMOPSISORA CHUQUIRAGUAE** Dietel (sic), Hedwigia 38: 255. 1899. TYPE on *Chuquiraga tomentosa* Baker from **Brazil**, Santa Catarina, Serra do Oratorio, April 1889, *Ule-1319*. (0/-,-/III).

On Compositae:

*Chuquiraga glabra* Philippi var. *multiflora* Baker, Riode Janeiro (Jackson, 1932: 183; Buriticá & Hennen, 1980: 36).

*Chuquiraga paniculata* D. Don, Rio Grande do Sul (Lindquist & Costa Neto, 1967: 64).

*Chuquiraga tomentosa* Baker, Santa Catarina (Dietel, 1899: 255; Buriticá & Hennen, 1980: 36).

*Chuquiraga* sp., Minas Gerais (IBI-14583).

*Didymopsisora chuquiraguae* has been reported only from Brazil.

Spermogonia on adaxial side of leaves, in groups, flask-shaped, 100-160  $\mu\text{m}$  in diameter. Telia on spots up to 1 cm across on abaxial side of leaves, columnar, hair-like, 1 mm or more long, brown to golden-brown; teliospores 50-65 x 23-28  $\mu\text{m}$ , walls 1-2  $\mu\text{m}$  thick, pale yellow-brown, germ pore one per cell, usually lateral (Buriticá, & Hennen, 1980).

**DIDYMOPSISORA SOLANI** Dietel, Hedwigia 38: 255. 1899. TYPE on *Solanum* sp., Solanaceae, from **Brazil**, Rio de Janeiro: Nova Friburgo, Jan 1898, *Ule-2540*. (0/-,-/III). Known only from the type specimen.

A color photo of the type specimen from HBG suggests that the host is probably *Cestrum* sp. and the yellow circular rust sori are probably *Chrysocyclus cestri*. To determine this with certainty telia from the type specimen need to be examined microscopically.

**DIDYMOPSISORA SOLANI-ARGENTEI** (Hennings) Dietel, Hedwigia 38: 255. 1899.. (0/-,-/III).

≡ *Aecidium solani-argentei* P. Hennings, Hedwigia 35: 260. 1896. TYPE on *Solanum argenteum* Dunal ex Poiret from **Brazil**, Santa Catarina, Aug 1887, *Ule-659*.

On Solanaceae:

*Solanum argenteum* Dunal ex Poiret, Rio de Janeiro (Dietel, 1899: 254; Maublanc & Rangel, 1915: 15; Buriticá & Hennen, 1980: 36), Santa Catarina (Hennings, 1896: 260), São Paulo (Viégas, 1945: 10; IAC-3313, IBI-12139, -13072, -15619).

*Solanum swartzianum* Roemer & Schultes, Minas Gerais (Thurston, 1940: 293), Rio de Janeiro (Jackson, 1932: 81; Buriticá & Hennen, 1980: 36).

*Solanum* sp., São Paulo (Jackson, 1932: 81; Buriticá & Hennen, 1980: 36; IBI-9445).

Dietel (1899: 254) records this species as a transfer from *Aecidium solani-argentei* P. Hennings and reported only one specimen, *Ule-2157*, which was collected in Rio de Janeiro, August 1895. When Hennings (1896: 260) proposed *Aecidium solani-argentei*, he recorded only one specimen, *Ule-659* on *Solanum argenteum* from Santa Catarina. This specimen, *Ule-659*, must be considered as the holotype of the species, not *Ule-2157* cited by Dietel.

Spermogonia on the adaxial side of leaves, in groups on round, discolored spots 2-5mm across, 100-160  $\mu\text{m}$  in diameter. Telia on the abaxial side of leaves opposite the spermogonia in circular groups, columnar, 1-5 mm long, whitish or light yellow. Teliospores 45-70 x 30-40  $\mu\text{m}$ , ellipsoid to ellipsoid-oblong, rounded at both ends; wall 1.5-2.5  $\mu\text{m}$  thick, irregularly verrucose, colorless or pale yellow-brown, germ pore not evident.

Telial columns are often hair-like and 1mm or more long. The yellow-brown cell walls of the teliospores and those of the persistent intercellular cells are noticeably verrucose. These traits distinguish this species from other *Didymopsisora* species (Buriticá, & Hennen, 1980).

**DIDYMOPSISORA TRIUMFETTAE** H. S. Jackson & Holway in Jackson, Mycologia 23: 476. 1931.

TYPE on *Triumfetta longicornis* Saint-Hilaire, **Brazil**, Minas Gerais, Juiz de Fora, 17 Dec 1921, *Holway-1405*. (-/-,-/III).

On Tiliaceae:

*Triumfetta longicornis* Saint-Hilaire, Minas Gerais (Jackson, 1931: 476; Buriticá & Hennen,

1980: 37).

*Didymopsora triumfettae* is known only from Brazil.

Spermogonia, aecia, and uredinia unknown, probably not formed. Telia on the abaxial side of leaves, single or in closely aggregated groups of 3-10 sori on slightly hypertrophied areas, groups usually more or less circular in outline, when associated with leaf veins more elongate; individual telia deep seated, waxy, in the form of cylindrical columns to 1 mm long x 200-275  $\mu\text{m}$  across at the base, without peridium or paraphyses; teliospores 18-38 x 8-14  $\mu\text{m}$ , oblong, in vertical rows, two celled, without intercalary cells, constricted at the septum, the septum often obscured, then appearing 1-celled, wall ca 1  $\mu\text{m}$  thick, but perhaps becoming thicker by swelling, colorless, smooth, or minutely verrucose, germ pore not seen, germinating at once from apex to base of column.

This very distinct species might easily be confused in the field with *Puccinosira pallidula* (Spegazzini) Lagerheim. The telia are more waxy in consistency and may become considerably longer than in that species, and are of considerably greater diameter at the base. Microscopically the two species are quite different. In this species there is no evidence of a peridium and a most careful search has failed to reveal the presence of intercalary cells, which are consistently present and quite easily demonstrated in the *Puccinosira*.

When the two-celled trait of the teliospores is not seen, this species can be confused with *Dietelia* or *Chionothrix*. If a peridium is present but not detected the rust could be *Puccinosira pallidula*, which is the most common rust species on *Triumfetta*.

I have assigned the species to *Didymopsora* as it seems to fit the characters of that genus better than any other. The two celled character of the spore is in sonic mounts very evident, in others one obtains the impression of chains of one celled spores suggesting *Endophylloides* or *Chionothrix*.

Elsewhere (Mem. Torrey Club 18: 78-80. 1931) I have discussed the possible origin of *Puccinosira* and similar genera and pointed out their resemblance to *Endophyllum*. In the species under discussion it seems possible to account for its origin from an *Endophyllum*-like species in which the spores have become vertically and laterally adherent due to tile gelatinization of tile cell wall, tile peridium has been lost or has reverted to the ancestral condition and retained the spore function, and in which the intercalary cell cut off from tile spore initial also becomes functional as a spore cell. It is noticeable that this species and the next as well as many other species in these and related genera have an *Aecidium*-like habit as shown by the deep seated character of the sorus initial and the tendency to be aggregated in close groups often on slightly hypertrophied areas.

#### DIETELIA P. Hennings,

Hedwigia 36: 215. 1897. TYPE SPECIES *Dietelia veruciformis* (P. Hennings) P. Hennings ( $\equiv$  *Cronartium veruciforme* P. Hennings, Hedwigia 35: 245. 1896. TYPE on *Sida flavescens* Cav., Malvaceae, from Argentina: Prov. Cordoba, Sierra Chica, between Pan de Azucar and Colanchanga, 11 Nov 1881, *Hieronymus s.n.*). Family Puccinosiriaceae.

= *Endophylloides* Whetzel & Olive in Olive & Whetzel, Amer. J. Bot. 4: 50. 1917.

= *Jacksonia* Lindquist, Rev. Fac. Agron. La Plata 46: 202. 1970. Not R. Brown, Act. Hort. Bol. Kew 2: 12. 1811.

$\equiv$  *Jacksoniella* Lindquist, Rev. Fac. Agron. La Plata 47: 304. 1971. Not Kamat & Sathe, Indian Phytopath. 25: 78. 1972.

Spermogonia subepidermal, flask-shaped, or wanting. Telia *Aecidium*-like but waxy or horny or somewhat powdery. Peridia persistent and somewhat attached to the teliospores, spores one-celled, in more or less coherent vertical rows to form a low compact, peridiate, cylindrical sori, intercalary cells at least in the base of the telia, wall lightly pigmented or colorless, smooth or somewhat verrucose, germ pore one or none.

The sori are similar to *Endophyllum* or even *Aecidium*. Spore germination is required to know with certainty that the spores are teliospores.

Six species of *Dietelia* have been reported, five neotropical and one from the Philippines. Only the following one has been reported in Brazil (Buriticá & Hennen, 1980).

#### DIETELIA DUGUETIAE (Thurston) Buriticá & Hennen, Fl. Neotropica 24: 17. 1980. (0/-,-/III).

$\equiv$  *Endophylloides degueliae* Thurston (sic), Mycologia 32: 293. 1940. TYPE on *Duguetia furfuracea* (Saint-Hilaire) Bentham & Hooker (Annonaceae) from **Brazil**, Minas Gerais, Uberlandia, 18 May 1936, *Muller s.n.* Thurston mistakenly reported the host as *Deguelia*, a

genus in the Leguminosae. Buriticá and Hennen corrected the spelling when they transferred the species to *Dietelia*.

= *Alveolaria duguetiae* Viégas, *Bragantia* 5: 9. 1945. TYPE on *Duguetia furfuracea* (Saint-Hilaire) Bentham from **Brazil**, São Paulo: Vale do Paraíba, 26 July 1937, *J. Ferra da Cunha* 2107.

On Annonaceae:

***Duguetia furfuracea*** (Saint-Hilaire) Bentham & Hooker, Federal District (IBI-14898), Goiás (IBI-13228), Minas Gerais (Thurston, 1940: 293; IBI-12638), São Paulo (Viégas, 1945: 9; IBI-12620).

*Dietelia duguetiae* has been reported only from Brazil and is easily confused with *Aecidium duguetiae*, also from Brazil. Without spore germination evidence, and there is none for either species, it may not be possible to distinguish between these two taxa. Spores of both species have well developed refractive granules. Perhaps only one taxon is involved.

Spermogonia and telia deep seated, often on the adaxial side of leaves on galls 1-5 mm (-2cm) across and 1 mm high, telia forming columns 0.5-2 mm long, may become powdery at maturity, pale orange-yellow when fresh, peridium firm, peridial cells 24-34 x 16-20 µm, rhomboid angular, wall 2-4 µm thick, outer facing wall irregularly radially striate around cell margin, inner facing wall verrucose in patches, colorless; spores 14-19 x 11-16 µm, broadly ellipsoid to globoid, wall 1-1.5 µm thick, verrucose in irregular bands, with well developed refractive granules (Buriticá & Hennen, 1980).

**DIETELIA PORTORICENSIS** (Whetzel & Olive) Buriticá & Hennen, *Flora Neotropica*, no. 24: 15.

1980. (0/-,-/III).

≡ *Endophylloides portoricensis* Whetzel & Olive in Olive and Whetzel. *Amer. J. Bot.* 4: 51. 1917.

TYPE on *Mikania cordifolia* (L.f) Willdenow from **Puerto Rico**, Mayaguez: "La Jaque", 29 July 1916, *Whetzel & Olive*-83.

≡ *Cronartium portoricensis* (Whetzel & Olive) Saccardo & Trotter, *Sylloge Fungorum* 23: 851. 1925.

*Dietelia portoricensis* has not been reported from Brazil but has been reported from Colombia and Venezuela. It is to be expected in Brazil.

Spermogonia on adaxial side of leaves. Aecia and uredinia not produced. Telia in groups on both sides of leaves, mainly on the abaxial side, sometimes on petioles and stems, cupulate or more or less in waxy or horny columns; peridia not strong, white, attached to the teliospore columns; peridial cells 20-28 x 10-16 µm, rhomboid, wall 4-6 µm thick, minutely verrucose to almost smooth, colorless. Teliospores 18-32 x 14-24 µm, globoid or ovoid; wall 0.5-1.5 µm thick, smooth, colorless; intercalary cells evident, frequently attached to teliospore (Buriticá and Hennen, 1980).

As a synonym of *Endophylloides portoricensis*, Olive and Whetzel (1917) cited the binomial "*Aecidium expansum* Arthur, *Mycologia* 7: 317. 1915. (not *A. expansum* Diet.)" but this is a later homonym and Arthur did not publish a description. If cited at all it should be "*Aecidium expansum* Arthur ex Olive & Whetzel, 1917".

See *Chrysocyclus mikaniae* for a key to help identify rusts on *Mikania* in the Neotropics.

#### **DIORCHIDIELLA** Lindquist,

*Darwiniana* 11: 416. 1957. TYPE SPECIES *Diorchidiella australis* (Spegazzini) Lindquist (≡ *Diorchidium australe* Spegazzini). Family Raveneliaceae. See below.

*Diorchidiella* is characterized by having teliospores with two probasidial cells united laterally separated by a vertical septum, a small intercalary cell subtends each probasidial cell, the two intercalary cells united laterally, and a pedicel subtends the two intercalary cells. Each probasidial cell has two opposite germ pores on the side walls of the cells.

*Diorchidiella* has been reported only from the two species listed below. Only telia are known. The genus is separable from *Dicheirinia* because of the two germ pores in each probasidial cell.

**DIORCHIDIELLA AUSTRALIS** (Spegazzini) Lindquist, *Darwiniana* 11: 415. 1957. (-/-,-/III).

≡ *Diorchidium australe* Spegazzini, *Contr. Estud. Fl. Sierra Ventana*. Min. de Obras Publicas de

la Prov. Buenos Aires. p.83, #386, April, 1896. TYPE on *Mimosa roca* Lor. & Niederl. from **Argentina**, Buenos Aires, Sierra de la Ventana, Curu-Malal, Nov 1895, *Spegazzini s.n.*

- ≡ *Puccinia mimosae* Sydow, Mon. Ured. 1: 837. 1904. Nom. nov. for *Diorchidium australe* Spegazzini, not *Puccinia australis* Koern. on *Sedum* sp.
- = *Uredo bonplandii* Spegazzini, Revista Argentina Bot. 1: 134. 1925. TYPE on *Mimosa bonplandii* from **Argentina**, Buenos Aires, La Plata, Punta Laura, Oct 1916, *Spegazzini s.n.* Spegazzini did not describe urediniospores.
- = *Diorchidium bonplandii* Lindquist (as "(Speg.) Lindquist"), Revista Argentina Agron (Buenos Aires) 13: 250. 1946. Lindquist described teliospores so the name is attributed to him alone and not as a transfer from *Uredo*. Lindquist (1957) determined that this species is a synonym of *Diorchidiella australis*.

On Leguminosae:

*Mimosa scabrella* Bentham, Santa Catarina (IBI-16854).

*Mimosa schomburgkii* Bentham, Rio de Janeiro (Silveira, 1974: 120).

Only telia are known for *Diorchidiella australis* which produces numerous witches' brooms on stems and galls on pods of *Mimosa scabrella* in southern Brazil and several other species of *Mimosa* in Argentina. Severe infections may occur on *Mimosa scabra* which is often planted as a cultivated species.

**DIORCHIDIELLA VERLANDII** F. A. Ferreira & A. O. Carvalho, Mycological Research 99: 885. 1995.

TYPE on *Mimosa schomburgkii* Bentham, Leguminosae, from **Brazil**, Minas Gerais, Viçosa, Dec 1993, *F. A. Ferreira s.n.(-J,-/III)*.

*Diorchidiella verlandii* has been reported only from the type. New collections are needed to determine the full range of this rust.

#### **DIORCHIDIUM** Kalchbrenner

Grevillea 11: 26. 1882. TYPE SPECIES *Diorchidium woodii* Kalchbrenner on *Milletia* sp. (Leguminosae) from South Africa.

= *Diphragmium* Boedijin, Nova Hedwigia 1: 472. 1959. TYPE SPECIES *Diorchidium koordersii* Wurth, on *Derris* sp. (Leguminosae) from Java.

See Hennen et al.(1998) for an account of this genus in the Neotropics. Raveneliaceae.

Spermogonia, known only for *D. puiggarii* and *D. taiwanensis*, subcuticular in origin, slightly erumpent exposing a minute ostiole, flattened conical, determinate in development, with a thin membranous peridium on the distal half appressed to the cuticle (type 7), hymenium flat. Aecia subepidermal in origin, erumpent, aeciospores borne singly on pedicels, early deciduous, wall echinulate, pores equatorial or basal (or obscure in *D. amapaensis*), peripheral paraphyses present or absent. Uredinia and urediniospores as in aecia. Telia subepidermal in origin, erumpent, teliospores with 2, or less commonly 3-4 probasidial cells by vertical septa, pedicelate, without intercalary cells between the pedicel and probasidial cells, wall smooth or sculptured, pigmented or colorless, germ pore 1 in each cell, apical or lateral, metabasidia external.

Nearly a dozen species of *Diorchidium* are known worldwide. They occur only in tropical areas. Species most common in Brazil are *D. copaiferae* (Sydow) Cummins & Hiratsuka on *Copaifera* spp. and *D. puiggarii* Spegazzini on *Piptadenia* spp. The hosts of both species are in the family Leguminosae. The genus is characterized by having teliospores with two to four probasidial cells separated by vertical septa, the cells attached directly to a pedicel without any intercalary cells. Only one germ pore occurs in each probasidial cell.

**DIORCHIDIUM ACANTHOSTEPHUM** H. Sydow & P. Sydow, Annal. Mycol. 14: 67. 1916. TYPE

on *Pithecellobium* sp. from **Brazil**, Rio Acre, Seringal São Francisco, May 1911, *Ule 3504*. (??,?/III).

= *Puccinia aculeatispora* Hoehnel, Hedwigia 50: 140. 1918. TYPE on *Pithecellobium* sp. (reported as ?*Piptadenia* sp.) from **Brazil**, Rio Acre, Seringal São Francisco, date not recorded, *Ule-3496*).

On Leguminosae:

*Pithecellobium* sp., Rio Acre (Sydow, 1916: 67; Sydow, 1918: 240; Hoehnel, 1918: 140).

*Diorchidium acanthostephum* has been reported also from Ecuador.



Spermogonia, aecia, and uredinia unknown. Telia on both sides of leaves, without paraphyses, pulverulent, pale cinnamon-brown, teliospores 16-19 x (16-)20-23(-25)  $\mu\text{m}$  broadly ellipsoid to obovate sphaeroid, two-celled with septum vertical, wall ca (1-)1.5-2  $\mu\text{m}$  thick, 2-layered, golden- or cinnamon-brown, echinulate, spines 2-3(-3.5)  $\mu\text{m}$  long, spaced 2-3  $\mu\text{m}$  apart. Pores one in each cell on opposite sides of spore, pedicel colorless, usually broken-off at or near point of attachment.

**DIORCHIDIUM AMAPAENSIS** Hennen & Sotão, Mycologia 90: 1083. 1998. TYPE on *Geophila trichogyne* K. M. Schumann, Rubiaceae, from **Brazil**, Amapá: Porto Grande, 8 Dec 1992, H. Sotão & T. Figueiredo-92-05-10. (?-?,II/III).

On Rubiaceae:

*Geophila gracilis* DeCandolle, Amapá (Hennen et al. 1998: 1083), Pará (Sotão et al.-S97-428).

*Geophila trichogyne* K. M. Schumann, Amapá (Hennen et al., 1998: 1083).

*Diorchidium amapaensis* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaf, scattered or in irregular circles, 0.5-3.0 mm across, subepidermal in origin, erumpent, pulverulent; urediniospores 22-29(-31) x (15-)18-29(-31)  $\mu\text{m}$ , broadly ellipsoid, wall about 1  $\mu\text{m}$  thick, colorless, evenly echinulate, pores not seen. Telia in irregular spots on abaxial side of leaf, sori 0.5-2.0 mm across, pale brown, not pulvinate, but originating in substomatal chambers and emerging as minute crowded masses from between the epidermal cells; teliospores 16-20 x 13-18  $\mu\text{m}$ , broadly ellipsoid, two-celled by a vertical septum, wall evenly less than 1  $\mu\text{m}$  thick, colorless, smooth, germination by extension of apex of each cell without a defined germ pore, pedicel 9-11  $\mu\text{m}$  long.

*Diorchidium amapaensis* is anamolus because it infects *Geophila*, a genus of the Rubiaceae. All of the other species of *Diorchidium* infect members of the Leguminosae. Three other rust species have been reported on *Geophila*. *Puccinia geophilae* Raciborski, known mostly by only the anamorph *Uredo geophilae* P. Hennings, has been reported from tropical regions of Africa, America, and Asia (Joerstad, 1959; Viennot-Bourgin, 1959). However, more telial collections from these widely separated areas are required to substantiate that they are all *P. geophilae*. *Uredo geophiliana* Yen & Gilles from the Ivory Coast differs only slightly from *U. geophilae* (Yen, 1976). *Chrysocelis geophilicola* (Yen) Cummins & Y. Hiratsuka (Yen, 1971; Cummins and Hiratsuka, 1983; Ono and Hennen, 1983) from the Ivory Coast has unusual telial sori in which the sessile probasidial cells, located within the stomatal chambers, produce metabasidia that emerge through the stomata. Superficially they resemble the telia of *Diorchidium geophilae*.

*Diorchidium australe* Spegazzini, see **DIORCHIDIELLA AUSTRALIS** (Spegazzini) Lindquist.

*Diorchidium binatum* (Berkeley & Curtis) De-Toni, see **DIDHEIRINIA BINATA** (Berkeley & Curtis) Arthur.

*Diorchidium brasiliense* Arthur, see **DIORCHIDIUM PUIGGARII** Spegazzini.

*Diorchidium bonplandii* Spegazzini, see **DIORCHIDIELLA AUSTRALE** (Spegazzini) Lindquist.

*Diorchidium boutelouae* Jennings, see **PUCINIA BOUTELOUAE** (Jennings) Holway.

**DIORCHIDIUM COPAIFERA** (P. Sydow & H. Sydow) Cummins & Y. Hiratsuka, Illustrated Genera of Rust Fungi. Revised Ed. p. 147. 1983. (?/?,Ipe/III).

≡ *Sphenospora copaiiferae* P. Sydow & H. Sydow, Monogr. Ured. 4: 584. 1924. TYPE on *Copaifera* sp., Leguminosae, from **Brazil**, São Paulo: Morro Pelado, July 1904, Puttemans-1154.

Anamorph

*Uredo copaiiferae* P. Hennings, Hedwigia 48: 2-3. 1908. TYPE same as for *Sphenospora copaiiferae* P. Sydow & H. Sydow.

On Leguminosae:

*Copaifera langsdorfii* Desfontaines, São Paulo (IBI-12704), Minas Gerais (IAC-7913).

*Copaifera* sp., Goiás (IBI-13653), Mato Grosso (IBI-16780), Minas Gerais (Hennen et al. 1998:

1085, IBI-13525). São Paulo (Hennings, 1908: 2; Sydow, 1924: 583; *Puttemans -1154*, IBI-14230).

*Diorchidium copaiiferae* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, subepidermal in origin becoming erumpent, scattered, ca. 0.1-0.15  $\mu\text{m}$  across, powdery, brown, with abundant, peripheral, basally united, incurved, pale golden paraphyses, 35-60 x 8-12  $\mu\text{m}$ , the wall to 8  $\mu\text{m}$  thick dorsally, thinner ventrally, often nearly filling the lumen, urediniospores (30-)34-44(-46) x (12-)13-18(-20)  $\mu\text{m}$  variable in size and shape, alantoid, narrowly ellipsoid or rarely ovoid, the wall 1.5-2  $\mu\text{m}$  thick at sides, to 5  $\mu\text{m}$  at apex, cinnamon- or chestnut-brown, paler basally, finely echinulate pore 1, basal. Telia as the uredinia but pulvinate, yellowish brown, teliospores 2-celled, when both cells in view (30-)34-44(-50) x 15-18(-20)  $\mu\text{m}$ , mostly oblong-ellipsoid, wall 1  $\mu\text{m}$  thick except thicker around the germ pore, smooth, pale golden or nearly colorless, pore 1 in each cell, apical, germination occurs without dormancy, pedicel colorless, persistent, about same length as spore, sporogenous basal cells present.

Cummins and Hiratsuka (1983) transferred *Sphenospora copaiifera* to *Diorchidium* because its telia lack the gelatinous oily matrix characteristic of other species of *Sphenospora*. The long, narrow, curved urediniospores with one basal germ pore are characteristic. The teliospores develop from well differentiated sporogenous cells, as is characteristic of *Sphenospora*. Only the type specimen was known before our collections cited above.

*Diorchidium digitareae* Ahamad, see **Puccinia levis** (Saccardo & Bizzozero) Magnus var. **PANICI-SANGUINALIS** (Rangel) Ramachar & Cummins.

*Diorchidium goyazense* P. Hennings, see **Puccinia levis** var. **GOYAZENSIS** Ramachar & Cummins.

*Diorchidium leve* Saccardo & Bizzozero, see **Puccinia levis** (Saccardo & Bizzozero) Magnus var. **LEVIS**.

*Diorchidium manaosense* P. Hennings, see **DICHEIRINIA MANAOSENSIS** (P.Hennings) Cummins.

*Diorchidium pallidum* Winter, see **SPHENOSPORA PALLIDA** (Winter) Dietel.

*Diorchidium piptadeniae* Dietel, see **DIORCHIDIUM PUIGGARII** Spegazzini.

**DIORCHIDIUM PUIGGARII** Spegazzini, Bol. Acad. Nac. Cien. Cordoba (Argentina) 11: 479. 1889.

TYPE on *Piptadenia* sp. (originally reported mistakenly as *Cassia* sp.), Leguminosae, from **Brazil**, São Paulo: Apiai, summer 1881, *Puiggari-2712*. (**0/Ipe, Ipe/III**).

= *Diorchidium piptadeniae* Dietel, Hedwigia 38: 252. 1899. TYPE on *Piptadenia latifolia* Benthham from **Brazil**, Rio de Janeiro: Jacarepaguá, August 1897, *Ule-1081* (Dietel used a misnumbered duplicate of *Ule-1681*).

≡ *Puccinia piptadeniae* P. Hennings, Hedwigia Beiblatt 38: (68). 1899. TYPE on *Piptadenia* sp. from **Brazil**, Rio de Janeiro: Jacarepaguá, 4 Aug 1897, *E. Ule-1681*.

≡ *Puccinia papillifera* P. Sydow & H. Sydow. , Mon. Ured. 1: 836. 1904. Nom. nov. for *Diorchidium piptadeniae* P. Hennings.

≡ *Puccinia puiggarii* (Spegazzini) P. Sydow & H. Sydow. , Mon. Ured. 1: 836. 1904.

= *Diorchidium brasiliense* Arthur, Bull. Torrey Bot. Club 51: 54. 1924. Type on *Piptadenia latifolia* Benthham (originally reported mistakenly as *Cassia* sp.) from **Brazil**, Rio de Janeiro: Rio de Janeiro, 9 Aug. 1921, *E. W. D. & M. M. Holway-1009*.

Anamorph

*Uredo puiggarii* Spegazzini, Bol. Acad. Nac. Cienc. Cordoba 11: 482. 1889. TYPE, same collection as for *Diorchidium puiggarii*.

On Leguminosae:

*Piptadenia adiatoides* Macbride, Fed. Dist. (Hennen et al., 1998: 1081).

*Piptadenia latifolia* Benthham, Rio de Janeiro(Hennen et al., 1998: 1081).

*Piptadenia laxa* Bentham, Bahia (Hennen et al., 1998: 1081); Minas Gerais (Jackson, 1931: 332); Rio de Janeiro (Spegazzini, 1889: 479; Dietel, 1899: 252; Hennings, 1899: (68); Arthur, 1924: 54; Jackson, 1931: 332).

*Piptadenia* sp., Minas Gerais (IBI-16433), Rio de Janeiro (Ule-1681). São Paulo (IBI-17816).

*Diorchidium puiggarii* has been reported only from Brazil.

Spermogonia on the adaxial side of leaves, subcuticular. Aecia on the abaxial side of leaves opposite the spermogonia, sori and spores similar to uredinia. Uredinia hypophyllus, usually grouped, subepidermal becoming erumpent, pale cinnamon-brown, with variable but mostly cylindrical, more or less colorless paraphyses from narrow to 15 µm wide, urediniospores (20-)23-28(-31) x (18-)19-22 µm, obovoid or broadly ellipsoid, wall 1.5-2(-2.5) µm thick, yellowish or pale golden, echinulate, pores 4, equatorial. Telia as the uredinia except dark cinnamon- or pale chestnut-brown, teliospores (20-)23-29 µm long x 24-28(-30) µm wide, 2-celled with relatively equal-size cells, wall 1.5 µm thick basally and smooth, darker brown apically and adorned with irregularly-shaped blocks that form more or less a corona at the apex but become smaller and fewer toward the smooth basal part, pores obscure but probably 1 in each cell in the coronate area, pedicel colorless, thin-walled, usually broken short.

Lindquist (1957) clarified the synonymy of this species. Germinated teliospores in Hennen & Ono 88-324 reveal that a germ pore occurs in the apical coronate area of each cell.

*Diorchidium tricholaenae* H. Sydow & P. Sydow, see **Puccinia levis** (Saccardo & Bizzozero) Magnus var. **TRICHOLAENAE** (H. Sydow & P. Sydow) Ramachar & Cummins.

#### **DIPYXIS** Cummins & Baxter,

*Mycologia* 59: 369. 1967. Type species *D. mexicana* Cummins & Baxter on *Adenocalymna* sp. (Bignoniaceae) from Mexico.

Spermogonia subcuticular, conical Group VI (type 7). Aecia subepidermal in origin, erumpent, aeciospores borne singly on pedicels as in urediniospores. Uredinia subepidermal in origin, erumpent, walls echinulate, pores zonate. Telia subepidermal in origin, erumpent, teliospores borne singly on pedicels, 2-celled by transverse septum, wall pigmented, germ pores 3, rarely 4, per cell, metabasidia external (Cummins & Hiratsuka, 2003).

The genus is characterized by pedicellate teliospores with two probasidial cells, each cell with three germ pores. Telia bear cylindrical paraphyses 40-80 x 7-9 µm, composed of 4-5 catenulate cells with walls evenly 0.5-1 µm thick, colorless to pale clear yellow. Paraphyses were first recorded by Hennen & McCain, 1993).

*Dipyxis* is a genus of two species, both on Bignoniaceae, the one listed below and the type from Mexico. Family Uropyxidaceae.

**DIPYXIS VIEGASII** (Joerstad) Cummins & J.W. Baxter, *Mycologia* 59: 369. 1967. TYPE same as for *Prospodium arrabidaee* Viégas. **(0/Ipe/?/III)**.

≡ *Prospodium arrabidaee* Viégas, *Bragantia* 5: 12. 1945. Not H. S. Jackson & Holway, 1932.

TYPE on **Arrabidaea** sp., Bignoniaceae, from **Brazil**, Paraíba: Espírito Santo, Estação Experimental da Fruticultura, Feb 1939, *J. Deslandes-232*.

≡ *Prospodium viegasii* Joerstad, *Nytt. Mag. Bot.* 6: 137. 1958. *Nom. nov* for *P. arrabidaee* Viégas.

On Bignoniaceae:

**Arrabidaea** sp., Paraíba (Viégas, 1945A: 12; Joerstad, 1958: 137; Cummins & Baxter, 1967: 369; IAC-3800).

*Dipyxis viegasii* has been reported only from the type. Uredinia were not found on the type. The telia apparently develop from the aecial mycelium. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia grouped on the adaxial side of leaves on hypertrophied areas 2-4 mm diam, subcuticular. Aecia on both sides of leaves, around the spermogonia, dark brown, aeciospores pedicellate, asymmetrical, ellipsoid with pores in optical axis, (30-)36-40(-44) µm long, (18-)20-23 µm wide, or reniform with pores in optical section, (15-)18-20 µm wide, echinulate except around the pore in the concave side, cinnamon-brown, pores 2, near the hilum, 1 in the concave and 1 in the convex side. Uredinia not seen. Telia associated with the aecia, dark brown, teliospores (34-)38-48 x (20-)22-25(-27) µm, oblong-ellipsoid, wall not

obviously bilaminar, uniformly 2-4  $\mu\text{m}$  thick, chestnut-brown, verrucose-echinulate with cones about 1.5  $\mu\text{m}$  wide at base, spaced 3-4  $\mu\text{m}$ , pores 3(4), equatorial, pedicel to 90  $\mu\text{m}$  long, colorless.

*Doassansia*

*Doassansia* is a genus of Ustilaginales (smut fungi), not Uredinales.

*Doassansia hypoxidis* Bresadola, see **UROMYCES AFFINIS** Winter.

*Endophylloides*, a synonym of Dietelia. Puccinosiriaceae.

*Endophylloides degueliae* (sic) Thurston, see **DIETELIA DUGUETIAE** (Thurston) Buriticá & Hennen.

**ENDOPHYLLUM** J. H. Lévillé,

Mém. Soc. Linn. Paris 4: 208. 1825. TYPE SPECIES, *Endophyllum persoonii* Lévillé [a new name for *Uredo sempervivi* Albertini & Schweinitz (= *Endophyllum sempervivi* (Albertini & Schweinitz) de Bary) on *Sempervivum globiferum* (Crassulaceae) from Prussia.

= *Monosporidium* A. Barclay, J. Asiat. Soc. Beng. 56: 367. 1888. LECTOTYPE SPECIES,

*Monosporidium euphorbiae* A. Barclay on *Euphorbia cognata*, Euphorbiaceae, from

**India** (lectotype species tentatively chosen by Laundon, 1963).

≡ *Kulkarniella* V. P. Gokhale & M. K. Patel, Indian Phytopath. 4: 172. 1952. TYPE

SPECIES, *Kulkarniella pavettae* Gokhale & Patel on *Pavetta tomentosa* Roxb.

Rubiaceae, from **India**, Mahalbashwar. ≡ *Aecidium pavettae* Berkeley

*Endophyllum* is an artificial, "convenience" teleomorph genus. The sori have the morphology of the anamorph genus *Aecidium* but the spores germinate with a metabasidium, thus they are teliospores. In theory, all species of *Endophyllum* are short cycle forms derived from various long cycle species of rusts that have an *Aecidium* sp. anamorph in their life cycle.

Some species of *Endophyllum* have the subepidermal *Puccinia-Uromyces* type of spermogonia associated with their telial sori, others have subcuticular spermogonia, not the *Puccinia-Uromyces* type. Many have no spermogonia. Species that have subcuticular spermogonia were segregated as the genus *Monosporidium*. We include *Monosporidium* as a synonym of *Endophyllum* because many collections do not have spermogonia.

**ENDOPHYLLUM CIRCUMSCRIPTUM** Whetzel & Olive in Olive & Whetzel, Amer. J. Bot. 4: 49.

1917. TYPE on *Cissus sicyoides* L. from **Puerto Rico**: Mayaguez, 29 March 1916, *Olive-s.n.* (0/-, -/III).

= *Aecidium guttatum* Kunze in Weigelt exsicc. Sine no. 1827. TYPE on *Cissus sicyoides* L. from **Surinam**, date not reported, *Weigelt s.n.*

≡ *Endophyllum guttatum* H. Sydow & P. Sydow, as "(Kze.) Syd.", Ann. Mycol. 18: 179.

1920. TYPE same as for *Aecidium guttatum* Kunze.

= *Aecidium circumscriptum* Schweinitz in Berkeley & Curtis, Jour. Philadelphia Acad. Sci. 2: 283.

1853. TYPE on *Cissus* sp., reported originally as "some unknown plant" from **Surinam**, date of collection not reported, *Weigelt s.n.*

= *Aecidium cissi* Winter, Hedwigia 23: 168. 1894. TYPE on "*Cissus syciaefolium*" from **Brazil**, Santa Catarina, near São Francisco, March 1884, *Ule-51*.

On Vitaceae:

*Cissus crosa* Richi, Maranhão, (IBI-15606).

*Cissus sicyoides* Linnaeus, Amazonas (Hennings, 1904B: 167), Santa Catarina (Hennings, 1896: 256).

*Cissus syciaefolia*?, Santa Catarina (Winter, 1884: 168; Pazschke, 1892: 95).

*Cissus* sp., Goiás (Hennings, 1895A: 102), Maranhão (specimen from Gilson Soares da Silva), Rio de Janeiro (Dietel, 1899: 257), Rio Acre (Sydow, 1916: 71), São Paulo (IBI-13011).

*Endophyllum circumscriptum* has been reported also from Argentina, Ecuador, Colombia, Venezuela, Central America, and the West Indies.

Spermogonia on the adaxial side of leaves in groups of 2-5, subepidermal, flask-shaped, 80-85  $\mu\text{m}$  wide. Telia on both sides of leaves, but mainly on the abaxial side, numerous borne on rounded somewhat

hypertrophied, pulvinate areas, cupulate; peridia recurved, yellowish, peridial cells 18-28 x 15-20 µm, angular, wall 2.5-4 µm, minutely verrucose; teliospores 15-23 µm, more or less rounded and angular or irregular from pressure, wall 1-2 µm thick, minutely verrucose, without refractive granules (Buriticá and Hennen, 1980).

Buriticá and Hennen (1980) designated the specimen listed above as the lectotype of *E. circumscriptum* because it was from the material used by Olive and Whetzel that demonstrated that the spores germinate with a metabasidium.

**ENDOPHYLLUM PAMPEANUM** (Spegazzini) Lindquist, see **Puccinia pampeana** Spegazzini.

*Endophyllum singulare* Dietel & Holway, see **Aecidium byrsonimatis** P. Hennings.

**ENDOPHYLLUM STACHYTARPHETAE** Whetzel & Olive in Olive & Whetzel, Amer. J. Bot. 4: 50. 1917. TYPE on *Stachytarpheta cayennensis* L. C. Rich. from **Puerto Rico**, Rio Piedras, Experiment Station Farm, 11 & 22 Apr 1916, Olive & Whetzel s.n. (-/-, -/IIIendo) or ? (??, IIIendo/IIIpuccinia). = *Aecidium stachytarphetae* P. Hennings, Hedwigia Beiblatt 38: (71). 1899. TYPE on *Stachytarpheta dichotoma* Vahl from **Brazil**, Rio de Janeiro: Tijuca, 14 Dec 1895, Ule-2163.

On Verbenaceae:

*Stachytarpheta dichotoma* Vahl, Rio de Janeiro (P. Hennings, 1899); São Paulo (Jackson, 1932: 63; Buriticá & Hennen, 1980: 13).

*Endophyllum stachytarphetae* has been reported also from Bolivia, Colombia, Trinidad, Central America, and the West Indies.

Spermogonia aecia, and uredinia unknown, but see below. Telia on abaxial side of leaves, in rounded or somewhat irregular inconspicuous pulvinate areas; peridia evanescent, hemispheric, to cupulate, peridial cells 20-26 x 5-20 µm, polyhedral, wall 3-6 µm thick, colorless, reticulate-echinulate; teliospores 15-20 x 12-17 µm, wall 1 µm or less thick, minutely verrucose, colorless (Buriticá and Hennen, 1980).

Although Whetzel and Olive (1917) treated *Endophyllum stachytarphetae* as a transfer from *Aecidium stachytarphetae* P. Hennings, Buriticá and Hennen (1980) designated the specimen listed above as the type of *E. stachytarphetae* because it was from the material used by Olive and Whetzel that demonstrated that the spores germinate with a metabasidium, and they gave a description of the telia. In theory sori of *Endophyllum stachytarphetae* may not always function as telia but they may function as uredinia or even aecia (Jackson, 1932).

Several collections of *Endophyllum stachytarphetae* also have telia of *Puccinia urbaniana*, indicating a life cycle connection and plasticity similar to *Puccinia pampeana* and *Endophyllum pampeanum* (Buriticá & Hennen, 1980).

***Eriosporangium*** Bertero ex Arthur,

Result. sci. Congr. internat. Bot. Wien 1905 p. 343. 1906. TYPE SPECIES, *Uredo baccharidis* Lev. [= *Caeoma baccharidis* (Lev.) Dietel & Neger], Ann. Sci. nat. ser. 3, 5: 269. 1846. On *Baccharis* sp., Compositae from **Chile**.

Laundon (198X) reported that the type species of *Eriosporangium* is an anamorph and cannot be used as a teleomorph name. This genus name is no longer in use and many of the species that have been placed in it are synonyms of uncertain taxa. It was used for a while by some authors as a teleomorph genus that included species of *Puccinia* that were long cycle and had teliospores that germinate without dormancy.

*Eriosporangium hyptidis* (Lagerheim) Arthur, see **Puccinia neohyptidis** Laundon.

*Eriosporangium hyptidis-mutabilis* (Mayor) H. Sydow, see **Puccinia hyptidis-mutabilis** Mayor.

*Eriosporangium medellinense* (Mayor) H. Sydow, see **Puccinia medellinensis** Mayor.

*Eriosporangium tucumanensis* (Spegazzini) Arthur, (in part), see *Aecidium tucumanense* Spegazzini (**Puccinia gibertii** Spegazzini).

**ESALQUE** Hennen, Figueiredo & Carvalho,

Mycologia 92: 315. 2000. TYPE SPECIES: *Esalque holwayi* (H. S. Jackson) Hennen et al. ( $\equiv$  *Triactella holwayi* H. S. Jackson).

Spermogonia and aecia unknown. Teliospores three celled, triquetrous, the pedicel attached to a proximal probasidial cell with two other distal probasidial cells joined to the proximal cell; pores not seen, germ slits probably present.

*Esalque* has been reported only from the type species. Family probably Raveneliaceae.

**ESALQUE HOLWAYI** (H. S. Jackson) Hennen, Figueiredo, & Carvalho, Mycologia 92: 315. 2000.

( $0/?,\text{Ipe/III}$ ).

$\equiv$  *Triactella holwayi* H. S. Jackson, Mycologia 31: 341. 1931. TYPE on *Caesalpinia* sp.

(originally reported mistakenly as *Cassia* sp.) from **Brazil**, Rio de Janeiro, Tijuca, 23 Dec 1921, *Holway-1419*.

On Leguminosae

*Caesalpinia ferrea* Martius ex Tulasne var. *leiostachya* Bentham, São Paulo (IBI-12517).

*Caesalpinia punctata* Willdenow, Minas Gerais, São Paulo (IBI-13540).

*Caesalpinia* sp., Rio de Janeiro (H. S. Jackson, 1931: 341).

*Esalque holwayi* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, mostly on abaxial side of leaflets, scattered, 0.2-0.4 mm across, subepidermal in origin, erumpent, pulverulent, ruptured epidermis not conspicuous, golden-brown to dark-brown, with numerous peripheral, 1-celled, irregularly incurved paraphyses 25-38 x 6.5-9  $\mu\text{m}$ , united at the base, walls greatly thickened, almost obliterating the lumen, chestnut-brown above to nearly colorless at the base; urediniospores 17-20 x 12-14  $\mu\text{m}$ , broadly ellipsoid to obovoid, wall 1-1.5  $\mu\text{m}$  thick, colorless, finely and closely evenly echinulate, pores 2-3, equatorial. Telia not seen, teliospores often intermixed in uredinia, teliospores mostly 3-celled, 26-31 x 25-30  $\mu\text{m}$  in face view, 17-22  $\mu\text{m}$  thick in side view, walls 0.5-1(-1.5)  $\mu\text{m}$  thick, wall projections (tubercles) up to 5(-6  $\mu\text{m}$  high, often irregularly bent or knobbed, pores not seen, probably each cell with a germ slit, pedicel to 10-15  $\mu\text{m}$  long (Hennen et al., 2000: 315).

The numerous peripheral, pale to dark chestnut-brown, uredinial paraphyses that are seen with a 10X hand lens as small, dark sori suggesting telia help identify *Esalque holwayi*. An important trait for identifying the two *Caesalpinia* host species are the characteristic small black glandular dots on the abaxial side of the leaflets.

**FROMMEËLLA** Cummins & Y. Hiratsuka,

1983. Illustrated genera of rust fungi. Revised Edition. American Phytopathological Society. St. Paul. 152 pp.. p. 120. TYPE species: *Frommeëlla tormentillae* (Fuckle) Cummins & Hiratsuka on *Potentilla*, Rosaceae.

Spermogonia intraepidermal type 10. Aecia and spores similar to uredinia. Uredinia subepidermal in origin, erumpent, spores pedicellate, echinulate, pores equatorial, obscure. Telia subepidermal in origin, erumpent, spores borne singly on short pedicels, 3- several-celled by horizontal septa, wall pigmented, smooth, germ pore 1 per cell, germinating without dormancy, metabasidia well differentiated.

*Frommeëlla* is characterized by pedicellate teliospores with rows of usually three to five probasidial cells, each cell having only one germ pore. Only two species have been named in *Frommeëlla*. *Phragmidium* is similar but its teliospores have 2 or more pores per cell.

**FROMMEËLLA MEXICANA** (Mains) J. W. McCain & Hennen var. **INDICAE** J. W. McCain &

Hennen, Mycotaxon 39: 251. 1990. TYPE on *Duchesnea indica* (Andrzejowski) Focke (reported as "*Fragaria indica* Andrzejowski") from **The United States of America**, Alabama: Lee Co., Auburn, Nov 1899, *F. S. Earle* (Alabama Biol. Survey #2164). ( $0/\text{Ipe},\text{Ipe/III}$ ).

Anamorph

*Uredo duchesneae* (J. C. Arthur) P. A. Saccardo & A. Trotter in Saccardo and Trotter, Sylloge Fungorum 23: 827. 1925.

$\equiv$  *Kuehneola duchesneae* Arthur, No. Amer. Flora 7: 185-186. 1912. TYPE on

*Duchesnea indica* (reported as "*Fragaria indica* Andrzejowski"), from **The United States of America**, North Carolina, West Raleigh, 19 May 1909, *B. B. Higgins-185*. Only uredinia present in the type.

- ≡ *Phragmidium duchesneae* (Arthur) H. Sydow & P. Sydow, Monogr. Ured. 3: 93. 1912.
- ≡ *Frommea duchesneae* (Arthur) Arthur, Bull. Torrey Bot. Club 44: 504. 1917.
- ≡ *Frommea obtusa* (F. Strauss) Arthur var. *duchesneae* (Arthur) Arthur, published as "*Frommea obtusa duchesneae* (Arth.) n. comb. (*Kuehneola d.*, *Frommea d.*)" Manual Rusts U. S. and Canada, p. 93, 1934.
- ≡ *Frommeëlla duchesneae* (Arthur) Yohe, Cummins, & R. Gilbertson, Mycotaxon 22: 451. 1985.
- ≡ *Frommeëlla obtusa-duchesneae* (Arthur) Buriticá in Buriticá & Pardo-Cardona, Rev. Acad. Colombia Cienc. 20: 225. 1996.

On Rosaceae:

***Duchesnea indica*** (Andrews) Focke, Minas Gerais (PUR-F19253), São Paulo (PUR-F19251).

In South America, *Frommeëlla mexicana* var. *indicae* has been reported from Argentina, Brazil, and Colombia. The same rust is widespread in North America. *Duchesnea indica* is the only host for this rust.

Telia mostly on abaxial side of leaflets, scattered, 0.2-0.5 mm across, pulvinate, cinnamon-brown, ruptured epidermis inconspicuous, teliospores 50-80 x 19-26 µm clavate-cylindrical, to clavate-lanceolate, rounded to obtuse above, obtuse or narrowed below, slightly or not constricted at septa, 3-5 celled, wall 1.5-2 µm thick at sides, 5-10 µm above, cinnamon-brown, paler at base, smooth; pedicel about once or twice the length of the spore, 7-10 µm wide, firm, colorless or pale cinnamon-brown next to the spore.

*Frommeëlla mexicana* (Mains) J. W. McCain & Hennen var. *mexicana* [≡ *Frommea mexicana* Mains, var. *mexicana*. TYPE on *Duchesnea* sp. from **Mexico**, Hidalgo: Chapulhuacan, 12 July 1937, *Amelia Lundell-7182* (Bull. Torrey Bot. Club 66: 618. 1939)] differs because its teliospores are 38-60 x 23-32 µm, clavate-cylindrical, rounded above and below or narrowed a little below, with 2-3 septa, 3-4-celled, wall 1.5-2 µm thick at sides, 4-6 at apex.

*Groveola indurata* (H. Sydow & P. Sydow & Holway) H. Sydow, see **UROMYCES INDURATUS** H. Sydow, P. Sydow & Holway.

*Gymnoconia hyptidis* Lagerheim, see **PUCINIA NEOHYPTIDIS** Laundon.

***Haplopyxis*** H. Sydow & P. Sydow,

Ann. Mycol. 17: 105. 1920. TYPE SPECIES: *Uropyxis crotalariae* Arthur on *Crotalaria* sp. from Guatemala.

The Sydows (1920) proposed the genus *Haplopyxis* based on the assumption that it was like *Uropyxis* but had only one celled teliospores. Baxter (1962) reported that the probasidial cells of *Haplopyxis* have only one apical germ pore, not two lateral ones as in *Uropyxis*, and thus is a synonym of *Uromyces*.

*Haplopyxis crotalariae* (Arthur) H. Sydow & P. Sydow, see **UROMYCES CROTALARIAE** (Arthur) J.W. Baxter.

*Haploravenelia*

*Haploravenelia ingae* (Arthur) Syd., see **YPSILOSPORA TUCMANENSIS** J. Hernandez & J. Hennen.

*Haploravenelia macrocarpa* (H. Sydow & P. Sydow) H. Sydow, see **RAVENELIA MACROCARPA** H. Sydow & P. Sydow.

*Haploravenelia mesillana* (Ellis & Bartholomew) H. Sydow, see **Ravenelia mesillana** Ellis & Bartholomew

*Haploravenelia microcystis* (Pazschke) H. Sydow, see **RAVENELIA MICROCYSTIS** Pazschke.

**HEMILEIA** Berkeley & Broome,

Gard. Chron. 1869. p. 1157. 1869. TYPE SPECIES *Hemileia vastatrix* Berkeley & Broome.

See *Hemileia vastatrix* below for description.

Nearly 50 species of *Hemileia* have been published but only about 30 of these have had telia described. Authors of the 20 names without telial descriptions were confident that the species should be placed in *Hemileia* because of the unique morphology of the uredinia of the genus *Hemileia*.

Anamorph: *Wardia*.

Except for the introduced *Hemileia vastatrix* on cultivated *Coffea* spp., we believe no other species of *Hemileia* occur in the neotropics. See: *Cladoma* - anamorph. The suprastomatal part of the sori of *Cladoma* is composed of a complex branching of hyphae and sporogenous cells, unlike the comparatively simple suprastomatal fascle of only sporogenous cells as in *Wardia*. *Synnoma* - anamorph. The suprastomatal part of the sori of the anamorph genus *Synnoma* is a synnema that has sporogenous cells only at its distal end. The spores are globoid, not radially asymmetrical as in *Wardia*. and *Pelastoma* - teleomorph.

Anamorph taxa are especially useful in mycology and plant pathology because these stages of a life cycle are the ones most often collected and usually most important in disease development. Often overlooked by those who prefer to use only holomorph names if available is the fact that the ICBN states that a holomorph name of a fungus stands for "the species in all its morphs" while an anamorph name stands for only a specific morph in a life cycle (Greuter et al., ICBN, 2000, Article 59.1). For example, in the yellow leaf rust disease of coffee the complete life cycle of the pathogen remains unknown, telia are only rarely collected or reported, the role of the telial stage in disease development is unknown, and nearly all of the research that has been published on this disease, including genetic variability in pathogenicity, has involved only the uredinial anamorph stage. For this important plant pathogen this stage can now be referred to specifically by its anamorph name, *Wardia vastatrix*.

All *Hemileia* and *Wardia* species are restricted to the paleotropics and paleo-subtropics, except for *H. vastatrix* which now has been introduced from its original home probably in tropical East Africa to nearly all coffee growing regions in the world. No *Hemileia* or *Wardia* species have what seem to be overseasoning spores. All have hyaline or nearly so, thin walled spores that, where known, germinate without dormancy. The incubation period from infection to production of new uredinial sori for *H. vastatrix* is 25-30 days, or more. This is much longer than the 7-10 days for important cereal rusts caused by species of *Puccinia*, which presumably are all native of temperate regions.

We chose the anamorph of *Hemileia vastatrix* as the type species for *Wardia*. because it is widespread in tropical regions, its morphology is relatively well known, and it is easily identified because of the unique morphology of its sori and spores. McCain and Hennen (1990) illustrated and described the developmental anatomy of these sori using SEM and light microscopy. Much earlier, Ward (1882) published elegant illustrations drawn from light microscopy. Saville (1978) described the radially asymmetrical spores as "hedgohog" shaped, the convex side echinulate and the concave or flat face smooth.

Sori of nearly a dozen genera of rusts are known as "suprastomatal" (Hiratsuka and Cummins, 1983, 2004). The sori of *Hemileia* are described as "suprastomatal" because the sporogenous cells emerge in fascicles through stomata and spores are produced directly on the sporogenous cells outside of the host epidermis. Gopalkrishnan (1951) found in a sample of 32 species of *Hemileia* (and *Wardia*) important variations in the morphology of the part of the sorus that remains in the substomatal chambers. He classified these variations into four types that are useful for classification of anamorph and teleomorph species. Also, a range of variation occurs in the morphological development of suprastomatal sori in other genera: These developmental features are useful for defining taxa, even though, as is frequently the case, there may occur intergradations between these variations. Ono et al. (1988) reported some of the range of this variation by introducing the term "pseudosuprastomatal".

When all taxa of *Hemileia* and *Wardia* have been studied sufficiently to place them in one of Gopalkrishnan's or other categories, an improved classification can be made.

*Hemileia americana* Masee, see **CLADOMA BEHNICKIANA** (P. Hennings) J. F. Hennen.

*Hemileia oncidii* Griffon & Maublanc, see **CLADOMA BEHNICKIANA** (P. Hennings) J. F. Hennen

**HEMILEIA VASTATRIX** Berkeley & Broome in Berkeley, Gard. Chron. 1869: 1157. 1869. TYPE on *Coffea arabica* from Sri Lanka (Ceylon), *Thwaites*. (??,IIpe/III).  
On Rubiaceae:



*Coffea arabica* Linnaeus, Bahia (IBI-10826), Espírito Santo (IBI-10849), Minas Gerais (PUR-F19292), Rio de Janeiro (PUR-F19291), São Paulo (IBI-11032).

*Hemileia vastatrix* occurs throughout the major coffee growing regions of the World.

Anamorph sori numerous on abaxial side of leaves, minute, in yellowish leaf spots, substomatal in origin and development, without peridium or paraphyses, sporogenous cells emerging through the stomata in fascicles, spores borne sympodially on minute pedicels from the sporogenous cells, spores 26--40 x 20--30 µm, bilaterally symmetrical, ovoid to reniform, wall evenly ca 1 µm thick, colorless or pale yellowish, the part of the wall facing the fascicle of sporogenous cells more or less flattened, smooth or partly so, wall facing away from the sporogenous cells convex, irregularly echinulate, germ pores usually obscure.

*Hemileia vastatrix* was accidentally introduced into Bahia, Brazil in 1970. It probably came from Africa with coffee seedlings mixed with cacao seedlings. Arnaldo Gomez Medeiros discovered this rust on coffee plants growing near a cacao nursery. Since that time this rust has spread to all major coffee producing areas in the New World. The rust infects leaves, young fruit, and buds. This rust is the most important disease of coffee world wide. Control by fungicides and the development of resistant varieties has added much cost to coffee production.

***Holwayella*** H. S. Jackson,

Mycologia 18: 49. 1926. Type species *Holwayella mikaniae* (Arthur) H. S. Jackson. *Holwayella* is now considered a synonym of *Chrysocyclus*.

*Holwayella mikaniae* (Arthur) H. S. Jackson, see **CHRYSOCYCLUS MIKANIAE** (Arthur) H. Sydow.

**INTRAPES** Hennen & M. Figueiredo, Anamorph,

Mycologia 71: 836. 1979. TYPE SPECIES, *Intrapes paliformis* Hennen & Figueiredo.

This genus was established for anamorph sori that have a hymenium of sporogenous cells that produce spores by percurrent proliferation. Spores develop one after the other from the top part of a sporogenous cell. The first spore is formed endogenously inside the tip of a sporogenous cell, the sporogenous cell wall breaks open as the first spore is pushed out by an elongating pedicel. After that, each new spore comes through the pedicel of the previous spore. In this process a small, irregularly split collar is left at the top of the sporogenous cell after a spore becomes detached. The collar is the remains of a part of the pedicel of the previous spore. After a sporogenous cell has produced several spores, several closely spaced, irregular collars are present. Only one species has been named.

***Jacksoniella*** Kamat & Sathe,

in Sathe, Indian Phytopathology 25: 78. 1972 (not Lindquist, 1971).

*Jacksoniella holwayi* Kamat & Sathe, see **PHRAGMIDIELLA HOLWAYI** (H. S. Jackson) Buriticá.

**KIMUROMYCES** Dianese, Santos, Medeiros & C. Furlaneto,

Fit. Bras. 20: 251. 1995. TYPE SPECIES: *Kimuromyces cerradensis* Dianese Santos, Medeiros & C. Furlaneto.

*Kimuromyces* has been reported only from the type species described below. Dianese (1995) tentatively placed the genus in the Uropyxidaceae.

The relationship of this genus to other genera is unknown. The wall sculpture of the teliospores, and the occasional three-celled teliospore with the apical septum vertical or oblique resemble teliospores of some *Sphaerophragmium* or *Nyssopsora* species.

**KIMUROMYCES CERRADENSIS** Dianese, Santos, Medeiros, & C. Furlaneto, Fit. Bras. 20: 251.

1995. TYPE on *Astronium fraxinifolium* Schott ex Spreng. from **Brazil**, Goiás: Cristalina, Fazenda Nova India, 10 April 1993, *Dianese & R. B. Medeiros-837. (?!?,Ipe/III)*.

Anamorph

***Uredo rhombica*** Spegazzini, An. Soc. Cient. Argentina 17: 124. 1884. TYPE on *Astronium*

*urundeuva* Englar, reported originally as “*Astronium juglandifolium*”, from **Paraguay**, Cordillera de Peribebuy, July 1883, *Balansa-3797*.

= *Uredo mauriae* H. Sydow, Ann. Mycol. 23: 325. 1925. TYPE on *Mauria glauca* Donn Smith, Anacardiaceae, from **Costa Rica**, La Caja near San José, 14 Feb 1925, *H. Sydow-10*.

= *Uredo roupalae* Cummins, Bull. Torrey Bot. Club 64: 43. 1937. TYPE on *Mauria glauca* Donn Smith, Anacardiaceae (mistakenly reported originally as *Roupala veraguensis* Klotzsch, Proteaceae) from **Costa Rica**, San José, 1928, *H. Schmidt-2052*.

On Anacardiaceae

*Astronium fraxinifolium* Schott ex Spreng., Ceará (IBI 17135), Goiás (Dianesi et al., 1995: 251; IBI 13303), Mato Grosso (IBI 16724), Mato Grosso do Sul (IBI 14317), Minas Gerais (Dianesi et al., 1995: 251; IBI 13547), Pará (IBI 13492.), São Paulo (IBI 15238).

*Astronium lecointe* Ducke, Pará (*Ferreira s.n.*).

*Astronium sp.*, Pará (Caxiuanã, *Sotão-97-626*).

*Uredo rhombica*, anamorph of *Kimuromyces cerradensis*, has been reported also from Paraguay, Venezuela, and Costa Rica.

Spermogonia and aecia not seen. Uredinia mostly on the abaxial side of leaves, scattered, powdery, light chestnut-brown (whitish if spores not abundant because of the paraphyses), 0.1-0.2 mm across, paraphyses peripheral, numerous, whitish, 27-48 x 7-11 µm, irregularly cylindrical or clavate, more or less straight to somewhat curved, 1-celled or with a short stalk cell, rounded above and tapering below, usually filled with highly refractive material, wall ca 0.75 µm thick, colorless, smooth or very slightly verrucose at top, smooth below; urediniospores mostly irregularly flattened-rhombic to flattened broadly rhombic, 23-27(-29) x (15-)17-23 µm in face view, ca one-half as wide in lateral view, sometimes slightly curved in lateral view, wall ca 1 µm thick, golden-brown, finely echinulate but with smooth spots on each flattened side, germ pores 2, opposite each other at the side corners, thus equatorial; paraphyses and spores coming from well developed sporogenous cells, these in mature sori with numerous collapsed pedicels from mature spores that have been released. Telia not seen, teliospores in uredinia, spores 2-3-celled, 27-32 x 15-20 µm, flattened obovoid to irregularly ellipsoid, with digitate processes 3-5 µm long, these more numerous on the top cells, sometimes bifurcate, rarely nearly lacking, pedicel attached to the odd cell in 3-celled spores, wall between the upper two cells usually perpendicular, sometimes oblique, rarely nearly parallel, wall irregularly thickened 1-1.5 µm, light chestnut-brown, pore not seen, pedicel thin-walled, deciduous, breaking at 2-10 µm below the spore.

This description is based on our specimens cited above from IBI. It is close to that reported by Dianese et al. (1995) who found telia separate from uredinia as well as in mixed sori. They also reported one germ pore in each probasidial cell and a metabasidium with basidiospores. They did not report the highly refractive material in the paraphyses, the 3-celled teliospores, nor the connection to *Uredo rhombica*. In our specimens we could not find telia separate from uredinia and we did not see pores in the teliospore cells.

*Kimuromyces cerradensis* may cause considerable damage to seedlings of host plants under nursery conditions.

#### **Klebahnia** Arthur,

Résult. Sci. Congr. Bot. Vienne, p.345. 1906. TYPE SPECIES designated by Laundon (1965A) as

*Uromyces glycyrrhizae* Magnus on *Glycyrrhiza*, Leguminosae.

Arthur proposed *Klebahnia* based on a confusing mixture of variations in the morphological and ontogenic concepts of life cycles. In ontogenic terminology the species are long cycled and autoecous, both the uredinia and aecia, when known, have the morphology of anamorph genera that are pedicellate. In morphologic terminology the species have no aecia. Teliospores are one-celled. Later, Arthur abandoned the use of *Klebahnia* and it is not used any more. Most of the species are now placed in *Uromyces*.

*Klebahnia bidentis* (P. Hennings) Arthur, see **UROMYCES BIDENTICOLA** Arthur.

*Klebahnia dolichospora* (Dietel & Holway) Arthur, see **UROMYCES DOLICHOSPORUS** Dietel & Holway.

*Klebahnia gemmata* (Berkeley & Curtis) Arthur, see **UROMYCES BRASILIENSIS** Trotter.

#### **KUEHNEOLA** Magnus,

Bot. Centralbl. 74: 169. 1898. TYPE SPECIES: *Oidium uredinis* Link, in Willd. Sp. pl. 6: 123. 1824. [*Chrysomyxa albida* Kuhn (= *Kuehneola uredinis* Link) Arthur on *Rubus fruticosus* (Rosaceae) from Germany]. Phragmidiaceae.

Spermogonia subcuticular or intra-epidermal, growth determinate or indeterminate, hymenium flat or slightly concave, Group 4 of Hiratsuka & Hiratsuka (1980). Aecia commonly producing host deformations, subepidermal in origin, erumpent, powdery, aeciospores pedicellate. Uredinia subepidermal in origin, erumpent, powdery, uredinospores pedicellate. Telia subepidermal in origin, erumpent or teliospores produced in uredinia; teliospores several celled in a vertical row, often subtended by a pedicel-like cell, germ pore obscure but evidently one in each cell, germination without dormancy, metabasidia well differentiated from the probasidial cells.

Although the presence of pedicels in teliospores is an essential trait for defining the genus *Kuehneola*, their presence is difficult to determine in some species. A common representative of this genus in the neotropics is *Kuehneola loeseneriana* (Arthur) H. S. Jackson and Holway which may incite large powdery, orange galls on leaves and stems of *Rubus* spp.

In some older literature, *Phakopsora nishidana* Ito, the common rust of *Ficus carica* (cultivated fig), has been reported as *Kuehneola fici* Butler. But this rust is properly placed in *Cerotelium fici* (Butler) Arthur and is known only from India. *Phakopsora gossypii* (Lagerheim) N. Hiratsuka, a tropical rust of *Gossypium hirsutum* (Cotton), has been reported as *Kuehneola desmium* (Berkeley & Curtis) Butler and *Kuehneola gossypii* Arthur.

For practical identification of species of *Kuehneola* in the New World, we restrict species to the Rosaceae host genera: *Rosa*, and *Rubus*.

#### **Key to help identify species of *Kuehneola* on Rosaceae: *Dryas*, *Rosa*, and *Rubus***

1. Teliospore walls uniformly thin
  2. Teliospores with 3-4 cells in vertical rows
    3. Teliospores 21-37 x 10-20 µm, on *Dryas* 1. *Kuehneola dryadis*
    3. Teliospores 20-34 x 17-22 µm, on *Rosa* 2. *Kuehneola japonica*
  2. Teliospores with 4-6 cells in vertical rows, on *Rubus*
    4. Connection between teliospore cells narrow 3. *Kuehneola filipina*
    4. Connection between teliospore cells wide 4. *Kuehneola andina*
1. Teliospore walls irregularly thickened, on *Rubus*
  5. Aeciospores and uredinospores echinulate
    6. Uredinospores 18-28 x 16-23 µm 5. *Kuehneola albida* (North temperate)
    6. Uredinospores 23-27 x 19-25 µm 6. *Kuehneola guatemalensis*
  5. Aeciospores and uredinospores with verrucae or spines in spirals
    7. *Kuehneola loeseneriana* Neotropics (*K. loeseneriana* includes *Kuehneola arthurii*, and *K. uleana*)

*Kuehneola desmium* (Berkeley & Curtis) Butler, see **PHAKOPSORA GOSSYPHII** (Lagerheim) N. Hiratsuka.

*Kuehneola fici* Butler, [as "(Cast.) Butler"] Ann. Mycol. 12: 79. 1914. TYPE on *Ficus glomerata* from **India**, Pusa, date and collector not reported, presumably *Butler*.

Although Butler (1914) published this rust on *Ficus glomerata* as a new combination, "*Kuehneola fici* (Cast.) Butler", based on the basionym *Uredo fici* Cast., he included a description of an anamorph and a teleomorph. Because of the inclusion of a reference to a teleomorph specimen and a teleomorph description, we treat the name as a new species attributed to Butler alone. We believe this rust, which is known only from India, is properly placed as *Cerotelium fici* (Butler) Arthur but with the concept of *Cerotelium* as defined by Buriticá and Hennen (1994). However neither *Kuehneola fici* Butler nor *Cerotelium fici* (Butler) Arthur apply

to the common fig rust, *Phakopsora nishidana* S. Ito, widely distributed on *Ficus carica*. See *Phakopsora nishidana* for other notes.

*Kuehneola ficici*(Castagne) Arthur , see **PHAKOPSORA NISHIDANA** Ito.

*Kuehneola gossypii* Arthur, see **PHAKOPSORA GOSSYPHII** (Lagerheim) N. Hiratsuka f.

**KUEHNEOLA LOESENERIANA** (Arthur) H. S. Jackson & Holway in Jackson, Mycologia 23: 105.

1931. [recorded as “(P. Hennings) Jackson & Holway”] TYPE same as for *Spirechina loeseneriana* Arthur. **(0/Ipe-gall,IIpe/III)**.

≡ *Spirechina loeseneriana* Arthur [as “(P. Hennings) Arthur”], J. Mycol. 13: 30. 1907. TYPE on *Rubus bogotensis* Humboldt, Bonpland & Kunth from **Bolivia**, Yungus, 1890, *A. Miguel Bang-684*.

≡ *Uromyces loesenerianus* (Arthur) P. Sydow & H. Sydow [as “(P. Hennings) Sydow”], Mon. Ured. 2: 202. 1910. TYPE same as for *Spirechina loeseneriana* Arthur.

= *Uromyces arthuri* P. Sydow & H. Sydow, Monogr. Ured. 2: 203. 1910. TYPE on *Rubus schiedianus* Steud. from **Guatemala**, Dept. de Alta Verapaz, Coban, *H. von Tuerckeim s.n.*

≡ *Spirechina arthuri* (P. Sydow & H. Sydow) Arthur, N. Am. Fl. 7: 183. 1912. TYPE same as for *Uromyces arthuri* H. & P Sydow.

≡ *Kuehneola arthuri* (P. Sydow & H. Sydow. ) H. S. Jackson, Mycologia 23: 106. 1931. TYPE same as for *Uromyces arthuri* P. Sydow & H. Sydow.

= *Kuehneola uleana* H. Sydow & P. Sydow, Ann. Mycol. 14: 258. 1916. TYPE on *Rubus* sp. from **Brazil**, Bahia, Serra de Sincora, Nov. 1906, *Ule-3318*.

Anamorph

*Uredo loeseneriana* P. Hennings, Hedwigia 37: 273. 1898. TYPE on *Rubus* sp. from **Guatemala**, Jalambohoch, Dept. Huehuetenango, 22 Aug. 1896, *C. & E. Seler-2687*.

= *Uredo imperialis* f. *ramulicola* Spegazzini, Anal. Soc. Ci. Argentina 47: 276. 1899. TYPE on *Rubus imperialis* Chamisso & Schlechtendahl, from **Argentina**, Tucumán, Jan 1899, *F. Sivori s.n.*

= *Uromyces usteri* Spegazzini, Revista Mus. La Plata 15: 7. 1908. TYPE on *Rubus urticaefolius* Poirret from **Brazil**, São Paulo, Avenida Paulista, date not reported, *A. Usteri s.n.* Only anamorph spores described.

On Rosaceae:

*Rubus brasiliensis* Martius , Minas Gerais (Jackson,1931: 105; IBI-2086), São Paulo (IBI-211).

*Rubus erythroclados* Martius, São Paulo (Jackson, 1931: 105).

*Rubus sellowii* Chamisso & Schlechtendahl, Rio Grande do Sul (IAN-712).

*Rubus urticaefolius* Poirret, São Paulo (Jackson, 1931: 105).

*Rubus* sp., Espírito Santo (IBI-2829), Minas Gerais (Jackson, 1931: 105; Thurston, 1940: 294; IAC-5166), Paraná (IBI-12150), Rio de Janeiro (Jackson, 1931: 105; IBI-1649), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 123; IBI-5780), Santa Catarina (Hennings, 1899A: 69; IBI-12727), São Paulo (Jackson, 1931: 105; Viégas, 1945: 10; IAC-533; IBI-17474).

*Kuehneola loeseneriana* has been reported from Argentina to Central America, and Mexico. The closely spaced spiral rows of small verrucae on the anamorph spore walls help to identify this species.

Arthur (1912), and Gallegos & Cummins (1981) reported that spermogonia and aecia of *Kuehneola loeseneriana* were on bright orange-yellow galls on stems and leaves. We also found spermogonia and aecia associated with galls. The masses of aeciospores made the galls very powdery. At maturity stem galls were as large as 8-10 cm across. Now we believe that all of the galls produced by this species are the result of basidiospore infections and that they produce spermogonia and aecia. Uredinia are scattered on the leaves.

Although this rust has been reported mainly on wild species of *Rubus* that grow mainly in Mata Atlantica region, it can also infect some cultivated *Rubus* plants that have been developed for fruit from which jelly is produced. The rust causes many large galls on stems and leaves. These galls are covered with large amounts of bright orange spores. Because of the management of cultivated *Rubus* plantings in which the plants are well spaced thus increasing air circulation and leaf drying, the disease is of little importance in Brazil.

**Nomenclatural explanation.** *Kuehneola loeseneriana* was first named *Uredo loeseneriana* by P. Hennings in 1898 from an anamorph collection from Guatemala. Arthur (1907) was the first to report telia. He found the rust on a phanerogamic herbarium specimen of *Rubus bogotensis* from Bolivia in the Field Museum Herbarium in Chicago. Arthur designated this material as the type specimen of his new genus *Spirechina*. Because the only species that he placed in *Spirechina* was *S. loeseneriana*, it automatically became the type species for the genus *Spirechina*. He published this species as “*Spirechina loeseneriana* (P. Henn.) Arthur *nom. nov.*” indicating that the name was a new name for *Uredo loeseneriana* P. Hennings, the basionym. Arthur reported that the type of *Uredo loeseneriana* is from Guatemala. During that time Arthur gave nomenclatural priority to the oldest legitimate name that had been applied to any part of the life cycle of a species. Thus, for his genus *Spirechina* Arthur designated the Bolivian collection as type specimen for the genus because it had teliospores, and he then listed a different type specimen for the type species of the genus when he used *Uredo loeseneriana* as the basionym for *Spirechina loeseneriana*.

Arthur (1907) stated that the genus *Spirechina* has one-celled teliospores because that is what he found in the Bolivian specimen cited above. Later, Arthur (1912) included five species in the genus, all parasites of species of *Rubus*. Three of these species are now known to be in the genus *Gerwasia*, a genus that has only one-celled teliospores. The other two, *S. loeseneriana* and *S. arthuri*, are now placed in *Kuehneola*, a genus which has at least some multicelled teliospores, with the probasidial cells in rows.

Jackson (1931) transferred *S. loeseneriana* to *Kuehneola* as “*K. loeseneriana* (P. Henn.) Jackson & Holway” because he discovered that the teliospores of *S. loeseneriana* are mostly one celled but two or more probasidial cells in rows also are produced.

The Code (International Code of Botanical Nomenclature) requires that the type specimen of a teleomorph taxon must have a telemorph present. To follow this requirement the Code now permits us to ignore Arthur’s designation of *Spirachina loeseneriana* as a new name for, or as a transfer of, *Uredo loeseneriana* P. Hennings. We may attribute the name *Spirechina loeseneriana* to Arthur alone, i. e. *Spirechina loeseneriana* Arthur, with the type specimen being the one from Bolivia that Arthur found with telia.

Cummins & Stevenson (1956) were the first to apply this nomenclatural correction to Arthur’s (1907) and Jackson’s (1931) designations for this species by publishing the name as *Kuehneola loeseneriana* (Arthur) H. S. Jackson & Holway.

*Kuehneola malvicola* (Spegazzini) Arthur see **CATENULOPSORA PRAELONGA** (Spegazzini) Buriticá.

*Kuehneola uleana* H.& P. Sydow, see **KUEHNEOLA LOESENERIANA** (Arthur) H. S. Jackson & Holway.

#### **KWEILINGIA** Teng,

- Sinensia 11: 124. 1940. TYPE SPECIES, *Kweilingia bambusae* (Teng) Teng, Sinensia 11: 124. 1940.  
 = *Chrysomyxa bambusae* Teng, Sinensia 9: 226. 1938. TYPE on “bamboo”, Bambusoideae, from **China**, Kwangsi: Yangso, 24 March 1928, *S. C. Teng & K. L. Teng-3236*.  
 = *Dasturella* Mundkur & Kheswala, Mycologia 35: 202-203. 1943. TYPE SPECIES, *Dasturella divina* (H. Sydow) Mundkur & Kheswala, Mycologia 35: 202. 1935. (≡ *Angiopsora divina* H. Sydow, Ann. Mycol. 34:71. 1936. TYPE on *Bambusa* sp. from **India**, Majhgawan, 5 Jan 1935, *R. A. Tandon-188*.  
 = *Kweilingia divina* (H. Sydow) Buriticá & Hennen, Rev. Acad. Colombia Cienc. 22: 330. 1998.  
 = *Tunicopsora* Singh & Pandey, Trans Br. Mycol. Soc. 56: 301. 1971. TYPE SPECIES, *Tunicopsora bagchii* Singh & Pandey. Trans British Mycol. Soc. 56: 301. 1971. TYPE on *Dendrocalamus strictus* Nees from **India**, Uttar Pradesh: Dehra Dun, New Forest, July 1962, *B. K. Bakshi s.n.*  
 = *Kweilingia bagchii* (Singh & Pandey) Buriticá, Rev. Acad. Colombia Cienc. 22: 330. 1998.

We follow Buriticá (1998) in the delimitation and nomenclature of *Kweilingia*.

*Kweilingia* is characterized by its large erumpent, blackish, telia that are discoid-pulvinate, flabelliform in longitudinal section, or in some species effused over large areas of the leaf sheaths.

Teliospores are one celled with dark chestnut-brown walls about (1-)2-3  $\mu\text{m}$  thick, arranged in tightly or loosely adhering more or less verticle rows. The upper layer of spores often have apically thickened walls that may appear as a continuous layer suggesting a peridium. Two germ pores have been reported in teliospores of *Kweilingia bagchii*.

Even though Thirumalachar and Narasimhan (1951) concluded that *Kweilingia* is a member of the Auriculariales, we have no doubt that it is a rust because of the characteristic anamorphs. The large, black telia superficially resemble some Ascomycete structures.

Cummins and Hiratsuka (2003) kept *Kweilingia* and *Dasturella* as separate genera but reported that Buriticá (1998) had combined them as *Kweilingia*. Cummins and Hiratsuka (2003) included a key to separate genera in Phakopsoraceae that stated *Dasturella* has "catenulate teliospores" while *Dasturella* has "teliospores not catenulate". In their descriptions both genera were reported only to have catenulate teliospores, which was shown also by the illustrations. Another trait they reported as different was that the teliospores of *Dasturella* were "firmly adherent laterally and terminally" while those of *Kweilingia* are "loosely adherent at first but separating later". *Uredopeltis* also is difficult to separate from *Kweilingia*.

**KWEILINGIA DIVINA** (H. Sydow) Buriticá, Rev. Acad. Colombia Cienc. 22: 330. 1998.

(0/Icv  $\rightleftharpoons$  IIse,III).

$\equiv$  *Angiopsora divina* H. Sydow, Ann. Mycol. 34: 71. 1936. TYPE on *Bambusa* sp. (= *Dendrocalamus* sp.) from **India**, Majgawan, 5 Jan 1935, *Tandon-188*.

$\equiv$  *Dasturella divina* (H. Sydow) Mundkur & Kheswalla, Mycologia 35: 203. 1943.

$=$  *Dasturella oxytenantherae* Sathe, Sydowia 19: 1965. TYPE on *Oxytenanthera* sp. from **India**, Mahableshwar, 20 Jan 1965, *A.V. Sathe s.n.* .

Synanamorphs

***Physopella inflexa*** (Ito) Buriticá & Hennen, Rev. Acad. Colombia Cienc. 19: 56. 1994. This is the anamorph name for uredinia.

$\equiv$  *Uredo inflexa* Ito, J. Agr. Coll. Tohoku Imp. Univ. 3: 247. 1909. TYPE on "Sasa" sp. from **Taiwan**, Daihoku, date not reported, *H. R. Suzuki s.n.*

$=$  *Uredo ignava* Arthur, Bull. Torrey Bot. Club 45: 121. 1919. TYPE on "*Bambos vulgaris* Schrad." from **Cuba**, Santiago de las Vegas, 29 Jan 1916. *J. R. Johnston-424*.

$\equiv$  *Dicaeoma ignavum* (Arthur) Arthur & Fromme, N. Am. Fl. 7: 341. 1920.

$\equiv$  *Puccinia* (?) *ignava* (Arthur) Arthur, Bot. Gaz. (Crawfordsville) 73: 65. 1922.

$\equiv$  *Physopella ignava* (Arthur) Buriticá, Rev. Acad. Colombiana Cienc. 20: 204. 1996.

***Aecidium thaungii*** Carvalho, Hennen, & Figueiredo, Summa Phytopatol. 27:261. 2001

$\equiv$  *Aecidium randiicola* Thuang, Trans. British mycol. Soc. 66: 107. 1976. TYPE on *Randia* sp. aff. *dumetorum*, Rubiaceae, from **Burma**, Kyaukchaw, east of Mandalay, 7 Sept 1974, *M. M. Thuang s.n.* (not *Aecidium randiicola* Spegazzini, Rev. Arg. de Bot. 1 (2a.-3a.): 99-100. 1925). This is the anamorph name for aecia but Thuang's species requires a new name (*nom. nov.*) because Spegazzini (1925) published this name earlier for a different rust.

On Gramineae:

***Bambusa vulgaris*** Schrader, Amapá (IBI-1600, **II**), Mato Grosso do Sul (IBI-14356, **II**), Pará (IBI-13629; **II**; IBI-16156, **II**), Pernambuco (IBI-15579, **II**); Rio de Janeiro, (IBI-12481, **II**), São Paulo (IBI-17684, **II**, **III**). We are uncertain about the nomenclature of the hosts.

*Kweilingia divina* has been reported as widespread in warm regions of the world wherever certain species of bamboo occur or are cultivated for food, ornamentals, and bamboo poles. Genera of Bamboos reported as hosts include: *Bambusa*, *Dendrocalamus*, *Ochlandra*, *Oxytenanthera*, *Thyriostachys*, and *Gigantochloa*.

Spermogonia and aecia (*Aecidium thaungii*, unknown in the New World) . Uredinia (*Physopella inflexa*) on both sides of leaves, pale brown, paraphyses abundant, incurved, colorless or brownish, wall 1-1.5  $\mu\text{m}$  thick on inner facing side, 3-5  $\mu\text{m}$  thick on the outer facing side and apically; urediniospores (21-)23-28(-31) x (14-)16-19(-21)  $\mu\text{m}$ , obovoid or ellipsoid, wall 1-2  $\mu\text{m}$  thick, yellowish or pale brownish, echinulate, germ pores probably 4, equatorial, very obscure. Telia blackish brown, erumpent, pulvinate, crustose, mostly 150-200  $\mu\text{m}$  thick, teliospores 13-18 x 10-16  $\mu\text{m}$ , mostly cuboid, or oblong, in vertical rows of mostly 3-6 spores, wall 1-1.5  $\mu\text{m}$  thick at sides, 3-12  $\mu\text{m}$  thick at apex, chestnut-brown or darker (Cummins, 1971).

*Kweilingia divina* has been reported from the New World before only by the anamorph name *Uredo ignava* Arthur (Cummins, 1971). Carvalho et al. (2001) were first to report the teleomorph from the New World [Parque Estadual do Fontes do Ipiranga (PEFI), São Paulo, 95-107/IBI 17684] and first to connect the anamorph *Uredo ignava* (= *Physopella inflexa*). The rust seems to have been dispersed with the vegetatively reproduced hosts. In Asia, Bamboos have been reported to be attacked also by about 20 species of *Puccinia* but none of these have been reported from Latin America.

Because the morphology of the uredinial anamorph is that of *Physopella*, Buriticá & Hennen (1994) transferred *Uredo inflexa* S. Ito to *Physopella*. The synonymy of *Dasturella divina* given by Cummins (1971) reveals that *Uredo inflexa* S. Ito has priority over *U. ignava* Arthur. Cummins (1971) suggested that *U. ignava* would be found to be an anamorph of *Dasturella*. The collection from PEFI that has both teleomorph and anamorph sori clearly shows Cummins was correct. Later Buriticá (1998) placed *Dasturella* as a synonym of *Kweilingia* as shown above.

Thirumalachar et al. (1945) in India reported successful inoculations with aeciospores from an unnamed *Aecidium* sp. infecting *Randia dumetorum* Lamarck, Rubiaceae, onto leaves of bamboo resulting in uredinia and telia of *Dasturella divina* (= *Kweilingia divina*). Thaug (1976) named the same species of *Aecidium* on *Randia dumetorum* from Burma *Ae. randiicola* but Spegazzini used this name before for a different rust in Argentina. That is why we provided a new name, *Aecidium thuangii*, for this anamorph.

Several collections of *Aecidium randiae* P. Hennings on *Basanacantha* sp. are known from Brazil but their connection to *K. divina*, if any, is unknown.

This is the second species of *Kweilingia* to be reported in the Western Hemisphere. *K. americana* Buriticá & Hennen was described on *Costus pictus* Don, Zingiberaceae (Costaceae), from Chiapas, Mexico (Buriticá, 1998).

#### **Lecythea** Léveillé,

Ann. Sci. nat. ser. 3, 8:373. 1847.

*Lecythea*, a name not currently in use, is an anamorph genus for uredinia of *Phragmidium* spp. (Laundon, 1965A). The genus is characterized by sori that are surrounded by peripheral incurved paraphyses and have pedicellate, echinulate spores.

*Lecythea pezizaeformis* Berkeley & Curtis, see **DICHEIRINIA BINATA** (Berkeley & Curtis) Arthur.

#### **LEPTINIA** Juel,

Bih. K. Svenska Vet.-Akad. Handl. 23 Afd. 3: 15. 1897. TYPE SPECIES, *Leptinia brasiliensis* Juel. See below.

Spermogonia and aecia unknown. Anamorph spores produced by percurrent proliferation, the first spore in a series formed endogenously within the tip of a sporogenous cell, the apical part of the sporogenous cell wall breaks open as the first spore is pushed out by an elongating pedicel, later spores develop one after the other from the top part of the same sporogenous cell., each new spore comes through the pedicel of the previous spore. A small, irregularly split collar is left at the top of the sporogenous cell after a spore becomes detached. The collar is the remains of a part of the pedicel of the previous spore. After a sporogenous cell has produced several spores, several closely spaced, irregular collars are present. Telia subepidermal in origin, teliospores produced endogenously similar to the anamorph spores but usually only one teliospore per sporogenous cell, pedicellate, two-celled, wall very thin, colorless, germination without dormancy.

We recognize *Leptinia* because of our discovery of the unusual endogenous production of teliospores. Except for their endogenous production, these teliospores are similar to thin-walled, colorless teliospores of *Puccinia*. Very young sori must be examined to observe the endogenous nature of teliospore production. Neither Juel (1897), the Sydows (1904), nor Hiratsuka and Cummins (2003) reported the endogenous production of teliospores.

Cummins and Hiratsuka (2003) did not recognize *Leptinia*, they considered it a synonym of *Puccinia*.

**LEPTINIA BRASILIENSIS** Juel, Bih. K. Svenska Vet.-Akad. Handl. 23 Afd. 3: 15. 1897. TYPE on *Astronium* sp., reported originally as on an unidentified host, from **Brazil**, Mato Grosso: Buritizinho, Serra do Itopirapuan, 20 April 1894, *Lindman s.n. (-J-, -/III)*.

On Anacardiaceae:

*Astronium* sp., Goiás (IBI-13336), Mato Grosso (Juel, 1897: 15), Mato Grosso do Sul (IBI-14335).  
*Leptinia brasiliensis* has been reported only from Brazil.

Spermogonia, aecia, and uredinia not produced. Telia on abaxial side of leaflets, subepidermal in origin, long covered by the epidermis, minute, in dense angular groups, waxy-crustose, dark chocolate-brown; teliospores formed endogenously, pedicellate, two-celled, 30-38 x 10-14 µm, oblong to fusiform, rounded above and below, slightly constricted at the septum, wall uniformly less than 1 µm thick, smooth, colorless to pale yellow, septum often oblique, pedicel pale brown, germination without dormancy.

**MACABUNA** Buriticá & Hennen (anamorph),

Rev. Acad. Colomb. Cienc. 19: 50. 1994. TYPE SPECIES *Macabuna zizyphi* (Patouillard) Buriticá & Hennen (≡ *Uredo zizyphi* Patouillard on *Zizyphus* sp., Rhamnaceae, from **Viet Nam**).

Sori subepidermal in origin, erumpent, paraphyses peripheral, numerous, curved inward; sporeogenous cells produce spores sympodially on pedicels, spores easily deciduous leaving remnants of pedicels in the mature sori, spores echinulate.

See *Aeciure* for aids to identify anamorph genera of Uredinales.

*Macabuna adenocalymmatidis* (Hennings) Buriticá & Hennen, see **PHRAGMIDIELLA PAULISTA** Buriticá & Hennen.

*Macabuna arrabideae* (Hennings) Buriticá & Hennen, see **PHRAGMIDIELLA HOLWAYI** (H. S. Jackson) Buriticá in Buriticá & Pardo-Cardona.

*Macabuna daleae* Buriticá & Hennen, see **PHRAGMIDIELLA BIGNONIACEARUM** (Dale) Buriticá & Hennen.

*Macabuna marnavea* Buriticá & Hennen, see **PHRAGMIDIELLA MINUTA** (Arthur) Buriticá & Hennen.

*Macabuna qualeae* Buriticá & Hennen, see **APLOPSORA HENNENII** J. Dianese & L. T. P. Santos.

**MALUPA** Ono, Buriticá & Hennen (anamorph),

Mycol Res. 96: 828. 1992. TYPE SPECIES, *Malupa meibomia* (Arthur) Ono, Buriticá & Hennen (original description given by Arthur as ≡) on *Desmodium incanum* de Candolle, Leguminosae, from Puerto Rico.

Sori subepidermal or intraepidermal in origin, paraphyses peripheral, numerous, raised up by subtending hyphoid tissue and incurved over the sorus but leaving a pore-like opening. Spores echinulate, appear sessile in mature sori.

In some species sporogenous cells with distal collars have been reported indicating repetitive spore production from the same sporogenous cell. This results in spores without true pedicels and are described as sessile

*Malupa bixae* (Arthur) Buriticá, see **CROSSOPSORA BIXAE** Buriticá.

*Malupa colubrinae* (Cummins) Buriticá & Hennen, see **PHAKOPSORA COLUBRINAE** Viégas.

**MALUPA CONDYLOCARPI** (H. S. Jackson & Holway) Buriticá & Hennen in Buriticá, Rev. Acad. Colomb. Cienc. 23: 410. 1999. (?/?,II/?)

≡ *Uredo condylocarpi* H. S. Jackson & Holway, Mycologia 23: 493. 1931. TYPE on *Condylocarpon rauwolfiae* Mueller -Arg. from **Brazil**, São Paulo: São Joao, 2 Jul 1922, E.W.D. Holway & Mary M. Holway-1986.

On Apocynaceae

**Undetermined genus**, perhaps *Condylocarpon* sp., Minas Gerais (IBI-16269, IBI-16291), São Paulo (Jackson, 1931: 493; IBI-16524).

*Malupa condylocarpi* has been reported only from Brazil.



Spermogonia, aecia, and telia unknown. Uredinia 0.2-0.3 mm across on the abaxial side of leaves, scattered or in loose groups, subepidermal in origin, erumpent, ruptured epidermis not evident, powdery, cinnamon-brown; paraphyses abundant, 60-225  $\mu\text{m}$  long x 6  $\mu\text{m}$  wide above, to 12  $\mu\text{m}$  wide below, peripheral, incurved at first, becoming erect, wall 1-1.5  $\mu\text{m}$  thick, sometimes thickened to 4  $\mu\text{m}$  on outer side at base; urediniospores 32-38 x 19-25  $\mu\text{m}$ , ellipsoid, obovoid or pyriform; wall 1-1.5  $\mu\text{m}$  thick, closely and minutely echinulate, pores obscure (Jackson, 1931).

The erect peripheral paraphyses often more than 100  $\mu\text{m}$  long, aid in identifying this species. The two other species of *Crossopsora* known on Apocynaceae in the neotropics are *C. angusta*, also from Brazil, with peripheral paraphyses 30-50  $\mu\text{m}$  long and curved, and those of *C. stevensi*, from Guyana and Trinidad, with paraphyses usually more than 80  $\mu\text{m}$  long and also curved (Buriticá, 1999).

Buriticá predicted that *Malupa condylocarpi* will be found to belong to a *Crossopsora* species.

***Malupa montesina*** Buriticá, see **CROSSOPSORA ULEANA** (H. Sydow & P. Sydow) R. S. Peterson.

***Malupa piperinum*** (Sydow) Buriticá & Hennen, see **CROSSOPSORA PIPERIS** Berndt et al.

*Malupa uvifera* (Sydow) Buriticá & Hennen ( $\equiv$  *Uredo uvifera* Sydow), see **CEROTELIUM COCCOLOBAE** for notes.

***Malupa vignae*** (Bresadola) Ono, Buriticá & Hennen [**PHAKOPSORA MEIBOMIAE** (Arthur) Arthur].

#### MARAVALIA Arthur,

Bot. Gaz. (Crawfordsville) 73: 60. 1922. TYPE SPECIES, *Maravalia palida* Arthur & Thaxter on *Pithecolobium latifolium*, Leguminosae. [See Ono, Y. 1984. A monograph of *Maravalia* (Uredinales). Mycologia 76: 892-911].

= *Scopella* Mains, Ann. Mycol. 37: 58. 1939. TYPE SPECIES: *Maravalia echinulata* Ono, Mycologia 76: 904. 1984;  $\equiv$  *Uromyces echinulatus* Niessl ex Rabenhorst on *Madhuca latifolia* Macbride, Sapotaceae, from **India**, Bombay, 22 Feb 1922, *H. M. Chebber s.n.*

= *Acervulopsora* Thirumalachar, Mycologia 37: 299. 1945. TYPE SPECIES: *Acervulopsora ichnocarpi* Thirumalachar on *Ichnocarpus frutescens* Br., Apocynaceae, from India.

= *Scopellopsis* T. S. & K. Ramakrishnan, Proc. Indian Acad. Sci. Sect. B. 26: 62: 1947. TYPE SPECIES: *Scopellopsis dalbergiae* T. S. & K. Ramakrishnan on *Dalbergia* sp., Leguminosae, from India.

= *Angusia* Laundon, Trans. Britt. Mycol. Soc. 47: 327. 1964. TYPE SPECIES: *Angusia lonchocarpi* Laundon on *Lonchocarpus capassa* Rolfe., Leguminosae, from Zimbabwe.

Probasidia (teliospores) one-celled, thin-walled, colorless or rarely palely pigmented, pedicellate, these arise sympodially from laterally free teliosporogenous cells, these not always evident; metabasidia develop without a dormancy period either by extension of the apex of the probasidium or from an apically differentiated germ pore; pedicels hygroscopic in some species. The walls of urediniospores of some species on Sapotaceae have very characteristic echinulations that are surrounded by basal halos in the cell wall. Spermogonia type 5 or 7.

About 30 species are included in the genus by Ono (1984). They occur world wide in tropical areas, and infect nine different dicot families. Most species occur on the Leguminosae with 13 species and the Sapotaceae with ten species.

Ono (1984) reported that the placement of *Maravalia* in a family is uncertain. Cummins and Hiratsuka (2003) reported it in Chaconiaceae.

#### Key to help identify species of *Maravalia* in Brazil

1. Basidiosori not accompanied by other kinds of sori, locally systemic in leaves, pedicels not hygroscopic
  2. Basidiosori paraphysate, effused on large abaxial leaf spots  
*Maravalia swartziae* (*Swartzia*, Leguminosae)
  2. Basidiosori without paraphyses, on puckered, yellow-green, blister-like, leaf spots  
*Maravalia erythroxyli* (*Erythroxyllum*, Erythroxylaceae)
1. Basidiosori with other sori, without paraphyses
  3. Urediniospores asymmetrically narrowly obovoid to ellipsoid, often with a concave side,

apex often broadly papillate

*Maravalia perae* on *Pera* (Euphorbiaceae)

3. Urediniospores globose, ellipsoid, to obovoid, , probasidia pedicels hygroscopic

4. Urediniospores with basal smooth areas

*Maravalia amazonensis* (*Swartzia*, Leguminosae)

4. Urediniospores completely echinulate

*Maravalia bauhiniicola* on *Bauhinia*, Leguminosae

*Maravalia sebastianae* on *Sebastiana*, Euphorbiaceae

*Maravalia palaquii* on *Palaquium*, Sapotaceae

#### Other species of *Maravalia* in Latin America

1. *Maravalia pallida* Arthur & Thaxter on *Pithecellobium* sp., Leguminosae, from Trinidad, reported only from the TYPE.
2. *Maravalia guianensis* Ono on *Faramea multiflora* A. Richard, Rubiaceae, from Guyana, reported only from the TYPE.
3. *Maravalia manettiae* Joerstad on *Manettia* sp., Rubiaceae, reported from only two specimens, both from Ecuador.
4. *Maravalia bolivariensis* Ono on *Achras zapota* Linnaeus, Sapotaceae, from Venezuela.
5. *Maravalia kevorkianii* (Cummins) Cummins on *Mimusops*, Sapotaceae, from Cuba, reported only from the TYPE.
6. *Maravali sapotae* (Mains) Ono on *Achras zapota* Linnaeus, Sapotaceae, from Belize, Cuba, and Venezuela.
7. *Maravalia quadrilobata* (Hennen & Cummins) Ono on *Vitex* sp., Verbenaceae, from Mexico reported only from the TYPE.

*Maravalia albescens* Sydow, see **CHACONIA ALUTACEA** Juel.

**MARAVALIA AMAZONENSIS** (Albuquerque) Y. Ono, Mycologia 76: 898. 1984. (?/?, IIpe/III).

≡ *Scopella amazonensis* Albuquerque, Pesq. Agropec. Bras. Ser. Agron. 6: 149. 1971. TYPE on *Swartzia arborescens* (Aublet) Pittier, Leguminosae, from **Brazil**, Amazonas: Manaus, 28 Jan 1963, *Albuquerque* (IPEAN-929, IAN-585).

*Maravalia amazonensis* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Uredinia and basidiosori on abaxial side of leaves, often in confluent groups up to 2 mm across, superepidermal in origin, paraphyses absent; urediniospores 17-25 x 14-18(-25) μm, subglobose, ovoid, to broadly ellipsoid, walls about 1.5 μm thick, colorless, echinulate but with an almost smooth base, germ pores not seen. Basidiosori compact, waxy, probasidia 29-50 x (10-)14-19 μm, ovoid to fusoid, -cylindric or oblong, walls thin, colorless, smooth, pedicels to 100 μm long, persistent, hygroscopic (Ono, 1984).

**MARAVALIA BAUHINIICOLA** (Cummins) Y. Ono, Mycologia 76: 899. 1984. (?/?, IIpe/III).

≡ *Scopella bauhiniicola* Cummins, Mycologia 48: 606. 1956. TYPE on *Bauhinia heterophylla* Kunth, Leguminosae, **Cuba**, Matanzas, Canasi, 25 March 1919, *J. R. Johnston-1115*.

Anamorph

*Uredo bauhiniicola* P. Hennings, Hedwigia 34: 98. 1895. TYPE on *Bauhinia rubiginosa* Bongard from **Brazil**, Goiás: Goiás, Jan 1893, *Ule-1994*.

≡ *Scopella bauhiniicola* (P. Hennings) Cummins, Bull. Torrey Bot. Club 67: 72. 1940.

On Leguminosae.

?*Bauhinia rubiginosa* Bongard, Goiás (Hennings, 1895A: 98; Cummins, 1940: 42; 1950: 211; 1956: 606), Mato Grosso do Sul (IBI-14319).

*Bauhinia heterophylla* Kunth, Goiás (Cummins, 1956: 606; Ono, 1984: 899).

*Bauhinia* sp., Amapá (IBI-16025), Pará (IBI-16050)

*Maravalia bauhiniicola* has been reported only from Cuba and Brazil.

Spermatogonia and aecia unknown. Uredinia on abaxial side of leaves, in small groups or forming concentric rings, 0.2-0.8 mm diam, often confluent to 5 mm diam, subepidermal in origin, erumpent, pale yellow or whitish, urediniospores pedicellate, (19-)20-25(-26) μm, subglobose, obovoid to broadly ellipsoid,

walls 1.5-2.5  $\mu\text{m}$  thick, evenly finely echinulate, colorless to pale yellow; germ pores obscure. Basidiosori similar to and often completely replacing uredinia, compact, waxy, probasidia (30-)35x47 x 12-18(-21)  $\mu\text{m}$ , obovoid to oblong-ellipsoid, walls evenly very thin, smooth, colorless, pedicels to 55  $\mu\text{m}$  long, , persistent, hygroscopic and swelling, colorless (Ono, 1984).

*Uredo ulei* may belong here. See *Uromyces anthemophilus* for notes on rusts on *Bauhinia*.

**MARAVALIA ERYTHROXYLI** (Viégas) Ono & Hennen, Trans . Mycol. Soc. Japan 24: 387. 1983. (-/-, -/III).

≡ *Puccinia erythroxyli* Viégas, Bragantia 3: 54. 1943. TYPE on *Erythroxyllum suberosum* Saint-Hilaire from **Brazil**, São Paulo: cerrado near Mogi-Mirim, 12 Oct 1941, A. P. Viégas & G. P. Viégas-4095.

≡ *Chaconia erythroxyli* (Viégas) Viégas, Índice fung. Amer. do Sul, p. 405. 1961.

On Erythroxyllaceae.

*Erythroxyllum daphnites* Martius, São Paulo (IBI-13361).

*Erythroxyllum engleri* O. E. Shultz, Minas Gerais (IBI-12644).

*Erythroxyllum suberosum* Saint-Hilaire, Federal District (13213), Minas Gerais (IBI-13359), São Paulo (Viégas, 1943: 54; 1945: 25; IAC-4325; IBI-13142).

*Erythroxyllum* sp., Federal District (IBI-14897), Minas Gerais (IBI-14885), São Paulo (IAC-3879, IBI-12599).

*Maravalia erythroxyli* has been reported only from Brazil.

Spermogonia, aecia, and uredinia unknown. Basidiosori mostly on abaxial side of leaves, sori minute but usually confluent to form large irregular sori on raised convex lesions of various sizes, often 2-4 cm across or more, subepidermal in origin, erumpent, compact, waxy, bright yellowish-orange, when fresh; without paraphyses, probasidia 27-41 x 10-16  $\mu\text{m}$ , ellipsoid to oblong-ellipsoid, walls thin, colorless, smooth; pedicels 8-16  $\mu\text{m}$  long, colorless, persistent; basidiospores 10-13 x 9-11  $\mu\text{m}$ , subglobose to obovoid (Ono & Hennen, 1983: 387).

Infections by *Maravalia erythroxyli* induce large, pale yellow-green, blister-like puckering on leaves. This unusual symptom is helpful for identifying this species.

**Key to help identify three rust species on *Erythroxyllum*, Erythroxyllaceae, in Latin America**

1. Sori not powdery, on large lellow or yellowish-green, blister like or puckered areas on leaves  
*Maravalia erythroxyli*.
1. Sori powdery or crust-like, not on blister-like or puckered areas of leaves. **2 (*Phakopsora*)**.
  2. Anamorph spores obovoid to broadly ellipsoid, 20-24 x 16-22  $\mu\text{m}$ , yellowish, telia punctiform with a nearly sphaerical hymenium, spores in 13 layers. *Phakopsora erythroxyli*.
  2. Anamorph spores irregularly or angularly obovoid or ellipsoid, 22-30 x 16-20  $\mu\text{m}$ , brownish, telia lenticular, crusty with a flat or slightly concave hymenium, with more than 3 spore layers *Phakopsora coca*.

*Maravalia ingae* H. Sydow, see **CHACONIA INGAE** (H. Sydow) Cummins.

**MARAVALIA LUCUMAE** (Dietel) Y. Ono, Mycologia 76: 906. (??, Ipe/III).

≡ *Uromyces lucumae* Dietel Ann. Mycol.. 6: 95. 1908. TYPE on *Lucuma caimito* Roemer from **Brazil**, Pará: Belém, Botanical Garden of Museu Goeldi, Jan 1908, *Huber*.

≡ *Scopella lucumae* (Dietel) Cummins, Bull. Torrey Bot. Club 67: 75. 1940.

On Sapotaceae

*Lucuma caimito* Roemer & Schultes, Pará (Cummins, 1940: 75; 1950: 211), Rio de Janeiro (IBI-6775), São Paulo (IBI-3146.).

*Lucuma* sp., São Paulo (IBI-68).

*Maravalia lucumae* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, 0.2-2 mm long, scattered or grouped, often confluent to 5 mm long, subepidermal in origin, erumpent, urediniospores pedicellate, (16-)20-24(-26) x 16-24  $\mu\text{m}$ , globose, subglobose, to oblong-ellipsoid; walls (1.5-)2-3  $\mu\text{m}$  thick, completely echinulate, colorless, germ pores not seen. Basidiosori on abaxial side of leaves, similar to and often

replacing uredinia, probasidia (35-)38-50(-54) x (12-)14-19 µm, oblong-ellipsoid to cylindrical, walls ca 1 µm thick, smooth, colorless; pedicels to 50 µm long, hygroscopic, colorless, persistent (Cummins, 1940).

**MARAVALIA PALAQUII** (Cummins) Y. Ono, Mycologia 76: 907. (??,IIpe/III).

≡ *Scopella palaquii* Cummins, Bull. Torrey Bot. Club 77: 211. 1950. TYPE on *Palaquium* sp. from **Brazil**, Rio de Janeiro: Rio de Janeiro Botanical Garden, Aug 1897, *Ule-2359*.

Anamorph

*Uredo palaquii* P. Hennings, Hedwigia Beiblatt 38: (129). 1899. TYPE on *Palaquium* sp. from **Brazil**, Rio de Janeiro: Rio de Janeiro, Botanical Garden, August 1897, *Ule-2357*.

On Sapotaceae

*Palaquium* sp., Rio de Janeiro (Hennings, 1899: (129); Cummins, 1950: 211).

*Maravalia palaquii* has been reported only from the two collections made by Ule from the type locality, one is the type of the teleomorph, the other is the type of the anamorph.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, 0.2-0.5 mm across, scattered to loosely grouped, sometimes confluent, subepidermal in origin, erumpent; urediniospores pedicellate, (20-)21-30 x (15-)17-24 µm, subglobose, obovoid to ellipsoid; walls 1.5-2.5(-3) µm thick, completely echinulate, colorless, germ pores not seen. Basidiosori on the abaxial side of leaves, similar to the uredinia, probasidia (36-)41-62 x 9-18(-19) µm, oblong-ellipsoid to cylindrical, walls thin, smooth, colorless; pedicels 20-55 µm long, hygroscopic, persistent, colorless.

The identification of the host genus needs to be confirmed. The host genus *Palaquium* is from southeast Asia and has been introduced into Brazil.

*Maravalia pura* (H. Sydow) Mains, see **UROMYCES PURUS** (H. Sydow) Cummins.

**MARAVALIA SEBASTIANIAE** Lindquist, Darwiniana 9: 609. 1952. TYPE on *Sebastiania*

*klotzschiana* Mueller-Arg. from **Argentina**, Córdoba: Sierra de Achala, Rio Yuspe, between La Hoyada and Pampa del Matadero, 10 Dec 1950, *Hunziker-8700*. (??,IIpe/III).

Anamorph

*Uredo sebastianiae* Winter, Hedwigia 26: 12. 1887. TYPE on *Sebastiania* sp. from **Uruguay**, Montevideo, Oct 1886, *Arechavaleta s.n.*

On Euphorbiaceae.

*Sebastiania klotzschiana* Mueller-Arg., Rio Grande do Sul (Lindquist & Costa Neto, 1967: 61), Santa Catarina (IBI-12904).

*Sebastiania* sp., Rio de Janeiro (HBG, *Ule-2113*).

*Maravalia sebastianiae* has been reported also from Argentina and Uruguay (Ono, 1984).

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves, sometimes on young stems, scattered or often confluent in large irregular patches, covered at first by the epidermis, erumpent and surrounded by the broken epidermis, powdery or waxy after spores are gone, yellow-orange; urediniospores pedicellate, 16-21 x 12-15 µm, obovoid or ellipsoid, wall 1.5-2 µm thick, uniformly echinulate or often becoming smooth at the base, pores invisible. Probasidia in the uredinia, 20-50 x 12-16 µm, cylindrical to oblong-ellipsoid, narrowed above and below, straight or slightly curved, wall very thin, colorless; pedicel 20-50 x 7-10 µm, hygroscopic, persistent, colorless (Lindquist, 1982).

*Maravalia utriculata* H. Sydow, see **CHACONIA INGAE** (H. Sydow) Cummins.

**MARAVALIA SWARTZIAE** Ono, Mycologia 76: 902. 1984. TYPE on *Swartzia* sp., Leguminosae, from **Brazil**, Pará: Monte Dourado, Jari-Portal, 26 Jan 1970, *N. Tomaz-1262*. (-/-,III).

*Maravalia swartziae* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia, aecia, and uredinia unknown. Basidiosori locally systemic in leaves, forming large deformed effused abaxial patches, intradermal or subepidermal, paraphyses 41-62 x 7-11 µm, wall somewhat thickened and angular at the apex, pale yellow to colorless; probasidia 31-41 x 10-14 µm, tightly packed, walls thin, colorless; pedicels 10-15 µm long, colorless, non-hygroscopic (Ono, 1984).

Albuquerque (1971) included this species in a list of rusts from Pará, Brazil but did not publish a description.

**MELAMPSORA** L. Castagne,

Observations sur Quelques Plantes Acotylédonées Requeillies dans le Department des Bouches-du-Rhone 2: 18, 1843. TYPE SPECIES: *Melampsora euphorbiae* (Schubert) Castagne.

When Castagne (1843) proposed the genus *Melampsora*, he included only one species, *M. euphorbiae* (Schubert) Castagne, which automatically became the type species. Schubert in 1823 was first to name this fungus but he placed it in the Ascomycete genus *Xyloma* as “*X. (Placuntium) euphorbiae*” Schubert, in Ficinus, Fl. Dresden, ed. 2, 2: 31. 1823. The type specimen is from near Dresden, Germany on *Euphorbia exigua* Linnaeus. *Xyloma* and *Placuntium* are now synonyms of the Ascomycete genus *Rhytisma*, Rhytismataceae (Dictionary of the Fungi, 8<sup>th</sup> ed., 1995).

The citation of the name of the publication where Castagne published the name *Melampsora* has not been consistent. Arthur (1925, p. 670) published it as “Obs. Myc. 2: 18. 1843”; Laundon (1965A, p. 11) as “Observations Urédinées 2 18, 1843”; and Cummins and Hiratsuka (1983, p. ) as “Obs. Pl. Acotyl. Fam. Ured. 2: 128. 1843”. We give the complete title of the publication as it appears on the title page of a copy available to us.

*Melampsora* is a large genus of perhaps as many as 80 species, probably all native of the Northern Hemisphere. The genus includes both heteroecious and autoecious species. The heteroecious species have spermogonia and aecia on Gymnosperms and uredinia and telia on *Populus* and *Salix* in the Salicaceae. The autoecious species infect mainly herbaceous plants. *Melampsora* is most readily identified by the characteristic, usually numerous, intrasoral, capitate paraphyses in the uredinia. Where known, the aeciospores of *Melampsora* are catenulate with intercalary cells and belong to the anamorph *Caeoma*. But a number of these anamorphs have evanescent or poorly developed peridia, which could place them in the anamorph *Aecidium*. At least one species, *Melampsora hypericorum*, whose spermogonia and aecia are unknown, has urediniospores that are catenulate. This species is widespread in the Northern Hemisphere on cultivated species of ornamental *Hypericum*.

Curiously, Arthur (1907) used the genus name *Uredo* for *Melampsora*. Later, he abandoned this usage in favor of the name *Melampsora*, now used by all modern authors.

*Melampsora* is best known in Brazil by the three or four species that cause rust disease on several introduced species of *Salix* and *Populus* (Salicaceae). These *Melampsora* species are heteroecious but persist in Brazil by repeated infections by urediniospores. The Gymnosperm spermogonial and aecial hosts are absent from Brazil. *Melampsora* species on *Populus* spp. have urediniospores with their lateral walls noticeably thickened while those on *Salix* spp. have urediniospores in which the lateral walls are not noticeably thickened.

*Melampsora euphorbiae* produces a rust disease of *Euphorbia* sp., plants that are considered as important weeds. The rust may help reduce populations of these weeds, thus acting as a natural biological control agent.

*Melampsora lini* (Ehrenberg) Leveille on *Linum usitatissimum* Linnaeus, flax, which has been reported from Brazil but not reported in recent decades, is of great scientific importance because this was the species that was used to develop the theory of "gene for gene" relationships between physiologic races of rusts and cultivars of cultivated crops.

*Melampsora epitea* was one of the first rust species to be cultured axenically in Brazil (Carvalho, Jr., et al., 1998).

*Melampsora abieti-caprearum* Tubeuf, see **MELAMPSORA EPITEA** Thuemen.

*Melampsora alli-populina* Klebahn, see **MELAMPSORA POPULNEA** (Persoon) Karsten.

*Melampsora argentinensis* Spegazzini, see **PHAKOPSORA ARGENTINENSIS** (Spegazzini) Arthur.

**MELAMPSORA EPITEA** Thuemen, Mitth. Forstl. Versuchsw. Oesterr. 2: 38. et 40. 1879. TYPE on *Salix* sp. (0/Icv  $\cong$  IIpe/III).

= *Melampsora abieti-caprearum* Tubeuf, Centralblatt f. Bacteriol. II. Abt.9: 241: 1902. TYPE on *Salix caprea* Linnaeus from **Germany**, Bavaria: Bernau near Chiemsee.

= *Melampsora humboldtiana* Spegazzini, An. Mus. Nac. Hist. Nat. Buenos Aires 23: 28. 1912. TYPE on *Salix humboldtiana* Willdenow, a lectotype needs to be chosen from the two

collections listed by Spegazzini, one from **Uruguay** and one from **Argentina**, "prope Montevideo, Nov. 1909, et in insulis Ibiary, Entre Rios, Mayo 1911".

On Salicaceae:

*Salix babylonica* Linnaeus, Minas Gerais, São Paulo (IBI-15969; see Carvalho, A. A. Jr. et al., 1998).

*Salix discolor* Muhlenberg, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 121, reported as *Melanpsora abieti-caprearum*; IAN-721).

*Salix* sp., Rio Grande do Sul (IBI-14086).

*Melanpsora epitea* is a species complex that occurs circumglobally especially in North Temperate regions. The uredinial and telial phases of *Melanpsora epitea* parasitize more than 15 species of *Salix*. Hylander et al. (1953) were first to report *Melanpsora epitea* as a species complex with at least 15 names applied to various populations of the complex. Some authors have recognized at least eight formae speciales of this species based mainly on aecial hosts. In most of its range no spermogonia and aecia are produced because the Gymnosperm hosts of these stages are absent. *Melanpsora epitea* has been reported on *Salix babylonica* previously in North America. Walker (1978) reported an introduced rust on *Salix babylonica* in Australia as *Melanpsora coleosporioides* Dietel which has been reported mainly from Japan and China and surrounding regions.

*Melanpsora epitea* was one of the first rust species to be cultured axenically in Brazil (Carvalho, Jr., et al., 1998).

**MELAMPSORA EUPHORBIAE** (Schubert) Castagne, Obs. Pl. Acotyl., 2p. 18, 1843. TYPE, see discussion above about the type species of the genus. **(0/Icv, IIpe/III)**.

The following synonymy is from Joerstad (1958). We have not attempted to determine the type specimens of these names, none of which are from The Americas.

= *Melanpsora euphorbiae-dulcis* Otth, Mitth. Naturf. Ges. Bern, 1868 p. 70. 1869.

= *Melanpsora helioscopiae* Winter in Rhabenhorst Krypt.-Fl., Ed. 2, I, 1 p. 240. 1882.

= *Melanpsora euphorgiae-gerardianae* W. Mull., Centralbl. f. Bakt., II, 19 p. 548. 1907.

= *Melanpsora cyparissae* W. Mull., l. c., p. 553. 1907.

= *Melanpsora gelmii* Bres., Bull. Soc. Bot. Ital., 1897 p. 75.

= *Melanpsora ricini* Passerini ex Noronha, Agron. Lusit. 14 p. 242. 1952.

Anamorph

*Uredo ricini* Biv.-Bern. in Stirp. Rar. Sicil., 3 p. 10. 1815.

= *Melanpsora ricini* Passerini, Erb. Critt. Ital., Ser. 2, Fasc. 14, No 684. 1878.

= *Melanpsorella? ricini* (Biv.-Bern.) De Toni in Sacc., Syll. Fung., 7n p. 596. 1888.

On Euphorbiaceae

*Euphorbia ?heterophylla*. Minas Gerais (IBI-16305), Pernambuco (IBI-14305), Rio de Janeiro (Barreto and Evans, 1998), Rio Grande do Sul (17418), São Paulo (IBI-13991).

*Melanpsora euphorbiae* has been reported as wide spread in the Northern Hemisphere, Africa, Australia, and New Zealand. In South America it has been reported also from Argentina, Chile, and Colombia. More than 50 species of *Euphorbia* have been reported as hosts. *Ricinus communis* Linnaeus has been reported as a host in Africa and Europe. *Melanpsora euphorbiae* is an autoecious, long cycle rust but spermogonia and aecia have been reported only rarely.

*Melanpsora humboldtiana* Spegazzini, see **MELAMPSORA EPITEA** Thuemen.

**MELAMPSORA LARICI-POPULINA** Klebahn, Zeits. Pflanzenkr. 12: 25. 1902. TYPE on *Populus canadensis* Moench from **Germany**: Hamburg. **(0/Icv ≅ IIpe/III)**.

On Salicaceae:

*Populus canadensis* Moench, Brazil (Silveira, 1951: 225).

*Populus nigra* Linnaeus var. *italica* DuRoy, Minas Gerais (Viégas, 1945: 6; IAC-4015), São Paulo (IAC-7949).

?*Salix monolifera?*, São Paulo (Puttemans-1623) This record is based on a host or a rust misidentification.

During the last several decades *Melanpsora larici-populina* has been reported worldwide in many countries, having spread from its original range in northern Eurasia to introduced plantings of its *Populus* spp.

hosts. This rust causes severe defoliation especially on young plants of *Populus nigra* and *Populus* spp. causing retarded development.

Urediniospores are smooth on top. *Melampsora medusae*, a very similar species on *Populus* spp., has urediniospores that are smooth in the equatorial region.

**MELAMPSORA LINI** (Ehrenberg) Lèveillé, Ann. Sc. Nat. Bot. Ser. 3, 8: 376. 1847. **(0/Icv/IIpe/III)**.

≡ *Xyloma? lini* Ehrenberg, Sylvae Myc. Berol., p. 27. 1918. TYPE on *Linum usitatissimum* L. from Europe

On Linaceae:

*Linum usitatissimum* Linnaeus, Paraná (Fontoura & Nowacki, 1967/70: 142; IBI-5747), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 129; IAN-728; IBI-4714), São Paulo (IBI-10244).

Although of little economic importance in Brazil now because of practically no production of flax in Brazil, this rust has been of great importance in the biological sciences because of its use in a model system for working out the theory of gene for gene relationship between host and parasite in plant disease resistance. H. H. Flor working in North Dakota in the United States of America was able to develop this theory using this rust because it is a long cycle, autoecious rust species on flax with which Flor made sexual crosses and thus was able to study the genetics of virulence of the fungus in conjunction with resistance in the host.

*Melampsora lisianthi* Patouillard, see **PUCCINIA LISIANTHI** H. S. Jackson & Holway.

**MELAMPSORA MEDUSAE** Thuemen, Bull. Torrey Bot. Club 6: 216. 1878. TYPE on.

**(0/Icv ÷ IIpe/III)**.

On Salicaceae:

*Populus* sp., Minas Gerais (Viégas, 1945: 6), Paraná (IBI-17592), São Paulo (Viégas, 1945: 6; IAC-11045).

This rust is similar to *Melampsora larici-populina* and causes similar damage to *Populus* spp. but not to *P. nigra*. The urediniospores are echinulate but have a smooth equatorial region. *Melampsora larici-populina* has urediniospores that are echinulate but smooth on top.

**MELAMPSORA OCCIDENTALIS** H. S. Jackson, Phytopathology 7: 354. 1917. TYPE on *Populus trichocarpa* from **The United States of America**, Oregon: Benton Co., Corvallis, 15 Oct 1915, H. S. Jackson s.n. . **(0/Icv ÷ IIpe/III)**.

On Salicaceae:

*Populus* sp., São Paulo (IAC-4536).

The occurrence of the North American rust, *Melampsora occidentalis*, in Brazil requires confirmation. The urediniospores of *M. occidentalis* are reported to be 32-48 µm long and ellipsoid. The two other species of *Melampsora* on *Populus* in North America that have ellipsoid urediniospores have shorter urediniospores (26-35 µm).

**MELAMPSORA POPULNEA** (Persoon) P. Karsten, Bidr. Känned. Finl. Nat. Folk 31 (or ?39): 53. 1879.

**(0/Icv ÷ IIpe/III)**.

The following synonymy and anamorph citations are from Joerstad (1958) and Henderson (1966) who considered *Melampsora populnea* as a collective species. We have not determined the type collections of these names. They are all from Europe.

≡ *Sclerotium populneum* Persoon, Syn. Meth. Fung., p. 125. 1801.

= *Melampsora tremulae* Tulasne, Ann. Sci. Nat. Bot. III, 8: 95. 1854.

= *Melampsora aecidioides* Schroeter, in Cohn, Krypt. Fl. Schles., III, 1: 362. 1887.

= *Melampsora pinitorqua* Rostrup, 1889.

= *Melampsora rostrupii* Wegner, Oestr. Bot. Zeits. 56: 273. 1896.

= *Melampsora larici-tremulae* Klebahn, 1897.

= *Melampsora pulcherrima* Maire, Bull. Soc. Hist. Nat. Afr. Nord. 7: 139. 1915.

Anamorph

*Uredo aecidioides* DeCandolle, Fl. Fr. 2: 236. 1805.

On Salicaceae

*Populus alba* Linnaeus, var. *nivea* Rio Grande do Sul (Lindquist & Costa Neto, 1967: 60, IBI-16867).

*Populus canadensis* Moench, Brasil (Silveira, 1951: 225, as *Melampsora alli-populina* Klebahn).

*Populus monolifera* Ait., São Paulo (*Puttemans-1623*, as *Melampsora alli-populina* Klebahn).

*Melampsora populnea* has been reported also from Uruguay in South America and as widespread in the temperate regions of the Northern Hemisphere, and is considered as a species complex with at least five names given to its "formae speciales". This rust is most common on cultivated *Populus alba* (white poplar) and its varieties. Only its uredinial and telial stages are known in South America. It has been reported to overseason in buds.

*Melampsora rostrupii* Wegner, see **MELAMPSORA POPULNEA** (Persoon) P. Karsten.

#### **Micropuccinia** Rostrup,

Plantep. Haandb. 266. 1902. See Laundon (1965A) for details about the type species.

Arthur proposed that *Micropuccinia* should be used for short cycled species of *Puccinia*. Spermogonia may or may not be produced. No aecia or uredinia are formed in the life cycle. Teliospores are two-celled. Later, Arthur abandoned the use of *Micropuccinia* and it is not used any more. Most of the species are now placed in *Puccinia*. We have not included all of the *Micropuccinia* names that may be synonyms of species of *Puccinia* in Brazil.

*Micropuccinia heterospora* (Berkeley & Curtis) Arthur & H. S. Jackson, see **PUCGINIA HETEROSPORA** Berkeley & Curtis

*Micropuccinia obliqua* (Berkeley & Curtis) Arthur & H. S. Jackson, see **PUCGINIA CYNANCHI** Berkeley & Curtis.

#### *Milesia* White (anamorph),

Scottish Nat. 4: 162.1878, TYPE SPECIES *Milesia polypodii* White.

*Milesia bauhiniicola* Ono, Buriticá & Hennen, see **PHAKOPSORA BAUHINIICOLA** Ono, Buriticá & Hennen.

*Milesia brasiliae* Buriticá & Hennen, see **PHAKOPSORA BUTLERI** Dianese, Santos & Medeiros in Dianese.

*Milesia caryocae* Buriticá & Hennen, see **CEROTELIUM GIACOMETTII** J. C. Dianese, Santos, & Medeiros in J. C. Dianese et al.

**MILESIA CROTALARIAE** (Dietel) Ono, Buriticá & Hennen, Mycol. Res. 96: 847. 1992. (?!/?, **Ilse**/?).

≡ *Uredo crotalariae* Dietel, Hedwigia 38: 257. 1899. (see Gjaerum, 1978). TYPE on *Crotalaria* sp., Leguminosae, from **Brazil**, Rio de Janeiro: Copa Cabana, Aug 1897, *Ule-2328*.

*Milesia crotalariae* (*Uredo crotalariae*) has been reported only from the type. Gjaerum (1978) reported that two rust species are present on the type. Dietel described *Uredo crotalariae* Dietel, a rust with echinulate urediniospores with four equatorial germ pores. A teleomorph is unknown for it. Arthur (1917) found another rust on the type material that had uredinia with paraphyses, urediniospores nearly colorless without visible germ pores, and associated with *Phakopsora* telia. Arthur named this rust *Phakopsora crotalariae* (Hennings) Arthur. We ascribed this name to Arthur alone, not as a new combination, because Arthur described telia from the original type. Now, we consider this name a synonym of *Phakopsora meibomia* Arthur. Ono et al. (1992) made a new combination of *Uredo crotalariae* as *Milesia crotalariae* (Dietel) Ono et al. They reported traits that help to identify *Milesia crotalariae* include sori on the abaxial side of leaves in small groups on discolored spots, subepidermal in origin, covered by a peridioid hyphal cell layer, also with a few peripheral and hymenial paraphyses, opening through a central pore, paraphyses cylindrical to clavate, 20-30 x 6-9 µm, wall uniformly 1 µm thin, colorless, spores sessile, 21-30 x 16-21 µm,



obovoid to broadly ellipsoid, wall uniformly 1-1.5  $\mu\text{m}$  thick, yellowish to colorless, minutely and densely echinulate, germ pores 4, equatorial.

*Milesia crotonicola* (P. Hennings) Buriticá & Hennen in Buriticá, see **PHAKOPSORA ARGENTINENSIS** (Spegazzini) Arthur.

*Milesia cupheae* (P. Hennings) Buriticá, see **PHAKOPSORA CUPHEAE** Buriticá.

*Milesia erythroxyli* (Graziani) Buriticá & Hennen in Buriticá, see **PHAKOPSORA COCA** Buriticá & Hennen.

*Milesia erythroxyli-antillanae* Buriticá & Hennen., see *Phakopsora erythroxyli* (Cummins) Kern in Stevenson.

*Milesia lindquistii* Buriticá & Hennen, see **PHAKOPSORA CHAVESII** Dianese, Santos & Medeiros in Dianese et al.

*Milesia pavida* (H. S. Jackson & Holway) Buriticá & Hennen, **PHAKOPSORA PAVIDA** Buriticá & Hennen.

*Milesia phyllanthi* (Hennings) Buriticá & Hennen, **PHAKOPSORA ULEI** (H. Sydow & P. Sydow) Buriticá & Hennen in Buriticá.

*Milesia tijucae* (H. S. Jackson & Holway) Buriticá & Hennen in Buriticá, see **PHAKOPSORA TIJUCAE** Buriticá & Hennen.

#### **MIMEMA** H. S. Jackson,

Mycologia 23: 338. 1931. TYPE SPECIES: *Mimema holwayi* H. S. Jackson on *Dalbergia* sp. (originally reported mistakenly as *Cassia versicolor*) from **Bolivia**, Sur Yungas: Villa Aspiazu, 31 May 1920, *Holway-690*. Uropyxidaceae.

Spermogonia and aecia not known. Uredinia with abundant peripheral, mostly pointed paraphyses, *Calidion* type, urediniospores finely and closely echinulate/verrucose, germ pores 1-6, equatorial. Telia develop following uredinia in the same sorus, emerging from the dense peripheral paraphyses as columns of teliospore tendrils, teliospores cylindrical or fusiform, multicelled usually 4 (3-6, or more, 9-12 in *Uredo dalbergiae* Ule-2916), with long tapering pedicels, or these broken short, germination through discrete germ pores, metabasidia external. (Cummins & Hiratsuka, 2003).

*Mimema* has been considered as a synonym of *Sorataea* but was recognized by Cummins and Hiratsuka (2003) because of the trait of one germ pore in each probasidial cell through which the metabasidium emerges. In *Sorataea* the metabasidium develops by the elongation of the apex of the probasidial cells. Also, the teliospores in *Mimema* are extruded from the sorus as a column or a tendril, a trait not reported for *Sorataea*. Cummins and Hiratsuka placed *Mimema* in the Uropyxidaceae but did not include it in their key to genera of this family.

**MIMEMA VENTURAE** Dianese, L. T. P. Santos, R. B. Medeiros & M. Sanchez, Mycological Research 98: 786. 1994. TYPE on *Dalbergia miscolobium* Bentham, Leguminosae, from **Brazil**, Federal District (?/?,II/III). *Mimema venturae* has been reported only from the type.

The following may represent other collections of *Mimema venturae*.

**UREDIO DALBERGIAE** P. Hennings, Hedwigia 34: 98. 1895. TYPE on *Dalbergia* sp. from **Brazil**, Goiás: Goiás, Feb 1893, *Ule-1995*.

= *Uredo mararyensis* P. Hennings, Hedwigia 43: 162. 1904. TYPE on *Dalbergia* sp., Leguminosae, from **Brazil**, Amazonas: Rio Juruá, Marary, September 1900, *Ule-2916*.

= *Uredo nidulans* H. Sydow & P. Sydow, Ann. Mycol. 1: 332. 1903. TYPE on *Dalbergia foliolosa* Benth from **Bolivia**, Guani-Tipuani, date not reported, *M. Bang s.n.*

On Leguminosae.

*Dalbergia variabilis* Vogel, Santa Catarina, (Hennings, 1896: 251), Brasil (Joerstad, 1959: 75).

*Dalbergia* sp., Goiás (Hennings, 1895: 98), Mato Grosso (Joerstad, 1959: 75).

*Uredo dalbergiae* has also been reported from Bolivia as shown above.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves, on yellowish leaf spots, scattered or in loose or dense groups to 4 mm across, cinnamon-brown, erumpent, pulverulent; paraphyses 40-80 x 5-8 µm, numerous, peripheral, incurved, apically sharp-pointed, wall colorless to subcolorless, outer lateral wall 2.5-5 µm thick, inner lateral wall 1-2 µm thick; urediniospores 17-24 x 14-18 µm, subglobose, ovoid, to pyriform, often slightly reniform, wall 1-1.5 µm thick, pale brown, echinulate, germ pores probably several, obscure (P. & H. Sydow, 1924). Telia like the uredinia but teliospores emerge as a minute column or tendril, teliospores up to 130 x 5 µm, elongate-needle-like, up to 9(-12) septate, pointed on both ends, wall uniformly about 1 µm thick, colorless to pale yellow, pedicel broken ca 12 µm from spore.

Telia were found on an isotype specimen of *Uredo mararyensis* in PUR-F8906. *Uredo dalbergiae* is probably an anamorph of *Mimema* sp. or *Sorataea* sp.

The Sydows (1924) determined that *Uredo mararyensis*, which has been reported only from the type, is a synonym of *Uredo dalbergiae*.

#### **NEPHLYCTIS** Arthur,

Jour Myc. 13: 31. 1907. TYPE SPECIES: *Puccinia elegans* Schroeter.

Arthur proposed *Nephlyctis* for microcyclic species of *Prospodium*. The genus is no longer used.

*Nephlyctis elegans* Arthur, see **PROSPODIUM ELEGANS** (Schroeter) Cummins.

#### **NIGREDO** Roussel,

Fl. Calvados ed. 2: 47. 1806. Laundon (1965A) states that this is a "rejected name" for *Uromyces*.

Arthur (1912) used this genus for 83 macrocyclic species of *Uromyces*, both autoecious and heteroecious, that presumably have or do have spermogonia, aecia in the genus *Aecidium*, and uredinia with pedicellate spores. Later Arthur abandoned the use of the genus and it is no longer in use.

*Nigredo hyperici-frondosi* (Arthur) Arthur, see **UROMYCES TRIQUETRUS** Cooke.

*Nigredo (?) howei* (Peck) Arthur, see **UROMYCES ASCLEPIADIS** Cooke.

#### **OLIVEA** Arthur,

Mycologia 9: 60. 1917. TYPE SPECIES *Olivea capituliformis* Arthur. See below.

= *Tegillum* E. B. Mains, Bull. Torrey Bot. Club. 67: 707. 1940. Type species *Tegillum fimbriatum* Mains on *Vitex* sp., Verbenaceae, from **Belize** (British Honduras).

*Olivea* is characterized by having 1-few, sessile, colorless, thin-walled probasidial cells formed successively on laterally free basidiogenous cells; metabasidia develop by continuous apical elongation of probasidia without dormancy.

About ten species are known and are reported from Africa, Asia, and Latin America on the Euphorbiaceae (*Alchornea*), Labiatae (*Colebrookia*), and Verbenaceae (*Petitia*, *Tectonia*, *Vitex*). (Ono & Hennen, 1983).

**OLIVEA CAPITULIFORMIS** Arthur [as "(P. Henn.) *comb. nov.*"], Mycologia 9: 61. 1917. TYPE on *Alchornea latifolia* Sw. **Puerto Rico**, El Yunque, 12 March 1916, Whetzel & Olive-345. Arthur described telia from the specimen listed here as the type. (**0/Ice,IIpe/III**).

Anamorph

*Uredo capituliformis* P. Hennings, Hedwigia 34: 97. (1895) 1896. TYPE on *Alchornea* sp. from **Brazil**, Goiás: Serra dos Pyreneos, Aug 1892, *Ule-1908*.  
= *Ravenelia capituliformis* (P. Hennings) P. Hennings, Hedwigia 43: 160. 1904 (Based on uredinia).

On Euphorbiaceae:

*Alchornea fluviatilis* Secco, Amapá (*H. Sotaõ-93-101*).

*Alchornea iricurana* Casaretto, Rio de Janeiro (Jackson, 1931: 466), São Paulo (IBI-12076).

*Alchornea pycnogyne* Mueller-Arg., São Paulo (Jackson, 1931: 466).

*Alchornea sidifolia* Muell.-Arg., São Paulo (IBI-17564).

*Alchornea* sp., Amapá (IBI-16087), Bahia (IBI-13581), Goiás [Hennings, (1895) 1896: 97], Minas Gerais (IBI-13511), São Paulo (IBI-12136).

*Olivea capituliformis* has been reported also from Paraguay, Colombia, and Caribbean Islands.

Uredinia mostly on the abaxial side of leaves, in the shape of little balls, easily dislodged, dark chestnut-brown, surrounded by numerous, dark reddish brown, cylindrical, incurved, basally united paraphyses forming a globose, basket-like sorus, urediniospores pedicellate, usually with one apical and four lateral protuberances which gives a somewhat stellate appearance (Ono and Hennen, 1983).

See also **UREDO ALCHORNEA** P. Hennings.

**OLIVEA VITICIS** Ono & Hennen, Trans. Mycol. Soc. Japan 24: 393. 1983. TYPE on *Vitex capitata* from **Trinidad**, O'Meara Savana, 22 March 1921, *Seaver-3293*. (??, **Ипе/III**).

Anamorph

*Uredo viticis* Juel, Bih. Till, K. Svenska Vet.-Akad. 23: 26. 1897. TYPE on *Vitex* sp. from

**Paraguay**, between Asuncion and Lambaré, 28 Aug 1893, *Malme*.

= *Uredo viticis-polygamae* P Hennings, Hedwigia Beiblatt 41: (15). 1902. TYPE on *Vitex flavens* from **Brazil**, Pará: Belém, Botanical Garden, date?, *Huber-54*.

On Verbenaceae:

*Vitex flavens* Humboldt, Bonpland & Kunth, Pará (Hennings, 1902: 15; Ono, 1978: 99; PUR-F9004).

Baker and Dale (1951) reidentified the host of the teleomorph type as reported here. The Sydows (1924) reidentified the host of the type of *Uredo viticis-polygamae* as reported here.

#### ***Peridermium*** (anamorph)

*Peridermium* has not been reported from Brazil. The genus name *Peridermium* is used arbitrarily only for aecial sori of several heteroecious genera of rusts in the Northern Hemisphere whose aecia are produced on various Gymnosperms. The best known are the aecia of *Cronartium* spp. that produce large galls on stems and cones of *Pinus* spp. Another well known example is the widespread genus *Coleosporium* whose aecia are produced on leaves (needles) of *Pinus* species in the Northern Hemisphere. Even though the uredinia and telia of several species of *Coleosporium* occur in Brazil on several species of Compositae (*Elephantopus*, *Senecio*, *Solidago*), on *Ipomoea* in the Convolvulaceae, and on *Plumeria* in the Apocynaceae, spermogonia and aecia of *Coleosporium* have never been reported on the needles of the many species of *Pinus* that have been introduced into Brazil.

The basic structure of the sori of *Peridermium* is similar to that of *Aecidium*. Its sori have a basal hymenium of tightly packed sporogenous cells that produce long rows of catenulate spores. The sorus is surrounded by a well developed peridium. When the peridium ruptures great masses of spore are liberated and disseminated by the wind currents. The sori however, are not cylindrical as in *Aecidium*, but are flattened longitudinally or are blister like. Other differences include the number of layers of cells in the peridium.

Arthur (1924) reported that *Peridermium* is a "form genus" that he defined as "Species whose life-cycle is not known, or is not readily assumed from related forms...These genera do not represent the whole cycle of development, and are not based upon type species" Later, he abandoned this usage presumably in favor of using *Peridermium* as a teleomorph genus in the modern sense.

*Peridermium ipomeae* Hedgcock & Hunt, see **COLEOSPORIUM IPOMEAE** Burrill.

#### ***Peridipes*** Buriticá & Hennen (anamorph),

Rev. Acad. Colomb. Cienc. 19: 50. 1994. TYPE SPECIES, *Peridipes arachidis* Buriticá & Hennen.

*Peridipes arachidis* was first described in the description of *Puccinia arachidis* Spegazzini, An. Soc. Cient. Argentina 17: 90. 1884. TYPE on *Arachis* sp. from **Paraguay**, Caa-guazu, Jan 1882, *Balansa-3449*.

A sorus of *Peridipes* begins as a small mass of irregularly intertwined hyphae usually in an abaxial substomatal chamber. Intercellular hyphae extend into this mass from surrounding mesophyll tissue. The hyphal mass increases radially, especially just below the epidermis, but it does not cross the larger leaf veins. Increase in diameter occurs by the addition of new hyphal cells around the margin of the young protosorus. These new hyphal cells originate from beneath the developing sorus and their tips terminate just beneath the epidermis. This forms a radially expanding disk-like, palisade of hyphal tips. As growth continues, beginning in the central part of the protosorus, the hyphal tip cells differentiate into a region of catenulate cells, 2-3 cells deep.

The upper layer of these catenulate cells adjacent to the epidermis develops into a thin-walled, reticulate-like peridium one cell thick. The cells proximal to the peridial cells eventually rupture as disjuncter cells. This separates the peridium layer from the remainder of the sorus. The thin one cell thick peridium usually remains attached to the epidermis when the sorus becomes erumpent and breaks through the epidermis. The mycelial cells below the disjuncter layer become spore producing cells. They divide to form spore initials, which in turn undergo a division to form young urediniospores distally and pedicel cells proximally.

As the urediniospores mature, they enlarge, their walls become thicker, pigmented, and echinulate, and germ pores are differentiated. Pedicel cells elongate during maturation. At magnifications of about x 15, immature uredinia appear as minute, hyaline or yellow-orange, blister-like areas. As an uredinium matures, the epidermis and peridium break open irregularly.

Remnants of the epidermis and peridium may remain loosely attached. Mature spores are loosely attached to the pedicels. They are easily detached by the development of younger spores pushing distally beneath them, and by plant movements, or wind. The first-formed spores are irregular, angular, because of the surrounding pressure under which they are formed. Additional spores are apparently formed by the spore mother cells by a similar method although the details were not observed clearly. They push between the old pedicels, eventually reaching the exterior surface of the sorus. The later-formed spores are broadly ellipsoid and more regular in shape than the first-formed spores.

At maturity, a sorus is composed of an hymenial layer of sporogenous cells subtended by a pseudoparenchymatous region, from which numerous intercellular hyphae extend into the surrounding mesophyll. The intercellular hyphae are shaped and branched irregularly. Arising from the hymenial layer are numerous older pedicels, whose spores have become detached; pedicels with mature spores still attached; and pedicels of varying shorter lengths, with various stages of spore maturity, pushing their way up between the other pedicels and spores. Because the peridium continues its development radially, as the sorus matures, the youngest part of the peridium remains around the circumference of the sorus, while the older part is attached to the broken and recurved epidermis (Hennen et al., 1987).

The peridium described here is illustrated clearly in an SEM photo on the cover of the publication cited (Hennen et al., 1987).

See **Puccinia arachidis** Spegazzini.

See under *Aecidium* for aids to identify anamorph genera of Uredinales.

**PERIDIPEs HYMENAEAE** (Mayor) Buriticá & Hennen, see **CROSSOPSORA HYMENAEAE**  
Dianese, Buriticá & Hennen.

#### **PHAKOPSORA** Dietel,

Ber. Deutsch. Bot. Ges. 13: 333. 1895. TYPE species *Phakopsora punctiformis* (Barclay & Dietel) Dietel on *Galium aparine* DeCandolle (Rubiaceae) from India.

= *Bubakia* Arthur, Result. Sci. Congr. Bot. Vienne, p. 338. 1906. Type species: *Bubakia crotonis* (Burrill) Arthur, Result. Sci. Congr. Bot. Vienne p. 339. 1906. ≡ *Melampsora crotonis* Burrill, Bot. Gaz. 9: 189. 1884. Type: not designated, chosen by Arthur (*l.c.*): on *Croton capitatus* Michx. (Euphorbiaceae), **USA**: Illinois, Oct 1881, *A.B. Seymour*. PUR.

Anamorph: II. *Milesia crotonis* (Cooke) Buriticá and Hennen, Flora neotropica monograph. ≡ *Trichobasis crotonis* Cooke, Grevillea 6(40): 137. 1878. Type: on *Croton procumbens* Jac. (Euphorbiaceae), **USA**: California, *M. Edwards*.

= *Angiopsora* Mains, Mycologia 26: 126. 1934. Type species: *Angiopsora lenticularis* Mains;

Mycologia 26: 127. 1934. Type: on *Lasiacis ruscifolia* (H. B. K.) Hitch. and Chase (Gramineae), **Ecuador**: Guayaquil, 31 Jul 1920, E.W.D. Holway and M. Holway 801, PUR.

Anamorph: II. *Physopella lenticularis* Cummins and Ramachar, Mycologia 50743. 1958. Type: same as for *Angiopsora lenticularis* Mains.

= *Stakmania* Kamat and Sathe, in Sathe, Sydowia 20253. 1968. Type species *Stakmania indica* Kamat and Sathe, in Sathe, l. c. Type: on *Glochidion hoheneckeri* Bedd. (Euphorbiaceae), India: Maharashtra, Mahableshwar, Nov 1965, A.V. Sathe, MACS.

Anamorph: II. *Milesia glochidii* Buriticá and Hennen, Flora neotropica monograph.

Type: same as for *Stakmania indica* Kamat and Sathe.

Spermogonia in Group VI (Hiratsuka and Hiratsuka, 1980). Anamorphs in the morphological genera *Aecidium*, *Caecoma*, *Malupa*, *Physopella*, *Uredendo*, *Milesia* and *Uredostilbe*.

Telia subepidermal in origin, not erumpent, composed of two or several irregular to regular layers of probasidial cells, these firmly united into crust-, disk-, or lens-like units; walls sometimes thickened and pigmented, especially in distal cell layers.

Formerly, *Physopella* was considered as a teleomorph genus and segregated from *Phakopsora* because many of its species, especially those on grasses, have their teliospores arranged one on top of the other to form regular vertical rows, while in *Phakopsora* the spores are irregularly arranged. But a number of species in this complex have telia that are intermediate between these two arrangements. This, and the similarity of their anamorphs, are the reasons for combining the two genera. In addition, Ono, Buriticá & Hennen (1992) argued that *Physopella* must now be considered as an anamorph genus name because the type specimen of the type species designated by Arthur is composed only of anamorph (it lacks telia).

With the inclusion of *Physopella* within *Phakopsora* (Ono, et al., 1992) around 50 species have been reported from the New World and 50 from the Old World. This makes *Phakopsora*, with around 100 species, probably the third or fourth largest genus of rusts (after *Puccinia*, *Uromyces*, and *Ravenelia*). *Phakopsora* species occur throughout the warmer regions of the world on both monocot and dicot flowering plant host families. Most are probably autoecious but spermogonia and aecia are unknown for most species.

Buriticá (1999), Cummins (1971), and Ono, Buriticá & Hennen (1992), published papers that have been the most help to clarify the taxonomy of the genus *Phakopsora* in the Neotropics.

In Brazil about 30 species have been reported. *Phakopsora euvitis* Ono on *Vitis* sp. *Phakopsora gossypii* (Lagerheim) N. Hiratsuka on species of *Gossypium* and *P. meibomia* (Arthur) Arthur on various legume genera including *Glycine max* Merrill are among the species of most economic importance.

*Phakopsora aeschynomenis* (Arthur) Arthur, see *Malupa vignae* (Bresadola) Ono, Buriticá & Hennen [PHAKOPSORA MEIBOMIAE (Arthur) Arthur].

**PHAKOPSORA APODA** (Hariot & Patouillard) Mains, Mycologia 30: 45. 1938. (?? ≙ IIse/III).

≙ *Puccinia apoda* Hariot & Patouillard, Bull. Mus. Hist. Nat. Paris 15: 199. 1909. TYPE on *Pennisetum setosum* Richard (Gramineae) from **Chad** (French Congo), Chairi, Fort Lamy, Oct 1903. A. Chevalier-s.n.

Anamorph

*Physopella apoda* Buriticá & Hennen in Buriticá, Rev. I. C. N. E. (Medellín) 5(2): 179. 1994.

TYPE the same as for *Puccinia apoda* Hariot & Patouillard.

On Gramineae:

*Pennisetum clandestinum* Hochst. Ex Chiov., Minas Gerais (IBI-14936), Rio de Janeiro (IBI-13207), São Paulo (IBI-12179).

*Phakopsora apoda* has been reported from several countries in Africa and more recently from India, Australia, New Zealand, Hawaii, and Ecuador, Colombia, and Costa Rica. The rust is probably spreading with the movement of its cultivated host, kikuyu grass (*Pennisetum clandestinum*).

Spermogonia and aecia unknown. Uredinia on both sides of leaves, scattered, yellowish, covered at first by the epidermis, opening by a pore, later opening widely, ruptured epidermis evident; paraphyses peripheral, conspicuous, 40-60 x 8-10 µm, curved, united at the base, walls 0.5-1 µm on one side, with dorsally and apically thickened walls 5-7 µm, anamorph spores without pedicels, 24-30 x 18-23 µm, ellipsoid to obovoid, wall more or less evenly 1.5-1 µm thick, yellowish, with numerous and small echinulae, germ pores obscure, probably few scattered. Telia on both sides of leaves, mostly on the abaxial side, around the

anamorph sori, often coalescing, black, crust-like, flat, growth indeterminate, the hymenium of the telia concave at first becoming flattened, spores in 2-4 layers, teliospores 16-32 x 14-20 µm, ellipsoid to obovoid, wall 1-2 µm thick, cinnamon-brown, distal walls in spores in outer layer 2-5 µm thick (Buriticá, 1999).

***Phakopsora argentinensis*** (Spegazzini) Arthur, Bull. Torrey Bot. Club 44: 508. 1917. (?!?, IIse/III).

Buriticá (1999) reported that this species has been reported only from Argentina. Previous reports of this species in Brazil are based on other species.

- ≡ *Melampsora argentinensis* Spegazzini, Anal. Soc. Cient. Argentina 47: 266. 1899. TYPE on *Croton hirtus* L'Heritier from **Argentina**, Córdoba, 15 Apr 1899, *T. Stuckert s.n.*
- ≡ *Schroeteriaster argentinensis* (Spegazzini) P. Sydow & H. Sydow, Mon. Ured. 3: 401. 1914.
- ≡ *Bubakia argentinensis* (Spegazzini) H. S. Jackson & Holway in Jackson, Mycologia 13: 465. 1931.

Anamorph

- Milesia crotonicola*** (P. Hennings) Buriticá & Hennen in Buriticá, Rev. Acad. Colombia Cienc. 23: 293. 1999.
- ≡ *Uredo crotonicola* P. Hennings, Hedwigia 35: 251. 1896.
- ≡ *Phakopsora crotonicola* (P. Hennings) Kern, Thurston & Whetzel in Chardon & Toro, Monogr. Univ. Puerto Rico Ser. B., 2: 271. 1934. Telia not described.

On Euphorbiaceae: The citations listed below were reported mistakenly as *Phakopsora argentinensis*.

- Croton chaetophorus*** Mueller-Arg., São Paulo (Jackson, 1931: 465; PUR-1222).
- Croton compressus*** Lamarck, Minas Gerais (Thurston, 1940: 294).
- Croton hirsutus*** L'Heritier, Minas Gerais (Jackson, 1931: 465).
- Croton* sp.**, Minas Gerais (Hennings, 1895A: 99), Paraíba (Viégas, 1945: 1; IAC-3802, -3803).

**PHAKOPSORA ARRABIDAEAE** Buriticá & Hennen, Rev. Colomb. Cienc. 23: 302. TYPE on *Arrabidaea selloi* (Sprengl) Sandwith, from **Brazil**, São Paulo: Santana de Parnaíba, 6 July 1978, *M. B. Figueiredo-78-33*; IBI-13794. (?!?, IIse/III).

Anamorph

- Physopella cerotelioides*** (H. S. Jackson & Holway) Buriticá & Hennen, Rev. Colomb. Cienc. 23: 302. 1999.
- ≡ *Uredo cerotelioides* H. S. Jackson & Holway in Jackson, Mycologia 24: 94. 1932. TYPE on Bignoniaceae, genus undetermined, probably *Arrabidaea* sp. from **Brazil**, São Paulo: Guarulhos, 1 June 1922, *E. W. D. Holway & M. M. Holway-1927*.

On Bignoniaceae

- Arrabidaea sellowi*** (Sprengl) Sandwith, São Paulo (IBI-13794, Buriticá, 1999).
- Phakopsora arrabidaeae* has been reported only from São Paulo state, Brazil.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, whitish to yellowish, scattered or in groups, on large spots, subepidermal in origin, hymenium flat, opening by a central pore, paraphyses peripheral and intra soral, 22-30 x 5-10 µm, clavate, septate, curved, capitate; wall 1-5 µm thick apically, sometimes verrucose; urediniospores sessile, 22-24 x 16-20 µm, ellipsoid, ovoid; wall 0.5-1.0 µm thick, yellowish to cinnamon-brown, finely and abundantly echinulate, germ pores obscure. Telia on the abaxial side of leaves, around the uredinia, waxy, ambar-colored, indeterminate in growth; teliospores 16-22 x 11-13 µm, rectangular, cuboid, ellipsoid, irregularly arranged; wall uniformly 0.5-1.0 µm thick, yellowish (Buriticá, 1999).

Amphisporangia with smooth walls and 1-2 germ pores were reported in some collections.

*Spermogoniis adhuc ignotis. Soris anamorphis hypophyllis, albidis vel flavidis, aggregatis vel dispersis in maculo grandis primo tectis, tandem poro centrali apertis, subepidermalibus; hymenio subepidermal, applanato; paraphysibus peripheribus et in hymenio liberis, curvatis, capitatis, elevatis, septatis 22-30 x 5-10 µm; parietis flavido, apice 1.0-1.5 µm crasso. subtiliter et aequaliter aculeato; poris germinationis obscuris. Soris teleutosporiferis sparsis circa soros anamorphis, hypophyllis, ceraceis, brunneis, indeterminatis, subepidermalibus, hymenio applanato vel leniter curvatis; teliosporos irregulariter dispositis in 2-4 stratis laxis. rectangularibus, ellipsoideis, 16-22 x 11-13 µm, flavidis; constanter parietis flavido, constanter 0.5-1.0 µm crasso.*

**PHAKOPSORA ARTHURIANA** Buriticá & Hennen in Buriticá, Rev. I. C. N. E. F(Medellin) 5 (2): 180. 1994. *Nom. nov.* for *Phakopsora jatrophicola* Cummins. (?!?, IIse/III).  
 ≡ *Phakopsora jatrophicola* Cummins, Mycologia 48: 604. 1956. TYPE on *Jatropha canescens* Mueller from **Mexico**, Baja California: Laguna Mountains, east of Todos los Santos, *M. E. Jones-24531*. See below for explanation for *nom. nov.*

Anamorph

**Malupa jatrophicola** (Arthur) Buriticá & Hennen in Buriticá, Rev. I. C. N. E. (Medellin) 5 (2): 180. 1994.  
 ≡ *Uredo jatrophicola* Arthur, Mycologia 7: 331. 1915. TYPE on *Jatropha curcas* Linnaeus from **Puerto Rico**, Hormigueros, 14 Jan 1914, *F. L. Stevens-220*.

On Euphorbiaceae:

*Jatropha canescens* Mueller-Arg., Brazil (Silveira, 1951: 225).  
*Jatropha curcas* L., Amapá (IBI-16103), Maranhão (IBI-17113), Pará (IBI-16059), São Paulo (Viégas, 1945: 7; IAC-699; IBI-18774).  
*Jatropha gossypifolia* L. Pará (Albuquerque, 1971: 148; IAN-522).  
*Jatropha pohliana* Mueller-Arg., Pernambuco (IBI-15521).  
*Jatropha* sp., Maranhão (IBI-17098).

*Phakopsora arthuriana* has been reported from southern Texas in the United States of America to Brazil including the Antilles.

Espermogonio desconocido. Anamórfo hipófilo. raramente epífilo, en grupos en manchas delimitadas por las nervaduras, amarillento, redondo. abierto por un poro, subepidermal; himenio intraepidermal, cóncavo; parafisos periferales cubriendo los esporos, levantados por tejido hifoide, los superiores proyectándose hacia afuera del hospedante, curvos, cilíndricos clavados, aseptados 20-50 x 9-12 µm; pared de incolora a amarillenta, 1 µm de gruesa, 3-7 µm engrosada dorsalmente y en el ápice; parafisos en el himenio del mismo tipo; esporos sesiles, de obovoides a elipsoides, 24-29 x 16-20 µm; pared de incolora a carmelita, 0.5 µm de gruesa, uniforme. con abundantes y pequeñas espinas; poros germinativos imperceptibles. Teliosoro hipófilo, alrededor del anamórfo, inicialmente ambar, luego carmelita, costriforme, crecimiento indeterminado, coalescentes, 6-12 capas de esporos, cubiertos por la epidermis; himenio intraepidermal, cóncavo; teliosporos irregularmente arreglados, libres, de cuboides a oblongos, 13-27 x 7-13 µm; pared carmelita, 1 µm de gruesa, 1-3 µm engrosada en el ápice de los esporos superiores.

The anamorph is found frequently on plants of *Jatropha* sp. that are cultivated in home gardens for their medicinal qualities.

Buriticá (1994) published a new name for this species because the combination *Phakopsora jatrophicola* (Arthur) Cummins, published in 1937, technically refers only to an anamorph. Cummins (1937) published the combination as a transfer of an anamorph name, *Uredo jatrophicola* Arthur, to a teleomorph genus, *Phakopsora*. At that time Cummins did published a description of telia in English, but not in Latin as required by the Code. Later, Cummins (1956) published *Phakopsora jatrophicola* Cummins as a new species with Latin, but since the combination *Phakopsora jatrophicola* had been preoccupied, it could not be used as a name for a new species.

### *Phakopsora arthuriana*

#### *Phakopsora jatrophicola*

Spermogonia and aecia unknown. Uredinia hypophyllous, occasionally epiphyllous, in small groups on leaf spots framed by leaf veins, yellowish, circular, subepidermal, opening by a pore; surrounded by numerous incurved, cylindrical, clavate, not septate paraphyses, 20 - 50 x 9 - 12 µm, that project outside the host, and that have colorless to yellowish walls, 1 µm thick on the inner side and 3 - 7 µm thick on the outer side and at the apex, the paraphyses surmount a peripheral, basal, hyphoid tissue that is raised somewhat above the base of the sorus, some paraphyses may develop with the sorus, not from the periphery; urediniospores, ellipsoid, to obovoid, 24 - 29 x 16 - 20 µm, appear sessile; wall colorless to brownish, uniformly 0.5 - 1 µm thick, closely and finely echinulate; germ pores obscure. Telia 22 - 28 x 16 - 19 µm; wall hyaline, uniformly 1 - 1.5 µm thick, densely and minutely echinulate but with somewhat larger spines below, germ pores obscure, probably 2, more or less equatorial. Telia hypophyllous, subepidermal in origin, closely around the uredinia, yellowish to brownish, waxy, dome-shaped, determinate in growth, coalescent, 5 - 7 spore layers deep, early covered by the epidermis, later erumpent; teliospores irregularly arranged, cuboid, ellipsoid to polygonal, 12 - 20 x 8 - 12 µm wall yellowish, uniformly 1 - 2 µm thick but distal wall of distal spores 3 - 5 µm thick.

*Phakopsora aeschynomenis* (Arthur) Arthur, see *Malupa vignae* (Bresadola) Ono, Buriticá & Hennen [PHAKOPSORA MEIBOMIAE (Arthur) Arthur].

**PHAKOPSORA BAUHINIICOLA** Ono, Buriticá & Hennen, Mycol. Res. 96(10): 828. 1992. TYPE on ?*Bauhinia smilacina* Steud. from **Brazil**, São Paulo, 22 Aug 1975, Hennen & Figueiredo-75-69. (?!?, IIse/III).

Anamorph.

*Milesia bauhiniicola* Ono, Buriticá & Hennen, Mycol. Res. 96(10): 828. 1992. TYPE same as for *P. bauhniicola* listed above.

On Leguminosae

?*Bauhinia smilacina* (Schott) Steudel, São Paulo (Ono et al., 1992; Butiticá, 1999).

*Phakopsora bauhiniicola* has been reported from the type locality region.

Spermogonia and aecia unknown. Uredinia on roundish leaf spots on both sides of leaves, in groups or circles, subepidermal in origin, erumpent, opening at first by a pore, later open widely, powdery, paraphyses peripheral and in hymenium, 25-35 x 4-6 µm, cylindrical, wall evenly thin and colorless; urediniospores sessile, 22-28 x 16-20 µm, obovoid to ellipsoid, wall evenly ca 0.5-1 µm thick, evenly abundantly, and finely echinulate, germ pores obscure, probably 6, more or less equatorial or scattered Telia usually around the anamorph sori on the abaxial side of leaves, subepidermal in origin, often confluent, in flat to lenticular brown crusts, teliospores 18-28 x 10-14 µm, angularly oblong to ellipsoid, irregularly arranged in more or less 3-5 layers, wall uniformly 1-1.5 µm thick, distal walls of spores in upper layer 2-3(-5) µm thick.

The identification of the host of *Phakopsora bauhiniicola* requires confirmation, it is probably *Dioscorea* sp., Dioscoreaceae, not *Bauhinia*, Leguminosae.

See *Uromyces anthemophilus* for notes on rusts on *Bauhinia*.

Especimenes estudiados: sobre Leguminosae, *Bauhinia smilacina* Steudel, BRASIL: Sao Paulo, Arboleda Natural alrededor del Jardin Botanico, 22 Ago. 1975, Hennen & Figueiredo 75-69 (Tipo); 75-127. Sobre *Bauhinia* .sp., BRASIL: Sao Paulo, cerca Atibaia, I 1 Jun.

**PHAKOPSORA BUTLERI** Dianese, Santos & Medeiros in Dianese et al., Fitopatol. Bras. 18: 438. 1993.

TYPE on *Kielmeyera coriacea* Martius from **Brazil**, Federal District: Brasilia, 30 Aug 1992, Dianese s.n. (?!?, IIse/III).

Anamorph

*Milesia brasiliae* Buriticá & Hennen, Rev. Acad. Colombia Cienc. 23: 300. 1999. TYPE same as for the teleomorph.

On Clusiaceae (Guttiferae)

*Kielmeyera coriacea* Martius & Zuccarini, Federal District (IBI-1246; -12669), Minas Gerais (IBI-15824; -15836; 15845), Mato Grosso do Sul (IBI-16722; IBI-16754, good III).

[Distrito Federal, Parque Nacional Aguas Emendadas, NE de Brasilia, 4 Ago. 1976; J. F. Hennen, Y. Ono & E. E. Heringer 76 - 486; IBI-12669].

Espermogonio desconocido. Anamorfo anfigineo, amarillento, solitarios o en pequeños grupos, subepidermal en origen, posteriormente erumpente; himenio subepidermal, plano; peridio hifoide; parafisos en el himenio libres, hialinos, de cilíndricos a clavados. 30-40 x 8-12 µm; pared hialina, delgada, ocasionalmente engrosada 3 µm dorsalmente y en el ápice, con pocas verrugas; esporas sésiles de incoloras a amarillentas, asymerically pyriforme (de obovoides a elipsoides), 24-30 x 20-24 µm; pared de incolora a amarillenta, 1-1.5 µm de gruesa, uniforme, con abundantes y pequeñas espinas; poros germinativos imperceptibles, 4-6 supraecuatorial [pores 4-6(-7), more or less equatorial, in chloral hydrate]. Teliosoro anfigineo, principalmente epifilo, dispersos o alrededor del anamórfico, ambar, cerosos, lenticular, crecimiento indeterminado, coalescentes, 5-7 capas de esporas, profundas; himenio subepidermal, plano, teliosporos irregularmente arreglados, amarillentos, cuboides, oblongos, elipsoides, 20-25 x 12-14 µm; pared amarillenta, 2-4 µm de gruesa, irregularmente engrosada, en los angulos y en el ápice de las esporas superiores (Dianese et al., 1993; Buriticá, 1999).

Our specimens had anamorph spores mostly pyriform with up to 7 equatorial germ pores, as revealed when mounted in chloral hydrate. Neither Dianese et al. (1993) nor Buritica (1999) reported this.



**PHAKOPSORA CAMELIAE** (Arthur) Buriticá in Buriticá & Pardo-Cardona, Rev. Acad. Colombiana Cienc. 20 (77): 205. 1996. (?!?& IIse,III).

≡ *Puccinia cameliae* Arthur, Mycologia 7: 227. 1915. TYPE on *Setaria scandens* (Jacquin) Schrader from **Colombia**, Antioquia, Cafetal La Camelia near Angelopolis, 30 Aug 1910, Mayor-275. Arthur described telia from the type specimen of *Uredo cameliae* Mayor which Mayor had overlooked.

≡ *Angiopsora cameliae* (Arthur) Mains [ published as “(Mayor) Mains” but Mains also cited *Puccinia cameliae* Arthur], Michigan Acad. Sci. Arts. & Let. 22: 154. 1937.

Anamorph

*Physopella cameliae* (Mayor) Cummins & Ramachar, Mycologia 50: 742. 1958. (*Physopella* is an anamorph genus).

≡ *Uredo cameliae* Mayor, Mem. Soc. Neuchatel. Sci. Nat. 5: 578. 1913. TYPE same as for *Puccinia cameliae* Arthur. Mayor did not describe telia.

On Gramineae:

*Panicum* sp., Brazil (Cummins, 1971: 61).

*Setaria scandens* Schrad., Minas Geraes (Thurston, 1940: 297).

*Setaria* sp., Brazil (Cummins, 1971: 61), São Paulo (PUR-F4947).

*Phakopsora cameliae* has been reported also from Colombia, Trinidad, Jamaica, Puerto Rico, Mexico, and The United States of America.

Espermogonio desconocido. Anamórfo anfigineo, dispersos ó en grupos a to largo de las nervaduras, amarillento, ruptura de la epidermis evidente, subepidermal; himenio subepidermal, levemente cóncavo; parafisos periferales y en el himenio, libres ó 2-3 unidos en la base, hialinos, de clavados a cilindricos, 25-35 x 8-14 µm: pared delgada, ocasionalmente engrosada en el apice; esporos sésiles, de incoloros a amarillentos, de obovoides a elipsoides, 20-27 x 15-18 µm; pared 0.5-1 µm de gruesa, uniforme, de incolora a amarillenta, con abundantes y pequeñas espinas; poros germinativos 7-9, dispersos. Teliosoro anfigineo, de carmelita a negruzco, dispersos, puntiformes, crecimiento determinado, coalescentes, 23 capas de esporos, cubiertos por la epidermis; himenio subepidermal, esférico; teliosporos irregularmente arreglados, libres, de cuboides a oblongos, 20-25 x 10-18 µm; pared de amarillenta a carmelita, 1-1.5 µm de gruesa, 3-5 µm engrosada en el ápice de los esporos del extremo superior.

**PHAKOPSORA CHAVESII** Dianese, Santos & Medeiros in Dianese et al., Fitopatol. Bras. 18: 140.

1993. TYPE on *Terminalia phaeocarpa* from **Brazil**, Federal District: Brasilia, 2 May 1993,

Dianese-3850. (?!?,IIse/III).

Anamorph

≡ *Uredo byrsonimatis* P. Hennings, Hedwigia 34: 98. 1895. TYPE on *Terminalia argentia* (mistakenly published as *Byrsonima* sp.) from **Brazil**, Minas Gerais: Uberaba, July 1892, Ule-1902.

≡ *Uredo terminaliae* P. Hennings, Hedwigia 34: 321. 1895. An unnecessary new name for *Uredo byrsonimatis* P. Hennings.

= *Uredo batistae* Lindquist, Revista Fac. Agron. (La Plata) 47: 305. 1971. TYPE on *Terminalia argentia* Martius from Brazil, Minas Gerais, location and date not published, Herringer-s.n.

= *Milesia lindquistii* Buriticá & Hennen, Rev. Acad. Colomb. Cienc. 23: 302. 1999. TYPE on *Terminalia* sp. from **Brazil**, Mato Grosso: 25 km S. W. of Chapada do Guimares, 21 July 1988, J. F. Hennen & R. M. López-Franco-88-617.

On Combretaceae

*Terminalia argentea* Martius, Goiás (Buriticá, 1999: 302; Dianese et al., 1993: 440), Minas Gerais (Hennings, 1895: 98; 1895A: 321; Lindquist, 1971: 305)..

*Terminalia hylobates* Eichler, Minas Gerais (published as *Uredo terminaliae*, Thurston, 1940: 306).

*Terminalia phaeocarpa*, Federal District (Dianese et al., 1993: 440).

*Terminalia* sp., Goiás (IBI-16689); Mato Grosso (type of *Milesia lindquistii*, Buriticá, 1999: 302, IBI-16739; 16740; 16745); Minas Gerais (IBI-15358, IBI-15866; 15964; 16402, 16344; 16379; ).

*Phakopsora chavesii* has been reported only from Brazil.

Espermogonio desconocido. Soro anamórfico principalmente hipófilo, en pequeños grupos o poco aislados, redondo, amarillento. inicialmente abierto por un poro, posteriormente erumpente; himenio subepidermal, plano; peridio hifoideo; parafisos libres en el himenio, hialinos, de cilíndricos a clavados, 14-18 x 10-12 µm, pared hialina, delgada; esporos sesiles, de palidos a amarillentos, de elipsoides a angularmente elipsoides, 20-24 x 17-21 µm; pared de hialina a amarillenta, 1.0-1.5 µm de gruesa, uniforme, con abundantes y pequeñas espinas: poros germinativos imperceptibles, +/- 2-3 dispersos ó hacia los ángulos. Teliosoro anftgineo, principalmente hipófilo, alrededor del anamórfico, de amarillento a carmelita, ceroso, lenticular, crecimiento indeterminado, coalescentes; himenio subepidermal, plano; teliosporos irregularmente arreglados. 3-4 en capas, rectangulares, oblongos, elipsoides, 15-17 x 8-10 µm; pared amarillenta, 1.5-2.5 µm de gruesa, uniforme (Buriticá, 1999).

**PHAKOPSORA CHEOANA** Cummins, Mycologia 42: 784. 1950. TYPE on *Cedrela sinensis* Jussieu from **China**, Kweichow, Chiang K'ou Hsien, Fan Ching Shan, 27 Oct 1931, S. Y. *Cheo*-789. (???,IIse/III).

Anamorph

*Malupa cheoana* Buriticá & Hennen in Buriticá, Rev. Acad. Colombia Cienc. 23: 287. 1999. TYPE same as for **PHAKOPSORA CHEOANA**.

On Meliaceae

*Cedrela* sp., São Paulo (IBI-14275).

*Phakopsora cheoana* may have been introduced into Brazil from Asia. Only the anamorph has been found in Brazil. The only specimens are from Horto Florestal at Mogi-Mirim, and from a location near Piracicaba, São Paulo. There are no other reports of this rust from the Americas.

Espermogonio desconocido. Anamórfico hipófilo, disperso ó en pequeños grupos, amarillento, abierto por un poro, subepidermal; himenio subepidermal, levemente cóncavo; parafisos periferales levantados por tejido hifoide, parafisos libres en el himenio, clavados, clavado-capitados, 20-35 x 7-10 µm; pared amarillenta, 1-1.5 µm de gruesa, 3-6 µm engrosada en el ápice; esporos sésiles, de incoloros a amarillentos, elipsoides, 22-26 x 15-18 µm; pared incolora, 1.5-2 µm de gruesa, uniforme, con abundantes y pequeñas espinas; poros germinativos imperceptibles. Teliosoro hipófilo, alrededor del anamórfico ó aislados, costiforme, plano, ceroso, de amarillento a carmelita, crecimiento indeterminado, coalescentes, 3-4 capas de esporos, cubiertos por la epidermis; himenio subepidermal, plano; teliosporos irregularmente arreglados, basales hialinos, superiores carmelitas, de cuboides a elipsoides, 10-23 x 6-10 µm, pared hialina en esporos inferiores, amarillenta en los superiores, 1-1.5 µm de gruesa, uniforme (Cummins, 1950: 784).

*Phakopsora cherimoloiae* Cummins, see **PHAKOPSORA NEOCHERIMOLIAE** Buriticá & Hennen.

**PHAKOPSORA COCA** Buriticá & Hennen in Buriticá, Rev. I.C.N.E. (Medellín) 5(2): 177. 1994. TYPE on *Erythroxylum engleri* Schultz from **Brazil**, Goiás: 196 km S of Goiania near Itumbiara, 16 Jul 1979, J. F. & M.M. *Hennen*-79-186. (???,II(p)e/III).

Anamorph

*Milesia erythroxyli* (Graziani) Buriticá & Hennen in Buriticá, Rev. I.C.N.E. (Medellín) 5(2): 177: 1994.

≡ *Uredo erythroxylois* Graziani, Bull. Soc. Mycol. France 7: 152. 1891. TYPE not designated, collections reported on *Erythroxylum coca* Lamarck from **Bolivia** and **Peru** from which a LECTOTYPE may be chosen.

On Erythroxylaceae

*Erythroxylum campestre* Saint-Hilaire, São Paulo (Buriticá, 1999: 286).

*Erythroxylum citrifolium* Saint-Hilaire, Minas Gerais (79-74/IBI, Buriticá, 1999: 286).

*Erythroxylum daphnites* Martius, Minas Gerais (77-166/IBI, Buriticá, 1999: 286).

*Erythroxylum decidium* Saint-Hilaire, São Paulo (82-146/IBI, Buriticá, 1999: 286).

*Erythroxylum engleri* Schultz, Federal District (76-261/IBI), Goiás (79-186/IBI, Buriticá, 1999: 286), Minas Gerais (79-66/IBI, Buriticá, 1999: 286).

*Erythroxylum ovalifolium* Peyritsch, Minas Gerais (Thurston, 1940: 305), Rio de Janeiro (Dietel, 1899: 256; Buriticá, 1999: 286).

*Erythroxylum pelleterianum* Saint-Hilaire, Minas Gerais (Thurston, 1940: 305), São Paulo (79-

212/IBI, Buriticá, 1999: 286).

*Erythroxyllum suberosum* Saint-Hilaire, São Paulo (Buriticá, 1999: 286).

*Erythroxyllum tortuosum* Martius, Federal District (77-221/IBI, ), Minas Gerais (79-200/IBI, Buriticá, 1999: 286).

*Erythroxyllum* sp., Federal District (PUR-F18933), Goiás (PUR-F18987), Minas Gerais (Hennings, 1895A: 99), Rio de Janeiro (Dietel, 1899: 256).

*Erythroxyllum vacciniifolium* Martius, Federal District (76-281/IBI, Buriticá, 1999: 286).

*Phakopsora coca* has also been reported from Mexico, Central America, Caribbean Islands, Colombia, Peru, and Bolivia.

Espermogonio desconocido. Anamórfo hipófilo, carmelita, dispersos ó en pequeños grupos, inicialmente abiertos por un poro, posteriormente completamente abiertos, subepidermal; himenio subepidermal, plano; peridio hifoide (evidente en estados tempranos); parafisos en el himenio, hialinos, de globosos a cilíndricos, 15-25 x 7-9 µm, esporos en pseudopedicelos (celulas disyuntoras) cortos, carmelitas, esporos inmaduros incoloros de la mitad hacia abajo. de angularmente obovoides a elipsoides, 22-30 x 16-20 µm; pared carmelita, 0.5 µm de gruesa, uniforme, con abundantes y pequeñas espinas; poros germinativos 2-4, ecuatoriales ó en los ángulos. Teliosoro hipófilo, alrededor del anamórfo, redondo. lenticular, de amarillento a carmelita, 3-5 capas de esporos, crecimiento determinado, cubierto por la epidermis; himenio subepidermal, plano; teliosporos irregularmente arreglados, hacia la base incoloros, hacia arriba amarillentos, de rectangulares a elipsoides, 18-25 x 7-10 µm; pared amarillenta, 1 µm de gruesa, irregular, 35 µm engrosada en el ápice de los esporos del extremo superior (Buriticá, 1999).

*Erythroxyllum coca* Lamarck and at least 12 other species of *Erythroxyllum* have been listed as hosts. Buriticá (1999) suggested that *P. coca* might be considered as a biological control agent for the notorious cultivated coca plant. *Phakopsora erythroxyllonis* (Cummins) Kern, known only from islands in the Caribbean, also infects species of *Erythroxyllum*.

See *Maravalia erythroxyli* for a comparison of traits of the three rust species known on *Erythroxyllum* spp. in Latin America.

**PHAKOPSORA COLUBRINAE** Viégas, *Bragantia* 19:CIII (103). 1960. TYPE on *Colubrina ruffa* Risseck from **Brazil**, Minas Gerais: Agua Limpa, Experimental Station, 23 June 1946, *E. P. Herringer-458*. (??,IIse/III).

Anamorph

**Malupa colubrinae** (Cummins) Buriticá & Hennen, in Buriticá, *Rev. Acad. Colombia Cienc.* 23: 296. 1999.

≡ *Uredo colubrinae* Cummins. *Bull. Torrey Bot. Club* 70: 79. 1943. TYPE on *Colubrina ferruginosa* Brongniart from **Guatemala**, Quetzaltenango, 20 Feb 1941, *Standley-87894*.

= *Uredo hoveniae* Lindquist & Costa Neto. *Rev. Fac. Agronomia, La Plata* 43: 61. 1967. TYPE on *Hovenia dulcis* Thunberg from **Brazil**, Rio Grande do Sul: Taquari, 9 July 1948, *Costa Neto s. n.*

On Rhamnaceae

*Colubrina rufa* Reiss, Minas Gerais (Viégas, 1960:CIII), São Paulo (IBI-16174).

*Hovenia dulcis* Thunberg, Minas Gerais (IBI-15817), São Paulo (IBI-14086).

*Phakopsora colubrinae* has been reported also from Guatemala.

Spermogonia and aecia unknown. Uredinia in groups on abaxial side of leaves on well defined spots, superepidermal in origin, hymenium slightly concave, erumpent by a pore, peridium surmounted by short paraphyses, hymenial paraphyses 30-50 x 6-9 µm, cylindrical, wall uniformly thin, or occasionally 1-3 µm thick at apex; urediniospores 18-28 x 15-18 µm, obovoid, to ellipsoid, sessile, wall uniformly 1.5-1 µm thick, yellow to pale brownish-yellow, echinulae small, abundant, pores obscure, probably 4-6, equatorial. Telia on abaxial side of leaves around the uredinia, subepidermal, lenticular, with 5-7 irregular layers of teliospores, teliospores 10-18 x 6-10 µm, cuboid to ellipsoid, walls of spores 1-1.5 µm thick, apical walls of distal spores 2-4 µm thick, cinnamon-brown, walls of proximal spores colorless (Buriticá, 1999).

*Phakopsora colubrinae* is very similar to *Phakopsora zizyphi-vulgaris*, which infects *Zizyphus vulgaris*, Rhamnaceae, a host species that is cultivated for its edible fruit. *Phakopsora zizyphi-vulgaris* is widespread in Asia from Pakistan, India, China and Taiwan. It has also been reported in Florida in the United States of America and was probably introduced into Brazil along with its cultivated host. The uredinia of

both rust species have similar intrasoral paraphyses and a peripheral basal peridium surmounted with numerous incurved short paraphyses-like cells.

*Hovenia dulcis* was introduced into Brazil from Asia as a cultivated species. After it was introduced, it seems to have been infected by *Phakopsora colubrinae*, a native neotropical rust on *Colubrina* spp.

**PHAKOPSORA COMPRESSA** (Arthur & Holway) Buriticá & Hennen, in Buriticá, Rev. I. C. N. E. (Medellín) 5(2): 179. 1994. (?!?≠ **IIse/III**).

≡ *Puccinia compressa* Arthur & Holway in Arthur, Proc. American Phil. Soc. 64: 257. 1925.

TYPE on *Paspalum elongatum* Grisebach from **Bolivia**, Cochabamba, 26 Feb 1920, Holway-331½. Not *Puccinia compressa* Dietel, 1906.

≡ *Angiopsora compressa* (Arthur & Holway) Mains, Mycologia 26: 29. 1934.

[≡ *Physopella compressa* (Arthur & Holway) Cummins & Ramachar, Mycologia 50: 742. 1958.

*Physopella* is an anamorph genus, not a teleomorph genus. See below under Anamorph. ]

Anamorph

***Physopella paspalicola*** (Hennings) Buriticá & Hennen, in Buriticá Rev. I. C. N. E. (Medellín) 5(2): 179: 1994.

≡ *Uredo paspalicola* P. Hennings, Hedwigia 44: 57. 1905. TYPE on *Paspalum conjugatum* Berg from **Peru**, Yurimaguas, Rio Huallaga, August 1902, *E Ule*-3175.

≡ *Puccinia paspalicola* (P. Hennings) Arthur, Manual Rusts U.S. & Canada. Purdue Res. Found. 438 p. (p. 127), 1934. Telia not described. Ramachar & Cummins (1965) attribute the name to Arthur alone as "*Puccinia paspalicola* Arthur" but they nor Arthur did not make any specific reference to type material with telia. The type of this combination is that of *Uredo paspalicola*, so it must be considered as an epithet placed in an inappropriate (teleomorph) genus.

= *Uredo stevensiana* Arthur, Mycologia 7: 360. 1915. TYPE on *Paspalum humboldtianum* Fluegge from **Mexico**, Morelos, Cuernavaca, 28 September 1899, Holway 3510.

= *Physopella compressa* (Arthur & Holway) Cummins & Ramachar, Mycologia 50: 742. 1958. The type of this combination is the same as that of *Puccinia compressa*, a teleomorph genus. *Physopella* is an anamorph genus, therefore this is a case of a teleomorph epithet being placed in an anamorph genus, which is not allowed by the Code.

On Gramineae

***Paspalum conjugatum*** Berg, Rio de Janeiro (PUR-F4898).

***Paspalum distichophyllum*** H.B.K., São Paulo, (PUR-F4841).

***Paspalum plicatulum*** Michaux, São Paulo (IAC-2678).

***Paspalum*** sp., São Paulo (Cummins, 1971: 63; IBI-12249).

*Phakopsora compressa* as a relatively common rust on *Paspalum* spp. and *Axonopus* spp. from Northern Argentina to the Southern United States of America.

Espermogonio desconocido. Anamórfico anfigíneo, principalmente hipófilo, amarillento, dispersos, ruptura de la epidermis evidente, himenio subepidermal, levemente plano; parafisos periferales abundantes, unidos en la base, curvados, 26-50 x 8-14 µm; pared incolora, 3-7 µm engrosada dorsalmente y ocasionalmente en el apice; esporos sesiles, incoloros, de obovoides a elipsoides, 20-27 x 15-19 µm; pared incolora, 1-1.5 µm de gruesa, uniforme, con abundantes y pequeñas espinas; poros germinativos imperceptibles, mas o menos 6-9, dispersos. Teliosoro principalmente hipófilo, dispersos, alargados, de carmelitas a negruzcos, cupulados, crecimiento indeterminado en sentido longitudinal, coalescentes, 1-3 capas de esporos, cubiertos por la epidermis; himenio subepidermal, plano; teliosporos mas 6 menos uno debajo del otro, carmelitas, oblongos, cuboides 6 elipsoides, 20-32 x 12-14 µm; pared carmelita, 1-1.5 µm de gruesa, uniforme, 3-5 µm engrosada en el apice de los esporos del extremo superior.

When fresh, the uredinial sori are bright yellow (Buriticá, 1999).

The Sydows (1923) mistakenly placed *Uredo paspalicola* with what is now *Puccinia substriata* (= *Physopella compressa* Cummins & Ramachar, Mycologia 50: 742. 1958).

*Phakopsora crotalariae* Arthur, see **PHAKOPSORA MEIBOMIAE** Arthur.

*Phakopsora crotonicola* (P. Hennings) Kern, Thurston & Whetzel, see **PHAKOPSORA ARGENTINENSIS** (Spegazzini) Arthur.

**Phakopsora crotonis** (Burrill) Arthur, Bull. Torrey Bot. Club 44: 508. 1917. **(0/Ise,IIse/III)**.

≡ *Melampsora crotonis* Burrill, Bot. Gaz. (Crawfordsville) 9: 189. 1884. TYPE on *Croton capitatus* Mixhaux from **The United States of America**, Illinois, place and date not available, *A. B. Seymours.n.* (Lectotype).

≡ *Bubakia crotonis* (Burrill) Arthur, Res. Sci. Congr. Bot. Vienne, p. 339. 1906.

Anamorph

**Milesia crotonis** (Cooke) Buriticá & Hennen, Rev. Acad. Colombia Cienc. 23: 294. 1999.

≡ *Trichobasis crotonis* Cooke, Grevillea 6: 137. 1878. TYPE on *Croton procumbens* Jacquin from **The United States of America**, California, place and date not available, *M. Edwards s.n.*

The following reports of *Phakopsora crotonis* from Brazil are a result of missidentifications.

Buriticá (1999) records *Phakopsora crotonis* only from Central and North America, and the Antilles.

On Euphorbiaceae:

*Croton* sp., Rio Grande do Norte (Viégas, 1945: 2; IAC-2671, -2917).

*Julocroton fuscescens* Baill., Rio de Janeiro (Viégas, 1945: 2; IAC-3670).

**PHAKOPSORA CUPHEAE** Buriticá, Rev. Acad. Colombia Cienc. 19: 464-465. 1995(?3). TYPE on *Cuphea* sp. from **Ecuador**, Pichinchia: highway Toachi-Paloquemado, 19 July 1975, *K. Dumont, S. Carpenter, P. Buriticá 75-057E. (?/?,IIse/III)*.

Anamorph

**Milesia cupheae** (P. Hennings) Buriticá, Rev. Acad. Colombia Cienc. 19: 464-465. 1995.

≡ *Uredo cupheae* P. Hennings, Hedwigia 34: 99. 1895. TYPE on *Cuphea* sp. from **Brazil**, Goiás: Goiás, Jan 1893, *Ule-2001*.

On Lythraceae

*Cuphea micrantha* Humboldt, Bonpland & Kunth, Piauí (Hennings, 1896: 248).

*Cuphea* sp., Goiás (Hennings, 1895: 99), Minas Gerais (Thurston, 1940: 305).

The anamorph of *Phakopsora cupheae* has been reported also from Argentina, Ecuador, Colombia, Puerto Rico, and The Dominican Republic.

Espermogonio desconocido. Anamorfo anfigineo, principalmente hipófilo, en grupos en manchas bien definidas, carmelitas, abiertos por un poro; himenio subepidermal, levemente cóncavo; peridio hifoide; parafisos en el himenio, cilindricos, libres, 20-30 x 6-8 µm; pared hialina, ocasionalmente 2-4 µm de gruesa en el ápice; esporos sésiles, carmelitas en la mitad superior, amarillentos en la mitad inferior, subglobosos, de oblongos a elipsoides. 18-24 x 14-21 µm; pared de incolora a amarillenta, 0.5-1.0 µm de gruesa. uniforme, densamente equinulada: poros germinativos 2-3, supraecuatorial. Teliosoros hipófilo, dispersos o alrededor del anamórfo, de carmelita a negruzco. lenticular. crecimiento indeterminado, coalescentes, 2 - 3 capas de esporas, piano; teliosporos irregularmente arreglados, carmelitas, oblongos, de obovoides a elipsoides, 18-27 x 9-16 µm; pared amarillenta, mas oscura hacia el ápice, 1-2 µm de grueso, 3-5 µm engrosada en el ápice de los esporos del extremo superior.

*Phakopsora desmium* (Arthur) Cummins, see **PHAKOPSORA GOSSYPII** (Lagerheim) N. Hiratsuka.

**Phakopsora erythroxyli** (Cummins) Kern in Stevenson, Fungi of Puerto Rico. Contr. Reed Herb., p. 267.

1978. (as “*erythroxylois*”). **(?/?,IIse/III)**.

≡ *Bubakia erythroxylois* (sic) Cummins, Mycologia 48: 601. 1956. TYPE on *Erythroxylois havanense* Jacquin from Cuba, Isle of Pines, Cerros de Vivijuaga, 28-29 Feb. 1916, *N. L. Britton, E. G. Britton & P. Wilson-15023*.

Anamorph

**Milesia erythroxyli-antillanae** Buriticá & Hennen. TYPE same as for the teleomorph.

Buriticá (1999) records this species only from the Antilles. The specimens reported under this name in the first edition of this Index are now placed with *Phakopsora coca* Buriticá & Hennen.

*Phakopsora erythroxyli* (Cummins) Kern, see *Phakopsora erythroxyli* (Cummins) Kern.

*Phakopsora fenestrata* (Arthur) Arthur, Bull. Torrey Bot. Club 44: 508. 1917. (??,II/III). Buriticá (1999) reported this species only from the Antilles. The records from Brazil [on *Phyllanthus grandifolius* Linnaeus, Rio Acre, Brazil (Sydow, 1916: 70). *Phyllanthus* sp., Minas Gerais (Joerstad, 1956: 486)] belong to **PHAKOPSORA ULEI** Buriticá & Hennen.

**PHAKOPSORA EUVITIS** Ono, Mycologia 92: 160. 2000. TYPE on *Vitis labrusca* L. x *V. vinifera* L. cv. Kyoho from **Japan**, Ibaraki: Hitachiota, 3 Nov 1991, Y. Ono2633. (0/Icv<sup>s</sup> IIpeIII).

Synanamorphs

Aecial anamorph (unknown in Brazil)

*Aecidium meliosmae-myrianthae* P. Hennings & Shirai in Hennings, Bot. Jahrb. 28: 264. 1900.

TYPE on *Meliosma myrianthae* Sieboldt & Zuccarini, Meliosmaceae, from **Japan**: Nikko: June 1895 & July 1897, M. Shirai-s.n.

Uredinial anamorph

*Physopella vitis* (Thuemen) Arthur, Result. Sci. Bot. Congr. Wien. 1905: 338. 1906..

≡ *Uredo vitis* Thuemen, Die Pilze das Weinstokes. p. 182. 1878. TYPE on *Vitis vinifera* L. from **The United States of America**, South Carolina: Aiken, 1868. H. W. Ravenels.n.

= *Uredo vialae* Lagerheim, Comp. Rendu Acad. Sci. 110: 729. 1890. TYPE on *Vitis vinifera* from **Jamaica**: between Kingston and Rockfort, Oct 1889, Lagerheim.

≡ *Physopella vialae* (Lagerheim) Buriticá & Hennen, Rev. Inst. Sci. Nac. Colombia Ecol 5: 181. 1994.

On Vitaceae

*Vitis labrusca* L. X *V. vinifera* L., Mato Grosso do Sul (IBI-), São Paulo (IBI-).

*Phakopsora euvitis* has been reported as widespread in Asia (Ono, 2000), and has also been found recently in Northern Australia.

Spermogonia and aecia on *Meliosma* in Asia. Uredinia mostly on abaxial side of leaves, minute, scattered or in small groups, often numerous, subepidermal in origin, erumpent; paraphyses numerous, peripheral, 30-75 µm long, cylindrical to weakly incurved, wall evenly thin to dorsally thickened (1.5-4 µm). Urediniospores 15-29 x 10-18 µm, obovoid, obovoid-ellipsoid or oblong-ellipsoid, wall ca 1.5 µm thick, echinulate, pores 6 scattered or rarely 4 equatorial. Telia on abaxial side of leaves, subepidermal crustose, not erumpent, brown to blackish brown, often confluent; teliospores more or less regularly arranged in 3-5 layers, 13-32 x 7-13 µm, oblong to oblong ellipsoid, wall thin, pale brown at the top layer of spores. Basidiospores 8-11 x 5-8 µm, reniform (Ono, 2000).

Perhaps the most common rust on *Vitis* in the United States of America, the West Indies and Northern South America is also *Phakopsora euvitis*, although before recent papers published by Buriticá (1999) and Ono (2000), most collections of rusts on *Vitis* in the New World were identified as either *Physopella vitis*, *Phakopsora vitis*, or *Physopella ampelopsidis*. At least one other rust, *Phakopsora uva* Buriticá & Hennen, which is easily identified by its paraphyses and anamorph soral structure, has been reported from the Neotropics but not yet from Brazil..

**PHAKOPSORA GOSSYPYII** (Lagerheim) N. Hiratsuka f., Uredinological Studies, KasiaPubl. Co., Tokyo, p. 226. Oct. 1955. (??,IIse/III).

≡ *Doassansia gossypii* Lagerheim, J. Mycol. 7: 49. 1891. TYPE on *Gossypium* sp. (Malvaceae) from **Ecuador**, Los Rios, Balsapamba, Dec 1890, G. Lagerheim s.n. Bonner (1968) determined that *Doassansia gossypii* Lagerheim was based on a rust, not a smut. He suggested that the name and citation of this *Phakopsora* should be as shown above even though N. Hiratsuka (1955) reported the name as *Phakopsora gossypii* (Arthur) N. Hiratsuka f.

≡ *Chrysomyxa gossypii* (Lagerheim) Setchell, Bot. Gaz. (Crawfordsville) 19: 187. 1894.

= *Kuehneola gossypii* Arthur, N. Amer. Flora 7: 187. 1912. TYPE on *Gossypium acuminatum* Roxburgh from **Cuba**, Santiago, March, 1903, L. M. Underwood & F. S. Earle 159.

≡ *Cerotelium gossypii* (Arthur) Arthur, Bull. Torrey Bot. Club 44: 510. 1917. Basionym is

*Kuehneola gossypii* Arthur.

≡ *Phakopsora gossypii* (Arthur) N. Hiratsuka f. Urediniological Studies 266. 1955. Basionym is *Kuehneola gossypii* Arthur.

= *Phakopsora gossypii* Dale, Common. Mycol. Inst. Mycol. Paper 60: 4. Dec. 1955.

Anamorph on Malvaceae

***Malupa desmium*** (Berkeley & Broome) Buriticá, Rev. I. C. N. E. 5: 175. 1994. ≡ *Aecidium desmium* Berkeley & Broome, Jour. Linn. Soc. 14: 95. 1875. TYPE on *Gossypium* sp. from **Sri Lanka** (Ceylon), Peradeniya, Jan 1868, collected by ? *Thwaites s.n.*

≡ *Uredo desmium* (Berkeley & Broom) Petch, Ann. Bot. Gard. Peradeniya 5(4): 247. 1912.

≡ *Kuehneola desmium* (Berkeley & Curtis) Butler, Fungi and Diseases of Plants, p. 363. 1918.

≡ *Cerotelium desmium* (Berkeley & Broome) Arthur, N. Amer. Flora 7: 698. 1925. Arthur specifically transferred an anamorph name whose type was not teleomorphic to a teleomorph genus. Arthur's name must be considered as a nomenclatural synonym of the original anamorph. Arthur's description of telia is from a specimen from Cuba but has no standing in formal nomenclature.

≡ *Phakopsora desmium* (Berkeley & Broome) Cummins, Bull. Torrey Bot. Club 2: 206. 1945. Cummins regarded the basionym as the anamorph, *Aecidium desmium* Berkeley & Broom, but mistakenly considered the type as the *Underwood & Earle 159* specimen from Cuba which was the source of the telial description for *Kuehneola gossypii* Arthur. Cummin's combination must be considered as a nomenclatural synonym of *Aecidium desmium*.

= *Uredo gossypii* Lagerheim, J. Mycol. 7: 48. 1891. TYPE on *Gossypium* sp. from **Ecuador**, Los Rios, Balsapamba, Dec 1890, G. Lagerheim (apparently not the same specimen as the type of *Doassansia gossypii* which had telia of *Phakopsora*, not *Doassansia*).

≡ *Cerotelium gossypii* (Lagerheim) Arthur, Bull. Torrey Bot. Club 44: 510. 1917. Based on the anamorph, *Uredo gossypii* Lagerheim.

≡ *Kuehneola gossypii* (Lagerheim) Arthur, N. Am. Flora 7: 187. 1912. Arthur lists *Uredo gossypii* Lagerheim as the basionym.

On Malvaceae

***Gossypium barbadense*** Linnaeus, São Paulo (IAC-25).

***Gossypium brasiliense*** MacFadyen, Minas Gerais (Thurston, 1940: 293).

***Gossypium herbaceum*** L. Bahia (IBI-5704).

***Gossypium hirsutum*** L., Pará (PUR-F19128), Rio de Janeiro(HNR-395), São Paulo (PUR-F1124).

***Gossypium*** sp., Ceará (IAC-8047), Espírito Santo (IBI-2831), Minas Gerais (Thurston, 1940: 293), Paraná (IBI-10277), Rio Grande do Norte (Viégas, 1945: 2), Rio de Janeiro (IAC-2703; Puttemans-2588), São Paulo (Viégas, 1945: 2; IAC-1395; IBI-1978).

*Phakopsora gossypii* is a common rust of cotton in tropical regions of the world.

Espermogonio desconocido. Anamórfico hipófilo, aislado ó en pequeños grupos en manchas bien delimitadas, amarillento, abierto por un poro, subepidermal; himenio de subepidermal a intraepidermal, cóncavo; parafisos periferales cubriendo los esporos, levemente curvados, cilindricos, 20-50 x 7-9 µm; pared hialina, 1-2 µm de gruesa, ocasionalmente 2-4 µm engrosada en el ápice; parafisos en el himenio del mismo tipo; esporos sesiles. de incoloros a amarillentos, angularmente elipsoides, obovoides, 22-28 x 16-19 µm; pared incolora, 1-1.5 µm de gruesa, uniforme, con abundantes y pequeñas espinas, espinas un poco mas grandes en la base; poros germinativos imperceptibles, 2 ecuatoriales. Teliosoro hipófilo, alrededor del anamórfico, de amarillento a carmelita, ceroso, cupular, crecimiento determinado, coalescentes, 5-7 capas de esporos; himenio subepidermal, inicialmente esferico, posteriormente semiesferico; teliosporos irregularmente arreglados, amarillentos, cuboides, elipsoides, angulares, 12-20 x 8-12 µm; pared amarillenta, 1-2 µm de gruesa, 3-5 µm engrosada en el ápice de los esporos del extremo superior.

This rust causes infections that result in sori on the undersides of the leaves which in some years may be very abundant. Usually little or no damage seems to result from this disease. This rust has been reported often as *Cerotelium gossypii* in some of the older literature.

*Phakopsora jatrophiicola* Cummins ex Cummins, see **PHAKOPSORA ARTHURIAN** Buriticá & Hennen.

*Phakopsora juelii* H. Sydow & P. Sydow, see **PHAKOPSORA ROSSMANIAE** J. Dianese et al.

**PHAKOPSORA MEIBOMIAE** (Arthur) Arthur, Bull. Torrey Bot. Club 44: 509. 1917. (?/?,IIse/III).

≡ *Physopella meibomiae* Arthur, Mycologia 9: 59. 1917. TYPE on *Desmodium incanum* DeCandolle from **Puerto Rico**, Anasco, 28 Mar 1916, *H. H. Whetzil & E. W. Olive-1219*.  
= *Phakopsora meibomiae* (Arthur) Trotter, *En: Saccardo, Syll. Fung.* 23: 843. 1925.  
a later homonym

= *Phakopsora crotalariae* Arthur, Bull. Torrey Bot. Club 44: 509. 1917 [as “(Dietel) Arthur comb. nov.”]. TYPE on *Crotalaria* sp. from **Brazil**, Rio de Janeiro: Copa Cabana, August 1897, *Ule-2328*. The Ule specimen had two different rust species on it: Arthur described telia of *Phakopsora crotalariae* from the Ule specimen and Dietel described *Uredo crotalariae* Dietel from the same collection, a rust that is not an anamorph of *Phakopsora*.

Anamorph

**Malupa vignae** (Bresadola) Ono, Buriticá & Hennen, Mycol. Res. 96(10): 831. 1992.

≡ *Uredo vignae* Bresadola, *Revue Mycol. (Toulouse)* 18: 66. 1891. TYPE on *Vigna marina* (Burman) Merrill from **São Tome**, date not recorded, *A. Moller*.

≡ *Phakopsora vignae* (Bresadola) Arthur, Bull. Torrey Bot. Club 44: 5009. 1917 (based on uredinia only).

= *Phakopsora vignae* (Arthur) Cummins, Bull. Torrey Bot. Club 70: 73. 1943.

= *Uredo teramni* Mayor, *Mem. Soc. Neuchatel. Sci. Nat.* 5: 587. 1913. TYPE on *Teramnus uncinatus* (Linnaeus) Swartz from **Colombia**, Antioquia, Medellín, Rio Porce, 6 Aug 1910, *E. Mayor-274*.

= *Uredo concors* Arthur, Mycologia 7: 330. 1915. TYPE on *Lablab purpureus* (Linnaeus) Sweet from **Puerto Rico**, Jayuya, 17 Dec 1913, *F. L. Stevens-6042*.

≡ *Physopella concors* (Arthur) Arthur, Mycologia 9: 60. 1917.

= *Uredo aeschenomenis* Arthur, *Bot. Gaz (Crawfordsville)* 39: 392. 1905. TYPE on *Aeschynomene americana* Linnaeus from **Mexico**, Morelos, Cusutla, 22 Oct 1903, *Holway-5220*.

≡ *Physopella aeschynomenis* (Arthur) Arthur, *N. Am. Fl.* 7:104. 1907.

≡ *Phakopsora aeschynomenis* (Arthur) Arthur.

= *Aecidium crotalariicola* P. Hennings, *Hedwigia Beiblatt* 38: (70). 1899. TYPE on *Crotalaria* sp. from **Brazil**, Santa Catarina, Blumenau, Jan 1888, *Ule-947*.

On Leguminosae:

***Crotalaria anagyroides*** Humboldt, Bonpland & Kunth, São Paulo (Viégas, 1945: 7; IAC-2106).

***Crotalaria paulina*** Schrank, São Paulo (Dietel, 1899: 257; Hennings 1908: 2; *Puttemans-1187*).

***Crotalaria striata*** DeCandolle, Minas Gerais (Thurston, 1940: 294).

***Crotalaria*** sp., Minas Gerais (Deslandes, 1979: 337, identified as *P. pachyrhizi*); Rio de Janeiro (Dietel, PUR-F1176), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 125; IAC-7675), São Paulo (1905, Puttemans-?number; Gjerum, 1978: 466).

***Desmodium*** sp., Minas Gerais (Deslandes, 1979: 337, identified as *P. pachyrhizi*).

***Dolichos lablab*** L., Minas Gerais (Deslandes, 1979: 337, identified as *P. pachyrhizi*).

***Glycine max*** Merrill, Minas Gerais (Deslandes, 1979: 337, identified as *P. pachyrhizi*).

***Glycine wightii***, Minas Gerais (Deslandes, 1979: 337, identified as *P. pachyrhizi*).

***Macroptillium lathyroides***, Minas Gerais (Deslandes, 1970: 337, identified as *P. pachyrhizi*).

***Phaseolus bracteolatus***, Minas Gerais (Deslandes, 1979: 337, identified as *P. pachyrhizi*).

***Phaseolus lunatus*** Linnaeus var. ***macrocarpus*** Bentham, Minas Gerais (Deslandes, 1979: 337, identified as *P. pachyrhizi*), Sao Paulo (IBI-16940).

***Phaseolus vulgaris*** L., Minas Gerais (Deslandes, 1979: 337, identified as *P. pachyrhizi*).

***Vigna sinensis*** Savi, Minas Gerais (Deslandes, 1979: 337, identified as *P. pachyrhizi*).

*Phakopsora meibomiae* is a widespread native rust in the New World tropics on many genera in the subfamily Faboideae of legumes.



Espermogonio desconocido. Anamórfo anfigíneo, principalmente hipófilo, redondo, aislados ó en pequeífos grupos en una misma mancha redonda, abierto por un poro, carmelita claro, subepidermal; himenio subepidermal, levemente cóncavo; parafisos periferales levantados por tejido hifoide, parafisos en el himenio de cilíndricos a clavados, 20-40 x 8-12 µm; pared amarillenta, engrosada en el ápice hasta 6 µm; esporos sésiles, de incoloros a amarillentos, de redondos a obovóides, 17-21 x 14-18 µm; pared 1-1.5 µm de gruesa, uniforme, incolora, con abundantes y pequeñas espinas; poros germinativos 4-8, dispersos. Teliosoro hipófilo, alrededor del anamórfo, de carmelita a negruzco, lenticular, piano, crecimiento indeterminado, coalescentes, 2-4 capas de esporos, cubierros por la epidermis; himenio subepidermal, piano; teliosporos irregularmente arreglados, incoloros en los esporos inferiores; carmelitas en los esporos superiores, cuboídes, elipsoídes, 14-18 x 6-9 µm; pared 1-1.5 µm de gruesa, 2-5 µm en el ápice de los esporos del extremo superior.

One of the first collections from Brazil was by Puttemans in 1905 at Largo da Luz near the Polytechnic Engineering School in São Paulo on *Crotalaria*. Deslandes (1979) first reported this rust on soy beans, *Glycine max*, from Brazil in Minas Gerais. He reported it as the more virulent species, *Phakopsora pachyrhizi*, from Asia. This report was of much concern to plant pathologists who used the name *P. pachyrhizi* for this rust in Brazil in several publications. Ono et al. (1992) reported that the identification of the rust on *G. max* in the Neotropics is *P. meibomia*. But Frederick et al. (2002) presented molecular data as further evidence that two species are able to attack soy beans in Brazil, an Asian, *P. pachyrhizi*, and a New World one, *P. meibomia*. Because the uredinia of the two species are morphologically identical, and because no collections of rust on soy beans from Brazil have been reported to have telia, it is not clear to which species of *Phakopsora* reports should be attributed.

**PHAKOPSORA MELAENA** H. Sydow, Ann. Mycol. 37: 315. 1939. TYPE on *Randia armata* (Swartz) DeCandolle from **Ecuador**, Guayas: Chongon, 31 Aug 1937, H. Sydow-7. (?!?,IIse/III).  
 ≡ *Angiopsora melaena* (H. Sydow) Thirumalachar & Kern, Mycologia 41: 286. 1949.  
 = *Phakopsora randiae* Kern & Thurston, Mycologia 36: 508. 1944. TYPE on *Randia* sp. Two collections *Randia annata* (Swartz) de Candolle and *Randia caracasana* Standley were reported from **Venezuela** Tucupe, near Caracas, 28 Feb. 1939, H.H. Whetzel & A.G. Muller-2842 and -2852, without designating a type. A lectotype needs to be chosen.

Anamorph

*Physopella melaena* Cummins & Ramachar Mycologia 50: 743. 1958. TYPE same as for *Phakopsora melaena* H. Sydow.

On Rubiaceae

*Randia* sp., Piauí (Buriticá, 1999: ), Mato Grosso do Sul (Buriticá, 1999: ).

*Phakopsora melaena* has been reported also from Venezuela and Ecuador.

Espermogonio desconocido. Soro anamórfico hipófilo, disperso, amarillento, inicialmente abierto por un poro, posteriormente completamente abierto; himenio subepidermal, levemente cóncavo, parafisos periferales curvados, de incoloros a amarillentos, 29-45 x 7-13 µm; pared incolora, 1-4 µm de gruesa en el ápice y en el dorso; esporos sésiles, incoloros, de globosos a obovóides; 19-25 x 16-21 µm; pared incolora, 1.0-1.5 µm de gruesa, uniforme, con abundantes y pequeñas espinas;

**PHAKOPSORA MELANOTES** H. Sydow & P. Sydow, Ann. Mycol. 14: 70. 1916. TYPE on *Alseis* sp., Rubiaceae, from **Peru**, Rio Acre, Seringal São Francisco, Jul 1911, Ule-34316. (?!?,IIse/III).

Anamorfo:

*Physopella melanotes* Buriticá y Hennen, nom. anamorph. nov. Tipo: el mismo que para el teliomorfo.

*Phakopsora melanotes* has been reported only from the type from nearby Peru. New collections are needed to determine if this rust occurs in Brazil.

Espermogonio desconocido. Soro anamórfico anfigíneo, principalmente hipófilo, carmelita, inicialmente abierto por un poro, posteriormente completamente abierto; himenio subepidermal, erumpente, plano; parafisos periferales curvados, amarillentos, 30-50 x 8-12 µm; pared amarillenta, 1-4 µm de gruesa dorsalmente y en el ápice; esporos sésiles, de incoloros a amarillentos, obovóides, elipsoídes, 20-26 x 18-21 µm; pared incolora, 0.5-1.0 µm de gruesa, uniforme, con abundantes y pequeñas espinas; poros germinativos imperceptibles. Teliosoro anfigíneo, principalmente hipófilo, alrededor del anamórfo o aislado de carmelita a negruzco, lenticular, crecimiento indeterminado, coalescente, 1-5 capas de esporos; himenio subepidermal, plano; teliosporos uno mas o menos debajo del otro, libres, superiores carmelitas, inferiores hialinos, cuboídes,

elipsoides, 12-20 x 10-14  $\mu\text{m}$ ; pared carmelita en Ins esporos superiores, hialina en Ins inferiores, 1.0-1.5  $\mu\text{m}$  de gruesa, engrosada 1-3  $\mu\text{m}$  en el ápice de los esporos del extremos superior.

***Phakopsora melanotes***

Spermogonia and aecia unknown. Uredinia mostly on abaxial side of leaf, subepidermal in origin, early opening by a large pore-like structure; surrounded by many curved, basally united paraphyses, 30 - 50 x 8 - 12  $\mu\text{m}$ ; wall 1 - 4  $\mu\text{m}$  thick dorsally and apically, colorless to yellowish; urediniospores obovoid, ovoid to broadly ellipsoid, 20 - 26 x 18 - 21  $\mu\text{m}$ , appearing sessile; wall uniformly .5 - 1  $\mu\text{m}$  thick, colorless, densely and minutely echinulate, germ pores obscure. Telia close to the uredinia or scattered, subepidermal in origin remaining covered by the epidermis, brown to blackish, crust-like, dome-shaped, sometimes coalescent, composed of 1 -5 irregular spore layers; teliospores 12 - 20 x 10 -14  $\mu\text{m}$ , cuboid, ellipsoid to cylindrical, proximal spores hyaline, distal spores brownish, walls uniformly 1 - 1.5  $\mu\text{m}$  thick but distal walls in distal spores 1 - 3  $\mu\text{m}$  thick.

poros germinativos imperceptibles. Teliosoro hipófilo, alrededor del anamórfo o aislados en grupos circulares, de carmelita a negruzco, cupuliforme, crecimiento indeterminado, coalescentes, 2-5 capas de esporos; himenio subepidermal, plano; teliosporos irregularmente arreglados, libres, superiores, carmelitas, inferiores hialinos, oblongos, cuboides, elipsoides, 16-26 x 10-17  $\mu\text{m}$ ; pared carmelita en los esporos superiores, hialina en los inferiores, 1.0-1.5  $\mu\text{m}$  de gruesa, 2-6  $\mu\text{m}$  engrosada en el apice de los esporos del extremo superior.

**PHAKOPSORA NEOCHERIMOLIAE** Buriticá & Hennen in Buriticá, Rev. I.C.N.E.(Medellin) 5: 176.

1994. TYPE on *Annona cherimola* Miller, Annonaceae, from **Guatemala**, Moran, 11 Feb 1905, W. A. Kellerman-5403. (?/?,IIse/III).

≡ *Phakopsora cherimoliae* Cummins, Mycologia 48: 604. 1956. (A later homonym of an anamorph name, therefore a new name was published by Buriticá & Hennen as shown above).

Anamorph

***Physopella cherimoliae*** (Lagerheim) Arthur, Result. Sci. Congr. Bot. Vienna. p. 338. 1906.

≡ *Uredo cherimoliae* Lagerheim in Patouillard & Lagerheim, Bull. Soc. Mycol. France 11: 215. 1895. TYPE on *Annona cherimola* Miller from **Ecuador**, Balas & San Nicolas, 1890. *Lagerheim s.n.*

≡ *Phakopsora cherimoliae* (Lagerheim) Cummins, Bull. Torrey Bot. Club. 68: 467. 1941.

= *Uredo cupulata* Ellis & Everhart in Millspaugh, Field Mus. Publ. Bot. 2: 16. 1900.

TYPE on *Annona* sp. from **Mexico**, Yucatán, Feb 1899, *F. Milspaugh s.n.*

*Phakopsora neocheimoliae* has been reported from the Argentina, northern South America, Central America, Mexico, some Caribbean Islands, and southern United States of America (Florida, Texas), and on cultivated species of *Annona*, especially *Annona cherimola*. It has not yet been reported from Brazil but can be expected.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves, sori 0.1-0.4 mm across, numerous, scattered or in irregular groups, early naked, powdery, pale brownish, ruptured epidermis evident; paraphyses peripheral, slightly imbricated to form a pseudoperidium, 40-50 x 10-13  $\mu\text{m}$ , clavate, contracted near the apex, wall about 1  $\mu\text{m}$  thick below, thickened above so as to obliterate the lumen, colorless; urediniospores 26-31 x 16-19  $\mu\text{m}$ , obovoid, wall about 1  $\mu\text{m}$  thick, pale-yellow, rather closely echinulate, the pores obscure (Arthur, 1923). Telia in or around the uredinia, waxy, lenticular, broadly concave at the base, cinnamon-brown, coalescent, subepidermal; teliospores in 3-5 layers, teliospores 13-23 x 7-13  $\mu\text{m}$ , cuboid, ellipsoid or oblong, free, yellowish basally, cinnamon-brown above, wall 1-2  $\mu\text{m}$  thick, slightly thicker above in the distal spores.

Espermogonio desconocido. Anamórfo hipófilo, de amarillento a carmelita, en grupos en la misma lesión delimitada por la nervadura de la hoja, abierto por un poro, subepidermal; himenio subepidermal, plano; parafisos periferales y en el himenio, rectos, curvados, flexuosos, 26-55 x 7-15  $\mu\text{m}$ ; pared 3-8  $\mu\text{m}$  engrosada en el ápice; esporos sésiles, de amarillentos a carmelitas, redondos, de elipsoides ovoides, 18-24 x 17-21  $\mu\text{m}$ ; pared 0.5-1  $\mu\text{m}$  de gruesa, irregularmente engrosada, con abundantes y pequeñas espinas; poros germinativos imperceptibles. Teliosoro desarrollado en el anamórfo ó alrededor, hipófilo, ceroso, lenticular, carmelita ó rojizo, coalescente, crecimiento determinado, subepidermal, 35 capas de esporos; himenio cóncavo; teliosporos irregularmente arreglados, libres, basales amarillentos superiores carmelitas, cuboides,

elipsoides, oblongos, 13-23 x 7-13  $\mu\text{m}$ ; pared 1-2  $\mu\text{m}$  de gruesa, levemente engrosada en el ápice de los esporos del extremo superior. (Buriticá, 1999).

#### **Nomenclature explanation by J. F. H. June, 2003**

1. The International Code of Botanical Nomenclature (ICBN, Article 36) requires that all fungus names must be published in **Latin** after 1 Jan 1935.

2. Cummins published in 1941 the name "*Phakopsora cherimoliae* (Lagerheim) Cummins" with a description of telia in English, not in Latin. He reported a specimen from Guatemala as the source of the information about telia. However, because he cited *Uredo cherimoliae* Lagerheim as the source of the epithet "cherimoliae" i.e. the basionym, the type specimen of that name from Ecuador is automatically the type specimen for *Phakopsora cherimoliae* (Lagerheim) Cummins. At that time Arthur and Cummins believed that he was transferring the epithet "*cherimoliae*" from the anamorph genus *Uredo* to a teleomorph genus *Phakopsora* and that he did not have to provide a Latin diagnosis, and that the type specimen did not have to be a teleomorph. However, the ICBN does not allow anamorph names to be transferred to teleomorph genera. Therefore "*Phakopsora cherimoliae* (Lagerheim) Cummins" technically and automatically became another name, i.e. a taxonomic synonym, for "*Uredo cherimoliae* Lagerheim",... [*Uredo cherimoliae* is the basionym of *Physopella cherimoliae* (Lagerheim) Arthur, which according to Buriticá and Hennen is now the anamorph *Physopella cherimoliae* (Lagerheim) Arthur, although Arthur thought he was providing what we call now a teleomorph name].

3. In order to overcome this nomenclatural problem Cummins (1956) published the name "*Phakopsora cherimoliae* Cummins sp. nov." with a description of telia in Latin and the citation of the specimen with telia from Guatemala as the type. But because the combination "*Phakopsora cherimoliae*" was already taken as a synonym of *Uredo cherimoliae* (now *Physopella cherimoliae*) this combination could not be used for a teleomorph name.

4. Therefore, Buriticá [Buriticá C, P. 1994. Cambios taxonomicos y nuevos registros de Uredinales de la flora Andina. Revista del Instituto de Ciencias Naturales y Ecología (Univ. Nac. de Colombia, Fac. de Ciencias, sede Medellín) 5(2); 173-190.] proposed the new name "*Phakopsora neocherimoliae* Buriticá & Hennen *nom. nov.*" (see citation above) for this taxon with the type being the specimen from Guatemala reported by Cummins in 1941

**PHAKOPSORA NISHIDANA** S. Ito ex S Ito & Homma, Trans. Sapporo Nat. Hist. Soc. 15: 117 (113-128). 1938. TYPE on *Ficus carica* Linnaeus, Moraceae, from **Japan**, Kyushu: Pref. Kumamoto-shi, Izumimura, Hotaku-gun, 15 Oct 1906, K. Yoshino. . (??, **IIse/III**).  
= *Phakopsora fici* Nishida, Engei-no-tomo 7: 881. 1911. *nom. nudum*.  
= *Phakopsora hengshanensis* Tai, Farlowia 3: 98. 1947. TYPE on *Ficus martinia* (?) (Moraceae) from **CHINA**, Hunan, Hengshan, 18 Nov 1937, C. C. Cheo 4757.

Anamorph

**Malupa fici** (Castagne) Buriticá, Rev. I. C. N. E. (Medellín) 5(2): 175. 1994.  
≡ *Uredo fici* Castagne in Desmazieres, Pl. Crypt. (fasc. 34) No. 1662. 1848. TYPE on *Ficus carica* Linnaeus from France.  
≡ *Physopella fici* (Castagne) Arthur, Res. Sci. Congr. Bot. Vienne, p. 338. 1906.  
≡ *Cerotelium fici* (Castagne) Arthur, Bull. Torrey Bot. Club 44: 509. 1917. Not *Cerotelium fici* (Butler) Arthur.

On Moraceae

***Ficus carica*** Linnaeus, Minas Gerais (Thurston, 1940: 293; IBI-16298), Paraná (Fontoura & Nowacki, 1967/70: 134), Pernambuco (Pickel, 1936: 212; Batista & Bezerra, 1960: 6). Rio Grande do Sul (Lindquist & Costa Neto, 1963: 121), São Paulo (IBI-16131).

***Ficus pumila*** L., Rio de Janeiro (IBI-13070), São Paulo (IBI-14083).

*Phakopsora nishidana* is circumglobal in warmer regions where *Ficus carica* is grown but usually only uredinia are collected

Spermogonia and aecia unknown. Uredinia 0.2-0.3 mm across, on abaxial side of leaves, often on yellowish-brown spots, scattered, or in groups, often densely covering large areas, subepidermal in origin, covered at first, erumpent by a pore, paraphyses 20-50 x 6-9  $\mu\text{m}$ ; numerous, peripheral and intermixed, slightly incurved, clavate to cylindrical, wall uniformly 1-1.5  $\mu\text{m}$  thick, peripheral paraphyses terminating a short hyphoid peridium; urediniospores 18-24 x 16-19  $\mu\text{m}$ , sessile, globoid, ellipsoid, or obovoid; wall uniformly ca 1-1.5  $\mu\text{m}$  thick, pale yellow to yellowish-brown, echinulate, pores obscure. Telia on the abaxial

side of leaves, subepidermal, not erumpent, 0.2-0.8 mm across, usually around the uredinia, lenticular, often coalescent, dark brown to blackish, teliospores 13-20 x 8-12  $\mu\text{m}$ , oblong, cuboid, or ellipsoid, irregularly arranged in (2-)3-4(-5) layers, wall ca 1.5  $\mu\text{m}$  thick, pale cinnamon-brown, (Buritica, 19xx, Hiratsuka et al., 1992).

The correct name of the widespread, common rust on cultivated fig has been confused. This rust has been reported mostly by the anamorph name *Uredo fici* Castagne or the teleomorph name *Cerotelium fici*. The authors of the latter name have been given as either “(Cast.) Arthur” or “(Butler) Arthur”. Arthur (1917) published the name *Cerotelium fici* as a transfer from the anamorph *Uredo fici* Castagne because at that time he considered that names of anamorphs could be transferred to teleomorph genera if they had priority. The Code does not permit this now. But Arthur mistakenly also cited *Kuehneola fici* Butler as a synonym of *Cerotelium fici* (Castagne) Arthur. Because Butler based *Kuehneola fici* on a teleomorph, which is a different rust in India and is now considered as the true *Cerotelium fici* (Butler), Arthur some later authors have cited Arthur’s *Cerotelium fici* as “(Butler) Arthur”. However, the rust on *Ficus carica* is a *Phakopsora* as shown above and not *Kuehneola* or *Cerotelium*, and its oldest anamorph name is *Uredo fici* Castagne.

Ito (1938), Ito and Homma (1938), and Hiratsuka (1944) were the first to use the correct holomorphic name for this common fig rust.

Infections on *Ficus pumila*, an ornamental clinging vine that is used to cover outdoor walls, are very few. *Ficus pumila* seems to have some resistance to this rust. Specimens on *Ficus ibapohy* reported by Jackson (1927, p52) belong to *Cerotelium ficicola* Buritica & Hennen.

*Phakopsora nishidana* is well known in Brazil by all those who cultivate purple fig because it causes bright yellow color on the underside of the leaves resulting in premature leaf fall and weakening of the plants. Even fruits may be infected. Chemical control with the traditional Bourdoux mixture and other fungicides adds costs to high quality fig production.

Only the two species of *Phakopsora*, as compared below, are known on Moraceae in the New World.

1. Anamorph sori *Malupa* sp., paraphyses usually less than 30  $\mu\text{m}$  long; wall thickened to 10  $\mu\text{m}$  or more at the apex, on *Morus* spp. ***Phakopsora mori*** Buritica & Hennen.

1. Anamorph sori *Malupa* sp., paraphyses usually more than 30  $\mu\text{m}$  long; wall uniformly ca 1-1.5  $\mu\text{m}$  thick, on *Ficus* ***Phakopsora nishidana*** Ito.

*Phakopsora mori* Buritica & Hennen has been reported only from Guatemala, Mexico, and Florida in the United States of America.

See *Kuehneola fici* for notes on nomenclature of that species and *Cerotelium fici*.

**PHAKOPSORA PACHYRHIZI** H. Sydow & P. Sydow, Ann. Mycol. 12: 108. 1914. TYPE on

*Pachyrhizus* sp. from **The Philippines**.

Samples from Brazil and Paraguay identified as *Phakopsora pachyrhizi* by DNA comparisons by Reid Fredrick at Ft. Dietrick, Md. in 2002. **PHAKOPSORA MEIBOMIAE** Arthur. Ono et al. (1991) determined that the rust in the New World that had been reported as *Phakopsora pachyrhizi* is

**PHAKOPSORA MEIBOMIAE**. *Phakopsora pachyrhizi* occurs in Asia.

**PHAKOPSORA PAVIDA** Buritica & Hennen, sp. nov. Rev. Acad. Cienc. Colombia 23: 290. 1999.

TYPE on *Croton* sp. from **Venezuela**, Tucupe near Caracas, 28 Feb 1939, H. H. Whetzel & A. S. Muller-2848. (PUR) (?/?, Ise/III).

Anamorph

***Milesia pavid*** (H. S. Jackson & Holway) Buritica & Hennen, *comb. anamorph. nov* Rev. Acad. Cienc. Colombia 23: 290. 1999.

≡ *Uredo pavid* H. S. Jackson & Holway in Jackson, Mycologia 23: 468. 1931. TYPE on *Croton compressus* Lamarck from **Brazil**, Rio de Janeiro, 29 Aug 1921, Holway-1080. Tipo: sobre *Croton compressus* Lamarck (Euphorbiaceae), BRASIL: Rio de Janeiro, 13 Nov. 1921, E. WD. & M.M. Holway 1296.

On Euphorbiaceae

***Croton compressus*** Lamarck, Rio de Janeiro, São Paulo (Buritica, 1999: 291).

***Croton sonderianus*** Muell-Arg., Ceará (Buritica, 1999: 291).

***Croton* sp.**, Bahia, Minas Gerais, Santa Catarina, São Paulo (Buritica, 1999: 291).

*Phakopsora pavid* has been reported only from Brazil and Venezuela.

*Spermogoniis adhuc ignotis*. Soris anamorphis hypophyllis, dispersis vel aggregatis, rotundatis, flavidis vel brunneis, primo con centrali apertis tandem erumpentibus, subepidermalibus; hymenio

*subepidermalibus, appanato; peridium hyphoideis evidentis; paraphysibus in hymenio copiosis, hyalinis, globosis, clavatis, 25-35 x 9-14 µm; parieti tenuo, apice 1-3 µm incrassato; sporis sessilibus, hyalinis vel flavidis, obovoideis vel elipsoideis, 25-30 x 18-21 µm; parieti flavido. 1-1.5 µm crasso, 3-7 µm, apice incrassato, versimiliter bilaminatis, densis et minuteque aculeatis; poris germinationis 4, aecuatorialibus. Soris teleutosporiferis hypophyllis, circa soris anamorphis vel dispersis, brunneis, crustiformibus, determinatis, coalescentibus, 2-3 sporis stratis, subepidermalibus; hymenio subepidermali, concavo; teliosporis irregulariter dispositis, liberis, brunneis, oblongis vel ellipsoideis, 22-26 x 12-14 µm; parietis flavido vel brunneo, 1.5-2.5 µm, 3-5 µm apice incrassato in sporis superioribus.*

Espermogonio desconocido. Anamórfio hipófilo, en grupos dispersos, redondo, de amarillento a carmelita, inicialmente abierto por un poro, posteriormente completamente abierto, subepidermal; himenio subepidermal, plano; peridio hifóide claramente evidente en estados tempranos; parafisos en el himenio, abundantes, hialinos, globosos 6 clavados, 25-35 x 9-14 µm; pared delgada, ocasionalmente 1-3 µm engrosada dorsalmente y en el apice: esporos sesiles, de incoloros a amarillentos, de obovoides a elipsoides, 25-30 x 18-21 µm; pared amarillenta, 1-1.5 µm de gruesa, 3-7 µm engrosada en el apice, apareciendo bilaminada, con abundantes y pequeñas espinas; poros germinativos imperceptibles, 4 ecuatoriales. Teliosoro hipófilo, alrededor del anamórfio o disperso, carmelita, costriiforme, crecimiento determinado, coalescentes, 2-3 capas de esporos, cubiertos por la epidermis; himenio subepidermal, cóncavo; teliosporos irregularmente arreglados, libres, carmelitas, de oblongos a elipsoides. 22-26 x 12-14 µm; pared de amarillenta a carmelita, 1.5-2.5 µm de gruesa, 3-5 µm engrosada en el apice de esporos superiores.

Traits that help to identify *Phakopsora pavidia* include anamorph sori on the abaxial side of leaves, scattered or irregularly grouped, subepidermal in origin, peridium hyphoid as seen in young sori, opening at first with a pore, later completely open, hymenial paraphyses numerous, 25-35 x 9-14 µm, globoid to clavate, wall thin, apex 1-3 µm thick, spores 25-30 x 18-21 µm, obovoid to ellipsoid, walls 1-1.5 µm thick, 3-7 µm thick at apex, pale yellowish, bilaminate,

**PHAKOPSORA PHAKOPSOROIDES** (Arthur & Mains) Buriticá & Hennen, Rev. Acad. Colomb. Cienc. 23(87): 277. 1999. (?!?, IIse/III).

≡ *Puccinia phakopsoroides* Arthur & Mains, Bull. Torrey Bot. Club 46: 412. 1919. TYPE on *Olyra latifolia* Linnaeus from Cuba, Guantanamo, 7 Feb 1918, J. R. Johnston-1028.

≡ *Dicaeoma phakopsoroides* (Arthur & Mains) Arthur & Fromme in Arthur, N. Amer. Fl. 7(4): 295. 1920.

≡ *Angiopsora phakopsoroides* (Arthur & Mains) Mains, Mycologia 26: 128. 1934.

Anamorph

*Physopella phakopsoroides* Cummins & Ramachar, Mycologia 50: 743. 1958. Type same as for *Puccinia phakopsoroides* Arthur & Mains.

On Gramineae:

*Olyra latifolia* Linnaeus (= *Olyra cordifolia* Humboldt, Bonpland & Kunth), Pará (Cummins, 1971: 58; PUR-F9519).

*Olyra* sp., Sao Paulo (IBI-13711).

*Phakopsora phakopsoroides* has been reported on *Olyra* spp. also from Ecuador, Venezuela, Central America, and Cuba.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves, paraphyses 35-50 x 10-12 µm, abundant, yellowish to brownish, incurved, wall apically and dorsally thickened; urediniospores (25-)28-34(-38) x (18-)20-24(-26) µm, ellipsoid or obovoid; wall 1-1.5 µm thick, colorless to yellow, echinulate, pores obscure, 7-11, scattered. Telia brownish to blackish, covered by the epidermis; spores 12-21 x 8-14 µm, cuboid to oblong, in vertical rows of 2 or 3; wall uniformly 1-1.5 µm thick, yellow to golden (Cummins, 1971).

#### Key to help identify five rust species on *Olyra* and *Parodiolyra*, Poaceae

The following is a key to the five rust species known on *Parodiolyra* and *Olyra* spp., as modified from Cummins (1971). All have been reported from the Americas. *Puccinia belizensis* from Central America is unknown in Brazil. *Puccinia deformata* has been reported also from Africa.

1. Teliospores in sessile rows, uredinia enclosed with numerous, peripheral, incurved paraphyses with walls thickened on one side *Phakopsora phakopsoroides*.
1. Teliospores pedicellate, paraphyses, if present, cylindrical or broadly capitate with uniformly thin, brownish walls, and short stalks. (2).
2. Uredinia with paraphyses cylindrical or broadly capitate with uniformly thin, brownish walls,

- and short stalks, pores equatorial
2. Uredinia without paraphyses, urediniospore pores equatorial. (3). *Puccinia obliquo-septata*.
3. Urediniospores mostly 34-46  $\mu\text{m}$  long *Puccinia belizensis*.
3. Urediniospores mostly less than 34  $\mu\text{m}$  long. (4). *Puccinia deformata*.
4. Urediniospores mostly 27-32  $\mu\text{m}$  long *Puccinia faceta*.
4. Urediniospores mostly 23-26  $\mu\text{m}$  long

**PHAKOPSORA ROSSMANIAE** (as "*rossmanii*") J. Dianese, Santos & Tessman in J. Dianese, Medeiros, Santos, Furlaneto, Sanchez & A. Dianese, Fitopatol. bras. 18: 437. 1993. TYPE on *Campomanesia adamantium* (Cambessedes) O. Berg from **Brazil**, Goiás: Goiatuba, 28 May 1993, J. Dianese-4050. (??, IIse/III).

Anamorph

- Physopella jueli* (P. Sydow & H. Sydow) Buriticá & Hennen, Rev. Acad. Colombia Cienc. 23: 271-305.  
 = *Phakopsora juelii* P. Sydow & H. Sydow, Monogr. Ured. 3: 416. 1912. TYPE on ? *Campomanesia aurea* O. Berg (reported originally as *Campomanesia cyanea* O. Berg) from **Brazil**, Rio Grande do Sul: Santa Maria de Boca de Monte, 1893, Malme s.n. A teleomorph not described.  
 = *Uredo juelii* J. Walker, Aust. J. Bot. 10: 122. 1983. not validly published.

On Myrtaceae

*Campomanesia adamantium* (Cambessedes) O. Berg, Goiás, Minas Gerais (J. Dianese et al., 1993: 437).

*Campomanesia* sp., Mato Grosso do Sul (IBI- 14336), Minas Gerais (12649), Sao Paulo (IBI- 12359).

*Phakopsora rossmaniae* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinaia on abaxial side of leaves, scattered singly or in groups, cinnamon-brown, subepidermal in origin, erumpent, paraphyses peripheral, numerous, (17-)20-29(-35) x 5-8(-12)  $\mu\text{m}$ , incurved, rounded above, wall 1.5-3.0  $\mu\text{m}$ , thickened on sides and at the apex, colorless to yellowish; urediniospores sessile, (14-)18-23 x (12-)14-18  $\mu\text{m}$ , reniform, obovoid; wall uniformly 0.5-1.0  $\mu\text{m}$  thick, echinulate with numerous small spines, cinnamon-brown, pores 3(-4), mostly equatorial, occasionally with one apical, pores sometimes obscure. Telia on the abaxial side of leaves, rarely found, usually around the uredinia, yellowish brown to cinnamon-brown, waxy, lenticular, teliospores in 2-4(-5) irregular layers, 10-14 x 6-9  $\mu\text{m}$ , cuboide, cylindrical to elipsoide; wall uniformly 1.0-1.5  $\mu\text{m}$  thick.

The asymmetric, reniform urediniospores aid in identifying *Phakopsora rossmaniae*.

This rust was first reported by Juel (1897) as "*Uredo* sp." from a collection made by Malme on 3 May 1893 from Rio Grande do Sul, Brazil. The Sydows (1912) named this rust "*Phakopsora juelii*" but did not describe a teleomorph. Walker (1983) designated this rust as "*Uredo juelii* J. Walker" but the name was not validly published because he did not designate the basionym properly. The peripheral paraphyses of the anamorph sori are characteristic of the anamorph genus *Physopella*.

**PHAKOPSORA TECTA** H. S. Jackson & Holway in Jackson, Mycologia 18: 148. 1926. LECTOTYPE on *Commelina quitensis* Bentham, from **Bolivia**, Sorata, 16 April 1920, Holway-536. (??, IIse/III).  
 = *Physopella tecta* (H. S. Jackson & Holway) Azbukina, Akad. Nauk Inst. Nov.Sist. Nizh. Rast. (Leningrad) 7: 223. 1970.

Anamorph

- Malupa commelinae* (Kalchbrenner) Buriticá & Hennen in Buriticá, Rev. I. C. N. E. (Medellín) 5(2): 180. 1994.  
 ? = *Uredo commelyneae* Kalchbrenner, Grevillea 11: 24. 1882, not that of Spegazzini, 1880. TYPE on *Commelina* sp. (Commelinaceae) from Natal, South Africa, M. Wood s.n.  
 = *Phakopsora commelinae* Gaeumann, Bull. Jar. Bot. Buitenzorg, Serie 3. 5: 4. 1922.  
 Telia not described. Tipo: sobre *Commelina nodiflora* Linneo (Commelinaceae), JAVA e ISLAS CELEBES.

Commelinaceae

*Commelina* sp., Minas Gerais (IBI-14587), Rio Grande do Sul (IBI-13394), São Paulo (IBI 14107).

? *Tradescantia* sp., São Paulo (Viégas, 1945: 8; IAC-4039).

*Phakopsora tecta* has been reported on *Commelina* spp. and *Dichorisandra*, and from Argentina to Texas in the United States of America, also from Hawaii and in Asia from India to Japan.

Espermogonio desconocido. Anamórfo en *Malupa*, hipófilo, agrupados en manchas circulares, amarillentos, cubierto por la epidermis, abiertos por un poro, subepidermal; himenio intraepidermal, levemente cóncavo; parafisos en la parte superior del peridio, curvados, clavados, capitados, 18-28 x 8-12  $\mu\text{m}$  pared incolora, de 12  $\mu\text{m}$ , uniforme, en los parafisos del extremo amarillenta. 5-10  $\mu\text{m}$  engrosada en el apice, esporos sesiles, irregularmente elipsoides. 24-32 x 18-22  $\mu\text{m}$ : pared incolora. 1-1.5  $\mu\text{m}$  de gruesa. con abundantes y pequeñas espinas: pores germinativos imperceptibles. Teliosoro hipófilo, en grupos circulares alrededor (lei ananórfico). redondo, cubierto por la epidermis. compacto, puntiforme, inicialmente ambar luego carmelita oscuro. 3-7 capas de esporos, crecimiento determinado, subepidermal: himenio intraepidermal, levemente cóncavo: teliosporos irregularmente arreglados, de elipsoides a oblongos, 24-34 x 13-16  $\mu\text{m}$ ; pared en los teliosporos interiores amarillenta. 1-2  $\mu\text{m}$  de gruesa. con excisiones irregulares en el apice. en los teliosporos exteriores carmelita, 6-10  $\mu\text{m}$  de gruesa.

Jackson (1926) published *Phakopsora tecta* as a "nov. nom." for a species originally named as the anamorph *Uredo commelynaea* Kalchbrenner from Natal, South Africa. But Jackson described telia from the collection that we listed above as the lectotype of *P. tecta*. Thus, the name *P. tecta* is to be considered as a new species attributable to Jackson and Holway alone and not as a *nom. nov.* for *U. commelynaea* Kalchbrenner.

**PHAKOPSORA TIJUCAE** Buriticá & Hennen in Buriticá, Rev. Acad. Colombia Cienc. 23: 292. 1999. sp. nova TYPE on *Phyllanthus lathyroides* Humboldt, Bonpland & Kunth from **Brazil**, Rio de Janeiro: Tijuca, 19 Aug 1921, E. W. D. & M. M. Holway-1056. (PUR) (??,IIse/III).

Anamorph

*Milesia tijucae* (H. S. Jackson & Holway) Buriticá & Hennen in Buriticá, Rev. Acad. Colombia Cienc. 23: 293. 1999. *comb. anamorph. nov.*

≡ *Uredo tijucae* H. S. Jackson & Holway in Jackson, Mycologia 23: 469. 1931. TYPE same as for the teleomorph.

On Euphorbiaceae

*Phyllanthus lathyroides* Humboldt, Bonpland & Kunth, Rio de Janeiro (Dietel, 1899: 256, as "*Uredo phyllanthi* P.Hennings", *Ule-2214*; Jackson, 1931: 469).

*Phakopsora tijucae* has been reported only from Brazil.

*Uredo tijucae* Jackson & Holway, sp. nov.

II. Uredinia subcuticular, hypophyllous, on yellowish spots, scattered, small, round, 0.2-0.4 mm. across, early naked, cinnamon brown, pulverulent, ruptured cuticle conspicuous; urediniospores ellipsoid or obovoid, 15-18 by 24-25  $\mu\text{m}$ ; wall thin, 1-1.5  $\mu\text{m}$ , cinnamon brown with some tendency to be darker in upper part of spore, finely and closely verrucose; pores 2, equatorial.

*Phyllanthus lathyroides* H.B.K. Tijuca, Rio de Janeiro, Brazil, Aug. 19, 1921, 1056 (type); Petropolis, Rio de Janeiro, Brazil, Oct. 25, 1921, 1245.

It seems probable that this is the uredinial stage of a *Ravenelia*. It differs, however, from any described on this host genus. Paraphyses appear to be absent. Our specimens agree with Ule's collection 2214 from Rio de Janeiro issued as *Uredo Phyllanthi* P. Henn. It is quite different from that species, however, which has larger irregular spores and has been assigned by Sydow to *Schroeteriaster ulei* Sydow (Jackson, 1931).

*Spermogoniis adhuc ignotis. Soris anamorphis hypophyllis, dispersis vel aggregatis, rotundatis, flavidis. primo con centrali apertis tandem erumpentibus; hymenio subcuticulari, erumpenti, aperto; peridio hypohideo; sporis sessilibus, allipsoideis vel obovodes, 23-26 x 15-18  $\mu\text{m}$ ; parieti 1-1.5  $\mu\text{m}$  crasso, aequaliter, superne brunneis inferne hyalinis, dense et minuteque aculeato; poris germinationibus 2, aequatorialibus. Soris teleutosporiferis hypophyllis, subepidermalibus, circa soros anamorphos, succineis, crustiformibus, indeterminatis, 2-3 sporis stratis, epidermis tectis; hymenio subepidermali, applanato vel concavo; teliosporis seriatim dispositis, liberis, oblongis vel cuboideis, 12-24 x 10-12  $\mu\text{m}$ ; parieti flavide vel brunnei, 0.5-1  $\mu\text{m}$  crassis, 2-3  $\mu\text{m}$  incrassatis in sporis superioribus.*

Espermogonio desconocido. Anamórfo hipófilo, en grupos ó dispersos, redondo, amarillento, inicialmente abierto por on poro, posteriormente completamente abierto; himenio subcuticular, erumpente, plano; peridio hifoide; esporos sésiles, de obovodes a elipsoides, 23-26 x 15-18  $\mu\text{m}$ ; pared carmelita hacia la parte superior, amarillenta hacia la parte inferior, 1-1.5  $\mu\text{m}$  de gruesa, con abundantes y pequeñas espinas;

poros germinativos 2, ecuatoriales. Teliosoro hipófilo, alrededor del anamórfo, ambar, costriforme, crecimiento indeterminado, 2-3 capas de esporos, cubierto por la epidermis; himenio subepidermal, plano ó ligeramente cóncavo; teliosporos uno debajo del otro, de oblongos a cuboides, 12-24 x 10-12  $\mu\text{m}$ ; pared de amarillenta a incolora, 0.5-1  $\mu\text{m}$  de gruesa, 2-3  $\mu\text{m}$  engrosada en el spice de los esporos superiores.

**Especímenes estudiados:** sobre Euphorbiaceae. *Phyllanthus lathyroides* H.B.K., BRASIL: Rio de Janeiro. Tijuca, 19 Ago. 1921, E.W.D. & M.M. Holway 1056 (Tipo); Petropolis, 25 Oct. 1921, E.W.D. & M.M. Holway 1245; We 2214.

**Observaciones:** el tipo escogido por Jackson (1931) para designar el anamórfo posee teliosporos y es de allí, de donde se han descrito.

**"*Uredo tijucae* Jackson & Holway, sp. nov.**

Uredinia subcuticular, hypophyllous, on yellowish spots, scattered, small, round, 0.2-0.4 mm. across, early naked, cinnamon brown, pulverulent, ruptured cuticle conspicuous; urediniospores ellipsoid or obovoid, 15-18 by 24-25  $\mu\text{m}$ ; wall thin, 1-1.5  $\mu\text{m}$ , cinnamon brown with some tendency to be darker in upper part of spore, finely and closely verrucose; pores 2, equatorial. On *Phyllanthus lathyroides* H.B.K. Tijuca, Rio de Janeiro, Brazil, Aug. 19, 1921, 1056 (type); Petropolis, Rio de Janeiro, Brazil, Oct. 25, 1921, 1245.

It seems probable that this is the uredinial stage of a *Ravenelia*. It differs, however, from any described on this host genus. Paraphyses appear to be absent. Our specimens agree with Ule's collection 2214 from Rio de Janeiro issued as *Uredo Phyllanthi* P. Henn. It is quite different from that species, however, which has larger irregular spores and has been assigned by Sydow to *Schroeteriaster ulei* Sydow." (Jackson, 1931)

Buriticá (1999) reported two of the four species of *Phakopsora* on *Phyllanthus* from the Neotropics from Brazil. Two other species of *Phakopsora* on *Phyllanthus* have been reported from the Old World: *Phakopsora phyllanthi* Dietel, 1910, from India, The East Indies and the Philippines; and *Phakopsora phyllanthi-discoidei* Viennot-Bourgin, 1959, from Guinea, Africa.

#### **Key to help identify *Phakopsora* species on *Phyllanthus*, Euphorbiaceae, in the Neotropics**

All with anamorph sori surrounded by a hyphoid peridium, urediniospore walls are more or less uniformly thin, not thickened at the apex.

1. Urediniospore pores 3-4, scattered above the equator; teliospores in 2-3 layers, teliospores 10-16  $\mu\text{m}$  wide, walls 1-1.5  $\mu\text{m}$  thick at sides, 3-5 apically in distal layer. The West Indies  
*Phakopsora fenestrala* (Arthur) Arthur
2. Urediniospore pores 2-3, equatorial or in angles; teliospores in 1(-2) layer, teliospore walls 1.5-2.5  $\mu\text{m}$  thick at sides, 4-5 apically. Mexico  
*Phakopsora purdueae* Buriticá & Hennen
3. Urediniospore pores 2, equatorial; teliospores in 2-3 layers. walls 0.5-1  $\mu\text{m}$  thick at sides, 2-3 apically in distal layer. Brazil  
*Phakopsora tijucae* Buriticá & Hennen
4. Urediniospores pores 2-3, equatorial; teliospores in 4-7 layers, walls 1-1.5  $\mu\text{m}$  thick at sides, 2-3 apically in distal layer. Brazil  
*Phakopsora ulei* (H. Sydow & P. Sydow)  
Buriticá & Hennen

**PHAKOPSORA TOCOYENAE** Buriticá & Hennen, Rev. Acad. Colomb. 23: 304. 1999. TYPE on *Tocoyena* sp. from **Brazil**, Federal District: Aguas Emendadas National Park, 5 Nov 1977, J. F. Hennen & M. M. Hennen-77-213. (?/?,II/III).

***Phakopsora tocoyena* Buriticá & Hennen, sp. nov.**

Tipo: sobre *Tocoyena* sp. (Rubiaceae), BRASIL: Distrito Federal. circa al borde Este del Parque Nacional Aguas Emendadas en la carretera 020 entre Planaltina y Formosa. 5 Nov. 1977, J. F. & M.M. Hennen 77 - 217 (in IBI-13210).

Anamorfo: *Physopella tocoyena* Buriticá & Hennen, sp. anamorph nov. Tipo: el mismo que para el teliomorfo.

On Rubiaceae

***Tocoyena* sp.**, Amapá (IBI-16616, 16632), Federal District (IBI-13210; Buriticá, 1999: 304), Goiás (IBI-16672, -16687), Mato Grosso (IBI-16718), Mato Grosso do Sul (IBI-14354), Minas Gerais (IBI-15361,-16387, -16396; Buriticá, 1999: 304), São Paulo (IBI-13364, -16208).

*Spermogonii adhuc ignotis. Soris anamorphis hypophyllis, aggregatis, brunneis, primo poro centrali apertis tandem erumpentis, subepidermalibus; hymenio erumpenti. applanato; paraphysibus peripheralibus,*



*abundis. ad basim conjunctis, curvatis. 20-48 x 7-10 µm; parieti flavido. 3-5 µm apice et dorsaliter incrassato, sporis sessilibus, flavidis vel brunneis, obovoideis vel ellipsoideis, 24-28 x 18-22 µm; paieti 0.5-1.0 µm aequaliter crasso, dense et minuteque aculeati verrucosa; poris germinationis obscuris. Soris teleutosporiferis hypophyllis, circa soros anamorphis brunneis vel atris, crustiformibus, applanatis, indeterminatis, coalescentibus, epiderme tectis; hymenio subepidermali, applanato; teliosporis seriatim in 3-4 stratis dispositis adherenti, rectangulis oblongis vel ellipsoideis, 20-26 x 14-18 µm; parieti bruneo, 3-4 µm, 4-6 µm apice incrassato in sporis superioribus.*

Espermogonio desconocido. Sore, anamorfo hipófilo, en grupos, carmelitas, inicialmente abierto por un poro, posteriormente completamente abierto; himenio subepidermal. erumpente, piano; parafisos periferales abundantes, curvados. 20-48 x 7-10 µm; pared amarillenta. 3-5 µm de gruesa dorsalmente y en el apice; esporos sesiles, de amarillentos a carmelitas, obovoides, elipsoides, 24-28 x 18-22 µm; pared amarillenta, 0.5-1.0 µm de gruesa. uniforme, con abundantes y pequeñas espinas, y verrugas; poros germinativos imperceptibles. Teliosoro hipófilo, alrededor del anamorfo, de carmelita a negruzco, costriforme, plano, crecimiento indeterminado, coalescente, 3-4 capas de esporos; himenio subepidermal, plano; teliosporos mas o menos uno debajo del otro, rectangulares, elipsoides, 20-26 x 14-18 µm; pared carmelita, 3-4 µm de gruesa, 4-6 µm engrosada en el apice de los esporos del extremo superior,

**PHAKOPSORA TOMENTOSAE** Ferreira & Gasparotto in Ferreira, Gasparotto, & Lima, Fitopatol. bras. 26: 206-208. 2001. TYPE on *Licania tomentosa*, Manaus, Am, Brasil, Luadir Gasparotto. 23-IV-1993. Herbário UFV-VIC - 21998, holotypus".

**PHAKOPSORA ULEI** (H. Sydow & P. Sydow) Buriticá & Hennen in Buriticá, Rev. Acad. Colombia Cienc. 23: 292. 1999. (??, Hse/III).

≡ *Schroeteriaster ulei* H. Sydow & P. Sydow, Ann. Mycol. 14: 70. 1916. TYPE on *Phyllanthus* sp. from **Brazil**, Rio Acre, Seringal San Francisco, July 1911, *Ule-3487*.

[≡ *Bubakia ulei* (H. Sydow & P. Sydow) H. S. Jackson & Holway in Jackson, Mycologia 23: 466. 1931. Jackson (1931) missidentified the specimen that led him to make this combination. He reported it as "*Phyllanthus brasiliensis* (Aubl.) Rusby" from Bolivia, Nor Yungas: Coroico, 11 June 1920, *Holway-734*. But the host is *Maprounea brasiliensis* and the rust is **CHACONIA MAPROUNEAE** (Viégas) Ono & Hennen.]

Anamorph

*Milesia phyllanthi* (Hennings) Buriticá & Hennen in Rev. Acad. Colombia Cienc. 23: 292. 1999.  
≡ *Uredo phyllanthi* Hennings, Hedwigia 35: 248. 1896. TYPE on *Phyllanthus* sp. from **Brazil**, Rio de Janeiro: Corcovado, July 1887, *Ule-699*.

On Euphorbiaceae

*Phyllanthus grandifolius* Linnaeus, Rio Acre, Brazil (Sydow, 1916: 70, as *Phakopsora fenestrala*).

*Phyllanthus* sp., Minas Gerais (Joerstad, 1956: 486, as *Phakopsora fenestrala*).

*Phyllanthus* sp., Rio de Janeiro (Hennings, 1896: 248).

Espermogonio desconocido. Anamórfico hipófilo, en grupos ó dispersos, amarillento, inicialmente abierto por un poro, subepidermal; himenio subepidermal, plano; peridio hifoide; esporos sésiles, de incoloros a amarillentos, irregularmente piriformes, arrifionados, 26-33 x 16-20 µm; pared de incolora a amarillenta, 0.5-1 µm de gruesa, uniforme, con pequeñas y abundantes espinas; poros germinativos 2-3, ecuatoriales. Teliosoro hipófilo, dispersos, de carmelita a negruzco, costriforme, 3-7 capas de esporos, cubiertos por la epidermis; himenio subepidermal, plano, teliosporos irregularmente arreglados, amarillentos, ovoides, oblongos, cuboides, 16-25 x 10-12 µm; pared de incolora a amarillenta, 1-1.5 µm de gruesa, 1-4 µm engrosada en el ápice de los teliosporos del extremo superior (Buriticá, 1999).

See *Phakopsora tijucae* for comparison of species of *Phakopsora* on *Phyllanthus* in the Neotropics.

*Phakopsora vignae* (Bresadola) Arthur, see **PHAKOPSORA MEIBOMIAE** Arthur.

**PHAKOPSORA ZEAE** (Mains ) Buriticá, I. C. N. E. (Medellin ) 5(2): 183. 1994. (??≠ Hse/III).

≡ *Angiopsora zae* Mains, Mycologia 30: 42. 1938. TYPE on *Zea mays* Linnaeus from **Guatemala**, Alameda, 2 Nov 1936, *J. R. Johnston s.n.*

Anamorph

*Uredendo zae* (Cummins & Ramachar) Buriticá, Rev. I. C. N. E. (Medellín) 5: 183. 1994.  
 ≡ *Physopella zae* Cummins & Ramachar, Mycologia 50: 743. 1958. TYPE the same  
 specimen as for *Angiopsora zae* Mains, the teleomorph.

On Gramineae

*Zea mays* Linnaeus, São Paulo (IBI-15450).

*Phakopsora zae* has been reported mostly as *Physopella zae* from Venezuela, Central America, The West Indies, and some Southern United States of America. *Phakopsora zae* has been reported also on *Eucleana mexicana*, a very close relative of *Zea mays*. This rust has been given the common name of "tropical corn rust".

Espermogonio desconocido. Anamórfo anfigíneo, principalmente hipófilo, amarillo pálido, dispersos, abriendo la epidermis tempranamente, subepidermal; himenio subepidermal, plano; parafisos en el himenio pocos, libres, de cilíndricos a clavados, 16-30 x 8-14 µm; pared hialina, delgada, ocasionalmente 1-1.5 µm engrosada en el ápice; esporos sésiles, amarillo pálido, de obovoide a elipsoide, 24-30 x 15-20 µm; pared hialina, 1-2 µm de gruesa, uniforme, con abundantes y pequeñas espinas; poros germinativos imperceptibles, más ó menos 6-8 dispersos. Teliosoro anfigíneo, principalmente hipófilo, alrededor del anamórfo, de carmelita a negruzco, lenticular, de cupular a plano, crecimiento indeterminado, coalescentes, 1-3 capas de esporos, cubierto por la epidermis; himenio subepidermal, inicialmente cóncavo luego plano; teliosporos más ó menos uno debajo del otro, libres, elipsoides, 16-24 x 9-13 µm; pared amarillenta, 1.5-2 µm de gruesa, 2-4 µm engrosada en el ápice de los esporos superiores (Buriticá, 1999).

Closely related species of *Phakopsora zae* include *Phakopsora cumminsiana* and *Phakopsora pallescens*, both on *Tripsacum* spp.

Uredinia without paraphyses, urediniospores mostly more than 24 µm long (24-30 15-20 µm), teliospores mostly in 2(-3) layers and in vertical rows, the walls in distal layer 2.5-4(-6) µm thick, side walls 1.5-2 µm (Buriticá, 1999).

**PHAKOPSORA ZIZYPHI-VULGARIS** Dietel, Ann. Mycol. 8: 469. 1910. TYPE on *Zizyphus jujuba* Lamarck (Rhamnaceae) from **India**, Pusa, 8 Mar 1909, R. Sen s.n. (??,IIse/III).

Annamorph:

*Malupa zizyphi-vulgaris* (P. Hennings) Buriticá & Hennen, in Buriticá, Rev. Acad. Colombia Cienc. 23: 296. 1999.

≡ *Uredo zizyphi-vulgaris* P. Hennings, Hedwigia (Beiblatt) 41: 21. 1902. TYPE on *Zizyphus vulgaris* Lamark from **Japan**, Tosa: Nimura Aug 1901, *Yoshinaga-55*.

On Rhamnaceae

*Zizyphus* sp. (Rhamnaceae), São Paulo (Piracicaba, *Puttemans-1606*) & (Joazairo do Norte, ? State, *Puttemans-1605*).

*Phakopsora zizyphi-vulgaris* is widespread in Asia from Pakistan, India, China and Taiwan. It has also been reported in Florida in the United States of America and was probably introduced into Brazil along with its cultivated host.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves, scattered or in small groups, yellowish, subepidermal in origin, hymenium slightly concave, erumpent at first by a small pore, peridium well developed around lower peripheral half of sori, surmounted by shorter, incurved, thick-walled paraphyses-like cells, hymenial paraphyses 25-45 x 6-9 µm, cylindrical to clavate, free, wall uniformly thin or occasionally 1-3 µm thick at apex, colorless; urediniospores appear sessile, 18-24 x 14-18 µm, ellipsoid to ovoid, wall uniformly 0.5-1 µm, colorless, echinulae evenly numerous and small, germ pores obscure, probably 3, equatorial. Telia on the abaxial side of leaves around the uredinia, subepidermal in origin, cinnamon-brown, crust-like; teliospores in 1-4(-5) irregular rows or layers, teliospores 10-18 x 6-10 µm, ellipsoid to oblong, wall 1-1.5 µm thick, cinnamon-brown, upper spores 2-4 µm thick apically,

Buriticá (1999) reported traits of *Phakopsora zizyphi-vulgaris* that included anamorph sori with intrasoral paraphyses and a peripheral basal peridium surmounted with numerous incurved paraphyses-like, thick-walled cells.

*Phakopsora zizyphi-vulgaris* is very similar to *Phakopsora colubrinae* which infects *Colubrina* spp., Rhamnaceae, a native neotropical host genus. The uredinia of both rust species have similar intrasoral paraphyses and a peripheral basal peridium surmounted with numerous incurved short thick-walled, paraphyses-like cells.

**PHRAGMIDIELLA** P. Hennings,

Bot Jahrb. Syst. 38: 104. 1905. Type species *Phragmidiella markhamiae* Hennings on *Markhamia sansibarensis* Schumann, Bignoniaceae, from "Ost Usambara, East Africa", **Tanzania**, Jan 1903, *Zimmerman-180*. Phakopsoraceae.

= *Methamyces* Mundkur & Thirumalachar, Mycoologia 37: 620. 1945. Type species *Phakopsora stereospermi* Mundkur, Mycologia 35: 542. 1943 (see note below).

= *Jacksoniella* Kamat & Sathe, in Sathe, Indian Phytopath. 25: 78. 1972. Not Lindquist, 1971.

= *Thirumalacharella* Sathe, Indian Phytopath. 27: 617. 1974.

The species of *Phragmidiella* in the Neotropics are characterized by their minute telia that are subepidermal in origin, early erumpent, and composed of compact vertical rows of one-celled, thin walled, colorless probasidial cells (teliospores) that are laterally free but remain in short to long columns. Teliospore germ pores have not been detected. The spores at the tops of the columns germinate quickly without dormancy resulting in a mass of irregular, collapsed probasidial cells and intermixed metabasidia and basidiospores. Telia are collected infrequently and usually of little help for identifying species. The four species that occur in Brazil can be identified by the more frequently collected anamorph sori.

Spermogonia and aecia have not been recorded for any New World species. Aecial sori are reported to be subcuticular in origin. Uredinial sori are of the *Macabuna* type: subepidermal in origin, spores appear to be sessile, not produced on obvious pedicels but evenescent disjunct cells associated with the anamorph spores may be seen in some species, spore walls echinulate, and sori usually are surrounded by peripheral paraphyses. The paraphyses are few and hyphoid in a few species but septate, incurved, and thick-walled in others.

Buriticá (1999) included five species of *Phragmidella* from the New World. *P. aliena* (H. Sydow, P. Sydow & Butler) Buriticá & Hennen [= *Chrysomyxa aliena* H. Sydow, P. Sydow & Butler; = *Cerotelium alienum* (H. Sydow, P. Sydow & Butler) Arthtur] is an introduced species from India on cultivated *Spondias mombin* L. (Anacardiaceae) from Puerto Rico. Four others are on Bignoniaceae species from Brazil. Three of these species of *Phragmidiella* were placed in the genus *Cerotelium* previously. *Phragmidiella* cannot be separated from *Cerotelium* easily. The main difference is that the teliospores of *Phragmidiella* tend to remain in discrete vertical rows while those of *Cerotelium* tend to become disconnected from each other and are irregularly arranged in the sori.

In an unpublished survey, Buriticá included nine other species of *Phragmidiella* from tropical regions of Africa, India, Sri Lanka, and the Phillipines. Cummins and Hiratsuka (2003) followed Ramachar and Rao (1981) who considered *Metamyces* as a separate genus [type: *Metamyces stereospermi* (Mundkur) Mundkur & Thirumalachar (= *Phakopsora stereospermi* Mundkur) on *Steriospermum suaveolens* Wall., Bignoniaceae].

**Key to help identify species of *Phragmidiella* in the Neotropics based on anamorph sori**  
(modified from Buriticá, 1999).

- |   |                            |
|---|----------------------------|
| 1. Sori with no or few short, colorless, non-septate, peripheral paraphyses | <i>P. bignoniacearum</i> . |
| 1. Sori with abundant, long, yellowish, septate, peripheral paraphyses      | <b>2</b>                   |
| 2. Spore walls with short spines more or less uniformly distributed         | <b>3</b>                   |
| 2. Spore walls with spines mainly on the upper half of the spores           | <i>P. paulista</i> .       |
| 3. Spore walls thickened apically   | <i>P. holwayi</i> .        |
| 3. Spore walls uniformly thin   | <i>P. minuta</i> .         |

**PHRAGMIDIELLA BIGNONIACEARUM** (Dale) Buriticá & Hennen, Rev. Acad. Colomb. Cienc. 23: 425. 1999. (?!?, IIse/III).

= *Cerotelium bignoniacearum* Dale, Commonwealth Mycological Institute Papers 59: 3. 1955.

TYPE on *Cydista aequinoctialis* (Linnaeus) Miers from **Trinidad**, Dropouche, Nov 1949, R. E. D. Baker s.n.

Anamorph

*Macabuna daleae* Buriticá & Hennen, Rev. Acad. Colomb. Cienc. 23: 425. 1999. TYPE same as for the teleomorph name.

On Bignoniaceae

**Genus undetermined**, Pará (Sotão, IBI 97-415).

*Phragmidiella bignoniacearum* was reported previously only from Trinidad and Panama.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, mostly on the abaxial side, on discolored spots, scattered singly or in small groups, 0.1-0.5 mm across, roundish, pale brown; ruptured

epidermis noticeable, paraphyses 18-26 x 8-12 µm, few, peripheral, wall colorless, verrucose, hymenium flat, urediniospores 18-28 x 14-20 µm, globose to broadly ellipsoid, wall 1-1.5 µm thick, moderately echinulate, colorless to pale yellow, germ pores obscure. Telia on the abaxial side of leaves, subepidermal in origin, 130-450 µm across, pale brown, composed of vertical rows of 2-8 spores, rows slightly adherent laterally, teliospores (10-)16-18(-22) x 9-13(-15) µm, subcuboid, wall 1-1.5 µm thick, hyaline.

Paraphyses are not abundant and Dale did not report them in the original description.

**PHRAGMIDIELLA HOLWAYI** (H. S. Jackson) Buriticá in Buriticá & Pardo-Cardona, Rev. Acac. Colombiana Cienc. 20: 189. 1996. (??,IIse/III).

≡ *Cerotelium holwayi* H. S. Jackson, Mycologia 24: 86. 1932. TYPE on unidentified species of Bignoniaceae from **Brazil**, Rio de Janeiro: Jacareipagua, 16 Nov 1921, *Holway-1315*.

≡ *Jacksoniella holwayi* (H. S. Jackson) Kamat & Sathe, Indian Phytopath. 25: 78. 1972. Not Lindquist, 1971.

≡ *Thirumalachariella holwayi* (H. S. Jackson) Kamat & Sathe in Sathe, Indian Phytopath. 27: 617. 1974.

Anamorph

*Macabuna arrabideae* (Hennings) Buriticá & Hennen in Buriticá, Rev. Acad. Colomb. Cienc. 19: 60. 1994.

≡ *Uredo arrabideae* Hennings, Hedwigia 35: 250. 1896. TYPE on *Arrabidea subsericea* L. from **Brazil**, Rio de Janeiro, Sept 1887, *Ule-692*.

On Bignoniaceae

*Arrabidaea subsericea* Linnaeus, *Arrabidaea conjugata* Martius, Rio de Janeiro (Hennings, 1896: 250).

**Genus undetermined**, Rio de Janeiro (Jackson, 1932: 86), São Paulo (Jackson, 1932: 86).

*Phragmidiella holwayi* has been reported also from Colombia.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, scattered singly, numerous, 0.2-0.3 mm across, pale cinnamon-brown, subepidermal in origin, hymenium flat, erumpent, pulverulent, paraphyses numerous, peripheral, 35-60 x 6-15 µm, straight to mostly curved, apically sharply pointed, 2-4 septate, basally united, wall irregularly thickened to 6-8 µm, yellowish to pale cinnamon-brown; urediniospores 21-28 x 16-19 µm, obovoid, wall 1 µm thick, thickened above to 4 µm, abundantly and finely echinulate, germ pores obscure; telia like the uredinia but waxy, teliospores in vertical rows of 6-8 spores, each spore 15-18 x 12-15 µm, cuboid, wall uniformly thin, colorless, smooth, germination without dormancy.

Traits that help identify *Phragmidiella holwayi* include urediniospores with apically thickened walls, and paraphyses 35-60 x 6-15 µm, sharply pointed at the apex, 2-4 septate, and with walls thickened irregularly 6-8 µm.

**PHRAGMIDIELLA MINUTA** (Arthur) Buriticá & Hennen, Rev. Acad. Colomb. Cienc. 23: 427. 1999. (??,IIse/III).

≡ *Cerotelium minutum* Arthur, Bot. Gaz. (Crawfordsville) 73: 59. 1922. TYPE on *Arrabidea sieberi* DeCandolle from **Trinidad**, La Seiva Valley, 9 June 1921, *Thaxter-38*.

Anamorph

*Macabuna marnavea* Buriticá & Hennen, Rev. Acad. Colomb. Cienc. 23: 427. 1999. TYPE, same as for the teleomorph.

On Bignoniaceae

*Adenocalymna paulistarum* Bureau ex Schumann, Santa Catarina (Hennings, 1896: 249; IAN-538).

*Arrabidaea conjugata* Saint-Hilaire, Rio de Janeiro (*Ule-909*).

*Arrabidaea chica* Vahl, Pará (Albuquerque, 1971: 147; IAN-538).

*Arrabidaea subexerta* Bureau & Schumann, Bahia (IBI 79-138).

*Fredericia speciosa* Martius, Minas Gerais (IBI 76-633).

Spermogonia and aecia unknown. Uredinia on discolored spots on the abaxial side of leaves, scattered singly or in small groups, 0.1-0.2 mm across, roundish, subepidermal in origin, erumpent, hymenium flat and raised upwards, powdery, paraphyses peripheral, 36-42 x 8-10 µm, curved, septate, pointed at apex, wall thickened irregularly 3-4 µm on the back side, yellowish, urediniospores 18-26 x 13-16 µm, obovoid to globose, wall uniformly 1 µm thick, colorless to yellowish, sparingly, prominently, and

uniformly echinulate, germ pores 3-5, scattered. Telia on the abaxial side of leaves, 0.3-0.8 mm across, waxy, yellowish, teliospores 13-16 x 12-14  $\mu\text{m}$  cuboid to broadly ellipsoid, wall uniformly 1  $\mu\text{m}$  thick, pale cinnamon-brown, smooth, arranged in vertical rows 30-50  $\mu\text{m}$  long, including 3-5 teliospores.

In the type specimen, the unusually small sori are hidden in the dense pubescence. The paraphyses were not reported (Arthur, 1922: 59).

**PHRAGMIDIELLA PAULISTA** Buriticá & Hennen, Rev. Acad. Colomb. Cienc. 23: 425. 1999. TYPE on *Arrabidea chica* Vahl from **Brazil**, São Paulo: Mogi-Guaçu, Fazenda Sete Lagoas, 29 Sept 1977, J. F. Hennen & M. M. Hennen-77-124. (?!?,IIse/III).

Anamorph

*Macabuna adenocalymmatidis* (P. Hennings) Buriticá & Hennen, Rev. Acad. Colomb. Cienc. 23: 425. 1999.

$\equiv$  *Uredo adenocalymmatidis* P. Hennings Hedwigia 35: 249. 1896. TYPE on *Adenocalymna* sp. paulistanum Bureau ex Schumann from **Brazil**, Santa Catarina: Blumenau, April 1888, *Ule-90* from **Brazil**, Santa Catarina: Blumenau, April 1888, *Ule-902*.

On Bignoniaceae

*Adenocalymna* sp., Santa Catarina (Hennings, 1896: 249).

*Arrabidea chica* Vahl, São Paulo (Buriticá & Hennen, 1999: 426: IBI-13121).

*Phragmidiella paulista* has been reported also from Paraguay as *Uredo adenocalymmatidis* but the identification of that specimen requires confirmation, otherwise *Phragmidiella paulista* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia scattered singly on abaxial side of leaves, often with pale yellow-green leaf spots on adaxial side, subepidermal in origin, erumpent, hymenium flat; paraphyses numerous, peripheral, 23-34 x 6-8  $\mu\text{m}$ , curved, 1-septate, apically sharply pointed, wall to 2-4  $\mu\text{m}$  thick dorsally, smooth, yellowish; urediniospores 22-26 x 15-18  $\mu\text{m}$ , obovoid, wall uniformly ca 1  $\mu\text{m}$  thick, minutely and finely echinulate on the upper part of the spore, becoming smooth below, germ pores obscure, probably 4(-5) subequatorial. Telia scattered on the adaxial side of leaves, hemispheric, whitish, subepidermal in origin, teliospores in vertical rows of 5-7 spores, each spore 15-18 x 8-12  $\mu\text{m}$ , cuboid, wall less than 1  $\mu\text{m}$  thick, colorless, smooth, germination without dormancy.

Traits that help identify *Phragmidiella paulista* include its uredinia with short, apically sharply pointed, one-septate, peripheral paraphyses, and urediniospore walls that lack echinulations on their lower part toward the hilum.

#### PHRAGMIDIUM Link,

Mag. Ges. Naturf. Freunde Berlin 7: 30. 1816. TYPE SPECIES: *Phragmidium mucronatum* (Persoon) Schlechtendahl ( $\equiv$  *Puccinia mucronata* Persoon) on *Rosa* sp. from Europe.

Teliospores usually have three to seven probasidial cells arranged in rows, their walls deeply pigmented, and each cell has two or three germ pores. Teliospore pedicels are hygroscopic in many species and the lower part swells in liquid.

Cummins and Hiratsuka (1983) reported that about 60-65 species of *Phragmidium* are known but not all are distinctive. All are autoecious, mostly long cycle, and infect genera in the Rosaceae, mostly *Rosa* spp., *Rubus* spp. and a few on *Potentilla* spp. The genus occurs mostly in the Northern Hemisphere but one or two species have become widespread on cultivated roses, *Rosa* spp.

Although several species names of *Phragmidium* have been reported from Brazil on cultivated *Rosa* spp., probably only one or perhaps two species are involved. These two species are very similar with telia on the abaxial side of leaflets, blackish, pulverulent; teliospores 57-90 x 26-33  $\mu\text{m}$ , composed mostly of 6-7 cells, cylindrical to ellipsoid, with an apiculate apex, walls mostly 4-7  $\mu\text{m}$  thick, dark chestnut-brown, prominently coarsely verrucose, 3-4 pores in each cell, pedicel about as long as the spore and swollen in its lower third. Lindquist (1982) separated the two species as follows:

#### Key to help identify the two species of *Phragmidium* on *Rosa* in Brazil

1. Urediniospore walls minutely echinulate with pores only slightly visible.

*Phragmidium mucronatum.*

This is the most widespread and common species on cultivated roses.

1. Urediniospore walls minutely echinulate with pores scattered, 6-8, easily visible because of the interior hemisphere shapes associated with the pores.

*Phragmidium tuberculatum.*

**PHRAGMIDIUM MUCRONATUM** (Persoon) Schlechtendahl, Fl. Berol. 2: 156. 1824. (0/Icv,IIpe/III).

= *Phragmidium disciflorum* (Tode) James, Contr. U.S. Nat. Herb. 3: 276. 1895.

= *Phragmidium rosae-pimpinellifoliae* Dietel, Hedwigia 44: 339. 1905.

= *Phragmidium subcorticium* (Shrank) Winter in DeToni & Saccardo, Syll. Fung. 7: 746.

On Rosaceae

*Rosa* sp., Espírito Santo (IBI-2838), Minas Gerais (Thurston, 1940: 294; IBI-3654; IBI-2011), Paraná (Fontoura & Nowacki, 1967/70: 167), Pernambuco (Pickel, 1936: 212), Rio de Janeiro (Puttemans, 1934: 4), Rio Grande do Sul (Lindquist & Costa-Neto, 1963: 124; IAN-710), Santa Catarina (Pazschke, 1892: 95; Hennings, 1896: 245), São Paulo (Spegazzini, 1889: 102; Hennings, 1896: 245; Puttemans-42; Viégas, 1945: 11; IAC-278; IBI-241. -641; -934).

*Phragmidium mucronatum* is widespread on cultivated roses. It has been reported from Brazil also by the synonyms listed above.

Infected plants show yellowish leaf spots on the upper leaf surface but the rust sori occur on the lower leaf surface. The uredinia are usually bright orange yellow but after teliospores form small blackish sori occur. Spermogonia and aecia have not been reported from South America and teliospores are rarely observed in Brazil. Newer varieties of roses cultivated in Brazil are genetically resistant

**PHRAGMIDIUM TUBERCULATUM** J. Mueller, Ber. Deutsch. Bot. 3: 391. 1885. (0/Icv,IIpe/III).

*Phragmidium tuberculatum* has not been reported from Brazil but has been from near by Uruguay. Perhaps it is to be expected.

*Phragmidium disciflorum* (Tode) James, see **PHRAGMIDIUM MUCRONATUM** (Persoon) Schlechtendahl.

*Phragmidium rosae-pimpinellifoliae* Dietel, see **PHRAGMIDIUM MUCRONATUM** (Persoon) Schlechtendahl.

*Phragmidium subcorticium* (Shrank) Winter **PHRAGMIDIUM MUCRONATUM** (Persoon) Schlechtendahl.

**PHYSOPELLA** Arthur (anamorph),

Rés. Sci. Congr. Internat. Bot. Vienna. p. 338. 1906. TYPE SPECIES: *Physopella vitis* (Thuemen) Arthur (≡ *Uredo vitis* Thuemen). TYPE on *Vitis* sp. the **United States of America**, South Carolina: Aiken, 1868, H. W. Ravenel.

Sori surrounded by numerous imbricated, incurved paraphyses that arise from an irregular hyphoid base. The hyphoid base does not extend upwards a short distance to surround the basal part of the sorus as in the anamorph *Malupa*. In mature sori spores appear sessile, spore walls echinulate, germ pores usually obscure, and sporogenous cells are with a distal collar.

Cummins and Hiratsuka (2003) placed *Physopella* as a teleomorph genus and as a synonym of *Phakopsora*. Formerly, they (1983) considered *Physopella* as a teleomorph genus and segregated from *Phakopsora* because many of its species, especially those on grasses, have their teliospores arranged one on top of the other to form regular vertical rows, while in *Phakopsora* the spores are irregularly arranged. But a number of species in this complex have telia that are intermediate between these two arrangements. This, and the similarity of their anamorphs, are the reasons for combining the two genera.

However, Ono, Buriticá & Hennen (1992) argued that *Physopella* must now be considered as an anamorph genus name because the type specimen of the type species designated by Arthur is composed only of anamorph (it lacks telia). Arthur explicitly cited an anamorph species, *Uredo vitis* Thuemen (≡

*Physopella vitis* (Thuemen) Arthur), as the type species. The isotype specimen of *Uredo vitis* in PUR that Arthur had available to him had no telia.

#### Nomenclature of *Physopella*

Article 59.2 of the ICBN states that the type specimen of a species name must be teleomorphic in order for the name to qualify as a holomorph name, i.e. a teleomorph must be present and described from the type. Article 59.3 states that if the type specimen is not teleomorphic the name **must** be considered as an anamorph. The presence or absence of a teleomorph in the type specimen of the name and was described determines whether the name is teleomorphic or anamorphic. Ono (2000) reported that *Physopella vitis* (Thuemen) Arthur ( $\equiv$  *Uredo vitis* Thuemen) is an uredinial anamorph of *Phakopsora euvtis* Ono on *Vitis* spp. in East Asia and the United States of America.

Other authors (Peterson, 2001; Hiratsuka, 2001) argue that the explicit citation of the type species by Arthur as *Uredo vitis* Thuemen **must** (?or may?) be taken as a "formal error" (ICBN Article 59.6) because Arthur intended for the genus to be what we now refer to as a teleomorph genus. Arthur did describe telia even though he did not report the source of the data about the telia. Peterson, Cummins and Hiratsuka believe that the type specimen must be the one that Arthur used to describe telia, not the one that he cited as the type. Cummins and Ramachar (1958) concluded that Arthur's description of telia came from a specimen in PUR labeled "Sydow, Uredineen No. 1327", identified as *Phakopsora vitis* P. Sydow, and presumably an isotype specimen of *Phakopsora vitis* P. Sydow. Cummins and Ramachar state that this was the only telial material available to Arthur at that time. Following this reasoning, then, the name of the type **species** of *Physopella* as a teleomorph genus becomes *Physopella vitis* (P. Sydow) Arthur ( $\equiv$  *Phakopsora vitis* P. Sydow), without any reference to Thuemen's name *Uredo vitis*. The type **specimen** of *Physopella vitis* (P. Sydow) Arthur is that specimen in PUR labeled "Sydow, Uredineen No. 1327", identified as *Phakopsora vitis* P. Sydow. Because that specimen is also an isotype of *Phakopsora vitis* P. Sydow, the result of this is that *Phakopsora vitis* P. Sydow becomes a nomenclatural synonym of (it is the basionym of) *Physopella vitis* (P. Sydow) Arthur. If *Physopella* is placed as a synonym of *Phakopsora*, then *Physopella vitis* (P. Sydow) Arthur becomes a synonym of *Phakopsora vitis* P. Sydow.

The question to be resolved is which Article in the ICBN is to be followed?: Article 59.2 or 59.6? That is, whether the type species of *Physopella* that was **SPECIFICALLY** declared by Arthur, *Physopella vitis* (P. Sydow) Arthur ( $\equiv$  *Uredo vitis* Thuemen), **MUST** be followed, or that designation of a type species by Arthur **MAY** (?must?) be designated as a "formal error" and *Physopella vitis* (P. Sydow) Arthur ( $\equiv$  *Phakopsora vitis* Sydow) becomes the type species.

If *Physopella* is considered to be teleomorphic, then most current authors agree that it should be placed as a taxonomic synonym of *Phakopsora*. However, Ono et al. (1992), Buriticá and Hennen (1994), Buriticá (1999), and others have already concluded that it is an anamorph genus and have published more than fifteen anamorph species of *Physopella* that have specific morphological traits that characterize the anamorph genus. If the final conclusion is that *Physopella* is a teleomorph genus, then a new anamorph genus needs to be proposed to accommodate these species.

#### *Physopella* in Brazil

In the following list, accepted species names of *Physopella* that are anamorphs are in **bold italic**. *Physopella* names that are synonyms of other anamorph genera are in *italic*. Names of teleomorphs are in **BOLD CAPS**.

*Physopella aeschynomensis* (Arthur) Arthur, see ***Malupa vignae*** (Bresadola) Ono, Buriticá & Hennen [PHAKOPSORA MEIBOMIAE (Arthur) Arthur].

*Physopella apoda* Buriticá & Hennen, see **PHAKOPSORA APODA** (Hariot & Patouillard) Mains.

*Physopella cameliae* (Mayor) Cummins & Ramachar, see **PHAKOPSORA CAMELIAE** (Arthur) Buriticá & Hennen.

*Physopella cerotelioides* (H. S. Jackson & Holway) Buriticá & Hennen, see **PHAKOPSORA ARRABIDAEAE** Buriticá & Hennen.

*Physopella cherimoliae* (Lagerheim) Arthur, see **PHAKOPSORA NEOCHERIMOLIAE** Buriticá & Hennen.

- Physopella coccolobae* (Hennings) Buriticá & Hennen, see **CEROTELIUM COCCOLOBAE** Buriticá & Hennen.
- Physopella compressa* (Arthur & Holway) Cummins & Ramachar, see *Physopella paspalicola* (Hennings) Buriticá & Hennen [**PHAKOPSORA COMPRESSA** (Arthur & Holway) Buriticá & Hennen].
- Physopella concors* Arthur, see *Malupa vignae* (Bresadola) Ono, Buriticá & Hennen (**PHAKOPSORA MEIBOMIAE** (Arthur) Arthur).
- Physopella fici* (Castagne) Arthur, see *Malupa fici* (Castagne) Buriticá (**PHAKOPSORA NISHIDANA** Ito).
- Physopella ficicola* (Spegazzini) Buriticá & Hennen, see **CEROTELIUM FICICOLA** Buriticá & Hennen.
- Physopella ficina* (Juel) Arthur, see *Physopella ficicola* (Spegazzini) Buriticá & Hennen (**CEROTELIUM FICICOLA** Buriticá & Hennen).
- Physopella guettardae* Buriticá & Hennen, see **UREDOPELTIS GUETTARDAE** Buriticá & Hennen.
- Physopella ignava* (Arthur) Buriticá, see *Physopella inflexa* (Ito) Buriticá & Hennen [**KWEILINGIA DIVINA** (H. Sydow) Mundkur & Kheswala].
- Physopella inflexa* (Ito) Buriticá & Hennen, see **DASTURELLA DIVINA** (H. Sydow) Mundkur & Kheswala.
- Physopella jaranae* (Albuquerque) Buriticá & Hennen, see **CEROTELIUM NUXAE** Buriticá & Hennen.
- Physopella jueli* (P. Sydow & H. Sydow) Buriticá & Hennen, see **PHAKOPSORA ROSSMANIAE** J. Dianese et al.
- Physopella meibomiae* Arthur (teleomorph described), see **PHAKOPSORA MEIBOMIAE** (Arthur) Arthur.
- Physopella melaena* Cummins & Ramachar, see **PHAKOPSORA MELAENA** H. Sydow.
- Physopella paspalicola* (Hennings) Buriticá & Hennen, see **PHAKOPSORA COMPRESSA** (Arthur & Holway) Buriticá & Hennen.
- Physopella phakopsoroides* Cummins & Ramachar, see **PHAKOPSORA PHAKOPSOROIDES** (Arthur & Mains) Buriticá & Hennen.
- Physopella rectangulata* (Albuquerque) Buriticá & Hennen, see **CEROTELIUM RECTANGULATA** Buriticá & Hennen
- Physopella sabiceicola* (Arthur) Buriticá & Hennen, see **CEROTELIUM SABICEAE** Buriticá & Hennen.
- Physopella tecta* (H. S. Jackson & Holway) Azbukina, see **PHAKOPSORA TECTA** H. S. Jackson & Holway.
- Physopella tocoyanae* Buriticá & Hennen, see **PHAKOPSORA TOCOYENAE** Buriticá & Hennen.



*Physopella zae* (Mains) Cummins & Ramachar, see *Uredendo zae* (Cummins & Ramachar) Buriticá [PHAKOPSORA ZEAЕ (Mains) Buriticá].

*Pleoravenelia* Long, 1903,

Bot Gaz. 37: 127. 24 Feb. 1903. LECTOTYPE: to be chosen.

*Pleoravenelia* is no longer used as a genus. Long defined the genus as having the inner part of the teliospores with two layers of probasidial cells ("inner teliospores in a head two-celled") and if aecia present with the morphology of the anamorph genus *Aecidium*.

*Pleoravenelia hieronymi* (Spegazzini) Long, see **RAVENELIA HIERONYMI** Spegazzini.

*Pleoravenelia indigoferae* (Tranzschel) Long, see **RAVENELIA INDIGOFERAE** Tranzschel.

*Poliotetium* H. Sydow,

Ann. Mycol. 20: 124. 1922. TYPE species *Poliotetium iresines* (Lagerheim) H. Sydow ( $\equiv$  *Uromyces iresines* Lagerheim in P. Sydow & H. Sydow, Monogr. Ured. 3: 227. 1910) on *Iresine* sp., Amaranthaceae, from Ecuador.

The genus *Poliotetium* is no longer used. *Uromyces iresines* is probably macrocyclic with both aecia and uredinia having the morphology of the anamorph genus *Aecidium*.

Using the morphological basis for defining life cycle stages and teliospore traits, H. Sydow defined the genus *Poliotetium* as having in its life cycle only spermogonia, aecia, and telia with the teliospores one-celled, the wall thin, colorless or only pale, with one distinct germ pore, and with the probasidium germinating with little or no dormancy giving rise to the metabasidium. Cummins and Hiratsuka (1983), using the ontological basis for defining life cycles, place *Poliotetium* as a synonym of *Uromyces*

*Poliotetium dolichosporum* (Dietel & Holway) Mains, see **UROMYCES DOLICHOSPORUS** Dietel & Holway.

**POROTENUS** Viégas,

Bragantia 19: XCVIII (98), 1960. TYPE SPECIES *Porotenus concavus* Viégas. See Hennen, J. F. and H. M. P. Sotão (1996).

Spermogonia type 5 or 7. Aecia subepidermal in origin, erumpent, spores borne singly on pedicels, usually radially asymmetrical, echinulate, pores equatorial or basal, usually on the incurved side. Uredinia subepidermal in origin, erumpent; spores as the aeciospores. Telia subepidermal in origin, erumpent; spores 2- or more-celled by horizontal septa, borne singly on pedicels, each cell germinating by elongation of the apex, with or without a differentiated pore in the wall (Cummins and Y. Hiratsuka (1983).

The type species, *Porotenus concavus*, occurs in Brazil on *Memora* (Bignoniaceae), attacks leaf blades and stems, often causing hypertrophy and distortion. *P. concavus* is scarcely separable from *Sorataea* on Leguminosae.

*Porotenus* has characters in common also with *Prospodium*, where three species were placed by Cummins, but the teliospores were misfits there... Three species, previously assigned first to *Puccinia* and then to *Prospodium* were transferred *Porotenus*: *P. elatipes* (Arth. & Holw.) Cummins and Y. Hiratsuka. (*Puccinia elatipes* Arth. & Holw.), and *P. permagnum* (Arth. & Holw.) Cummins and Y. Hiratsuka. (*Puccinia permagna* Arthur & Holway), and *P. depallens* (Arth. & Holw.) Cummins and Y. Hiratsuka. (*Puccinia depallens* Arth. & Holw.). Two of the species are macrocyclic and two are microcyclic. The present association may or may not be an improvement

The four species of *Porotenus* so far known to parasitize *Memora* have telial traits similar. Telia are scattered on the abaxial side of the leaflets, subepidermal in origin, erumpent, pulvinate, 0.1-0.5mm across, and cinnamon-brown but become whitish as the spores germinate in situ. The spores are mostly two-celled, oblong-ellipsoid to cylindrical but often narrowed above, rounded below, somewhat constricted at the septa, and pedicellate; the walls are uniformly 1.0-1.5  $\mu$ m thick, pale cinnamon-brown to nearly colorless, and smooth. Each probasidial cell has one germ pore at its distal end through which a metabasidium emerges on

germination. Germination occurs without any noticeable dormancy period. Except for some overlapping spore size differences, telial traits are not useful for identifying species of *Porotenus* on *Memora*.

Variations in anamorph traits are more useful than telia traits for characterizing these species of *Porotenus*. Sori are considered as aecial if they closely encircle small patches of spermogonia and develop from the same mycelium. In general, spermogonia and aecia are encountered much less frequently than uredinia. Uredinia are randomly scattered singly or in small irregular groups over the abaxial side of leaflets. They are not directly connected to spermogonia. Both aecia and uredinia are subepidermal in origin, become erumpent, with the broken epidermis usually remaining as a partial covering over the sorus. The sori are 0.1-0.5mm across and somewhat powdery. The many loose spores produced in the sorus are chestnut-brown in mass. Each spore breaks off of its pedicel, leaving a definite scar termed a hilum at the proximal end of the spore. Anamorph spores are bilaterally symmetrical or radially asymmetrical, usually with a convex and a concave side.

Using anamorph spores, the following key can help identified the four species of *Porotenus* and one *Uredo*, that we expect will prove to be a *Porotenus* species, all on *Memora* and all from Brazil and French Guiana.

#### Key to help identify *Porotenus* and *Uredo* on *Memora*, Bignoniaceae

- |   |  |
|---|--|
| 1. Pores near the hilum   | 2                                      |
| 1. Pores on the sides of the spores, more or less equatorial  | 3                                      |
| 2. Each spore with one pore on its convex echinulate side, the concave side with a smooth patch                             | <b>P. memorae</b> Albuquerque          |
| 2. Each spore with two pores, both the convex and concave sides with a smooth patch   | <b>P. bibasiporus</b> Hennen & Sotão   |
| 3. Spore walls more or less evenly strongly echinulate without smooth patches   | <b>Uredo amapaensis</b> Hennen & Sotão |
| 3. Spore walls with one or two smooth patches   | 4                                      |
| 4. Wall with one smooth patch on the concave side, pores near the edge of the smooth patch                                  | <b>P. concavus</b> Viégas              |
| 4. Wall with two smooth patches, one on the concave side, one on the convex side, pores in the echinulate area of the spore | <b>P. biporus</b> Hennen & Sotão       |

**POROTENUS BIBASIPORULUS** Hennen & Sotão, Sida 17: 177. 1996. TYPE on *Memora nodosa* (Manso) Miers, from Brazil, Goiás: between Rialma and Rianopolis, 15 July 1979, *M. M. Hennen & J. F. Hennen-79-182. (?/?,II/III)*.

On Bignoniaceae

*Memora nodosa* (Manso) Miers, Federal District, Goiás, Minas Gerais (Hennen & Sotão, 1996: 179).

*Porotenus bibasiporus* has been reported only from Brazil.

Spermogonia and aecia on both sides of leaves in small, blackened, hypertrophied areas to more or less 5mm diam; aeciospores similar to urediniospores but averaging 30-35 µm long. Uredinia on the abaxial side of leaves, scattered, dark brown, urediniospores (31-)34-43(-48) x (14-)18-24(-25) µm, mostly ellipsoid and 22-24 µm wide with pores in the optical axis, strongly uniform and (14-)17-20 µm wide with pores lateral, thus conspicuously radially asymmetrical, wall uniformly 1.5 µm thick, chestnut-brown, echinulate except smooth in the pore areas, pores 2, near the hilum. Telia on the abaxial side of leaves, scattered, cinnamon-brown, felty-pulvinate, spores 2 celled (rarely 3-celled), (40-)45-55(-66) x (15-)18-23 µm, mostly nearly cylindrical except constricted at septa, wall uniformly 1-1.5 µm thick, smooth, pale golden to nearly colorless, pore apical in each cell, pedicel colorless, thin-walled, to 50 µm.

*Uredo huallagensis* P. Hennings (Hedwigia 43:161. 1904), on *Memora* sp., Tarapoto, PERU, *Ule s n.*, 1902 (in *Ule's exsiccata, Mycotheca brasiliensis*, n. 23) also has 2 basal pores but perhaps is not synonymous, the pigmentation being much paler and the radially asymmetry much less pronounced.

**POROTENUS BIPORUS** Hennen & Sotão, Sida 17: 175. 1996. TYPE on *Memora flavida* (A.

DeCandolle) Bureau & K. Schumann from **Brazil**, Pará, near Belém at Mocambo Forest Preserve, 9 July 1979, *J. F. Hennen & M. M. Hennen-79-153. (?/?,II/III)*.

On Bignoniaceae

*Memora* spp., Amapá, Federal District, Maranhão, Minas Gerais, Pará, (Hennen & Sotão, 1996:

177).

*Porotenus biporus* has been reported only from Brazil.

Spermogonia and aecia on both sides of leaves in small blackened hypertrophied areas to more than 5 mm diam; these may finally fall from the leaf. Aecia arranged around the spermogonia, aeciospores similar to the urediniospores. Uredinia on the abaxial side of leaves, scattered, dark brown, urediniospores (31-)34-43(-48) x (14-)18-24(-25)  $\mu\text{m}$ , mostly ellipsoid and 22-24  $\mu\text{m}$  wide with pores in the optical axis, strongly uniform and (14-)17-20  $\mu\text{m}$  wide with pores lateral, thus conspicuously radially asymmetrical, reniform with pores in the optical axis, wall uniformly 1.5-2  $\mu\text{m}$  thick, dark cinnamon-to light chestnut-brown, echinulate except on part of the concave side near the pores, pores 2, equatorial. Telia on the abaxial side of leaves, brownish, pulvinate, teliospores (36-)40-49 x 17-22  $\mu\text{m}$ , oblong-ellipsoid or more or less cylindrical, wall 1-1.5  $\mu\text{m}$  thick, pale brownish to essentially colorless, smooth, pore apical in each cell, pedicel thin-walled, colorless, usually broken short, spores germinate without dormancy.

**POROTENUS CONCAVUS** Viégas, *Bragantia* 19:XCIX. 1960. TYPE on *Memora glaberrima* (Chamisso) K. Schumann from **Brazil**, Minas Gerais: São João del Rey, 27 Sept 1948, *P. Heringer s.n.* (?!?,II/III).

On Bignoniaceae

*Memora flavidula* (DeCandolle) Bureau & K. Schumann, Pará (Albuquerque, 1971: 148; IAN-755).

*Memora glaberrima* (Chamisso) K. Schumann, Minas Gerais (Viégas, 1960:XCIX).

*Porotenus concavus* has been reported only from the type.

Spermogonia and aecia unknown (or not recognized). Uredinia on both sides of leaves closely grouped on distorted parts of the plant, appearing to be locally systemic, cinnamon-brown, pulverulent, without paraphyses, urediniospores asymmetrical, (25-)28-35(-40) x (22-)24-26(-28)  $\mu\text{m}$  with pores in the optical section, ellipsoid, (18-)20-22  $\mu\text{m}$  wide with pores in the optical axis, reniform, wall (1.5-)2-2.5  $\mu\text{m}$  thick, cinnamon-brown or the concave side paler basally, echinulate except the concave side, pores 2, equatorial or slightly below. Telia mostly on the abaxial side of leaves, pale brown, pulvinate, spores variable in length, (48-)53-75(-82) x (14)15-18(-21)  $\mu\text{m}$ , mostly cylindrical, wall 0.5-1  $\mu\text{m}$  thick, smooth, tinted brownish to essentially colorless, each cell germinating apically through a large pore or clearly differentiated area, pedicel slender, colorless, to at least 75  $\mu\text{m}$  long but may be broken shorter.

It is possible that what are described as uredinia may be aecia but spermogonia, if present, are masked by the profuse sporulation.

**POROTENUS MEMORAE** F. Albuquerque, *Pesq. Agrope. Bras. Ser. Agron.* 6: 139. 1971. TYPE on *Memora consanguinea* Bureau & K. Schumann from **Brazil**, Pará: Belém, 12 Aug 1963, *F. Albuquerque s.n.* (?!?,II/III).

On Bignoniaceae

*Memora allamandiflora* Bureau ex Bureau & K. Schumann, Amazonas (PUR-F18821).

*Memora axillaris* Bureau & K. Schumann, Minas Gerais (PUR-F18820).

*Memora consanguinea* Bureau & K. Schumann, Pará (Albuquerque, 1971: 148; IAN-621).

*Memora peregrina* (Miers) Sandwith, São Paulo (IBI-13816).

*Porotenus memorae* has been reported also from French Guiana.

Spermogonia mostly on the adaxial side of leaves in discolored and sometimes slightly hypertrophied areas. Aecia on both sides of leaves around the spermogonia, brown, aeciospores (30-)35-45(-52) x (12-)17-21(-23)  $\mu\text{m}$ , pedicellate, asymmetrical (variably so), mostly ellipsoid in one view, reniform (often strongly curved) in the other view, wall 1.5-2  $\mu\text{m}$  thick, near chestnut-brown, echinulate except the concave side, pore 1 near the hilum. Uredinia scattered, otherwise and the urediniospores similar to the aecia. Telia on the abaxial side of leaves, pale brownish, teliospores (33-)40-50(-55) x 18-22  $\mu\text{m}$ , oblong-ellipsoid or more or less cylindrical, wall 1.5  $\mu\text{m}$  thick, slightly thicker at the pores, smooth, nearly colorless, pore apical in each cell; germination occurs without dormancy.

#### **PROSPIDIUM** Arthur,

*J. Mycol.* 13: 31. 1907. TYPE SPECIES: *Prospodium appendiculatum* (Winter) Arthur ( $\equiv$  *Puccinia appendiculata* Winter, see below). Uropyxidaceae.

Spermogonia subcuticular in origin, type 7. Aecia subepidermal in origin, erumpent, aeciospores borne singly on pedicels, mostly echinulate. Uredinia subepidermal in origin, erumpent in some species or substomatal in origin then emerging through stomata to sporulate above the leaf surface, i.e. suprastomatal, usually with peripheral paraphyses, the suprastomatal species basket-like with sporogenous cells at the bottom and paraphyses on the rim; urediniospores borne singly on pedicels, mostly echinulate, some radially asymmetrical, the wall simple or with an outer pale, hygroscopic layer, pores 2, equatorial. Telia as the uredinia of the species; or if microcyclic always subepidermal in origin, erumpent and associated with spermogonia, spores 2-celled by horizontal septum, borne singly on pedicels which often are appendaged basally, spore wall usually pigmented, often obviously bilaminar and usually echinulate or verrucose, or in a few species pale or colorless and smooth, germ pore 1 in each cell, metabasidium external.

Because all of the nearly 70 species of *Prospodium* are native to the Americas and more than half of the species occur in Brazil, we include a key and other information about all of the species.

Much of the data given here for *Prospodium* comes from an unpublished monograph of the Uropyxicadeae by Hennen and Cummins.

The classic monograph by Cummins (1940) is the starting point for all taxonomic research on *Prospodium*. All of the *Prospodium* species are autoecious, most are long cycled, some are microcyclic, and all are native to the Americas. About 60 species infect hosts in the Bignoniaceae and eight species infect Verbenaceae. At least three species reported from Africa, and one from India have been misplaced in *Prospodium*.

In *Prospodium* aecia are never suprastomatal although the uredinia of the same species may be. Telia of microcyclic species are always subepidermal in origin and erumpent as the aecia of the putative parental species, which may produce suprastomatal telia.

Three informal groups of species were recognized by Cummins (1940) based on soral traits and kind of life cycle:

1) Euprospodium - the aecia, uredinia and telia are subepidermal in origin and erumpent, a group of about 30 species;

2) Cyathopsora - the aecia are subepidermal in origin and erumpent, but the uredinia and telia are suprastomatal, a group of about 15 species characterized by a sorus that develops as a minute basket-like or disk-like structure from hyphae that emerge through stomata (suprastomatal). The structure of these suprastomatal sori provides the basis for the anamorph genus *Canasta* Hennen et al.

3) Nephlyctis - microcyclic, only spermogonia and telia are produced, a group of about 15 species. Despite such apparently divergent morphology as subepidermal versus suprastomatal sori the species obviously are closely related.

Three groups of urediniospores have been identified based on structural traits of the walls:

1. walls not two-layered,

2. walls two layered, the outer layer with a circular row of spines or minute rods oriented from pole to pole, these spores termed unicapitate because the ring at the apex of the spore appears as a little cap when a spore is oriented with the ring in the optical axis, and

3. wall two layered the outer layer similar to number 2 but the ring divided at the apex of the spore to form a crown-like sculpture. This trait is referred to as bicapitate in the older literature because the crown appears as two caps when a spore is oriented with the ring in the optical axis. The aecia are never suprastomatal although the uredinia of the same species may be.

About half of the species are characterized by teliospores with pedicels that have appendages that presumably function to help disperse the spores by attaching to minute arthropods.

Four species of *Prospodium* have teliospores with smooth walls: *P. aequinoctialis* on *Cydista* from West Indies; *P. cumminsii* on *Amphilophium* from Venezuela; *P. gentryi* on *Parmentiera* from Central America, and Florida; *P. laevigatum* on *Mansoa* from Brazil; and *P. venezuelanum* on ? *Tabebuia* from Venezuela.

**Number of species of *Prospodium* on different host genera of Bignoniaceae in the Americas and Brazil**

Genus	Americas	Brazil	Genus	Americas	Brazil
1. <i>Amphilophium</i>	5	1	11. <i>Parmentiera</i>	1	0
2. <i>Anemopaegma</i>	4	2	12. <i>Pithecoctenium</i>	6	2
3. <i>Arrabidaea</i>	3	1	13. <i>Pleonotoma</i>	3	1
4. <i>Clytostoma</i>	2	2	14. <i>Pyrostegia</i>	2	1
5. <i>Couralia</i>	1	0	15. <i>Sparattosperma</i>	1	0
6. <i>Cremastus</i>	1	1	16. <i>Stizophyllum</i>	2	1
7. <i>Cydistia</i>	2	0	17. <i>Tabebuia</i>	9	5
8. <i>Lundia</i>	2	2	18. <i>Tecoma</i>	7	2
9. <i>Mansoa</i>	4	1	19. <i>Tynanthus</i>	1	0
10. <i>Memora</i>	2	0	20. Undetn.	4	5
			21. <i>Cuspidaria</i>		1
			22. <i>Bignonia</i>		1

**Number of species of *Prospodium* on different genera of Verbenaceae in the Americas**

Genus	Americas	Brazil
1. <i>Alloysia</i> ( <i>Lippia</i> )	6	4
2. <i>Lantana</i>	1	1

**HOST GENUS/PROSPODIUM SPECIES INDEX OF SPECIES REPORTED FROM BRAZIL**

Each species name is followed by its author(s), host genus, host family, and abbreviations indicating supposed life cycles, some morphological traits, and if known only from the type, or if known only from Brazil.

**EXPLANATION OF ABBREVIATIONS:**

- Ontogenic life cycle stages** are in parentheses ( ): **0/** = spermogonia; **/I,** = aecia; **,II/** = uredinia; **/III** = telia; **-/ OR /-** = stage not produced; **?/** = stage unknown but probably produced. All stages for a species that are known may not all be known from Brazil.
- Morphology:** Anamorph spores: **c** = catenulate, **p** = pedicellate, **e** = echinulate, **re** = reticulate, **v** = verucose, **s** = sessile.
- KOFT** = known only from the type (names). **KOFB** = known only from Brazil (names). **3C** = known from three cerrados in Sao Paulo (names).

**BIGNONIACEAE*****Amphilophium***

PROSPODIUM PITHECOCTENII (Pazschke) Cummins, also on *Pithecoctenium* (**0/Ipe,IIpe/III**).

***Anemopaegma***

PROSPODIUM ANEMOPAEGMATIS (P. Hennings) Cummins (**0/I,?/III**). **Euprospodium, unicapitate.**

PROSPODIUM EVERNIUM H. Sydow (**?/?,II/III**) **Cyathopsora, unicapitate. KOFT**

***Arrabidaea***

PROSPODIUM ARRABIDAEAE H. S. Jackson & Holway (**0/-,-/III**) **Nephlyctis.**

***Bignonia* (? *Macfadyena*)**

PROSPODIUM BIGNONIACEARUM (Spegazzini) Cummins (**?/?,II/III**) **Cyathopsora, subcoronate.**

***Clytostoma***

PROSPODIUM BIGNONIACEARUM (Spegazzini) Cummins also on *Bignonia* (**?/?,II/III**)

**Cyathopsora, subcoronate.**

PROSPODIUM SINGERI Petrak (**0/Ipe,?IIpe/III**) **Euprospodium.**

***Cremastus***

PROSPODIUM CREMASTUM H. S. Jackson & Holway (**0/-,-/III**) **Nephlyctis. KOFT**

***Cuspidaria***

*Prospodium festivum* H. Sydow only an anamorph

***Lundia***

PROSPODIUM CYATHIFORME Cummins (**0/I,II/III**) **Cyathiform, Unicapitate.**

PROSPODIUM LUNDIAE H. S. Jackson & Holway (**0/-,-/III**). **KOFT**

***Mansoa***

PROSPODIUM LAEVIGATUM Hennen & Sotão (**0/I,?/III**) **Cyathopsora. KOFT**

*Pithecoctenium*

PROSPODIUM HOLWAYI H. S. Jackson (??,II/III) **Euprospodium, coronate.**

PROSPODIUM PITHECOCTENII (Pazschke) Cummins (0/Ipe,IIpe/III).

*Pleonotoma*

PROSPODIUM ANOMALUM H. S. Jackson & Holway (??,II/III) **Euprospodium, coronate. 3C**

*Pyrostegia*

PROSPODIUM IMPOLITUM H. S. Jackson & Holway (0/Ipe,IIpe/III) **Cyathopsora. KOFB**

*Stizophyllum*

PROSPODIUM STIZOPHYLLI H. S. Jackson & Holway (O/-,-/III) **Nephlyctis. KOFB, 3C**

*Tabebuia*

*Canasta tabebuiae* (Kern) Sotão & Hennen

PROSPODIUM BICOLOR F. A. Ferreira and J. Hennen (0/I,II/III) **Cyathopsora, unicapitate.**

PROSPODIUM PALMATUM H. S. Jackson & Holway on *Tecoma* (??,II/III). **KOFB**

PROSPODIUM TABEBUIICOLA Hennen & Cummins, sp nov. var. **TABEBUIICOLA (??,II/III)**

**Cyathoform, coronate.**

PROSPODIUM TABEBUIICOLA Hennen & Cummins, sp nov. var. **MELGACENSIS** Sotão & Hennen var. nov. on *Tabebuia*, (??,II/III) **Cyathoform, coronate.**

PROSPODIUM TECOMICOLA (Spegazzini) H. S. Jackson & Holway (0/Ipe,IIpe/III) **Cyathiform, unicap (0/I,II/III). 3C**

*Tecoma*

PROSPODIUM APPENDICULATUM (Winter) Arthur, var **APPENDICULATUM (0/I,II/III)**

**Euprospodium, unicapitate. 3C**

PROSPODIUM ELEGANS (Schroeter) Cummins (O/-,-/III) **Nephlyctis.**

**Genus undetermined**

PROSPODIUM AMAPAENSIS Hennen & Sotão (??,II/III) **Cyathopsora, coronate. KOFT**

PROSPODIUM ANOMALUM H. S. Jackson & Holway on *Pleonotoma* (??,II/III) **Euprospodium, coronate. 3C**

PROSPODIUM APPENDICULATOIDES (P. Hennings) Cummins (??,II/III) **Euprospodium, coronate.**

PROSPODIUM COMPRESSUM (Dietel) Cummins (O/-,-/III) **Nephlyctis.**

PROSPODIUM ELEGANS (Schroeter) Cummins on *Tecoma* (O/-,-/III) **Nephlyctis.**

**VERBENACEAE***Lantana*

PROSPODIUM TUBERCULATUM (Spegazzini) Arthur (??,II/III) **Euprospodium.. 3C**

*Lippia*

PROSPODIUM LIPPIAE (Spegazzini) Arthur (??,II/III).

PROSPODIUM PARAGUAYENSE (Spegazzini,) Spegazzini (??,II/III). **3C**

PROSPODIUM PERUVIANUM (P. Sydow & H. Sydow. ) Arthur (??,II/III).

PROSPODIUM VONGUNTENII (Mayor) Dietel on (??,II/III) **Euprospodium.**

**Alphabetical list of species of *Prospodium* reported from Brazil** (all on Bignoniaceae unless marked on Verbenaceae)

1. **PROSPODIUM AMAPAENSIS** Hennen & Sotão on unidentified Bignoniaceae (??,II/III) **Cyathopsora, coronate. KOFT**
2. **PROSPODIUM ANEMOPAEGMATIS** (P. Hennings) Cummins on *Anemopaegma* (0/I,?/III). **Euprospodium, unicapitate.**
3. **PROSPODIUM ANOMALUM** H. S. Jackson & Holway on *Pleonotoma* (??,II/III) **Euprospodium, coronate. 3C**
4. **PROSPODIUM APPENDICULATOIDES** (P. Hennings) Cummins on unidentified Bignoniaceae (??,II/III) **Euprospodium, coronate.**
5. **PROSPODIUM APPENDICULATUM** (Winter) Arthur, var **APPENDICULATUM** on *Tecoma* (0/I,II/III) **Euprospodium, unicapitate. 3C**
6. **PROSPODIUM ARRABIDAEAE** H. S. Jackson & Holway on *Arrabidaea* (O/-,-/III) **Nephlyctis.**
7. **PROSPODIUM BICOLOR** F. A. Ferreira and J. Hennen on *Tabebuia* (0/I,II/III) **Cyathopsora,**

- unicapitate.**
8. **PROSPODIUM BIGNONIACEARUM** (Spegazzini) Cummins on *Bignonia* (?/?,II/III) **Cyathopsora, coronate.**
9. **PROSPODIUM BRACHYPODUS** Hennen & Cummins on *Pithecoctenium* (0/I,-/III). **KOFT**
10. **PROSPODIUM COMPRESSUM** (Dietel) Cummins on undetermined Bignoniaceae (0/-,-/III) **Nephlyctis.**
11. **PROSPODIUM CREMASTUM** H. S. Jackson & Holway on *Cremstus*((0/-,-/III) **Nephlyctis. KOFT**
12. **PROSPODIUM CYATHIFORME** Cummins on *Lundia* (0/I,II/III) **Cyathiform, Unicapitate.**
13. **PROSPODIUM ELEGANS** (Schroeter) Cummins on *Tecoma* (0/-,-/III) **Nephlyctis.**
14. **PROSPODIUM EVERNIUM** H. Sydow on *Anemopaegma* (?/?,II/III) **Cyathopsora, unicapitate. KOFT**
15. **PROSPODIUM HOLWAYI** H. S. Jackson on *Pithecoctenium* (?/?,II/III) **Euprospodium, coronate.**
16. **PROSPODIUM IMPOLITUM** H. S. Jackson & Holway on *Pyrostegia* (0/Ipe,IIpe/III) **Cyathopsora. KOFB**
17. **PROSPODIUM LAEVIGATUM** Hennen & Sotão on *Mansoa* (0/I,?/III) **Cyathopsora. KOFT**
18. **PROSPODIUM LIPPIAE** (Spegazzini) Arthur on *Lippia*, Verbenaceae (?/?,II/III).
19. **PROSPODIUM LUNDIAE** H. S. Jackson & Holway on *Lundia* (0/-,-/III). **KOFT**
20. **PROSPODIUM PALMATUM** H. S. Jackson & Holway on *Tecoma* (?/?,II/III). **KOFB**
21. **PROSPODIUM PARAGUAYENSE** (Spegazzini,) Spegazzini on *Lippia* (?/?,II/III). **3C**
22. **PROSPODIUM PERUVIANUM** (P. Sydow & H. Sydow. ) Arthur on *Lippia* (?/?,II/III).
23. **PROSPODIUM PITHECOCTENII** (Pazschke) Cummins on *Pithecoctenium* (0/Ipe,IIpe/III).
24. **PROSPODIUM SCITULUM** Hennen & Cummins, *sp. nov., in edit.* on *Tabebuia* (0/I,II/III) **Cyathopsora, coronate.**
25. **PROSPODIUM SINGERI** Petrak on *Clytostoma* (0/Ipe,?Ipe/III) **Euprospodium.**
26. **PROSPODIUM STIZOPHYLLI** H. S. Jackson & Holway on *Stizophyllum* (0/-,-/III) **Nephlyctis. KOFB, 3C**
27. **PROSPODIUM TABEBUIICOLA** Hennen & Cummins, *sp nov. var. TABEBUIICOLA* on *Tabebuia* (?/?,II/III) **Cyathoform, coronate.**
28. **PROSPODIUM TABEBUIICOLA** Hennen & Cummins, *sp nov. var. MELGACENSIS* Sotão & Hennen *var. nov.* on *Tabebuia*, (?/?,II/III) **Cyathoform, coronate.**
29. **PROSPODIUM TECOMICOLA** (Spegazzini) H. S. Jackson & Holway on *Tabebuia* (0/Ipe,IIpe/III) **Cyathiform, unicap (0/I,II/III). 3C**
30. **PROSPODIUM TUBERCULATUM** (Spegazzini) Arthur on *Lantana*, Verbenaceae (?/?,II/III) **Euprospodium.. 3C**
31. **PROSPODIUM VONGUNTENII** (Mayor) Dietel on *Lippia*, Verbenaceae (?/?,II/III) **Euprospodium.**

**Key to help identify the species of *Prospodium* (all in the Neotropics, all on Bignoniaceae or Verbenaceae)**

- A§ Euprospodium** aecia, uredinia and telia subepidermal in origin, erumpent, species on Verbenaceae.
- B§ Euprospodium** aecia, uredinia and telia subepidermal in origin, erumpent, species on Bignoniaceae.
- C§ Cyathopsora** aecia subepidermal in origin, erumpent, uredinia and telia suprastomatal, usually basket-like, all species on Bignoniaceae.
- D§ Nephlyctis** microcyclic, only spermogonia and telia, species on Verbenaceae
- E§ Nephlyctis** microcyclic, only spermogonia and telia, species on Bignoniaceae

**A§ Euprospodium:** species on Verbenaceae.

1. Teliospore wall verrucose or pseudoreticulate.....1. *P. tumefaciens* (*Alloysia*, Argentina).
1. Teliospore wall echinulate or verrucose-echinulate.
2. Teliospore pedicel with obvious basal appendages.
3. Appendages simple or little branched .....2. *P. vonguntanii* (*Lippia*, Brazil, Colombia).
3. Appendages conspicuously branched.
4. Teliospores mostly 46-53 µm long.....3. *P. tuberculatum* (*Lantana*, Neotropics).
4. Teliospores mostly less than 45 µm long
5. Teliospores mostly 41-45 x 28-32 µm.....4. *P. lippiae* (*Lippia*, Brazil, Paraguay).
5. Teliospores mostly 35-42 x 23-26 µm.....5. *P. paraguayensis* (*Lippia*, Brazil, Paraguay).
2. Teliospore pedicel unadorned or usually so.

6. Urediniospores 22-26 x 19-25  $\mu\text{m}$ , spines spaced 2.5-3.5.....6. *P. perodiosum* (*Lippia*, Brazil, Uruguay).  
 6. Urediniospores 20-24 x 18-20  $\mu\text{m}$ , spines spaced 3-4  $\mu\text{m}$ .....7. *P. peruvianum* (*Lippia*, Brazil, Peru).
- B§ Euprosodium:** species on Bignoniaceae.
1. Urediniospore wall simple, non-laminate (See below for 2<sup>nd</sup> and 3<sup>rd</sup> number 1 choice)  
 2. Teliospore wall simple, non-laminate.  
 3. Teliospore wall smooth.....8. *P. aequinoctialis* (*Cydista*, West Indies).  
 3. Teliospore wall echinulate.  
 4. Teliospore finely echinulate, pedicel usually broken near spore.....20. *P. memorae* (*Memora*, Peru).  
 4. Teliospores strongly echinulate, pedicel persistent.....9. *P. singeri* (*Clytostoma*, Brazil, Uruguay, Argentina).
2. Teliospore wall bilaminate with pale outer layer.  
 5. Teliospore pedicel with warted basal area.....10. *P. pithecoctenii* (*Pithecoctenium*, Neotropics).  
 5. Teliospore pedicel with basal appendages.  
 6. Urediniospores 24-30 x 20-25  $\mu\text{m}$ , wall 2-3  $\mu\text{m}$  thick.....11. *P. amphiphonii* (*Pithecoctenium*, see *P. cordobense*, Mexico).  
 6. Urediniospores 21-24 x 16-20  $\mu\text{m}$ , wall 1.5-2  $\mu\text{m}$  thick.....12. *P. cordobense* (*Pithecoctenium*, Amphiphonium, Argentina, Mexico).
1. Urediniospore wall bilaminate, unicapitate.  
 7. Teliospore pedicel with 3 or more whorls of appendages.....13. *P. appendiculatum* (*Tecoma*, Neotropica).  
 7. Teliospore pedicel with fewer appendages. (see below for 3<sup>rd</sup> choice).  
 8. Teliospores mostly 40-45  $\mu\text{m}$  long wall 3-4  $\mu\text{m}$  thick.  
 9. Lower teliospore pore next to hilum.....14. *P. aculeatum* (*Tecoma*, Ecuador).  
 9. Lower teliospore pore midway or above.....15. *P. abortivum* (*Tecoma*, West Indies, Central America).  
 8. Teliospores shorter, wall thinner.  
 10. Teliospores 34-42  $\mu\text{m}$  long; urediniospores 31-35  $\mu\text{m}$  long.....16. *P. araguatum* (?*Tabebuia*, Venezuela).  
 10. Teliospores less than 38  $\mu\text{m}$  long; urediniospores less than 30  $\mu\text{m}$  long.  
 11. Teliospore wall bilaminate.....17. *P. tynanthi* (*Tynanthus*, Bolivia).  
 11. Teliospore wall simple.....18. *P. medusae* (*Pithecoctenium*, Paraguay).
7. Teliospore pedicel simple, without basal appendages.  
 12. Lower pore of teliospore next to the hilum.....19. *P. anemopaegmatis* (*Anemopaegma*, Brazil).  
 12. Lower pore of teliospore 1/3 or more above hilum.  
 13. Teliospores conspicuously, sparsely echinulate.....20. *P. mexicanum* (*Tecoma*, Mexico).  
 13. Teliospores finely echinulate.  
 14. Teliospores mostly 38-42  $\mu\text{m}$  long.  
 15. Urediniospores mostly 24-27  $\mu\text{m}$  long.....21. *P. memorae* (*Memora*, Peru).  
 15. Urediniospore mostly 34-39  $\mu\text{m}$  long.....22. *P. fimbriatum* (*Pleonotoma*, Brazil).  
 14. Teliospores mostly 37-48  $\mu\text{m}$  long.....23. *P. laevisimum* (*Anemopaegma*, *Pyrostegia*, Paraguay, Trinidad, Belize).
1. Urediniospore bilaminate, coronate (bicapitate)  
 16. Teliospore wall simple or obscurely bilaminate.  
 17. Teliospore pedicel always broke short.....24. *P. holwayi* (*Pithecoctenium*, Brazil).  
 17. Teliospore pedicel persistent, usually long.  
 18. Teliospores mostly 28-34  $\mu\text{m}$  long.....25. *P. appendiculatoides* (host undetermined, Brazil).  
 18. Teliospores mostly more than 40  $\mu\text{m}$  long.  
 19. Aculeae superficial on outer urediospore wall.....26. *P. cydistae* (*Cydista*, Guatemala).  
 19. Aculeae embedded in matrix of outer wall.....27. *P. anomalum* (*Pleonotonum*, Brazil).
16. Teliospore wall obviously bilaminate.  
 20. Teliospore wall rugose.....28. *P. irregulare* (*Pleonotoma*, Trinidad).  
 20. Teliospore wall echinulate.....29. *P. praeclarum* (host undetermined, Ecuador).
- C§ Cyathopsora:** all species on Bignoniaceae
1. Urediniospore wall simple, not laminate, see two more choices below  
 2. Teliospores vertically septate, diorchidoid.....30. *P. vertiseptum* (*Amphilophium*, Mexico).  
 2. Teliospores horizontally septate  
 3. Teliospore wall smooth, pedicels to 350  $\mu\text{m}$  long.....31. *P. cumminsii* (*Amphilophium*, Venezuela).



3. Teliospore wall echinulate, pedicels to 50-65  $\mu\text{m}$  long  
 4. Urediniospores 24-28  $\mu\text{m}$  long, paraphyses dark brown ..... 32. *P. bahamense* (*Tabebuia*, Bahamas).  
 4. Urediniospores 32-37  $\mu\text{m}$  long, paraphyses golden brown ..... 42. *P. evernium* (*Anemopaegma*, Brazil).
1. Urediniospore wall bilaminar, uncapitate  
 5. Teliospores smooth, colorless, septum vertical, telia without paraphyses  
 33. *P. gentryi* (*Parmentiera*, Guatemala, Mexico, Florida).
5. Teliospores echinulate or verrucose, septum horizontal. telia with paraphyses.  
 6. Teliospore pedicel breaking near hilum  
 7. Sori long, trumpet-like, to 200  $\mu\text{m}$  or longer ..... 34. *P. tubaeformis* (*Tabebuia*, Brazil).  
 7. Sori shorter, merely dish or cup-like ..... 35. *P. cyathiforme* (*Lundia*, Brazil).
6. Teliospore pedicel long, persistent  
 8. Teliospores of two size classes and colors ..... 36. *P. bicolor* (*Tabebuia*, Brazil, Trinidad).  
 8. Teliospores relatively uniform in sizes and color  
 9. Teliospore pedicels with 3-5 whorls of appendages ..... 37. *P. perornatum* (*Tabebuia*, Argentina, Mexico).  
 9. Teliospore pedicels with 1 or 2 whorls.  
 10. Teliospores mostly 36  $\mu\text{m}$  long or shorter.  
 11. Urediniospores mostly 22-26  $\mu\text{m}$  long ..... 38. *P. palmatum* (*Tabebuia*, Brazil).  
 11. Urediniospores mostly 30-35  $\mu\text{m}$  long ..... 39. *P. tecomicola* (*Tabebuia*, Brazil, Honduras).  
 10. Teliospores mostly 38  $\mu\text{m}$  long or longer.  
 12. Umbo over teliospore pores poorly defined ..... 40. *P. plagiopus* (*Tabebuia*, *Tabebuia*, West Indies, Florida)  
 12. Umbo over teliospore pores conspicuous.  
 13. Urediniospores mostly 28-33  $\mu\text{m}$  long ..... 41. *P. impositum* (*Pyrostegia*, Brazil)  
 13. Urediniospores mostly 32-37  $\mu\text{m}$  long ..... 42. *P. evernium* (*Anemopaegma*, Brazil)
1. Urediniospore wall bilaminar, coronate (bicapitate)  
 14. Teliospores mostly 46-54  $\mu\text{m}$  long, verrucose ..... 43. *P. couraliae* (*Couralia*, Costa, Rica, Belize, Mexico).
14. Teliospores mostly less than 45  $\mu\text{m}$  long, echinulate or smooth  
 15. Teliospores echinulate.  
 16. Teliospore pedicel unadorned ..... 44. *P. tabebuiicola* (*Tabebuia*, West Indies).  
 16. Teliospore pedicel with some appendages basally.  
 17. Appendages unbranched, short, few ..... 45. *P. bignoniacearum* (? *Bignonia* sp., Paraguay).  
 17. Appendages branched, in 2 or 3 whorls ..... 46. *P. scitulum* (*Tabebuia*, Brazil).
15. Teliospores smooth.  
 18. Teliospores mostly 28-35 x 17-21  $\mu\text{m}$  ..... 47. *P. laevigatum* (*Mansoa*, Brazil).  
 18. Teliospores mostly 24-30 x 19-23  $\mu\text{m}$  ..... 48. *P. venezuelanum* (*Tabebuia*, Venezuela).
- D§ Nephlyctis: species on Verbenaceae**  
 49. *P. conjunctum* (*Lippia*, Guatemala).
- E§ Nephlyctis: on Bignoniaceae.**
1. Teliospores obviously rugose-reticulate ..... 50. *P. stizophylli* (*Stizophyllum*, Brazil).  
 1. Teliospores with verrucae often united in short series ..... 51. *P. cremastum* (*Cremastus*, *Arrabidaea*, Brazil).
1. Teliospores echinulate, aculeate, or verrucose-echinulate.  
 2. Teliospore septum typically vertical.  
 3. Teliospore wall simple, spores 27-33  $\mu\text{m}$  long ..... 52. *P. perelegans*, (*Amphilophium*, Paraguay).  
 3. Teliospore wall bilaminar, spores 37-44  $\mu\text{m}$  long ..... 53. *P. haplophylli* (*Amphilophium*, Peru).  
 2. Teliospore septum typically horizontal.  
 4. Wall simple or bilamination obvious only at septum and over the pores.  
 5. Umbos over pores scarcely differentiated.  
 6. Spores mostly 35-43  $\mu\text{m}$  long ..... 54. *P. elegans* (*Tecoma*, Argentina, Peru).  
 6. Spores mostly 28-33  $\mu\text{m}$  long ..... 55. *P. transformans* (*Tecoma*, Cent. Amer., West Indies, Florida).  
 6. Teliospores 31-43 x 22-30  $\mu\text{m}$  ..... ?55A. *P. compressum* (Undetermined, Brazil).  
 5. Umbos over pores clearly differentiated.  
 7. Umbos smooth ..... 56. *P. trinidadense* (*Mansoa*, Trinidad).  
 7. Umbos echinulate or as the remainder of spore.

8. Pedicel usually adorned basally, to 45  $\mu\text{m}$  long.....57. *P. mansoae* (*Mansoa*, Brazil).  
 8. Pedicel unadorned, broken short.  
 9. Infection causing deformation of branches, leaves.....58. *P. destruens* (unidentified, Brazil).  
 9. Infection not causing obvious distortion.  
 10. Spores mostly 32-37  $\mu\text{m}$  long.....59. *P. minasense* (*Sparattosperma*, Brazil).  
 10. Spores mostly 37-44  $\mu\text{m}$  long.....60. *P. lundiae* (*Lundia*, Brazil).  
 4. Wall typically bilaminate throughout.  
 11. Spores of two size classes.....61. *P. arrabidaeae* (*Arrabidaea*, Brazil).  
 11. Spores of a single size class.  
 12. Wall sculpture tending to merge in ridges.....51. *P. cremastum* (*Cremastus*, *Arrabidaea*, Brazil).  
 12. Wall sculpture echinulate.  
 13. Pedicel to 45  $\mu\text{m}$  long, adorned basally.....57. *P. mansoae* (*Mansoa*, Brazil).  
 13. Pedicel broken short, unadorned.  
 14. Echinulae spaced 2-2.5  $\mu\text{m}$ .....62. *P. puttemansii* (*Pithecoctenium*, Brazil).  
 14. Echinulae spaced 3-7  $\mu\text{m}$ .....63. *P. costaricensis* (*Stizophyllum*,  
 Panama, Costa Rica).

**Species of *Prospodium* on *Tabebuia* reported from Brazil**

**PROSPODIUM BICOLOR** F. A. Ferreira & J. Hennen (0/I,II/III) *Cyathopsora*,  
 unicapitate. Brazil

**PROSPODIUM SCITULUM** Hennen & Cummins, *sp. nov.*, *in edit.* (0/I,II/III)  
*Cyathopsora*, coronate. Brazil

**PROSPODIUM TABEBUIICOLA** Hennen & Cummins, *sp. nov.* var. **TABEBUIICOLA**  
 (?/?,II/III) *Cyathoform*, coronate. Brazil

**PROSPODIUM TECOMICOLA** (Spegazzini) H. S. Jackson & Holway (0/Ipe,IIpe/III)  
*Cyathiform*, unicap (0/I,II/III). 3C Brazil

**KEY TO THE SPECIES OF *PROSPODIUM* ON *TABEBUIA* IN THE AMERICAS**

1. Uredinia and telia not suprastomatal nor basket- nor nest-like but breaking through the epidermis; known only from the type on Bignoniaceae, ? *Tabebuia* sp. (Venezuela)
  1. *P. araguatum* Kern & Thurston. 2
1. Uredinia and telia suprastomatal, basket- or nest-like 2
  2. Urediniospore wall not bilaminate nor capitate; known only from the type on *T. bahamensis* (Bahamas) 2. *P. bahamense* Arthur. 3
  2. Urediniospore wall bilaminate, either apically bi- or unicapitate 3
3. Urediniospore wall apically unicapitate 4
3. Urediniospore wall apically bicapitate 8
  4. Teliospore pedicels with 3-5 whorls of branched appendages; on *T. avellanadae* (the type, Argentina), *T. chrysantha* and *T. palmeri* (Mexico) 3 *P. perornatum* H. Sydow
  4. Teliospore pedicels with 0-2 whorls of dichotomously branched, irregularly palmate, or globoid appendages 5
5. Teliospores (38-)40-47(-49) x (27-)30-33(-35)  $\mu\text{m}$ ; wall 4-7  $\mu\text{m}$  thick, not bilaminate; on *T. guayacan* (U.S.A., Florida), *T. lepidota* (the type) and *T. sauvalei* (Cuba), and *T. lucida* (Puerto Rico) 4. *P. plagiopus* (Mont.) Arthur
5. Teliospores 27-36(38) x 20--27(-28)  $\mu\text{m}$ , walls 1-4(-5)  $\mu\text{m}$  thick except *P. couraliae*, bilaminate or not 6
  6. Teliospores usually a mixture of darker and slightly larger chestnut-brown and lighter and slightly smaller golden-brown ones; wall not bilaminate; aculeae distinct and more widely spaced; pedicels with (0-)1-2 whorls of short irregularly dichotomously branched appendages, on *T. serratifolia* (Trinidad and Brazil) 5. *P. bicolor* A. Ferreira & J. Hennen
  6. Teliospores mostly uniformly chestnut-brown; wall bilaminate, especially at pores and septum; outer layer paler, aculeae closely spaced or merging to pseudoreticulations; pedicel with (0-)1-2 pairs of irregular knob- or palm-like appendages 7
7. Teliospore walls more or less evenly echinulate, usually obviously bilaminate throughout; outer

layer pale brown to nearly hyaline; inner layer chestnut-brown; pedicel with a pair of irregularly echinulate or toothed protuberances, on *T. alba* (**Brazil**), *T. heterochicha* (Honduras), *T. ochracea* (Brazil, Paraguay, the type, Venezuela), *T. serratifolia* (Brazil), and on undetermined *T. sp.* (**Brazil**)

6. *P. tecomicola* (Spegazzini) H. S.

Jackson & Holway

7. Teliospore walls echinulate, verrucose-rugose, to pseudoreticulate, obviously bilaminate only over the pores and at the septum; pedicel with a pair of palmate or digitately enlarged appendages known only on *T. aff. rufescens* (**Brazil**, type from Poças de Caldas, MG.)

7. *P. palmatum* H. S. Jackson & Holway

8. Teliospores 46-54  $\mu\text{m}$  long; wall verrucose, 4-5  $\mu\text{m}$  thick on sides, not laminate; pedicel 45-75  $\mu\text{m}$  long, with (0-) 1-2 whorls of appendages; on *T. pentaphylla* (Mexico, Belize, Costa Rica, type

8. *P. couraliae* H. Sydow

8. Teliospores 23-43  $\mu\text{m}$  long; wall 2--4  $\mu\text{m}$  thick; pedicels less than 45  $\mu\text{m}$  long, without appendages

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9. Teliospores echinulate, 33-43  $\mu\text{m}$  long; wall bilaminate; pore apical in the upper cell and next to the pedicel in the lower cell; on *T. pentaphylla* (Puerto Rico, type), and *T. platyantha* (Dominican Republic)

9. *P. tabebuicola* Cummins & Hennen, *ined.*

(*P. tabebuae* Kern, an illegitimate binomial based on a uredinial anamorph).

9. Teliospores smooth, (23-)24--30(-34)  $\mu\text{m}$  long; wall not laminate; pores apical in each cell; known only from the type on *T. pentaphylla* or *T. hypolepra* (Venezuela)

10. *P. venezuelanum* Kern

**PROSPODIUM AMAPAENSIS** Hennen & Sotão, Sida 17: 180. 1996. TYPE on unidentified woody vine genus of Bignoniaceae from **Brazil**, Amapá: ca 10 km W of Mazagão, ca 40 km SW of Macapá, 14 Nov 1987, Hennen & Sotão-87-120. (?/?,II/III) **Cyathopsora, coronate.**

*Prospodium amapensis* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia and aecia unknown. Uredinia scattered on adaxial side of leaflets, suprastomatal, 0.2-0.5mm across, brown, pulverulent; sori composed of a circular basal peridium surmounted with paraphyses around the margin, paraphyses 31-40 x 6-9  $\mu\text{m}$ ; urediniospores 21-30 x 19-29  $\mu\text{m}$ ; globose to broadly ellipsoid, wall 1-1.5  $\mu\text{m}$  thick, yellowish-brown incompletely two-layered, the outer layer forming a longitudinal ring of irregularly interconnected spines, the ring divides distally to form a low crown (Cummins & Hiratsuka 1983, use the term "bicapitate" for this trait). The area of the lateral walls between the ring has widely spaced spines and two equatorial and opposite germ pores. Telia like the uredinia but light chestnut brown; teliospores 37-47 x 24-29  $\mu\text{m}$ , broadly ellipsoid, broadly rounded above and below, with a small umbo above and slightly constricted at the septum; wall evenly 2-3  $\mu\text{m}$  thick, echinulate with echinulae irregularly and widely spaced with echinulae sometimes basally interconnected; pore apical in upper cell and near the pedicel in the lower cell; pedicel usually with appendages and broken near spore.

*Prospodium amapensis* belongs to a group of six other species of *Prospodium* that are characterized by urediniospores that have an apical corona [coronate (bicapitate)] and the uredinial and telial sori are suprastomatal and basket-like. Teliospores have cell walls that are light chestnut-brown, have widely spaced echinulae that are sometimes interconnected basally, and pedicels that are usually without appendages.

*Prospodium amphilophii* (Dietel & Holway) Arthur. Jackson (1932) reported this species from several collections on *Pithecoctenium* sp. made by Holway from Brazil but Cummins (1940) reidentified all of them as *Prospodium pithicoctenii*. *Prospodium amphilophii* is now regarded as a synonym of *Prospodium cordobense* (P. Hennings) Cummins and has been reported only from Argentina and Mexico.

**PROSPODIUM ANEMOPAEGMATIS** (P. Hennings) Cummins, Lloydia 3: 30. 1940. (0/I,?/III). **Euprospodium, unicapitate.**

≡ *Puccinia anemopaegmatis* P. Hennings, Hedwigia 48: 2. 1908. TYPE on *Anemopaegma prostratum* DeCandolle from **Brazil**: São Paulo: March 1903, Puttemans-682.

On Bignoniaceae

*Anemopaegma prostratum* DeCandolle, São Paulo (Cummins, 1940: 30; IBI-3713; *Puttemans-682*).

*Prosopidium anemopaegmatis* has been reported only from two collections, both made in the early 1900's in São Paulo. New collections are needed to determine if this rust still occurs in Brazil.

The sori associated with spermogonia had both teliospores and anamorph spores. The latter are assumed to be aeciospores.

Spermogonia on both sides of leaves, few in groups. Aecia not seen but aeciospores present in the telia (28-)30-37(-40) x (26-)28-32(-35)  $\mu\text{m}$  with pores in face-view, variable but mostly globoid or obovoid, wall bilaminar, the outer layer unicapitate, colorless, 2.5-3.5(-4)  $\mu\text{m}$  thick, aculeate with embedded bacilliform papillae or rods, the inner wall 2.5-3  $\mu\text{m}$  thick, near chestnut-brown, pores 2 equatorial in slightly flattened, sparsely echinulate sides that lack the outer wall. Uredinia not seen and probably not produced. Telia on both leaf surfaces and on fruits, surrounding the spermogonia, subcuticular in origin, cinnamon-brown, with occasional colorless, flexuous, thick-walled paraphyses; teliospores variable in size, mostly (32-)36-44(-48) x (22-)24-29  $\mu\text{m}$ , oblong-ellipsoid, not or scarcely constricted at septum, wall non-laminar but somewhat paler toward the exterior, 2.5-3  $\mu\text{m}$  thick at sides, chestnut-brown, 4-6(-7)  $\mu\text{m}$  and more or less colorless over pores, echinulate with small, low cones spaced (2-)2.5-3.5(-4.5)  $\mu\text{m}$ , pore of upper cell apical, of lower cell next to hilum, each under a colorless or pale brownish umbo, pedicel colorless, typically broken at a septum about 12  $\mu\text{m}$  below the hilum, unadorned.

**PROSPIDIUM ANOMALUM** H. S. Jackson & Holway in Jackson, *Mycologia* 24: 87. 1932. TYPE on *Pleotoma tetraquetra* (Chamisso) Bureau, reported originally as unidentified Bignoniaceae and later probably *Memora* sp., **Brazil**, São Paulo: Mogi das Cruces, 4 July 1922, *Holway-1997*. (??,II/III). **Euprospidium, coronate**

On Bignoniaceae

*Pleotoma tetraquetra* (Chamisso) Bureau, São Paulo (Jackson, 1932: 87; Cummins, 1940: 37; IBI-16651).

*Prosopidium anomalum* has been reported also from Venezuela, and has been reported from four collections from São Paulo State, Brazil. Cummins (1940) reported the host questionably as *Memora*, but recently the late A. Gentry determined it as *Pleotoma tetraquetra*.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, subepidermal in origin, becoming erumpent, cinnamon-brown, with colorless, thin-walled, straight or usually incurved, peripheral paraphyses; urediniospores (28-)30-33 x (27-)28-33  $\mu\text{m}$  with pores face view, wall bilaminar, the outer colorless layer mostly 3-4  $\mu\text{m}$  thick, coronate (bicapitate), with embedded bacilliform papillae or rods, inner wall 1.5-2  $\mu\text{m}$  thick, cinnamon-brown, pores 2, equatorial in flattened, smooth sides. Telia as the uredinia except blackish brown; teliospores (38-)40-46(-48) x (26-)28-31(-33)  $\mu\text{m}$ , oblong-ellipsoid, not or only slightly constricted at septum, wall (2-)2.5-3.5(-4)  $\mu\text{m}$  thick at sides, echinulate-verrucose with small, low cones or verrucae spaced (1.5-)2-3.5  $\mu\text{m}$  or often joined by fine lines and often tending to be serially arranged, chestnut-brown, pore of upper cell apical, of lower cell next to hilum, each with a pale or colorless, low, 1.5-2  $\mu\text{m}$  thick, inconspicuous umbo, pedicel to about 65  $\mu\text{m}$  long, usually with a single pair of short, branched appendages and also some extensions at base, rarely unadorned.

**PROSPIDIUM APPENDICULATOIDES** (P. Hennings) Cummins, *Lloydia* 3: 41. 1940. (??,II/III).

**Euprospidium, coronate.**

$\equiv$  *Puccinia appendiculatoides* P. Hennings, *Hedwigia* 43: 186. 1904. TYPE on unidentified Bignoniaceae from **Brazil**, Amazonas: Rio Juruá, Juruá-miry, July 1901, *Ule-2909*.

*Prosopidium appendiculoides* has been reported only from the badly hyperparasitized type specimen. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia and aecia unknown. Uredinia and telia heavily parasitized. Uredinia on the abaxial side of leaves, subepidermal in origin becoming erumpent, with few thin-walled, colorless, peripheral paraphyses; urediniospores 25-29 x 20-24  $\mu\text{m}$  with pores face-view, broadly ellipsoid or obovoid, wall bilaminar, the outer layer 1-1.5  $\mu\text{m}$  thick, unicapitate, echinulate with more or less completely embedded echinulae, inner layer 1.5  $\mu\text{m}$  thick, pale cinnamon or golden, pores 2, equatorial, in smooth areas. Telia as the uredinia but dark brown; teliospores 28-34 x 21-24  $\mu\text{m}$ , oblong-ellipsoid, slightly or not constricted at septum, wall inconspicuously bilaminar, the outer layer usually visible only at septum and over pores, about chestnut-brown, verrucose-echinulate with small cones spaced (2-)2.5-3.5(-4)  $\mu\text{m}$ , pores of upper cell apical,

of lower cell next to hilum, each with a small, smooth, colorless umbo, pedicel to about 50  $\mu\text{m}$  long, with 1 pair of simple or divided appendages or unadorned.

**PROSPIDIUM APPENDICULATUM** (Winter) Arthur, var **APPENDICULATUM** Jour.Mycol. 13: 31. 1907. (0/I,II/III). **Euprospodium, unicapitate.**

≡ *Puccinia appendiculata* Winter, Flora 14: 4. 1884. TYPE on *Tecoma* sp., reported originally as unidentified Bignoniaceae, Mexico. *E. Kerber* "Ad folia viva Bignoniaceae (?) cujusdam e "Plantis mexicanis."

≡ *Dicaeoma appendiculata* (Winter) Kuntze, Rev. Gen. 3: 467. 1898.

= *Puccinia ornata* Harkness, Proc. California Acad. II. 2: 231. 1889. TYPE: on *Tecoma stans* (Linnaeus) Jussieu ex Humboldt, Bonpland, & Kunth from Mexico, Baja California, Comondu, 1889, *Brandegge s. n.* Not *Puccinia ornata* Arthur & Holway in Arthur, 1887 on *Rumex orbiculatus*.

≡ *Puccinia medusaeoides* Arthur, Bot. Gaz. (Crawfordsville) 16: 226. 1891. *Nom. nov.* for *Puccinia ornata* Harkness.

≡ *Puccinia tecomae* Saccardo & P. Sydow in Saccardo, Syll. Fung. 14: 358. 1899. *Nom. nov.* for *Puccinia ornata* Harkness.

Anamorph

**Uredo cuticulosa** Ellis & Everhart, Bull. Lab. Nat. Hist. Iowa 4: 67. 1896. TYPE on *Tecoma* sp., reported originally as *Bignonia* sp. from Nicaragua, place, date and collector not available. This anamorph is for both aecia and uredinia.

= *Uredo lilloi* Spegazzini Anal. Mus. Nac. Buenos Aires 6: 234. 1898. Lectotype on *Tecoma stans* from Argentina, Tucumán, Jan 1895, *Spegazzini-s.n.*

≡ *Puccinia cuticulosa* (Ellis & Everhart) Arthur, Mycologia 9: 83. 1917. Telia not described.

On Bignoniaceae

***Tecoma stans*** Humboldt, Bonpland & Kunth, Minas Gerais (Santos et al., 1999: 268), Rio de Janeiro (Santos et al., 1999: 268), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 138), São Paulo (IBI-17142.).

*Prospodium appendiculatum* var. *appendiculatum* is widespread from Argentina to the southern United States of America.

Spermogonia on both sides of leaves and on stem and fruit galls. Aecia surrounding the spermogonia, subepidermal in origin, cinnamon-brown, with paraphyses; aeciospores similar to urediniospores but 24-34 x 21-26  $\mu\text{m}$  and with outer wall 5-9  $\mu\text{m}$  thick. Uredinia on the abaxial side of leaves, subepidermal in origin, erumpent, pulverulent, small, pale cinnamon-brown, with peripheral, incurved, short, colorless paraphyses, 28-40  $\mu\text{m}$  long, ventral wall 1  $\mu\text{m}$  thick, dorsal wall 2.5-4  $\mu\text{m}$  thick; urediniospores (21-)23-26 x (20-)22-24(-25)  $\mu\text{m}$ , including outer wall, radially asymmetrical, unicapitate, mostly globoid with pores lateral, outer wall (2.5-)3-4  $\mu\text{m}$  thick, colorless, uniformly echinulate, echinulae spaced 2-4  $\mu\text{m}$ , inner wall 1.5-2(-2.5)  $\mu\text{m}$ , golden or cinnamon-brown, pores 2, equatorial, in the flattened sides with only a thin layer of the outer wall except at apex and base. Telia as the uredinia except blackish brown; teliospores (40-)43-53(-57) x (23-)25-30(-32)  $\mu\text{m}$ , oblong ellipsoid, only slightly constricted at septum, wall at sides (3-)3.5-4.5  $\mu\text{m}$  thick, 6-9  $\mu\text{m}$  over pores, chestnut-brown, not laminate, echinulate with cones spaced (3-)4-7(-8)  $\mu\text{m}$ , pore apical in upper cell, next to pedicel in lower cell, each with a paler umbo; pedicel colorless, thick walled, mostly 60-90  $\mu\text{m}$  long, with 4 or 5 conspicuous whorls of appendages with less developed ones below.

*Tecoma* spp. are often cultivated as ornamental shrubs for their bright yellow flowers and may be damaged by heavy infections of this rust, especially by the gall forming spermogonial and aecial stages.

**PROSPIDIUM ARRABIDAEAE** H. S. Jackson & Holway in Jackson, Mycologia 24: 89. 1932. not Viégas, 1945. TYPE on *Arrabidaea* sp. from **Brazil**, Minas Gerais, Belo Horizonte, 1 Dec 1921, *Holway-1354*. (0III). **Nephlictis.**

On Bignoniaceae

***Arrabidaea*** sp., Minas Gerais (Jackson, 1932: 89; Cummins, 1940: 69), São Paulo (IBI-14204).

*Prospodium arrabidaee* has been reported only from the collections from Minas Gerais and São Paulo states. The species differs from *P. cremastum* especially because the echinulae on the teliospores are discrete whereas those of *P. cremastum* are mostly united by narrow ridges in pseudoreticulate patterns.

Spermogonia on both sides of leaves and caulicolous. Aecia and uredinia not produced. Telia on both sides of leaves, confluent in a ring around the spermogonia or caulicolous and causing witches' brooms and distortion of shoots, cinnamon-brown, pulverulent; teliospores of two more or less distinct size classes, (29-)33-40 x 24-28(-30)  $\mu\text{m}$  or 25-30 x 19-22  $\mu\text{m}$ , both broadly ellipsoid or oblong-ellipsoid, slightly constricted at septum, wall bilaminate, the outer layer discrete, most obvious at septum and over pores, yellowish to nearly colorless, inner wall 2-3  $\mu\text{m}$  thick, clear chestnut-brown or dark golden brown, usually paler in the small spores, echinulate or verrucose-echinulae, the cones discrete and spaced mostly 2.5-4  $\mu\text{m}$ , pore in upper cell apical, in lower cell near pedicel; pedicel usually broken about 8-15  $\mu\text{m}$  below spore apparently at a septum or fracture zone, sometimes with small lateral process above the fracture.

*Prosopodium arrabidaeae* Viégas, see **DIPYXIS VIEGASII** (Joerstad) Cummins & J. W. Baxter.

**PROSPODIUM BICOLOR** F. A. Ferreira and J. Hennen, Mycologia 78: 795. 1986. TYPE on *Tabebuia serratifolia* (Vahl) Nichols from **Brazil**, Minas Gerais: Viçosa, Federal University, 16 June 1979, J. F. Hennen, M. M. Hennen & F. A. Ferreira-83-354. (0/I,II/III). **Cyathopsora, unicapitate.**

Anamorph

*Prosopodium suppressum* Arthur, Mycologia 14: 13. 1922. Based on an aecial anamorph. The name needs to be transferred to an anamorph genus.

On Bignoniaceae

*Tabebuia serratifolia* (Vahl) Nichols, Minas Gerais (Hennen et al., 1986: 795).

*Prosopodium bicolor* was reported also from Trinidad.

Spermogonia on both sides of leaves, closely grouped on the plane leaf surface or hypertrophied areas of the blade and veins. Aecia around or among the spermogonia, becoming extensively confluent, pulverulent, cinnamon-brown; aeciospores mostly 26-30 x 20-28  $\mu\text{m}$ , globoid or nearly so with pores in face view, ellipsoid when pores are lateral, wall bilaminate, the inner layer 1-1.5  $\mu\text{m}$  thick, about golden brown, smooth, the outer layer unicapitate, 3-5  $\mu\text{m}$  thick, colorless, absent over the pores, aculeate with columnar or conoidal aculeae that originate in the colorless layer, forming a fringe-like halo when pores are in face-view but mostly an apical cap when pores are lateral, pores 2, equatorial in flattened sides of the spore. Uredinia not seen, urediniospores similar to the aeciospores occasional with teliospores. Telia on the abaxial side of leaves, superstomatal, cyathiforme with a basal, golden brown peridial cup 50-80  $\mu\text{m}$  diam, surmounted by cylindrical or slightly tapered paraphyses 11-20  $\mu\text{m}$  long and 2-7  $\mu\text{m}$  wide at base; teliospores of 2 more or less distinct kinds, larger, 29-36 x 21-25  $\mu\text{m}$  with chestnut-brown wall and smaller, 27-32 x 20-22  $\mu\text{m}$ , with golden brown wall, both kinds strongly aculeate with cones 1.5-3  $\mu\text{m}$  high, usually lacking in the septal area, pore apical in upper cell, near the pedicel in lower cell, obscure; pedicel 30-50  $\mu\text{m}$  long, 3-5  $\mu\text{m}$  wide, with 1-3 (rarely no) whorls of dichotomously branched appendages; the golden spores germinating without dormancy. The chestnut-brown spore probably require dormancy before germination.

**PROSPODIUM BIGNONIACEARUM** (Spegazzini) Cummins, Lloydia 3: 58. 1940. (??,II/III).

**Cyathopsora, subcoronate.**

$\equiv$  *Puccinia bignoniacearum* Spegazzini, Anal. Soc. Cient. Argentina 26: 11. 1888. TYPE on ? *Clytostoma callystegioides* reported originally as an unidentified *Bignonia* sp. from **Paraguay**, Guarapi, Oct 1883, *Balansa-3932*.

Anamorph

*Uredo bignoniacearum* Spegazzini, Anal. Soc. Cient. Argentina 26: 14. 1888. TYPE on ? *Clytostoma callystegioides* reported originally as an unidentified *Bignonia* sp from **Paraguay**, Guarapi, Oct 1883, *Balansa-4029*.

On Bignoniaceae

? *Clytostoma callystegioides* (? *Bignonia* sp.), Guarapi, Paraguay (Spegazzini, 1888: 11; Cummins, 1940: 58).

*Prosopodium bignoniacearum* has been reported from Paraguay and Uruguay. See below for discussion of confusion about this species.

Spermogonia and aecia unknown. Uredinia unknown but urediniospores in telia (few seen) (24-)26-30(-32) x 24-27(-29)  $\mu\text{m}$  with pores face view, globoid, wall bilaminate, coronate (bicapitate), the outer layer colorless, 1.5-3  $\mu\text{m}$  thick, golden or pale cinnamon-brown, pores 2, equatorial in smooth, somewhat flattened sides. Telia on the abaxial side of leaves, grouped, brown, superstomatal, the peridial base yellowish

to golden brown surmounted by incurved, somewhat flexuous, concolorous, peripheral paraphyses; teliospores (32-)35-40(-42) x (22-)24-26(-27)  $\mu\text{m}$ , oblong ellipsoid, only slightly constricted at septum, wall inconspicuously bilaminate, the outer layer 1  $\mu\text{m}$  or less and usually obvious only at septum and over pores, echinulate with low cones spaced (2-)2.5-3.5(-4)  $\mu\text{m}$ , inner wall 2-2.5  $\mu\text{m}$  thick, chestnut-brown or dark golden, pore of upper cell apical, of lower cell next to hilum, each under a low, colorless umbo, pedicel to about 40  $\mu\text{m}$  long, more often about 20  $\mu\text{m}$ , with a few digitate appendages basally or unadorned.

P. & H. Sydow (1902), Cummins (1940), and Lindquist and Rosengurt (1967) reported that the type specimen of *Prospodium bignoniacearum* was from Guarapi, Brazil. Spegazzini (1888) and Farr (1973) reported the place as Guarapi, Paraguay. In any case, this species may be expected to occur in Brazil but new collections are needed to clarify its taxonomy and determine if this rust still occurs in Paraguay, Uruguay, or Brazil. Cummins (1940) also reported the confusion that developed because the type material contained two rust species, the macrocyclic one described above and a microcyclic species that was too badly hyperparasitized for correct identification. The host was reported originally as an undetermined Bignoniaceae, but Lindquist and Rosengurt (1967) reported the host of their specimen from Uruguay as *Bignonia speciosa* Hooker, which is a synonym of *Clytostoma callistegioides*. Perhaps this species, which is a widely cultivated ornamental woody vine, is the host of the type.

**PROSPODIUM COMPRESSUM** (Dietel) Cummins, Lloydia 3: 58. 1940. **(0/III). Nephlyctis.**

≡ *Puccinia compressa* Dietel, Ann. Mycol. 5: 245. 1907. not Arthur & Holway, 1925. TYPE on undetermined Bignoniaceae, from Brazil, São Paulo: Ipiranga, 21 Aug 1905, *Usteri s. n.*

On Bignoniaceae

**Genus undetermined**, São Paulo (Cummins, 1940: 65).

*Prospodium compressum* has been reported only from the type.

Spermogonia on both sides of leaves, subcuticular, becoming displaced by the telia. Telia on both sides of leaves, around the spermogonia, confluent in groups 1-3 mm across or more extended on the veins to 5 mm long, dark cinnamon-brown, powdery, surrounded by the upturned cuticle; teliospores 31-43 x 22-30  $\mu\text{m}$ , ellipsoid or oblong-ellipsoid, rounded at both ends or somewhat narrowed below, slightly constricted at the septum; wall 2.5  $\mu\text{m}$  thick, scarcely laminate or at least the outer semi-colorless layer visible only at septum, cinnamon-brown, moderately papillose echinulate, the pore apical in the upper cell, at the pedicel in the lower cell, without discernible papillae; pedicel shorter than spore, fragile, colorless, unadorned (Cummins, 1940).

Cummins (1940) was doubtful about this species because of the fragmentary host material to work with that could not be identified.

*Prospodium concinum* H. Sydow, see **PROSPODIUM TECOMICOLA** (Spegazzini) H. S. Jackson & Holway.

**PROSPODIUM CREMASTUM** H. S. Jackson & Holway in Jackson, Mycologia 24: 89. 1932. TYPE on *Cremstus sceptrum* Bureau & K. Schumann from **Brazil**, Minas Gerais: Belo Horizonte, 24 Nov 1921, *Holway-1331. (0/-/III). Nephlyctis.*

On Bignoniaceae

***Cremastus sceptrum*** Bureau & K. Schumann, Minas Gerais (Jackson, 1932: 89; Cummins, 1940: 69).

*Prospodium cremastum* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia not seen, probably formed but displaced early by telia. Telia apparently systemic, in local growth from buds, confluent over entire branchlets, pulverulent, about cinnamon-brown; teliospores (27-)31-38(-44) x (20-)22-24(-26)  $\mu\text{m}$ , mostly oblong-ellipsoid, slightly constricted at septum, wall bilaminate, the outer layer discrete and especially conspicuous over the pores and at the septum, yellowish to colorless, the inner wall 2-2.5(-)  $\mu\text{m}$  thick, from golden brown to chestnut-brown, irregularly verrucose-echinulate the echinulae separate or commonly united by fine ridges to form incomplete reticulae or short series, pore apical in upper cell, near pedicel in lower cell, each covered by a low, colorless umbo; pedicel usually broken 10-20  $\mu\text{m}$  below spore but may attain 30  $\mu\text{m}$  and have small, lateral processes basally.

**E§ Nephlyctis: on Bignoniaceae.**

1. Teliospores obviously rugose-reticulate .....50. *P. stizophylli Stizophyllum, Brazil*.  
 1. Teliospores with verrucae often united in short series .....51. *P. cremastum (Cremastus, Arrabidaea, Brazil)*.  
 1. Teliospores echinulate, aculeate, or verrucose-echinulate. Other species of *Prospodium*, series *Nephlyctis*.

**PROSPODIUM CYATHIFORME** Cummins, Lloydia 3: 55. 1940. TYPE on *Lundia* sp. from **Brazil**, São Paulo: Tremembe, 30 May 1922, *Holway-1908*. (**0/I,II/III**). **Cyathiform, Unicapitate** = *Prospodium lundiae* H. S. Jackson & Holway in Jackson, Mycologia 24: 91. 1932. In part.

On Bignoniaceae

*Lundia* sp., São Paulo (Cummins, 1940: 55).

*Puccinia cyathiforme* has been reported only from the type collection.

Spermogonia on both sides of leaves in small groups. Aecia on both sides of leaves on slightly hypertrophied areas, surrounding or displacing spermogonia, cinnamon-brown, pulverulent, with some scattered paraphyses as those of the uredinia; aeciospores (28-)30-38(-40)  $\mu\text{m}$  diam including "fringe", globoid with pores face-view, ellipsoid and unicapitate with pores lateral, wall bilaminate, the outer colorless layer fringe-like with embedded bacilliform rods (2.5-)4-6(-6.5)  $\mu\text{m}$  thick inner wall 1.5-2  $\mu\text{m}$  thick, near chestnut-brown, pores 2, equatorial in flattened, smooth sides. Teliospores may occur in the aecia (see below). Uredinia on the abaxial side of leaves, scattered or few in a group, pale cinnamon-brown, suprastomatal, cyathiform with basal pale golden peridium surmounted by concolorous, peripheral, incurved, often geniculate, thick-walled paraphyses to 70  $\mu\text{m}$  long; urediniospores similar to the aeciospores but the inner wall paler. Telia suprastomatal as the uredinia; teliospores 31-38 x 24-28  $\mu\text{m}$  broadly ellipsoid or oblong-ellipsoid, indistinctly or not bilaminate, the wall 2.5-3  $\mu\text{m}$  thick, chestnut-brown, finely and distantly verrucose-echinulate (teliospores in the aecia mostly 35-44(-46) x 24(-33)  $\mu\text{m}$ , wall 2.5-4  $\mu\text{m}$  thick, often appearing smooth, especially basally, pore of upper cell apical, of lower cell near pedicel, each with a pale, low umbo; pedicel septate about 5  $\mu\text{m}$  below spore, breaking at septum (Cummins, 1940).

Jackson (1932) reported two Holway collections (1563 and 1908) as *Prospodium lundiae*. Cummins (1940) proposed that one of these collections, 1908, was a microcyclic derivative and kept it as *P. lundiae* H. S. Jackson & Holway. Cummins (1940) named the other collection, 1563, *Prospodium cyathiforme* which is macrocyclic but apparently of variable life cycle as indicated by the production of teliospores in the aecia. *Prospodium lundiae* appears to have more or less stabilized as a microcyclic species, even though a few aeciospores re found in the telia, and doubtless is derived from *P. cyathiforme*. No microcyclic species has suprastomatal sori although some, as *P. lundiae*, doubtless are reduced cycle derivatives of suprastomatal species.

**PROSPODIUM ELEGANS** (Schroeter) Cummins, Lloydia 3: 67. 1940. (**0III**). **Nephlyctis**.

= *Puccinia elegans* Schroeter, in Hennings, Hedwigia 35: 238. 1896. TYPE on *Tecoma stans* Linnaeus from **Argentina**, Catamarca: Chacarita de los Padres, 21-24 Nov 1872, *G. Heironymus & Lorentz s.n.*

= *Nephlyctis elegans* (Schroeter) Arthur, J. Mycol. 13: 32. 1907.

= *Puccinia hymenochaetoides* P. Hennings, Bot. Jahrb. Syst. 40: 226. 1907.

= *Prospodium manabii* R. Berndt, Mycologia 90: 518. 1998. TYPE. on leaves and petioles of sterile Bignoniaceae, probably *Tecoma* sp. from Ecuador, Manabi, 8 March 1993, *R. Berndt s.n*

On Bignoniaceae

**Tecoma stans**, São Paulo (Sydow, 1907: 354).

*Prospodium elegans* has been reported also from Argentina, Peru, and Ecuador. The identification of *Prospodium elegans* from Brazil needs to be confirmed. The teliospores are larger and have a thicker wall than those of other microcyclic species of *Prospodium*.

Spermogonia on both sides of leaves on plane leaves, or on distorted leaves and branches, or on galls on the fruit, becoming displaced by telia. Telia around spermogonia on plane leaves or among and displacing them on distorted areas, where they may cover extensive areas, dark cinnamon-brown, pulverulent; teliospores oblong-ellipsoid or broadly ellipsoid, only slightly constricted at septum, (30-)35-43(-46) x (20-)22-28(-30)  $\mu\text{m}$ , wall 3-4(-5)  $\mu\text{m}$  at sides, 4-6(-7)  $\mu\text{m}$  over pores, not laminate, clear chestnut-brown or dark golden-brown, echinulate with cones spaced (2.5-)3-5  $\mu\text{m}$ , pore of upper cell apical, of lower cell near pedicel, each in a slightly paler, thickened area or less commonly a defined umbo; pedicel broken about 12-15  $\mu\text{m}$  below spore at a discrete fracture zone or septum, sometimes with small appendages at the fracture zone.



*Prospodium erinaceum* Sydow, see **PROSPODIUM PALMATUM** H. S. Jackson & Holway.

**PROSPODIUM EVERNIUM** H. Sydow, Ann. Mycol. 30: 93. 1932. TYPE on *Anemopaegma chamberlaynii* (Sims) Bureau & K. Schumann from **Brazil**, Paraná: Jaguariahyva, 27 Sept 1911, *P. Dusén-13039*. (??,II/III). **Cyathopsora, Unicapitate.**

On Bignoniaceae

*Anemopaegma chamberlaynii* (Sims) Bureau & K. Schumann, Paraná (Cummins, 1940: 45).

*Prospodium evernium* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil. The large sori and conspicuous (to 100 µm long) brownish or golden paraphyses are distinctive.

Spermogonia and aecia unknown. Uredinia unknown; urediniospores in telia (28-)32-37(-40) x (26-)28-34(-36) µm and globoid or broadly ellipsoid with pores face view, wall bilaminate, unicapitate, the outer layer 1-2.5 µm thick, colorless, aculeate with embedded aculeae but the matrix often dissolving so that the wall appears to be simple, aculeae spaced (1.5-)2-3.5 µm, inner wall 2-3 µm, cinnamon-brown or golden, pores 2, equatorial in smooth, somewhat flattened sides. Telia on the abaxial side of leaves, superstomatal but stipe 30-60 µm wide, broadly cyathiform, with long, brownish, flexuously incurved, thick-walled, peripheral paraphyses surmounting the basal peridial cup; teliospores (38-)42-49(-55) x (25-)28-30(-33) µm, oblong-ellipsoid, only slightly constricted at septum, wall discretely but inconspicuously bilaminate, the outer layer obvious only at septum and as 2.5-4 µm thick umbos over the pores, inner layer 2.5-4 µm thick, chestnut-brown, verrucose-echinulate with low broad cones spaced (2-)3-4 µm, pore apical in upper cell, next to hilum in lower cell, pedicel to 65 µm long but usually about 50 µm, sometimes adorned but usually with a pair of knob-like or lobed appendages near the base.

*Prospodium festivum* H. Sydow, Ann. Mycol. 30: 94. 1932. TYPE on *Cuspidaria corymbifera* (Vahl) Baillon from **Brazil**, Paraná: Jaguariahyva, 28 Oct 1910, *P. Dusén-10606*. This name is only for an anamorph and needs to be transferred to an anamorph genus. (0/I,??).

On Bignoniaceae

*Cuspidaria corymbifera* (Vahl) Baillon, Paraná (Cummins, 1940: 74).

*Cuspidaria pterocapea* DeCandolle, Paraná (Joerstad, 1956: 455).

**PROSPODIUM HOLWAYI** H. S. Jackson, Mycologia 24: 90. 1932. TYPE on *Pithecoctenium* sp. from **Brazil**, São Paulo: Taipas, 7 Feb 1922, *Holway-1541*. (??,II/III). **Euprospodium, coronate.**

On Bignoniaceae

*Pithecoctenium* sp., probably *P. crucigerum* (Linnaeus) A. Gentry, São Paulo (Jackson, 1932: 90; Cummins, 1940: 42).

*Prospodium holwayi* has been reported only from type and one other collection from the type area.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, subepidermal in origin becoming erumpent, small, without paraphyses, pale cinnamon-brown; urediniospores 22-26 µm and globoid with pores face view, wall bilaminate, coronate (bicapitate), the outer layer mostly 2 µm thick, colorless, with embedded bacilliform rods or papillae but the matrix may dissolve partly or wholly, inner wall about 1.5 µm thick cinnamon-brown or golden, pores 2, equatorial in smooth flattened sides. Telia as the uredinia except dark cinnamon-brown; teliospores 32-37(-40) x (20-)22-26 µm, elongately ellipsoid or oblong-ellipsoid, often diorchidioid, constricted at septum, wall 1.5-2 µm thick, pale chestnut-brown except for a low (to 3 µm thick) colorless umbo over pores, finely echinulate with low cones spaced 2-3(-4) µm, sometimes tending to be in lines, pore of upper cell apical, of lower cell next to hilum or in diorchidioid teliospores, both pores terminal, pedicel colorless, unadorned, usually broken about 8-12 µm below hilum at a fracture zone.

**PROSPODIUM IMPOLITUM** H. S. Jackson & Holway in Jackson, Mycologia 24: 90. 1932. TYPE on *Pyrostegia venusta* (Ker-Gawl.) Miers from **Brazil**, São Paulo: Juquery, 12 June 1922, *Holway-1958*. (0/Ipe,IIpe/III) **Cyathopsora.**

On Bignoniaceae

*Pyrostegia venusta* (Ker-Gawl.) Miers (*Pyrostegia ignea* (Velloso) K. Presl is a synonym), Minas Gerais (Cummins, 1940: 48; IBI-16289; Thurston, 1940: 295), Rio Grande do Sul (IBI-1235), São Paulo (Jackson, 1932: 90; Cummins, 1940: 48; IBI-2991; *Puttemans-1548*).

*Prospodium impolitum* has been reported only from Brazil.

Although Jackson (1932) reported *Haplolophium*, *Stizophyllum*, *Tynanthus* and unidentified genera of Bignoniaceae as hosts, Cummins (1940) reported all of these to be *Pyrostegia* spp.

Spermogonia few in a group. Aecia on both sides of leaves, surrounding the spermogonia, with a few scattered paraphyses; aeciospores similar to urediniospores. Uredinia on the abaxial side of leaves, grouped, cinnamon-brown, superstomatal, with a basal peridium about golden brown surmounted by abundant, conspicuous, dorsally thick-walled, incurved, peripheral paraphyses to 90  $\mu\text{m}$  long; urediniospores with pores face-view (26-)28-33(-35) x (24-)28-30(-32)  $\mu\text{m}$ , globoid or obovoid, wall bilaminar, the outer layer 2-3.5  $\mu\text{m}$  thick, unicapitate, aculeate on all surfaces with cones or rods partially embedded except on pore-bearing sides where superficial, inner layer 1.5-2.5  $\mu\text{m}$  thick, chestnut-brown or dark cinnamon-brown, pores 2, equatorial in somewhat flattened, aculeate sides. Telia as the uredinia except blackish brown; teliospores (35-)38-42(-44) x (25-)27-30  $\mu\text{m}$ , broadly oblong-ellipsoid, not or scarcely constricted at septum, wall nonlaminar, (1.5-)2.5-3.5(-4)  $\mu\text{m}$  thick, chestnut-brown, echinulate-verrucose with broad cones or verrucae spaced (3-)3.5-5(-6)  $\mu\text{m}$ , pore of upper cell apical, of lower cell next to hilum, each under an often smooth, colorless or pale brownish umbo 2.5-4  $\mu\text{m}$  thick, pedicel to about 60  $\mu\text{m}$  long with 1 pair of branched appendages one-half to two-thirds toward base and usually some smaller and simpler extension at base.

We have about 30 collections of *Prospodium impolitum*, all on *Pyrostegia venusta*, in IBI from Sao Paulo state which indicates that this rust is not uncommon. The host is a very widespread woody vine from northern Argentina to Florida in The United States of America where it is cultivated. . But the rust has been reported only from Brazil. Its bright red-orange flowers are well known in Brazil as Flor de São João

**PROSPODIUM LAEVIGATUM** Hennen & Sotão, Sida 17: 182. 1996. TYPE on *Mansoa kererae*

(Aublet) A. Gentry, Bignoniaceae, from **Brazil**, Pará: Belém, Mocambo forest preserve, 9 July 1979, J. F. Hennen & M.M. Hennen-79-153A. (0/I,?/III) **Cyathopsora**.

*Prospodium laevigatum* has been reported only from the type.

Spermogonia mostly on the adaxial side of leaves, few in a group. Aecia on the abaxial side of leaves opposite the spermogonia, confluent in a more or less circular group, pulverulent, cinnamon-brown; aeciospores mostly 21-24 x 20-23  $\mu\text{m}$ , globoid or essentially so, the inner wall clear chestnut-brown, the outer layer absent over the pores, beset with bacilliform papillae forming a complete halo when pores are in face view, but showing only as two caps or "ears" laterally from the apex, pores 2, equatorial in the smooth sides. Uredinia not seen, perhaps not produced. Telia on the abaxial side of leaves, scattered superstomatal, cyathiform with a basal, yellowish peridial cup 40-55  $\mu\text{m}$  diam, the rim of the cup with low knobs (scarcely paraphyses); teliospores mostly 28-35 x 17-21  $\mu\text{m}$ , oblong-ellipsoid and strongly constricted at septum, the cells nearly globoid, wall uniformly 1.5  $\mu\text{m}$  thick golden or clear cinnamon-brown, with a low lenticular, colorless umbo over each pore, smooth, pore apical in upper cell, at septum in lower cell; pedicel thin-walled, colorless, fragile, about 25  $\mu\text{m}$  long; germination occurs without dormancy (Hennen & Sotão, 1996).

*Prospodium laevigatum* is the only species of *Prospodium* in the cyathopsora group that has coronate (bicapitate) anamorph spores and smooth teliospores. Only four other species of *Prospodium* have teliospores with smooth cell walls. New collections are needed to determine if this rust still occurs in Brazil.

**PROSPODIUM LIPPIAE** (Spegazzini) Arthur, N. Amer. Flora 7: 161. 1912. (??,II/III).

= *Puccinia lippiae* Spegazzini, An. Mus. Nac. Buenos Aires 6: 224. 1899. TYPE on *Lippia lycioides* from **Argentina**, La Plata, Jan 1889, C. Spegazzini.n.

On Verbenaceae

*Lippia* sp., São Paulo (Viégas, 1945: 35; IBI-17824).

*Prospodium lippiae* has been reported also on *Aloysia* and *Lippia* and also from Argentina to Central America and Mexico (Cummins, 1940).

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, subepidermal, becoming erumpent, cinnamon-brown or somewhat darker, with cylindrical, nearly straight, thin-walled, colorless, peripheral paraphyses 30-40  $\mu\text{m}$  long; urediniospores (23-)24-28(-32) x (20-)22-26(-28)  $\mu\text{m}$ , mostly broadly ellipsoid or globoid, wall 1.5-2.5(-3)  $\mu\text{m}$  thick, sometimes slightly thicker apically, simple, cinnamon-brown or less commonly near chestnut-brown, uniformly echinulate, echinulae spaced 2.5-3(-4)  $\mu\text{m}$ , pores 2, equatorial in slightly or not flattened sides. Telia as the uredinia except blackish brown, teliospores (38-)41-45(-50) x (26-)28-32(-33)  $\mu\text{m}$ , broadly ellipsoid, wall scarcely bilaminar, chestnut-brown (3-)3.5-4.5(-5)  $\mu\text{m}$  thick at sides, 4-6  $\mu\text{m}$  over pores with a pale, differentiated umbo, echinulate, echinulae spaces 2-5  $\mu\text{m}$ , pore apical in upper cell, next the pedicel in lower cell; pedicel to about 65  $\mu\text{m}$  long, thin-walled, colorless,

adorned on the lower half with 2-4 whorls of branched or simple appendages, the upper ones more elaborate and longer than the lower ones, pedicel often slightly rugose basally.

**PROSPODIUM LUNDIAE** H. S. Jackson & Holway in Jackson, Mycologia 24: 91.1932. TYPE on *Lundia nitidula* DeCandolle from **Brazil**, São Paulo: Santo Amaro, 16 Feb 1922, E.W. D. Holway-1563. (0/i,-/III).

On Bignoniaceae

*Lundia nitidula* DeCandolle, São Paulo (Jackson, 1932: 91; Cummins, 1940: 68).

*Prospodium lundiae* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil. The life-cycle appears to be variable as indicated by the aeciospores in the telia, but is basically microcyclic. Teliospores have septate pedicels as do most microcyclic species of *Prospodium*.

Spermogonia on both sides of leaves, in small groups. Aecia and uredinia not produced but aeciospores (?) sparingly present in telia, (28-)33-40(-44)  $\mu\text{m}$  diam with pores face-view, strongly flattened on pore-bearing sides thus seldom seen with pores lateral, unicapitate, inner wall 1.5-2.5  $\mu\text{m}$  thick, near chestnut-brown, outer layer colorless, 3-5  $\mu\text{m}$  thick, fringe-like with bacilliform rods in a matrix, pores 2, equatorial. Telia encircling spermogonia, dark cinnamon brown, pulverulent, with straight or flexuous, thick-wall, colorless paraphyses 6-10  $\mu\text{m}$  wide; teliospores (33-)37-44(-50) x (20-)23-28(-30)  $\mu\text{m}$  (smaller teliospores usually present in small numbers), oblong-ellipsoid or broadly ellipsoid, slightly or not constricted at septum, wall lamination none or indistinct, wall 2-3(-3.5)  $\mu\text{m}$  thick, mostly chestnut-brown, verrucose-echinulate with cones spaced 2.5-3.5(-4)  $\mu\text{m}$ , pore apical in upper cell, near pedicel in lower cell, each with a low, colorless umbo; pedicel septate 4-8  $\mu\text{m}$  below spore, breaking at septum, colorless.

*Prospodium oblectum* H. Sydow, see **PROSPODIUM SINGERI** Petrak.

**PROSPODIUM PALMATUM** H. S. Jackson & Holway in Jackson, Mycologia 24: 92.1932 (January).

TYPE on *Tecoma alba* Chamisso, from **Brazil**, Minas Gerais: Poços de Caldas, 10 April 1922, Holway-1722. (?/?,II/III).

= *Prospodium erinaceum* Sydow, Ann. Mycol. 30: 92. 1932 (March). TYPE on *Tabebuia* sp., mistakenly reported originally as "*Tecoma leucoxyllum* Martius var. *longissima* Kraenzl" from **Brazil**, Paraná: Carvalho, 18 Nov 1909, P. Dusén s.n.

On Bignoniaceae

*Tabebuia rufescens* J.R. Johnston, Minas Gerais (Jackson, 1932: 92; Cummins, 1940: 54), Paraná (Sydow, 1932: 92; Cummins, 1940: 54).

*Prospodium palmatum* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, scattered, pale cinnamon-brown, suprastomatal, cyathiform, 40-60  $\mu\text{m}$  diam, peridium about golden brown, the surmounting paraphyses concolorous or nearly colorless, erect or incurved, cylindrical, 5-7  $\mu\text{m}$  wide, to 40  $\mu\text{m}$  long, apex rounded or somewhat pointed; urediniospores mostly 22-26  $\mu\text{m}$  diam with pores face-view, ellipsoid with pores lateral, 15-18  $\mu\text{m}$  wide, wall conspicuously bilaminate, the inner layer 1.5-2  $\mu\text{m}$  thick, golden brown, the outer layer 3-5  $\mu\text{m}$  thick, colorless, fringe-like with bacilliform rods in a matrix, unicapitate, pores 2, equatorial in strongly flattened, smooth sides. Telia as the uredinia but chestnut-brown; teliospores (29-)32-36(-38) x 22-26  $\mu\text{m}$  broadly ellipsoid or oblong-ellipsoid, slightly or not constricted at septum, wall bilaminate, the outer layer discrete but obvious only at septum and over pores, inner wall 2.5-3  $\mu\text{m}$  thick, verrucose-echinulate with discrete cones spaced 2-4  $\mu\text{m}$  or these often united in a series or even in a pseudoreticulate pattern, the arrangements variable, pore of upper cell apical, of lower cell near pedicel, each under a low, pale to colorless, low umbo; pedicel to 55  $\mu\text{m}$  long, colorless, thick-walled, adorned basally with opposite palmately branched appendages or the base enlarged and digitately divided.

**PROSPODIUM PARAGUAYENSE** (Spegazzini,) Spegazzini, Revista Argentina Bot.1: 104. 1925.

(?/?,II/III).

= *Puccinia paraguayensis* Spegazzini, Anal. Soc. Cient. Argentina 26: 11.1888. TYPE on *Lippia urticoides* Steudel from **Paraguay**, Paraguari, ? Aug 1883, Balansa-3930.

= *Prospodium wulfiae* Thurston, Mycologia 32: 295. 1940. TYPE on *Lippia* sp., mistakenly

identified originally as *Wulffia maculata* (Ker.) DC., Compositae, from Minas Gerais: Viçosa, 12 April 1933, *Mueller-456*.

Anamorph

*Uredo paraguayensis* Spegazzini, Anal. Soc. Cient. Argentina 26: 14. 1888. TYPE on *Lippia* sp. Steudel from **Paraguay**, Paraguari, ? Oct 1883, *Baslansa-3930*.

On Verbenaceae

*Lippia urticoides* Steudel, Minas Gerais (Thurston, 1940: 295; IBI-16337; Hennen & Figueiredo, 1981: 353), São Paulo (IBI-14720).

*Prospodium paraguayensis* has been reported only from Brazil and Paraguay.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, subepidermal in origin, erumpent, pale cinnamon-brown, with inconspicuous, cylindrical, thin-walled paraphyses; urediniospores 21-26 x 18-20 µm, broadly ellipsoid or globose, wall 1.5-2 µm thick, golden or pale cinnamon-brown, uniformly echinulate with echinulae spaced 2-3.5 µm, pores 2, equatorial in not or scarcely flattened sides. Telia as the uredinia but dark brown, pulverulent; teliospores (32-)35-42(-44) x (20-)23-26(-29) µm, oblong-ellipsoid, slightly constricted at septum, wall not bilaminar, 2.5-3.5 µm thick at sides, chestnut-brown, but with pale umbos 4-6 µm thick over pores, strongly echinulate with broad cones spaced (2-)3-4.5(-6) µm, pore apical in upper cell, near pedicel in lower cell, each with a conspicuous umbo; pedicel to 45 µm long, colorless, with a pair of branched appendages about midway and sometimes also basally or the lower portion simple and somewhat inflated.

**PROSPODIUM PERUVIANUM** (P. Sydow & H. Sydow.) Arthur, Estac. Exper. Agríc. Soc. Nac. Agr. Lima. Bol. 2: 5. 1929. (*??,II/III*).

≡ *Puccinia peruviana* P. Sydow & H. Sydow, Mon. Ured. 1: 308. 1902. TYPE on *Lippia urticoides* Steudel from **Peru**, Tarapoto, 1855-1856, R. *Spruce s.n.*

≡ *Prospodium peruvianum* (P. Sydow & H. Sydow.) Cummins, Lloydia 3: 19. 1940.

This combination was made earlier by Arthur.

= *Puccinia mariae* Jackson, Mycologia 24: 64. 1932. TYPE on *Lippia* sp. from **Brazil**, São Paulo: Prata, 9 Apr 1922, *Holway-1719*. (*??,II/III*).

On Verbenaceae

*Lippia* sp., São Paulo (Jackson, 1932: 64; Cummins 1940: 19).

*Prospodium peruvianum* has been reported also from Argentina and Peru.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, yellowish, brown, with small, cylindrical, peripheral paraphyses; urediniospores (17-)20-24(-26) x (15-)18-20(-22) µm, mostly obovoid, wall simple, 1.5-2 µm thick, pale golden brown, uniformly echinulate with spines spaced 3-4 µm, pores 2, equatorial, with slight caps. Telia as the uredinia but blackish brown; teliospores (30-)33-38(-40) x (22-)24-27(-29) µm, oblong-ellipsoid, very slightly constricted at septum, not discretely bilaminar by paler outward, clear chestnut-brown, (2.5-)3-4(-5) µm, verrucose-echinulate with cones spaced (3-)4-5(-6) µm, pore of upper cell apical, of lower cell near pedicel, each under a pale umbo, pedicel colorless, breaking at a septum or fracture zone 12-22 µm below hilum, unadorned or with small, abortive appendages basally.

*Prospodium piracicabanum* Viégas, see **PROSPODIUM STIZOPHYLLI** H. S. Jackson & Holway.

**PROSPODIUM PITHECOCTENII** (Pazschke) Cummins, Lloydia 3: 25. 1940. (*0/Ipe,IIpe/III*).

≡ *Puccinia pithecoctenii* Pazschke, Hedwigia 30: 199. 1891. TYPE on *Pithecoctenium* sp. from **Brazil**, Santa Catarina: São Francisco, July 1884, *Ule-sn*.

On Bignoniaceae

*Amphilophium paniculatum* (Linnaeus) Humboldt, Bonpland & Kunth, Paraná (Cummins, 1940: 25), Rio de Janeiro (Cummins, 1940: 25), São Paulo (Cummins, 1940: 25).

*Pithecoctenium cordifolium* Martius, Minas Gerais (Thurston, 1940: 302).

*Pithecoctenium echinatum* (Jacquin) K. Schumann, Paraná (Cummins, 1940: 25).

*Pithecoctenium hexagonum* DeCandolle, Brazil (Silveira, 1951: 41).

*Pithecoctenium* sp., Santa Catarina (Pazschke, 1892: 96; Hennings, 1896: 232; Cummins, 1940: 25), Brazil (Pazschke, 1891: 199).

*Prospodium pithecoctenii* has been reported also from Argentina, Central America, Mexico, and the West Indies.

Spermogonia on both sides of leaves in small groups. Aecia on both sides of leaves, encircling the spermogonia as a confluent ring, cinnamon-brown; aeciospores pedicellate, essentially as the urediniospores. Uredinia mostly on the abaxial side of leaves, cinnamon-brown, with colorless, incurved, thin-walled paraphyses 30-45  $\mu\text{m}$  long; urediniospores (18-)20-23(-25) x (16-)18-20  $\mu\text{m}$ , obovoid or broadly ellipsoid, wall pale golden 1.5-2  $\mu\text{m}$  thick, echinulate with echinulae spaced 2-2.5(-3)  $\mu\text{m}$ , less conspicuous basally, pores 2, equatorial in slightly flattened sides under very low cuticular caps. Telia as the uredinia but about chocolate-brown; teliospores (28-)30-37(-39) x (21-)24-28  $\mu\text{m}$ , broadly oblong-ellipsoid, wall bilaminate, inner wall 2-2.5  $\mu\text{m}$ , chestnut-brown, outer wall discrete, 1-2(2.5)  $\mu\text{m}$  thick, nearly colorless, echinulate, echinulae spaced (2-)3-4(-5)  $\mu\text{m}$ , pore apical in upper cell, near pedicel in lower cell, with only inconspicuous or no umbos, pedicels to 60  $\mu\text{m}$ , simple or the basal area rugose, or with a few wart-like protrusions, or the base enlarged.

*Prospodium pseudo-zonatum* Viégas, see **Puccinia sanguinolenta** P.Hennings.

**PROSPIDIUM SCITULUM** Hennen & Cummins, *sp. nov.*, in edit. TYPE on *Tabebuia rosea-alba* (Ridley) Sandwith from **Brazil**, Mato Grosso do Sul: Coxim, about 4 km SE of Rio Verde Fishing Camp on Rio Verde, 16 April 1983, *J. F. Hennen, Mary M. Hennen & R. Antunes 83-170*. (holotype at IBI, isotype at BRIT). **(0/I,II/III). Cyathopsora, coronate.**

*Prospodium scitulum* is has been reported only from Brazil.

Spermogonia and aecia on both sides of leaves in small slightly hypertrophied areas, finally dropping from the leaf, to old to describe otherwise. Uredinia on the abaxial side of leaves, brown, suprastomatal, 45-75  $\mu\text{m}$  diam, consisting of a cellular basal cup surmounted by incurved, brown, thick-walled, mostly acuminate paraphyses 20-40  $\mu\text{m}$  long, urediniospores coronate (bicapitate), (20-)22-24(-25) x (18-)19-22  $\mu\text{m}$ , broadly ellipsoid or globoid with pore face view, triangularly obovoid with pores lateral, wall bilaminate, the outer wall colorless 2-2.5  $\mu\text{m}$  thick, very inconspicuous between the bacilliform rods, inner wall 1.5  $\mu\text{m}$  thick, dark cinnamon-brown, pores 2, equatorial in the smooth, flattened sides. Telia as the uredinia, teliospores (30-)35-40(-42) x (20-)24-26(-28)  $\mu\text{m}$ , broadly ellipsoid, wall laminate when immature but lamination obscure except over pores when mature, chestnut-brown except a pale umbo over pores, echinulate with cones spaced 2.5-4  $\mu\text{m}$ , pore apical in upper cell, next to the pedicel in lower cell, pedicel 30-60  $\mu\text{m}$  long, thick-walled, bearing 1-3 well-developed whorls of appendages and some much reduced ones basally, rarely unadorned.

Specimens examined: in addition to the type, one other specimen: on ? *Tabebuia* sp., **Brazil**, São Paulo: 15-20 km S of Pereira Barreto, 15 July 1988, *J. F. Hennen & R. M. Lopez-Franco 88-542*.

**PROSPIDIUM SINGERI** Petrak, Sydowia 10: 296. 1956(1957). Nom. nov. for *Prospodium cumminsii* Petrak. **(0/Ipe,?Ipe/III). Euprospodium**  
 = *Prospodium cumminsii* Petrak, Sydowia 9: 504. 1955. TYPE on *Clytostoma callistegioides* (Chamisso) Bureau from **Argentina**, Tucumán: Instituto Miguel Lillo garden, 30 Aug 1951, *R. Singer-T1590*. (Not *P. cumminsii* Kern & Thurston, 1944).

Anamorph

*Uredo hieronymianus* (P. Hennings) H. Sydow & P. Sydow, Ann. Mycol. 6: 137. 1908.

= *Uromyces hieronymianus* P. Hennings, Hedwigia 33: 229. 1894. TYPE on *Clytostoma callistegioides* (Chamisso) Bureau from **Uruguay**: Concepcion del Uruguay, month not reported, 1878, *Lorentz s.n.* Telia not described.

= *Prospodium oblectum* H. Sydow, Ann. Mycol. 30: 95. 1932. TYPE on *Clytostoma callistegioides* (Chamisso) Bureau from **Brazil**, Rio Grande do Sul: Piratiny near Pelotas, 3 Nov 1901, *G.O.A. Malme-173*. Telia not described.

On Bignoniaceae

*Clytostoma callistegioides* (Chamisso) Bureau, Rio Grande do Sul (Sydow, 1932: 95; Cummins, 1940: 75; Lindquist & Costa Neto, 1963: 138), São Paulo (IBI-13789).

*Prospodium singeri* has been reported also from Argentina and Uruguay.

Spermogonia on both sides of leaves, abundant and closely grouped. Aecia on both sides of leaves, confluent around the spermogonia, pulverulent, cinnamon-brown; aeciospores pedicellate, obovoid or ellipsoid, 28-37(-39) x (23-)25-30(-33)  $\mu\text{m}$ , wall (2.5-)3.5-4  $\mu\text{m}$  thick at sides becoming 5-7  $\mu\text{m}$  apically, indistinctly or to bilaminate but becoming gradually paler toward the periphery, golden-brown or darker,

echinulate with spines spaced 2-4  $\mu\text{m}$ , becoming smooth around the pores and toward the hilum, pores 2, equatorial in slightly flattened sides, with slight cuticular caps. Uredinia apparently not seen; urediniospores occasional in the telia, as the aeciospores. Telia blackish brown, confluent in a ring around the aecia or separate, pulverulent; teliospores 33-40(-50) x (22-)25-30(-33)  $\mu\text{m}$ , broadly ellipsoid, constricted at the septum, wall uniformly (1.5-)2-2.5(-3)  $\mu\text{m}$ , chestnut-brown, echinulate with cones about 2  $\mu\text{m}$  high spaced 2.5-4  $\mu\text{m}$ , pore of upper cell apical, of lower cell next the pedicel, with slight cuticular caps 1-2.5  $\mu\text{m}$  thick, pedicel colorless, to 90  $\mu\text{m}$  long but usually about 50-70  $\mu\text{m}$ , thick walled, with a discrete fracture point toward the base and sometimes with a septum basally, unadorned.

**PROSPIDIUM STIZOPHYLLI** H. S. Jackson & Holway in Jackson, Mycologia 24: 93. 1932. TYPE on *Stizophyllum perforatum* (Chamisso) Miers from **Brazil**, São Paulo: São Paulo, Avenida Paulista, 5 March, 1922, *Holway-1613*. (**O/-, -/III**).

= *Prospodium piracicabanum* Viégas, Bragantia 5: 12. 1945. TYPE on *Stizophyllum perforatum* (Chamisso) Miers, reported originally as unidentified Bignoniaceae, from **Brazil**, São Paulo: Piracicaba, Escola Agrícola Luis de Quiroz, Dec 1933, A. S. *Costa-960*.

On Bignoniaceae:

*Stizophyllum perforatum* (Chamisso) Miers, Minas Gerais (Joerstad, 1956: 455; IBI-16294), São Paulo (Jackson, 1932: 93; Cummins, 1940: 72; Viégas, 1945: 12; IAC-960; IBI-15268). *Prospodium stizophylli* has been reported only from Brazil.

Spermogonia on the adaxial side of leaves, few. Aecia and uredinia not produced. Telia mostly along the veins on the abaxial side of leaflets, early exposed, dark blackish-brown, pulverulent; teliospores (34-)38-43(-46) x (19-)23-27(-29)  $\mu\text{m}$ , broadly ellipsoid or oblong-ellipsoid, slightly constricted at septum, wall indistinctly bilaminar, the outer wall obvious only at septum and over pores, inner wall 2-3  $\mu\text{m}$  thick over each pore, irregularly rugose-reticulate with narrow ridges that fuse variously or branch but a precise reticulum not formed, pore apical in upper cell, near pedicel in lower cell; pedicel septate about 10-15  $\mu\text{m}$  below the spore, breaking at septum, colorless; 1-celled teliospores abundant.

Infections tend to be locally systemic in small areas along veins of leaflets. *Prospodium stizophylli* and *P. cremastum* are the only species of *Prospodium* with the pseudoreticulate sculpture on the teliospores.

**E§ Nephlyctis: on Bignoniaceae.**

1. Teliospores obviously rugose-reticulate .....50. *P. stizophylli* (*Stizophyllum*, **Brazil**).

1. Teliospores with verrucae often united in short series .....51. *P. cremastum* (*Cremastus*, *Arrabidaea*, **Brazil**).

1. Teliospores echinulate, aculeate, or verrucose-echinulate. Other species of *Prospodium*, series Nephlyctis.

Leaflets of the host have minute pellucid dots visible with a X10 hand lens, a trait that may help identify *Stizophyllum*.

**PROSPIDIUM TECOMICOLA** (Spegazzini) H. S. Jackson & Holway in Jackson, Mycologia 24: 94. 1932. (**0/Ipe, IIpe/III**). **Cyathiform, unicap.**

= *Puccinia tecomicola* Spegazzini, Anal. Mus. Nac. Hist. Nat. Buenos Aires 31: 387. 1922.

TYPE on *Tabebuia araliacea* (DeCandolle) Morong & Britton (reported as *Tecoma araliacea*) from **Paraguay**, Asunción, July 1919, *Spegazzini s.n.*

= *Prospodium concinnum* H. Sydow, Ann. Mycol. 28: 45. 1930. TYPE on *Tabebuia ochracea* (Chamisso) Standley [reported as *Tecoma chrysantha* (Jacquin) DeCandolle] from Venezuela, La Victoria, date not recorded, *H. Sydow-371*.

Anamorph

*Uredo longiaculeata* P. Hennings, Hedwigia Beiblatt 38: (68). 1899. TYPE on *Tabebuia* sp. (reported originally as *Tecoma* sp.) from **Brazil**, Santa Catarina: Campo d'Una-Laguna, Dec. 1889, *Ule-1593*.

On Bignoniaceae

*Tabebuia alba* (Chamisso) Sandwith (*Tecoma alba* Chamisso), Paraná (IBI-12219) Rio Grande do Sul (Cummins, 1940: 49).

*Tabebuia araliacea* (DeCandolle) Morong & Britton, Rio de Janeiro (Viégas, 1945: 14; IAC-980).

*Tabebuia ipe* Standley, Paraná (Fontoura & Nowacki, 1967/770: 175).

*Tabebuia ochracea* (Chamisso) Standley, Minas Gerais (Cummins, 1940: 49), São Paulo (Cummins, 1940: 49, IBI-12544).

*Tabebuia serratifolia* (Vahl) Nichols, Minas Gerais (IBI 16267), Pará (Albuquerque, 1971: 148;

IAN-495, -882), Rio de Janeiro (Cummins, 1940: 49), São Paulo (IBI-12528).

*Tabebuia sp.*, Minas Gerais (Thurston, 1940: 295; IBI-14488), Santa Catarina (P. Hennings, 1889: 68); Cummins, 1940: 49), São Paulo (Jackson, 1932: 94; Viégas, 1945: 14; IAC-1099).

*Prospodium tecomicola* has been reported also from Honduras, Venezuela, and Paraguay.

Spermogonia and aecia on hypertrophied areas of small stems or on the abaxial side of leaves on hypertrophied veins; aeciospores as the urediniospores except more variable and larger, mostly (28-)30-35(-38) x (25-)27-30(-33)  $\mu\text{m}$ . Uredinia on the abaxial side of leaves, brown, suprastomatal with basal peridial cup and surmounting peripheral paraphyses; urediniospores mostly 26-30 x 24-29  $\mu\text{m}$  with pores face view, bilaminate, unicapitate, the outer wall 4-5  $\mu\text{m}$  thick, colorless, with nearly to completely embedded, fringe-like, bacilliform rods, the inner wall golden brown, 1.5-2  $\mu\text{m}$  thick, pores 2, equatorial in flattened sides. Telia as the uredinia; teliospores 32-36(-38) x (22-)24-27(-28)  $\mu\text{m}$ , oblong-ellipsoid, wall obviously bilaminate, the outer layer pale brownish, 1-3  $\mu\text{m}$  thick, echinulate with small cones spaced (2-)2.5-3.5(-5)  $\mu\text{m}$ , inner wall 1.5-2.5  $\mu\text{m}$  thick, chestnut-brown, pore of upper cell apical of lower cell next to pedicel, each under a low umbo, pedicel to 60  $\mu\text{m}$  long, adorned 2/3 to 3/4 toward base with 2 knob-like, echinulate or toothed protuberances, the base often swollen and with a few coarse warts.

Two or three rings of spiny, knob-like appendages on the lower part of the pedicel of the teliospores aid in identifying this species.

#### **PROSPODIUM TUBERCULATUM** (Spegazzini) Arthur, N.Amer. Flora 7: 161. 1912. (??,II/III).

##### **Euprospodium**

≡ *Puccinia tuberculata* Spegazzini, Anal. Soc. Cient. Argentina 10: 6. 1880. TYPE on *Lantana camara* from **Argentina**, near Recoleta, April 1880, *Spegazzini s.n.*

Anamorph

*Uredo tuberculata* Spegazzini Anal. Soc. Cient. Argentina 9: 172. 1880. TYPE on *Lantana camara* from **Argentina**, near Recoleta, Feb 1880, *Spegazzini, s.n.*

On Verbenaceae

*Lantana camara* Linnaeus, Mato Grosso (IBI-16765), Minas Gerais (Thurston, 1940: 295; IBI-14490), São Paulo (Jackson, 1932: 65; Cummins, 1940: 15; IBI-12032).

*Lantana mixta* L. São Paulo (Cummins, 1940: 15).

*Lantana robusta* Schauer, Santa Catarina (Hennings, 1896: 230).

*Lantana salvifolia* Jacquin, São Paulo (Hennings, 1902D: 296).

*Lantana triplinervia*, Mato Grosso (IBI-17177).

*Prospodium tuberculatum* has been reported on several species of *Lantana* from Argentina to Mexico, and The West Indies

Spermogonia and aecia unknown. Uredinia on both sides of leaves or mostly on the abaxial side of leaves, subepidermal in origin, erumpent, cinnamon-brown, with straight, cylindrical, thin-walled, colorless, peripheral paraphyses 25-35  $\mu\text{m}$  long, often few present; urediniospores (24-)26-31(-33) x (22-)24-27(-28)  $\mu\text{m}$ , broadly ellipsoid or globoid, wall 2-3  $\mu\text{m}$  thick, cinnamon-brown or golden, echinulate, echinulae spaced 2-4(-5)  $\mu\text{m}$ , pores 2, equatorial in slightly or not flattened sides. Telia as the uredinia except blackish brown; teliospores (40-)46-53(-55) x (30-)33-38(-40)  $\mu\text{m}$ , broadly ellipsoid, wall (3.5-)4-5.5(-6)  $\mu\text{m}$  thick at sides, inconspicuously if at all bilaminate, chestnut-brown, 6-8(-9)  $\mu\text{m}$  over pores as paler, differentiated umbos, echinulate, echinulae spaced (2-)2.5-4.5(-7)  $\mu\text{m}$ , pore apical in upper cell, near the pedicel in lower cell; pedicel (50-)65-90(-110)  $\mu\text{m}$  long, nearly or quite colorless and thin-walled, the lower one-third without or with 1 or 2 irregular whorls of branched appendages or some of these simple. .

Collections from Argentina & Brazil have teliospores with pedicels only partly adorned or unadorned. Telia were found only in May and June in Sao Paulo state Brazil.

Scientists have introduced *Prospodium tuberculatum* from Brazil into Australia as a biological control agent for *Lantana*. Weed scientists have dubbed *Lantanas* as one of the worst weeds in the world.

*Prospodium viegasii* Joerstad, see **DIPYXIS VIEGASII** (Joerstad) Cummins & J.W.Baxter.

#### **PROSPODIUM VONGUNTENII** (Mayor) Dietel in Engler & Prantl Nat. Pflanzenfam. 6:65. 1928.

##### (??,II/III). **Euprospodium.**

≡ *Puccinia vonguntanii* Mayor, Mém. Soc. Neuch. Sci. Nat. 5: 492. 1913. TYPE on *Lippia*

*americana* Linnaeus from **Colombia**, Dept. Bolivar: Magdalena –Baranquilla, 2 Nov 1910, Mayor-368.

≡ *Prospodium vonguntanii* (Mayor) Kern & Whetzel, J. Dept. Agr. Puerto Rico 14: 310. 1930.

On Verbenaceae

*Lippia* sp., São Paulo (IBI-14658).

This is the first record of *Prospodium vonguntanii* from Brazil. It was known before on *Lippia* and *Aloysia* from Argentina and Colombia. The pedicels of the teliospores usually have a few poorly developed appendages near their base.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, subepidermal becoming erumpent, cinnamon-brown, with few peripheral, colorless, thin-walled paraphyses; urediniospores (19-)21-24(-25) μm diam, mostly globose, wall 1.5(-2) μm thick, cinnamon-brown, uniformly echinulate with echinulae spaced 2.5-3.5(-4) μm, pores 2, equatorial in rounded, echinulate sides. Telia as the uredinia except blackish brown; teliospores (38-)42-50(-54) x (26-)28-30(-33) μm, broadly oblong-ellipsoid, not or only slightly constricted at septum, wall 4-5 μm thick, not laminate, dark chestnut-brown and only slightly paler toward exterior, echinulate-verrucose with low cones spaced 2.5-4 μm, pore apical in upper cell, next to hilum in lower cell, each with a low golden brown umbo, pedicel to 70 μm long but often much shorter, with 1 pair of small lobed or simple appendages or these sometimes lacking.

*Prospodium vonguntanii* (Mayor) Kern & Whetzel, see **PROSPODIUM VONGUNTENII** (Mayor) Dietel.

*Prospodium wulffiae* H. W. Thurston, see **PROSPODIUM PARAGUAYENSE** Spegazzini.

## PUCCINIA

Arthur (1922) reported that *Puccinia* is a "form genus" that he defined as "Species whose life-cycle is not known, or is not readily assumed from related forms...These genera do not represent the whole cycle of development, and are not based upon type species" Later, he abandoned this usage in favor of using *Puccinia* as a teleomorph genus in the modern sense.

**PUCCINIA ABNORMIS** P. Hennings, Hedwigia 35: 243. 1896. **TYPE** on *Echinochloa* sp from **Argentina**, Córdoba: Rio Tercero, date not reported, *Galander s.n.* Host erroneously originally reported as *Gymnothrix* sp. (?/? ≠ **Ipe/III**).

= *Puccinia subdiorchidioides* P. Hennings, Hedwigia 35: 244. **TYPE** on *Echinochloa crusgalli* (Linnaeus) P. Beauvois from **Argentina**, Buenos Aires: Rio Lujan near Buenos Aires, *Bettfreund s.n.* Host reported originally as *Panicum crus-galli*.

On Gramineae:

*Echinochloa crusgalli* (Linnaeus) P. Beauvois, Minas Geraes (Thurston, 1940, as *Puccinia flaccida* Berkeley & Broome).

*Panicum* sp., Rio Grande Sul (Lindquist & Costa Neto, 1963: 112). The host of this report is probably *Echinochloa crus-galli* because Cummins (1971) lists *P. abnormis* as infecting only *Echinochloa* spp.

*Puccinia abnormis* has been reported from northern Argentina to the southern United States of America.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, cinnamon-brown; urediniospores 18-20(-24) x (13-)17-19 μm, mostly broadly ellipsoid or obovoid, wall 1.5-2.5 μm thick, cinnamon-brown, echinulate, germ pores 4-6, scattered. Telia on both sides of leaves, early exposed, chestnut-brown, pulvinate; teliospores (26-)30-35(-48) x 12-15(-27) μm, mostly ellipsoid or oblong-ellipsoid, usually variously diorchidioid, wall 1-1.5 μm thick at sides, 2-4 μm apically, golden smooth; pedicels to 50 μm long, colorless, thin-walled and collapsing, fragile (Cummins, 1971).

*Puccinia abnormis* has been reported mistakenly a few times previously from South America as *P. flaccida*. But Cummins (1971) has shown that true *Puccinia flaccida* has been reported only from Sri Lanka (Ceylon), India, and Japan, and has 3 equatorial germ pores in its urediniospores instead of 4-6 scattered germ pores as in *Puccinia abnormis*. Cummins (1971) mistakenly listed *Diorchidium flaccidum* Lagerheim as a synonym of *Puccinia abnormis*. It should have been listed as a synonym of *Puccinia flaccida* Berkeley & Broome.



*Puccinia abrupta* Dietel & Holway var *partheniicola* (H. S. Jackson) Parmelee see **Puccinia SCHILEANA** Spegazzini var. **PARTHENIICOLA** (H. S. Jackson) Lindquist.

*Puccinia absinthi* DeCandolle, see **Puccinia TANACETI** DeCandolle.

*Puccinia acanthospermi* P. Hennings, see **Puccinia CNICI-OLERACEI** Persoon ex Desmazieres.

*Puccinia acanthospermi* P. Sydow & P. Sydow (not that of P. Hennings), see **Puccinia CNICI-OLERACEA** Persoon ex Desmazieres.

*Puccinia accedens* Sydow, see **Puccinia LANTANAE** Farlow.

**Puccinia ACHYROCLINES** H. S. Jackson & Holway in Jackson, [as "(P. Henn.) Jackson & Holway, *comb. nov.*"] Mycologia 24: 156. 1932. TYPE on *Achyrocline vargasiana* DeCandolle (*Achyrocline satureioides* var. *vargasiana* (DeCandolle) Baker) from **Brazil**, São Paulo: Tremembé, 6 March 1922, *Holway-1614*. (?/?,Ipe/III).

Anamorph

*Uredo achyrocines* P. Hennings, Hedwigia Beiblatt 38: (70). 1899. TYPE on *Achyrocline satureioides* (Lamarck) DeCandolle from **Brazil**, Santa Catarina: São Francisco, *Ule-326*.

On Compositae:

*Achyrocline satureioides* (Lamarck) DeCandolle, Bahia (IBI-13592); Minas Gerais (IBI-13165); Paraná (IBI-12885); Rio de Janeiro (PUR-F8240), Rio Grande do Sul (IBI-12930); Santa Catarina [Hennings, 1899: (70)], São Paulo (Jackson, 1932: 156; IBI-12725).

*Achyrocline vautheriana* DeCandolle, Rio de Janeiro (Jackson, 1932: 156; PUR-F8241).

*Puccinia achyrocines* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, scattered, almost obscured and difficult to see because of the host tomentum, round, long covered by the yellowish epidermis, blister like, erumpent, powdery; urediniospores pedicellate, 18-26 x 17-21 µm, globoid, ovoid to ellipsoid, wall ca 1 µm thick, finely and densely echinulate, colorless, germ pores usually obscure, or 8, scattered (Sydow, 1924). Telia on abaxial side of leaves, light chestnut-brown, obscured by the tomentum of the hoist; teliospores 38-50 x 18-21 µm, clavate, rounded above, narrowed and truncate below, wall 1-1.5 µm thick at sides, broadly and gradually thickened at apex 6-9 µm, light golden-brown, nearly colorless below; pedicel as long as the spore or shorter, broad at point of attachment, colorless (Jackson, 1932).

Jackson (1932) treated *Puccinia achyrocines* as a transfer from the anamorph species *Uredo achyrocines* P. Hennings. The teleomorph name, however, is to be ascribed to Jackson and Holway alone because Jackson described telia for the first time. He cited only one specimen with telia which is cited above as the type.

*Puccinia investita* Schweinitz is a closely related species that has *Aecidium gnaphaliatum* Schweinitz as its uredinial stage. This species has been reported from North America and on *Achyrocline* spp. from Ecuador and Bolivia and on *Gnaphalium* sp. from Peru. It is to be expected in Brazil.

A comparison of three species of *Puccinia* on *Achyrocline*, *Gnaphalium*, and perhaps other closely related host genera follows.

- |  |    |
|--|----|
| 1. Anamorph spores pedicellate, walls echinulate   | 2. |
| 1. Anamorph spores catenulate, walls verrucose ( <i>Aecidium</i> sp.)  | 3. |
| 2. Urediniospores with walls dark cinnamon-brown to light chestnut-brown, (1.5-)(2-)(2.5, -3) µm thick, with two(-3) equatorial pores, visible in some spores. |    |

**Puccinia GNAPHALICOLA** P. Hennings, (?/I,Ipe/III).

On *Gnaphalium* spp., includes *Puccinia gnaphalii* (Spegazzini) P. Hennings, anamorph name is *Uredo gnaphalii* Spegazzini.

- |  |  |
|--|--|
| 2. Urediniospores with walls colorless or pale yellowish, less than 2 µm thick, evenly finely echinulate, pores obscure (or 8 and scattered fide Sydow). |  |
|--|--|

**Puccinia ACHYROCLINES** H. S. Jackson & Holway.

(?/?,Ipe/III). On *Achyrocline* spp., anamorph name is *Uredo achyrocines* P. Hennings.

3. Aecia of *Puccinia gnaphaliicola* unknown

3. Uredinospores, if produced, *Aecidium*-like (sori cupulate, peridiate, spores catenulate, verrucose), spores (19-)20-26(-29) x (16-)18-22(-24)  $\mu\text{m}$ , wall 1-1.5  $\mu\text{m}$  thick, finely verrucose. Teliospores (36-)40-53(-58) x 14(-)18-23(-25)  $\mu\text{m}$ , lateral walls (1-)1.5(-)2  $\mu\text{m}$ , apical walls (5-)8-10(-13)  $\mu\text{m}$

**Puccinia INVESTITA** Schweinitz, (**0/Icv,?Icv/III**).

On **Gnaphalium** and ?**Achyrocline**. Includes *Caeoma* (*Aecidium gnaphaliatum* Schweinitz, and *Puccinia gnaphaliata* (Schweinitz) Arthur & Bisby.

*Puccinia actinostemonis* H. S. Jackson & Holway, see **Puccinia PSIDII** Winter.

*Puccinia aculeatispora* Hohnel, see **DIORCHIDIUM ACANTHOSTEPHUM** Sydow.

*Puccinia aequatoriensis* H. Sydow & P. Sydow, see **Puccinia ROULINAE** P. Hennings.

*Puccinia agnesiae* H. Sydow, see **Puccinia PUTA** H. S. Jackson & Holway.

**Puccinia AGNITIONALIS** H. S. Jackson & Holway in Jackson, Mycologia 24: 108. 1932. TYPE on *Vernonia diffusa* Lessing [ $\equiv$  *Vernonanthura diffusa* (Lessing) H. Robinson], Compositae, from **Brazil**, Rio de Janeiro: Teresopolis, 2 Oct 1921, *Holway-1184*. (**0/Icv,IIpe/III**).

*Puccinia agnitionalis* has been reported only from the type.

Spermogonia on adaxial side of leaves, 90-120  $\mu\text{m}$  wide, 120-150  $\mu\text{m}$  high, deep seated, ostiolar filaments short; aecia on both sides of leaves, cupulate, peridium well developed, peridial cells 40-50x16-23  $\mu\text{m}$ , irregularly polyhedral, aeciospores catenulate, 26-30x18-20  $\mu\text{m}$ , ellipsoid, walls 1-1.5  $\mu\text{m}$  thick, colorless, closely and finely verrucose. Uredinia not seen, uredinospores in telia, 26-30x18-22  $\mu\text{m}$ , ellipsoid, walls 1.5-2  $\mu\text{m}$  thick, colorless to pale golden-brown, minutely echinulate, pores obscure, probably 3, scattered. Telia on abaxial side of leaves, 0.4-0.8mm diam., scattered to in groups, numerous, soon naked, pale chestnut-brown at first, becoming grayish-white by germination, compact, pulvinate, ruptured epidermis inconspicuous, paraphyses 125-175 x 18-24  $\mu\text{m}$ , numerous, peripheral and scattered between the spores, clavate to straight or slightly curved, rounded at apex, wall ca 1  $\mu\text{m}$  thick or less, not thickened at apex, pale cinnamon-brown, teliospores 65-90 x 18-20 to 22-26  $\mu\text{m}$ , oblong to cylindrical, narrowed above, rounded below, conspicuously constricted at the septum, wall 1-1.5  $\mu\text{m}$  thick, cinnamon-brown, smooth; pedicel about half as long as spore or shorter, colorless (Jackson, 1932).

Jackson separated *Puccinia agnitionalis* by its thin teliospore walls, essentially unthickened at the apex, and by the presence of numerous, thin walled paraphyses with the telia. New collections are needed to determine if this rust still occurs in Brazil.

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but three from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

*Puccinia albida* Dietel & Neger, see **Puccinia PALLIDISSIMA** Spegazzini.

**Puccinia ALBULA** H. S. Jackson & Holway in Holway, Mycologia 24: 136. 1932. TYPE on *Baccharis* sp., Compositae, from **Brazil**, Rio de Janeiro: Niteroi, 23 Sept 1921, *Holway-1149*. (**0/Ice,IIce/III**).

Anamorph

*Caeoma* sp. unnamed sp., the TYPE the same as for *Puccinia albula*.

*Puccinia albula* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia on the adaxial side of leaves, numerous, subglobose to conical, paraphyses slightly exerted; aecia (*Caeoma* sp.) on adaxial side of leaves around the spermogonia, deeply immersed in the mesophyll, without peridia, covered by the epidermis, tardily opening with an irregular pore, yellowish; aeciospores catenulate, 36-54 x 28-36  $\mu\text{m}$  (Lindquist, 1958), 32-45 x 28-32  $\mu\text{m}$  (Jackson, 1932), ellipsoid to subglobose, wall 2.5-3.5  $\mu\text{m}$  thick, echinulate, echinulae large, 2-3  $\mu\text{m}$  long, widely spaced 3-6  $\mu\text{m}$  apart. Uredinia with the same morphology as the aecia but without spermogonia. Telia on yellowish spots on the

abaxial side of leaves, originating deeply within the mesophyll, 0.2-0.3 mm across, round, scattered or in groups, soon erumpent, ruptured epidermis not evident, bright golden-brown, becoming grayish-white by germination, teliospores 45-67 x 20-24 µm, ellipsoid, oblong to subclavate, rounded above, rounded or narrowed below, constricted at the septum, wall (1-)1.5-3 µm thick at sides, not or slightly thickened to 2.5-3 µm at apex, pedicel about as long as or shorter than the spore, fragile, colorless (Jackson, 1932; Lindquist, 1957).

*Puccinia* spp. have been reported on *Baccharis* spp. only in the Americas. Lindquist (1957) reported at least 55 of these species, 15 of which have been reported from Brazil. Thus, *Baccharis* has more *Puccinia* species than any other host genus in the Americas.

**PUCCINIA ALIA** H. S. Jackson & Holway in Jackson, Mycologia 24: 137. 1932. TYPE on *Baccharis trinervis* Persoon, Compositae, from **Brazil**, Rio de Janeiro, 9 Aug 1921, *Holway-1007*. (0/Ice, IIpe/III).

*Puccinia alia* has been reported with certainty only from the type. A questionable report of this species from Guatemala, also on *Baccharis trinervis*, is based on uredinia only.

Spermogonia on both sides of leaves; aecia (*Caecoma* sp) on both sides of leaves, deep seated, without peridium, covered by epidermis, opening by a pore, aeciospores catenulate, (23-)26-35(-40) x (16-)18-23(-25) µm, mostly ellipsoid or obovoid, wall 2-2.5(-3) µm thick at sides, often slightly thicker at one or both ends, echinulate, spines spaced (2-)3-5 µm. Uredinia on abaxial side of leaves, rather slowly exposed, pale yellowish (dry), bright yellow (fresh), urediniospores pedicellate, (22-)26-35(-40) x (17-)18-22(-24) µm, mostly obovoid or ellipsoid, wall 1.5(-2) µm thick, sometimes thicker apically, echinulate, yellowish or nearly colorless, pores obscure, equatorial, probably 2, perhaps sometimes 3. Telia on abaxial side of leaves, exposed, about cinnamon-brown, becoming gray from germination, compact; teliospores 40-60(-68) x (15-)17-22(-23) µm, mostly elongately ellipsoid, wall 1 µm thick at sides, golden-brown, 2-4 µm thick over pores by a small, nearly colorless umbo, smooth, pore of upper cell apical, of lower cell at septum; pedicel to 60 µm long but often shorter, colorless (Cummins, 1978).

Synonyms for the host binomial include *Conyza trinervia* ("trinervis") Mill., *Conyza trinervis* Lamarck, *Baccharis rexioides* Humboldt, Bonpland & Kunth, *Baccharis trinervis* var. *rhexioides* (H. B. K.) Baker, and *Psila trinervis* ("Lamarck) Cabrera (R. McVaugh, 1984).

Species of *Puccinia* are known to parasitize species of *Baccharis* only in the Americas. Lindquist (1957) reported at least 55 of these species. Thus, *Baccharis* has more *Puccinia* species than any other host genus in the Americas.

**PUCCINIA ALLAUDABILIS** H. S. Jackson & Holway in Jackson, Mycologia 24: 109.1932. TYPE on *Vernonia argyrotrichia* Schultz-Bipontius ex Baker [= *Lepidaploa argyrochria* (Schultz-Bipontius ex Baker) H. Robinson], Compositae, from **Brazil**, Rio de Janeiro: Teresopolis, 8 Oct 1921, *Holway-1199*. (0/I, IIpe/III).

*Puccinia alludabilis* has been reported from the type and one other Holway collection from the same location, 11 Oct 1921. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia and aecia produced but not adequate for description. Uredinia on abaxial side of leaves, scattered, few, 0.5-1 mm across, ruptured epidermis inconspicuous, powdery, pale cinnamon-brown, urediniospores 22-26 x 20-24 µm, globoid to broadly ellipsoid; wall 1.5-2 µm thick, closely and finely echinulate, pores 3-4, scattered, subobscure. Telia numerous on abaxial side of leaves, 0.5-0.8 mm across, scattered or in groups, pulvinate, ruptured epidermis mostly inconspicuous, chestnut-brown, becoming ashy-gray by germination, without paraphyses; teliospores 60-78 x 15-19 µm, cylindrical to terete, obtuse to narrowed above, rounded to somewhat narrowed to pedicel, slightly or not constricted at septum, wall more or less evenly 1-1.5 µm thick, smooth, cinnamon-brown, pedicel about as long as or shorter than the spore, colorless, fragile (Jackson, 1932).

*Puccinia alludabilis* may be distinguished from others on *Vernonia* by the slender, thin walled teliospores, not thickened at the apex and not over 20 µm wide, together with the thin walled, closely echinulate urediniospores.

A few old aecia accompanied by pycnia are present, but are too imperfect for adequate diagnosis. The pycnia are epiphyllous, deep seated, nearly globoid, 120-150 µm wide by 150 µm high, with short ostiolar filaments. The aecia are hypophyllous, with membranous, lacerate peridium. The peridial cells seen in face view are irregularly polyhedral, 23-28 by 40-60 µm. The wall is coarsely and prominently tuberculate

verrucose. The aeciospores are ellipsoid, 20-30 by 24-26  $\mu\text{m}$ , with colorless thin walls, 1-1.5  $\mu\text{m}$ , coarsely and prominently verrucose, with a tendency to be verrucose rugose near one end (Jackson, 1932).

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but three from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

**Puccinia ALLII** Rudolphi, Linnaea 4: 392. 1829. (**0/Icv,IIpe/III**).

= *Puccinia mixta* Fuckel, Fungi Rhen. no. 377. 1863.

= *Puccinia porri* Winter in Rabenhorst, Krypt. Fl. 1: 200. 1882.

Anamorph

*Uredo porri* Sow., English Fungi, pl. 411. 1810.

= *Uredo alliorum* DeCandolle, Fl. France. 6: 82. 1815.

On Liliaceae, *sensu lato*:

*Allium cepa* Linnaeus (Onion, leaf blades hollow), Paraná (Fontoura & Nowacki, 1967: 110), São Paulo (Viégas, 1945: 15; IAC-567).

*Allium esculonicum* Linnaeus (Shallot, leaf blade slender awl-like), São Paulo (IBI-5031).

*Allium porrum* Linnaeus (Leek, leaf blades equitant, keeled), Paraná (Fontoura & Nowacki, 1967: 111).

*Allium sativum* Linnaeus (Garlic, leaf blades flat), Minas Gerais (Thurston, 1940: 296; IBI-1013), Paraná (Fontoura & Nowacki, 1967: 111), Rio Grande do Sul (Lindquist & Costa Neto, 1936: 119; IBI-720), São Paulo (IBI-4960).

*Allium* sp., São Paulo (Viégas, 1945:15; IAC-4118; IBI-269).

Researchers do not agree about the number of species of *Puccinia* that infect various species of *Allium*. We follow Wilson and Henderson (1966) who regard *Puccinia allii* as widespread, with intergrading morphological traits in various populations infecting many species of *Allium*. Severe infections produced by this species complex can kill leaves of cultivate species of *Allium*. Garlic, chives, and leeks are the most susceptible. But Savile (1961) considers the rust on *Allium schoenoprasum* (chives) as *Puccinia mixta* and the rust on *A. porrum* (leeks) as *Puccinia porri*.

Spermogonia and aecia have not been reported from South America. The telial sori of *Puccinia allii* in the broad sense are covered by the epidermis and appear as a black crust when mature. The telial sori are composed of numerous, darkly pigmented, thick-walled paraphyses that surround locules filled with teliospores. Among the variable traits is the quantity of one-celled teliospores (mesospores) in the telia. *Puccinia porri* was considered as a separate species because it had more than 50 % mesospores while *Puccinia allii* had less than 50 %. Because this trait intergrades it seems not to be able separate species.

Paszchke (1892: 95) reported *Puccinia allii* on *Bomarea edulis* Herb., Alstroemeriaceae, the family reported sometimes as Amaryllidaceae, from Santa Catarina. (*Ule-130*) This specimen later became the type of *Puccinia bomareae* P. Hennings.

*Puccinia amphiospora* Cummins, see **Puccinia HYPTIDIS-MUTABILIS** Mayor.

*Puccinia amphistelmae* P. Hennings, see **Puccinia CYNANCHI** Berkeley & Curtis.

*Puccinia andropogonicola* Spegazzini (not that of Hariot), see **Puccinia POSADENSIS** Saccardo & Trotter.

*Puccinia anemopaegmatis* P. Hennings, see **PROSPODIUM ANEMOPAEGMATIS** (P. Hennings) Cummins.

*Puccinia anguriae* Arthur & Cummins, see **Puccinia ARECHAVALETAE** Spegazzini.

*Puccinia angustata* Peck var. *angustatoides* (Stone) Arthur, see **Puccinia ANGUSTATOIDES** R. E. Stone.

**Puccinia ANGUSTATOIDES** R.E. Stone, Bull. Torrey Bot. Club 36: 549. 1909. TYPE on

*Rhynchospora corniculata* (Lamarck) A. Gray from **The United States of America**, Alabama: Auburn, 17 Sept 1908, R. E. Stone s.n. Stone lists one other specimen: Auburn, Alabama, 1 Jan 1909, E. E. Binford s.n. A lectotype needs to be chosen. (0/I<sup>2</sup> IIpe/III).

≡ *Puccinia angustata* Peck var. *angustatoides* (Stone) Arthur, Manual of Rusts of United States and Canada. p. 196. 1934.

= *Puccinia rhynchosporicola* Spegazzini, Rev. Argent. Bot. 1: 123-124. 1925. TYPE on *Rhynchospora stricta* Boeck. from **Argentina**, other data not reported.

On Cyperaceae:

*Rhynchospora marisculus* Lindley & Nees, Paraná (Joerstad, 1956: 479).

*Rhynchospora* sp. Minas Gerais (Thurston, 1940: 296).

*Puccinia angustatoides* has been reported also from Argentina, The West Indies, and the Southern United States of America. Spermogonia and aecia occur on *Pluchia* sp., Compositae, in the Southern United States of America.

Lindquist and Costa Neto (1963) questioned the identification of a rust reported to be *Puccinia angustatoides* on *Cyperus* sp., Rio Grande do Sul, because the host was not *Rhynchospora* and no telia were found on this specimen. Rusts on Cyperaceae in Latin America require more detailed comparative studies to better sort out well defined morphological species.

Traits important for identifying *P. angustatoides* have been reported to be that the host is not *Carex*, the urediniospores usually have two supraequatorial germ pores, and telia are erumpent, without paraphyses, and usually with some one-celled teliospores. Arthur (1934) placed species of *Puccinia* that had urediniospores with supraequatorial germ pores and erumpent, non paraphysate telia which parasitized Cyperaceae genera other than *Carex* in *P. angustata* with three varieties, including *P. angustata* var. *angustatoides* (R. E. Stone) Arthur. The supraequatorial germ pores of the urediniospores seems to be a variable trait and difficult to determine in some collections.

Jackson (1926) reported that *Uromyces rhynchosporae*, which has been recorded also from Brazil, is a correlated species whose uredinia are almost identical to those of *Puccinia angustatoides*, making it almost impossible to identify uredinial collections with confidence.

**Puccinia ANTHEPHORAE** Arthur & Johnston, Mem. Torrey Bot. Club 17: 137. 1918. TYPE on *Antheophora hermaphrodita* from **Jamaica**, 5 Mar 1908, Britton-1917. (?/?<sup>2</sup> IIpe/III).

Anamorph

*Uredo antheophorae* H. Sydow & P. Sydow, Ann. Mycol. 1: 22. 1903. TYPE on *Antheophora hermaphrodita* (L.) Kuntze (reported as *Antheophora elegans* from **Cuba**, place and date not reported, R. de la Sagra s.n.

On Gramineae:

*Antheophora hermaphrodita* (L.) Kuntze (reported as *Antheophora elegans* Schreiber), Pernambuco (Batista & Bezerra, 1960: 15).

Cummins (1971) lists *Puccinia antheophorae* for the West Indies, Guatemala, and Colombia, but not Brazil. Its occurrence in Brazil needs to be confirmed.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, yellowish brown, rather compact; urediniospores (26-)28-31 x (22-)24-27(-29) μm, mostly broadly ellipsoid or broadly obovoid, wall (2.5-)3-4 μm thick, or 4-6 μm apically, golden to cinnamon-brown, rugose-verrucose in a labyrinthiform pattern, germ pores 3 or 4, equatorial. Telia on both sides of leaves, early exposed, blackish; teliospores (30-)33-40(-42) x (21-)25-30(-32) μm, broadly ellipsoid or broadly obovoid, wall 2.5-3.5(-4) μm at sides, (5-)6-8(-9) μm apically, chestnut-brown, smooth; pedicels thin-walled, collapsing, yellowish, to 100 μm long; 1-celled teliospores are common (Cummins, 1971).

Traits that help identify *Puccinia antheophorae* include uredinia without paraphyses, urediniospore walls rugosely verrucose in a labyrinthiform pattern, 3-4 equatorial pores (Cummins' Group VII), teliospores (21-)25-30(-32) μm wide, broadly ellipsoid or broadly obovoid, apical wall nearly uniformly chestnut-brown. *Puccinia cenchri* has been reported also on the grass genus *Antheophora*.

**Puccinia ANTIRRHINI** Dietel & Holway in Dietel, Hedwigia 36: 298. 1897. TYPE on *Antirrhinum majus* (cultivated) from **The United States of America**, California: Alameda Co., Berkeley, 1 Aug 1895, W. C. Blasdale s.n. (?/?<sup>2</sup>,IIpe/III).

On Scrophulariaceae

*Antirrhinum majus* Linnaeus. Rio Grande do Sul (IBI-15982), São Paulo (IBI-15980).

*Puccinia antirrhini* is common on snapdragon, *Antirrhinum majus*, where cultivated, but this rust was found in Brazil only recently. When severely infected, the plants produce no flowers and may die.

The original home of this rust is in Western North America on indigenous species of *Antirrhinum* and *Cordylanthus*. Even though *Antirrhinum majus* comes originally from the Mediterranean region, this rust has been able to infect the cultivated *snapdragons* and has become widespread.

**Puccinia APII** Desmazieres, Catal. des plantes Omis., p. 25. 1823.

On Umbelliferae:

*Apium graveolens* Linnaeus, Brazil (Silveira, 1951: 220).

The occurrence of *Puccinia apii* in Brazil needs confirmation.

*Puccinia appendiculata* Winter, see **PROSPIDIUM APPENDICULATUM** (Winter)Arthur.

*Puccinia appendiculatoides* P. Hennings, see **PROSPIDIUM APPENDICULATOIDES** (P. Hennings) Cummins.

**Puccinia ARACHIDIS** Spegazzini var. **ARACHIDIS**, Anal. Soc. Cient. Argentina 17: 90. 1884.

TYPE on a wild species of *Arachis*, mistakenly reported originally as *Arachis hypogaea*, from **Paraguay**, near Caa-guazu in a sub-virgin forest, Jan 1882, *B. Balansa-3449*. (?/?, **IIpe/III**).

Anamorph

*Peridipes arachidis* (Lagerheim) Buriticá & Hennen, Rev. Acad. Colomb. Cienc. 19: 50. 1994.

≡ *Uredo arachidis* Lagerheim, Tromso Mus. Aarsb. 17: 106. 1894. TYPE on *Arachis hypogaea* Linnaeus from **Surinam**, the year late 1827 or early 1828, *C. Weigelt s.n.*

≡ *Uromyces arachidis* P. Hennings, Hedwigia 35: 224. 1896. TYPE an isotype specimen of *Uredo arachidis* Lagerheim, only uredinia described.

On Leguminosae:

*Arachis glabrata* Bentham, Mato Grosso (PUR-F6248).

*Arachis hypogaea* Linnaeus, Mato Grosso (PUR-F6251), Pará (IAN-684), Paraná (Fontoura & Nowacki, 1967/70: 113), Rio Grande do Sul (PUR-F18746), Rio de Janeiro (IAC-4680), São Paulo (IBI-12220).

*Arachis* sp., Mato Grosso do Sul (IBI-14314), Minas Gerais (IBI-16788).

*Puccinia arachidis* has been reported world wide in most places where peanuts are cultivated.

Spermogonia and aecia unknown. Uredinia, *Peridipes arachidis*, mostly on the abaxial side of leaflets, sometimes on petioles, stipules, and stems, scattered or in irregular groups, subepidermal in origin, blister-like when immature, covered by a thin, membranous, net-like peridium just under the epidermis, erumpent, peridium remains stuck to the conspicuous, ruptured epidermis, powdery, dark cinnamon-brown; without paraphyses; urediniospores (21-)23-29 x (16-)18-22(-24) μm, broadly ellipsoid to obovoid, wall 1-2 μm thick, finely echinulate, echinulae 2-3 μm apart, pores mostly 2, occasionally 3-4, equatorial, pores often in slightly flattened areas. Telia mostly on abaxial side of leaves, 0.2-0.3 mm across, subepidermal in origin, erumpent, ruptured epidermis prominent, pulvinate, chestnut- or about cinnamon-brown, turning grayish by germination; teliospores (33-)38-56(-60) x (12-)14-16(-18) μm, oblong obovate or ellipsoid, rounded to narrowed at apex, slightly or not constricted at the septum, slightly or gradually narrowed at the base, or more or less rounded at both ends, predominantly 2-celled, 1, 3, or rarely 4 celled, wall smooth, 0.7-0.8 (-1.0) μm thick at sides, light- to golden- yellow, or chestnut-brown, 2.5-4(-5) μm thick at apex, apical thickening almost hyaline, pedicel up to 35-65 μm long, thin-walled, collapsing laterally, usually broken shorter or at the spore.

The urediniospores of *Puccinia arachidis* var. *arachidis* usually have 2 equatorial germ pores, those of *P. a.* var. *ofuscata* usually have three. But in both varieties the number of germ pores may vary from two to four.

*Puccinia arachidis* is one of the few species of *Puccinia* reported on Leguminosae. There is doubt that the rust belongs in the genus *Puccinia*. The presence of a thin membranous peridium on the young

uredinial sori, one of the traits of *Peridipes*, indicates that the species is misplaced in *Puccinia*. Perhaps the correct genus for this rust will be *Sorataea*.

The disease on peanuts is especially severe in parts of India, other parts of Asia, and Africa, causing leaf drop and lower production. Teliospores are known best from wild species of *Arachis* from Brazil. On cultivated peanuts teliospores are rare but seem to occur regularly in the region of Campinas, São Paulo. (see *Peridipes* and Hennen et al., 1987).

**Puccinia ARACHIDIS** Spegazzini var. **OFFUSCATA** (Arthur) Cummins, Mycotaxon 5: 402. 1977. (?/?, IIpe/III).

≡ *Puccinia offuscata* Arthur, Bull. Torrey Bot. Club 47: 469. 1920. TYPE on *Zornia diphylla* (Linnaeus) Persoon from **Cuba**, Herradurta, 30 September 1904, Baker 2143.

= *Puccinia zorniae* Bartholomew, N. Amer. Uredinales, Ed. 1: 176. 1928 (not McAlpine, 1906).

Anamorph

*Uredo zorniae* Dietel, Hedwigia 38: 257. 1899. TYPE on *Zornia diphylla* (Linnaeus) Persoon from **Brazil**, Rio de Janeiro: Copacabana, June 1897, Ule-2296.

*Uredo zorniae* probably belongs to the anamorph genus *Peridipes* but we have not yet found the thin evanescent peridium that characterizes this genus.

On Leguminosae:

*Zornia diphylla* (Linnaeus) Persoon, Amazonas (Hennings, 1904: 161). Minas Gerais (Thurston, 1940: 301), Pará (PUR-F17290), Rio de Janeiro (Dietel, 1899: 257; Hennings; 1904: 79), São Paulo (IBI-14191).

*Zornia sp.*, Pará (IBI-16011A), São Paulo (IBI-14191).

*Puccinia arauacana* Dietel, see **Puccinia PAMPEANA** Spegazzini.

**Puccinia ARAUJAE** Lèveillé, Ann. Sci. Nat., Ser. III, 3: 69. 1845. TYPE on *Araujia sericifera* Brotero from Brazil, place, date, and collector not reported, from specimen in the Paris Museum. (-/-, -/III).

= *Puccinia cynoctoni* Lèveillé, Ann. Sci. Nat., Ser. III, 5: 270. 1846. TYPE on *Cynoctonum pachyphyllum* from **Chile**, place and date not published, *Dombey s.n.* (in P).

= *Puccinia schnyderi* Spegazzini, Anal. Soc. Cient. Argentina 10: 8. 1880. TYPE on *Araujia albens* G. Don from **Argentina**, "al Tigre", April 1880, *O. Schnyder-s.n.*

= *Puccinia lagoensis* P. Hennings, Hedwigia 47: 267. 1908. TYPE on *Oxypetalum* sp. from **Brazil**, Bahia: Pianhy, Serra da Lagoa, Jan 1907, Ule-7157.

= *Puccinia cabo-friensis* P. Hennings, Hedwigia 43: 79. 1904. TYPE on *Oxypetalum* sp. from **Brazil**, Rio de Janeiro, Cabo-Frio, Oct 1899, Ule-s.n

On Asclepiadaceae:

*Araujia albens* Don, Brazil (Hennings, 1896: 237).

*Araujia sericifera* Brotero, Brazil (Lèveillé, 1845: 69), São Paulo (Jackson, 1931: 493; Puttemans-1251; PUR-F7098).

*Oxypetalum* sp., Bahia (Hennings, 1908: 267), Rio de Janeiro (Hennings, 1904: 79).

*Widgrenia corymbosa* Malme, Paraná (Joerstad, 1956: 450).

**Genus undetermined**, Santa Catarina (Pazschke, 1892: 95).

Arthur (1922), Jackson (1931), Joerstad (1956), and we have combined more than 20 microcyclic species names of *Puccinia* that have been reported on at least 12 genera of the subfamily Cynanchoideae, family Asclepiadaceae, from the Americas into three species. In some specimens, infections are systemic forming witches' brooms or other malformations. Joerstad (1950) separated these three species with difficulty, as follows:

**Key to help identify three microcyclic species of *Puccinia* on Asclepiadaceae subfamily Cynanchoideae**

1. Teliospores mostly broadly ellipsoid or nearly globose, up to 36 µm long and 23 µm (rarely 25 µm) broad, wall usually cinnamon-brown, comparatively thick, often 2-2.5 µm (-4 µm), pedicels often more or less frequently inserted obliquely. Telia dark brown. **Puccinia CYNANCHI**

(= **Puccinia OBLIQUA**).

1. Teliospores mostly oblong-ellipsoid, wall yellowish-brown or nearly colorless, pedicels usually not

inserted obliquely.

2. Teliospores comparatively large, up to 42  $\mu\text{m}$  (rarely 44  $\mu\text{m}$ ) long and up to 19-23  $\mu\text{m}$  broad, wall 1.5-2.5  $\mu\text{m}$  thick. Telia often dark brown. **Puccinia ARAUJAE.**

2. Teliospores up to 36  $\mu\text{m}$  (sometimes 39  $\mu\text{m}$ ) long, and up to 19  $\mu\text{m}$  wide, wall mostly from 1-1.5 to 2  $\mu\text{m}$  thick(-2.5  $\mu\text{m}$  thick). Telia usually cinnamon-brown.

**Puccinia ROULINIAE.**

**Puccinia ARECHAVALETAE** Spegazzini, Anal. Soc. Cient. Argentina 12: 67. 1881. **TYPE** on *Cardiospermum velutinum* from **Paraguay**, Montevideo, Quilmes, July 1881, *J. Arechavaleta s n.* (-/,-/III).

= *Uromyces pervius* Spegazzini, Anal. Soc. Cient. Argentina 17: 94. 1884. **TYPE** on “*Cupania*” sp. from **Paraguay**, Villa Rica, January 1882, *Balansa-3515*.

= *Uromyces aeruginosus* Spegazzini Rev. Argentina Hist. Nat. 1: 175. 1891. **TYPE** on unidentified Sapindaceae from **Paraguay**, Posta-cue, April 1884, *Balansa-4267*.

= *Puccinia serjaniae* Ellis & Everhart, Erythea 5: 6. 1897. **TYPE** on *Serjania* sp. from **Mexico**, Baja California, Pescadero, September 1893, *A. W. Anthony s n.*

= *Puccinia anguriae* Arthur & Cummins, Ann. Mycol. 31: 43. 1933. **TYPE** on undetn. Sapindaceae (originally recorded erroneously as *Anguria* sp, Cucurbitaceae) from **Brazil**, Cabo Frio, Rio de Janeiro, 8 August 1915, *J. N. Rose & P. G. Russel-20704*.

On Sapindaceae:

*Cardiospermum grandiflorum* Swartz, Mato Grosso (Joerstad, 1959: 87); Minas Gerais (Thurston, 1940: 296), São Paulo (Joerstad, 1959: 87).

*Cardiospermum halicacabum* Linnaeus, Minas Gerais (Jackson, 1931: 473; Thurston, 1940: 296), Santa Catarina (Hennings, 1896: 231), São Paulo (Jackson, 1931: 473).

*Cardiospermum* sp., Paraíba (Viégas, 1945: 16; IAC-3242), São Paulo (Sydow, 1907: 355).

*Paullinia* sp., Pará (PUR-F17401), Paraíba (Viégas, 1945: 16; IAC-3618), Pernambuco (Batista & Bezzera, 1960: 17), Rio de Janeiro (Dietel, 1899: 250), São Paulo (Hennings, 1902C: 105).

*Serjania communis* Cambessedes, Santa Catarina (Hennings, 1896: 231).

*Serjania cuspidata* Cambessedes, Rio de Janeiro (Jackson, 1931: 473; Viégas, 1945: 16; IAC-969).

*Serjania fuscifolia* Radlkofer, Bahia (PUR-F6360), Rio de Janeiro (PUR-F6361).

*Serjania glabrata* Kunth, Paraíba (Viégas, 1945: 16; IAC-2670).

*Serjania mansiana* Martius, Minas Gerais (Viégas, 1945: 16; IAC-4164).

*Serjania perulaceae* Radlkofer, Mato Grosso (PUR-F6366).

*Serjania* sp., Bahia (IBI-2270), Espírito Santo (IBI-4657), Goiás (Hennings, 1895A: 93); Mato Grosso (IBI-16134), Minas Gerais (Jackson, 1931: 473; Thurston, 1940: 296; Viégas & Teixeira, 1945: 55; IAC-5054), Paraíba (IAC-3622), Rio de Janeiro (IAC-4413), Santa Catarina (Pazschke, 1892: 95), São Paulo (Sydow, 1907: 355; Jackson, 1931: 473;; Viégas, 1945: 16; IAC-734).

*Thouinia* sp., Rio de Janeiro (Viégas, 1945: 16; IAC-2653).

*Urvillea* sp., Brazil (Rick, 191: 180), São Paulo (Sydow, 1907: 355; Viégas, 1945: 16; IAC-2753).

**Sapindaceae, gen. undetermined.**, Ceara (IBI-17133), Goiás (IBI-14892), Mato Grosso do Sul (IBI-14320), Minas Gerais (Jackson, 1931: 473; IBI-14911), Rio de Janeiro (Dietel, 1897: 28; Jackson, 1931: 473; Arthur & Cummins 1933: 43), São Paulo (Viégas, 1945: 16).

*Puccinia arechavaletae* has been reported from Argentina to Texas in The United States of America on at least six genera of Sapindaceae.

A comparison of the telial morphology of *Puccinia arechavaletae*, *P. heterospora*, which parasitizes genera of Malvaceae, and *Puccinia lantanae*, which parasitizes genera in the Acanthaceae and Verbenaceae, reveals that these three microcyclic species are remarkably similar. Both lack spermogonia, telia usually on the abaxial side of leaf blades, scattered or often in concentric groups, dark brown or becoming grayish by germination of the spores; teliospores mostly or almost entirely one-celled (“mesospores”), both one-celled and two-celled spores very variable in form and size, 15-24(-26) x (20-)27-35(-45)  $\mu\text{m}$ , globoid, ellipsoid, or oblong. two-celled spores may be rounded or narrowed at each end, not or slightly constricted at the septum, which is often oblique, cell walls 1.5-2(-3)  $\mu\text{m}$  thick at the sides and 3-7  $\mu\text{m}$  thick above, chestnut- to cinnamon-brown, smooth; pedicels (10-)25-105(-135)  $\mu\text{m}$  long, light cinnamon-brown or colorless.



Arthur (1934) reported that *Puccinia heterospora* is correlated with *P. schedonnardi*, but no correlated long cycle parental species has been reported for *P. arechavaletae* or *Puccinia lantanae*. Kern (1938) suggested that *Aecidium serjaniae* is part of the life cycle of an unknown heteroecious species that gave rise to *Puccinia arechavaletae*.

*Puccinia arenariicola* (P. Hennings) H. S. Jackson, see **PUCGINA MODICA** Holway.

*Puccinia argentina* Spegazzini, see **PUCGINA CNICI-OLERACEI** Persoon ex Desmazieres.

**PUCGINA ASPILIAE** Dietel, Hedwigia 36: 30. 1897. TYPE on *Viguiera* sp., Compositae, mistakenly reported originally as *Aspilia buphthalmifolia* Grisebach, Compositae, from **Brazil**, Santa Catarina, Serra Geral, Mar 1891, *Ule*-1695. (?!?,**Ипе/III**).

= *Puccinia ensenadensis* Spegazzini, An. Mus. Nac. Buenos Aires, 6:227. 1898. TYPE on *Viguiera* sp. from **Argentina**, Buenos Aires: La Plata, Ensenada, April 1892, *Spegazzini s.n.*

*Puccinia aspiliae* has been reported from Brazil only from the type listed above.

Lindquist (1982) recorded this species also from Argentina and the host as *Viguiera* sp., not *Aspilia* as originally reported. Lindquist (1982) found that Spegazzini (1925) mistakenly placed this species as a synonym of *P. spegazziniana* and reported the host as *Aspilia montevidensis*.

Telia are tardily dehiscent, teliospore walls are minutely striate and more or less uniformly thin but often a little thicker above. Urediniospores have 2 subequatorial germ pores (Lindquist, 1982).

*Puccinia asteris* Duby, see **PUCGINA CNICI-OLERACEI** Persoon ex Desmazieres.

*Puccinia atra* Dietel & Holway, see **PUCGINA ESCLAVENSIS** Dietel & Holway.

**PUCGINA AZTECA** Cummins & Hennen in Cummins, The Rust Fungi of Cereals, Grasses, and Bamboos, p. 174. 1971. TYPE on *Trisetum virletii* Fourn. from **Mexico**, Desert of the Lions National Park, 10 Miles west of Mexico City, 6 June 1970, *J. F. Hennen 70-3*. (?!?⇒ **Ипе/III**).  
On Gramineae:

*Calamagrostis viridiflavescens* (Poiret) Steudel var. **montevidensis** (Nees) Kampf (reported as *Calamagrostis montevidensis* Nees), São Paulo (Cummins, 1971: 67).

*Puccinia azteca* has been reported only from Mexico and Brazil.

Spermogonia and aecia unknown, uredinia mostly on the adaxial side of leaves, paraphyses capitate to clavate-capitate, wall mostly uniformly 1-1.5 µm thick, colorless; urediniospores (20-)23-28(-31) x (18-)20-23(-24) µm, obovoid to broadly ellipsoid, wall 1-1.5 µm thick, colorless to yellowish, echinulate, pores obscure, scattered, probably 7-9. Telia on both sides of leaves, to mostly on the adaxial side, erumpent, compact, blackish-brown, teliospores variable in size, (40-)50-95 x (11-)14-18(-20) µm, to 90-160 µm long with germination, mostly cylindrical, wall ca 1 µm thick at sides, (6-)10-18(-24) µm at apex, pale chestnut-brown, pedicel about 10 µm long (Cummins, 1971).

It seems probable that the lower cell elongates when teliospores germinate, thus accounting for the great variability in the lengths of the spores (Cummins, 1971).

**PUCGINA BACCHARIDICOLA** P. Hennings, Hedwigia 35: 242. 1896. TYPE on *Vernonia cauloni* Schultz-Bipontius. (reported mistakenly as *Baccharis* sp. originally), Compositae, from **Brazil**, Rio de Janeiro, Aug 1887, *Ule*-732. (?!?,**Иев/III**).

= *Puccinia membranacea* Dietel, Hedwigia 38: 251. 1899. TYPE on *Vernonia cauloni* Schultz-Bipontius from **Brazil**, Rio de Janeiro, Tijuca, May 1896, *Ule*-2337.

*Puccinia baccharidicola* has been reported only from the type. The label of the type collection of *P. baccharidicola* in HBG records the host as *Vernonia cauloni* Schultz-Bip. In the original publication the host was mistakenly reported as *Baccharis* sp. *Puccinia membranacea* Dietel also has been reported only from the type but belongs here as a synonym. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia and aecia unknown. Uredinia (*Aecidium* sp.) cupulate, on abaxial side of leaves, in small circles or solitary; dull white and in the middle of yellowish spots; minute; peridia cylindrical, falling

off early; white; urediniospores catenulate, 26-34  $\mu\text{m}$  long; 19-22  $\mu\text{m}$  wide, ellipsoid and globoid; cell wall colorless; verrucose. Telia abaxial, widely and irregularly scattered; minute; cinnamon; pulvinate, somewhat pulverulent, teliospores 60-90 x 19-24  $\mu\text{m}$ , oblong or fusiform; rounded at apical end and not thickened at apex; enlarged at base and rounded at pedicel; somewhat constricted at septum; cell wall very thin; pale yellow-brown; smooth; pedicel up to 80  $\mu\text{m}$  long, persistent; thick; colorless.

**Puccinia baccharidis** Dietel & Holway in Dietel, *Erythea* 1: 250. 1893. TYPE on *Baccharis viminea* from **The United States of America**, California: Pasadena, Aug 1893, *MacClatche-359*. (0/Icv,IIpe/III).

Synanamorphs

Unnamed *Caecoma* sp. and *Uredo* sp. are anamorphs of *Puccinia baccharidis*.

On Compositae:

*Baccharis burchellii* Baker, Rio de Janeiro (Jackson, 1932: 137).

*Baccharis* sp., Rio de Janeiro (Jackson, 1932: 137).

*Puccinia baccharidis* has been reported from Argentina to the United States of America.

Spermogonia on both sides of leaves, aecia on abaxial leaf surface and on stems, in groups without peridium rupturing the epidermis, bright yellow but fading when dry; aeciospores (27-)30-48(-60) x (20-)22-26(-30)  $\mu\text{m}$ , varying from globoid to fusiform, mostly oblong ellipsoid the apex often acute, wall (1.5-)2-2.5  $\mu\text{m}$  thick or the apex slightly thicker especially when acute, verrucose with bead like warts usually in more or less lineal arrangement, colorless or pale yellowish. Uredinia on both sides of leaves, yellowish to cinnamon brown; urediniospores (28-)32-43(-46) x (17-)20-24(-27)  $\mu\text{m}$ , oblong ellipsoid, ellipsoid or obovoid, wall 1.5-2(-2.5)  $\mu\text{m}$  thick, echinulate with fine spines spaced (1-)2(-3)  $\mu\text{m}$ , yellowish or golden brown, pores 5-8, scattered or tending to be bizonate. Telia mostly on abaxial leaf surface, exposed, in groups, pale cinnamon brown becoming gray from germination, compact; teliospores (45-)50-68(-72) x (22-)24-28(-31)  $\mu\text{m}$ , elongately ellipsoid or oblong ellipsoid, wall 1-1.5  $\mu\text{m}$  thick at sides, 2.5-5(-6)  $\mu\text{m}$  over pores, about golden brown except paler over pores smooth, pore apical in each cell; pedicel colorless, usually or often to 25  $\mu\text{m}$  wide, to 140  $\mu\text{m}$  long but usually less than 100  $\mu\text{m}$ ; germinating without dormancy (Cummins, 1978).

Lindquist (1957) reported at least 55 species of *Puccinia* on *Baccharis*. They occur only in the Americas. Thus, *Baccharis* has more *Puccinia* species than any other host genus in the Americas.

**Puccinia baccharidis-cassinoides** P. Hennings, *Hedwigia* 35: 241. 1896. TYPE on *Baccharis cassinoides* DeCandolle, Compositae, from **Brazil**, Santa Catarina, Blumenau, 12 April 1884, *Ule-132*. (??,II/?cv or ce/III).

*Puccinia baccharidis-cassinoides* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia and aecia not reported. Uredinia scattered on indeterminate, yellowish spots on the abaxial side of leaves, sori 0.3-0.5 mm in diameter, cinnamon-brown; urediniospores catenulate, 28-40 x 25-35  $\mu\text{m}$ , subgloboid, ovoid to broadly ellipsoid; wall finely verrucose in lines, yellow-brown. Telia like the uredinia but darker; teliospores 54-75 x 22-28  $\mu\text{m}$ , oblong-clavate, rounded to slightly narrowed above, rounded to narrowed below, slightly constricted at the septum; wall smooth, not thickened apically, pale yellow-brown; pedicel up to 60  $\mu\text{m}$  long, persistent, colorless (Sydow, P. & H. Sydow, 1904).

Jackson (1932) included in his key to species of *Puccinia* on *Baccharis* traits for *P. baccharidis-cassinoides* similar to the ones listed by Lindquist (1957), except he reported "? -opsis forms aeciospore wall finely verrucose in lines". Lindquist (1957) included this species in his key as having: distinctly pigmented teliospore walls, urediniospores unknown, aecia present (opsis form), aeciospores ellipsoid (not narrowly ellipsoid), 20-40  $\mu\text{m}$  long, walls finely echinulate in lines, teliospores not or only slightly constricted at the septum, and with a short pedicel.. He did not include other descriptive data because he reported that he did not see any specimens.

Lindquist (1957) reported at least 55 species of *Puccinia* on *Baccharis*. These are only in the Americas. *Baccharis* has more *Puccinia* species than any other host genus in the Americas.

*Puccinia baccharidis-triplinervis* P. Hennings, see **Puccinia conyzae** P. Hennings.

**Puccinia bambusarum** Arthur, Bot. Gaz. (Crawfordsville) 65: 467. 1918. TYPE on *Pariana* sp.

(mistakenly reported originally as *Olyra* sp.) from **Peru**, Iquitos, Rio Amazonas, July 1902, *Ule-3161*. (?/?≠ **Ipe/III**).

Anamorph

*Uredo olyrae* P. Hennings, Hedwigia 43: 164. 1904. TYPE same as for the teleomorph. Telia present but not described by P. Hennings.

On Gramineae:

*Pariana campestris* Aublet, Amapá (IBI-16595); Pará (Hennen & Figueiredo, 1981: 353).

*Puccinia bambusarum* has been reported only from Peru and Brazil.

Spermogonia and aecia unknown. Uredinia mostly on abaxial side of leaf, yellowish, probably brightly so when fresh; urediniospores (22-)24-32(-34) x (16-)18-22 µm, ellipsoid or obovoid, wall 1-5 µm thick, colorless or yellowish, echinulate, germ pores obscure. Telia on abaxial surface, cinnamon-brown, early exposed; teliospores 20-28(-30) x (10-)12-15(-17) µm, mostly ellipsoid or narrowly obovoid, septum often oblique but diorchidioid teliospores rare, wall (1-)1.5-2 µm at sides, (2-)2.5-4 µm apically, yellowish or pale golden brown, smooth; pedicels thin-walled, delicate, colorless, to 80 µm long but usually broken short (Cummins, 1971).

Hennen & Figueiredo (1981) reported that the host of *Uredo olyrae* is *Pariana* sp., not *Olyra* sp., as reported by Hennings (1904: 164), and not *Arundinaria* sp. as reported by Arthur (1918: 467). Arthur treated the species mistakenly as a transfer from *Uredo bambusarum* P. Hennings which is on *Olyra* sp. and an anamorph of *Puccinia obliquo-septata* Viennot-Bourgin. But because Arthur described the teleomorph that was present on the type of *Uredo olyrae* that Hennings had overlooked, the name *Puccinia bambusarum* is ascribed to Arthur alone and its lectotype is on *Pariana*, the same specimen as the type for *Uredo olyrae*.

**Puccinia BANISTERIAE** P. Hennings, Hedwigia 34: 94. 1895. TYPE on *Banisteriopsis* sp. (reported originally as *Banisteria* sp.) from **Brazil**, Goiás: Formosa, Sept. 1892, *Ule-1926*. (-/-, -/III).

[*Puccinia trachytela* is very similar, see below. After further study it might be placed as a synonym].

On Malpighiaceae:

*Banisteriopsis anisandra* (Adr. Jussieu) Gates, Goiás, Minas Gerais (specimens in IBI).

*Banisteriopsis clauseniana* (Jussieu) Anderson & Gates, Goiás (Hennings, 1897: 215), São Paulo (IBI-13373).

*Banisteriopsis gardneriana* (Adr. Jussieu) Anderson & Gates, Goiás (specimens in IBI).

*Banisteriopsis nummifera* (Adr. Jussieu) Gates, São Paulo (specimens in IBI).

*Banisteriopsis* sp., Goiás, Minas Gerais (PUR-F19110) Hennings, 1895A: 94).

*Heteropteris sericea* (host identification requires confirmation), Federal District, Brasília (PUR-F18749).

**Genus undetermined** (probably *Banisteriopsis* sp.), São Paulo (IBI-13474).

*Puccinia banisteriae* has been reported only from Brazil. Perhaps Costa Rica will be added.

Spermogonia, aecia, and uredinia not seen, probably not produced. Telia in irregular discolored spots 0.5-2 cm across on abaxial side of leaves, the infections sometimes appearing as locally systemic, sori 0.2-1 mm across, dark brown, erumpent, pulverulent, one to five or more sori per spot, sometimes causing chlorotic or necrotic spots on adaxial sides of leaves, sometimes sori grow together, the ruptured epidermis remaining and often more or less covering the sori, teliospores 40-50 X 18-32 µm, cylindrically ellipsoid, rounded at both ends, slightly constricted at the septum, wall evenly 3-5 µm thick, bilaminar, the outer layer 0.5 µm or less thin, forming a pale translucent yellowish reticulate-punctate to reticulate cover, the inner layer dark cinnamon-brown, pore apical in upper cell, next to the pedicel in the lower cell, pedicel up to 55-65 µm long, thin-walled, collapsing laterally, usually broken near the spore and leaving a short collar, the other part remaining attached to the sorus.

Traits helpful for identification of *Puccinia banisteriae* include: teliospore walls reticulate or reticulate-punctate, pore apical in the upper teliospore cell and the pore basal in the lower cell, and pedicels deciduous that leave a short collar remaining on the spore. The large, blackish-brown, irregular groups of powdery telia on the abaxial side of leaves are especially obvious in the field because of the contrast with the silvery grey undersides of the leaves of the hosts.

Previously this rust was described as having “verrucose-granulose” wall sculpture.

Specimens examined (all Brazil): On *Banisteriopsis anisandra* (Adr. Jussieu) Gates, Goiás: ca 10 km NE of Anópolis, 7 Dec 1977, *J.F. Hennen & M.M. Hennen-77-361*; 1 km E of Alto Paraíso, 5 March 1973, *W. R. Anderson-6341* (exUB), Minas Gerais: Sete Lagoas, 20 June 1979, *J.F. Hennen & M.M. Hennen-79-73*;

São Paulo, Monte Alegre, 16 Nov 1978, *M. B. Figueiredo-78-83*. On *Banisteriopsis gardneriana* (Adr. Jussieu) Anderson & Gates, Goiás, 10 km N of Figueiropolis, 5 Dec 1977, *J.F. Hennen & M.M. Hennen-77-341*. On *Banisteriopsis nummifera* (Adr. Jussieu) Gates, São Paulo, Conchal, 11 Dec 1977, *J.F. Hennen & M.M. Hennen-77-380*. On *Banisteriopsis* sp. Federal District: Brasília, 12 Apr 1979, *E. P. Heringer-s.n.*

The description of *Puccinia trachytella* is reproduced here because it is probably a synonym of *Puccinia banisteriae*.

Puccinia TRACHYTELA H. Sydow, Ann. Mycol. 24: 290. 1926. TYPE on ?*Tetraptis seemanii* Triana & Planch. from **Costa Rica**, San Pedro de San Ramon, 5 Feb 1925, *H. Sydow-382*. . (-/-,-/III).

*Puccinia trachytella* has been reported only from the type.

Spermogonia, aecia, and uredinia unknown. Telia 0.5-1.5 mm long, on obscure or large conspicuous spots on abaxial side of leaves, usually concentric around a central sorus, sometimes in groups, rarely solitary, irregular in shape, mostly elliptic or somewhat elongate, erumpent, surrounded by the ruptured epidermis, somewhat powdery, chestnut-brown; teliospores 33-44 x 16-24 µm, ovoid to oblong, rounded at both ends or slightly narrowed below, slightly or strongly narrowed at septum, wall evenly thick, densely verrucose-reticulate, dark chestnut-brown (Sydow, H. 1923).

See below for a key that aids in identification of species of *Puccinia* on Malpighiaceae

#### Key to help identify species of *Puccinia* on Malpighiaceae

Nine of the fourteen species of *Puccinia* that are known to parasitize genera of the Malpighiaceae have been reported from Brazil. All of these species are remarkable because of either the traits of their urediniospores or teliospores or both and are included in the key below. Seven of the species have teliospores with pedicels that have a globose-bulbose swollen part. The teliospore pedicels in these species are often attached near the septum. Except for one species that has colorless teliospores, the teliospore walls are darkly pigmented and verrucose or reticulate to reticulate-punctate. Only one species, *Puccinia hematitidis* from Africa, has been reported outside of the Americas.

A. Teliospore walls colorless, smooth, urediniospores 39-45 x 25-32 µm, broadly obovoid or ellipsoid, walls with 2 equatorial pores with large diameters (Brazil, Cuba, Belize)

*Puccinia barbatula*.

A. Teliospore walls pigmented, sculptured, urediniospore pores not with large diameters

B.

B. Teliospore pedicels not swollen globose-bulbose

C.

C. Teliospore walls verrucose, pedicel attached basally, urediniospores reniform with 2 equatorial germ pores (only in Africa on *Triaspis* sp.).

*Puccinia hematitidis* Sydow.

C. Teliospore walls reticulate to reticulate-punctate

D.

D. Teliospore walls reticulate, pedicels usually attached laterally, urediniospores reniform, walls with 2 equatorial germ pores associated with smooth spots (Brazil).

*Puccinia barretoii*.

D. Teliospore walls reticulate to reticulate-punctate, pedicels attached basally, urediniospores, if produced, not reniform

E.

E. Teliospores ellipsoid, rounded above, slightly constricted at septum, wall punctate, short cycled. (Brazil) .

*Puccinia banisteriae*.

E. Teliospores broadly ellipsoid, often acuminate-rounded at top, not constricted at septum, wall delicately reticulate to reticulate-punctate

F.

F. Teliospore walls delicately reticulate (Costa Rica).

*Puccinia trachytella*.

F. Teliospore walls reticulate to reticulate-punctate

G. Urediniospore walls 1.5-2(-2.5) µm thick, spores 20-28 µm wide, germ pores 2-3(-4), equatorial (Brazil, Argentina, Uruguay).

*Puccinia heteropteridis*.

G. Urediniospore walls 4-7 µm thick, spores 32-35

um wide, germ pores 4, equatorial (Argentina, Brazil, Venezuela, Mexico).

***Puccinia sanguenolenta.***

**B.** Teliospore pedicels mostly attached laterally with a swollen globose area **H.**

**H.** Teliospore walls radially verrucose, urediniospores reniform. (Guatemala).

***Puccinia laurifolia.***

**H.** Teliospore walls reticulate to reticulate-punctate **I.**

**I.** Urediniospore walls 6-9 um thick, two layered, swelling in liquid, strongly and sparsely echinulate

**J.** Teliospores smokey-black, wall with a thin, nearly colorless outer layer, urediniospore wall swelling somewhat (Brazil) .

***Puccinia picturata.***

**J.** Teliospores chestnut-brown, urediniospore outer wall layer greatly swelling (Brazil, Uruguay, Argentina, Bolivia).

***Puccinia insueta.***

**I.** Urediniospore walls 1.5-2.5 um thick, not obviously layered, not swelling in liquid **K.**

**K.** Urediniospore pores (2-)3-4, nearly equatorial (Cuba, Puerto Rico).

***Puccinia inflata.***

**K.** Urediniospore pores (2-3)4-8, scattered or rarely bizonate **L.**

**L.** Urediniospore walls nearly evenly echinulate, without smooth spots around pores, cuticular caps not evident over pores **M.**

**M.** Urediniospores strongly echinulate, (2-)3 nearly equatorial or scattered pores (Brazil).

***Puccinia guasua.***

**M.** Urediniospores not strongly echinulate, 6-8 scattered pores. (Mexico).

***Puccinia echinopteris.***

**L.** Urediniospore walls irregularly echinulate, with smooth spots around pores, cuticular caps evident over pores (Brazil). ***Puccinia inrecta.***

*Puccinia barbacensis* Rangel, see **Puccinia PSIDII** Winter.

**Puccinia BARBATULA** Arthur & J. R. Johnston, Mem. Torrey Bot. Club 17: 144. 1918. TYPE on *Heteropterys laurifolia* (Linnaeus) A. Jussieu (reported originally as *Banisteria laurifolia* Linnaeus) from **Cuba**, Oriente: Paso Estancia , 3 May 1916, *Johnston-678*. (**0/Ipe,IIpe/III**).  
= *Bullaria barbatula* (Arthur & J. R. Johnston) Arthur & Mains in Arthur, N. Amer. Flora 7: 485. 1922.

On Malpighiaceae

***Diplopterys*** sp., Federal District (IBI-12464).

***Heteropterys byrsonimifolia*** A. Jussieu, Minas Gerais (IBI-16389), São Paulo (IBI-13821).

***Heteropterys coriacea*** A. Jussieu, Federal District (IBI-13211).

***Heteropterys escalloniifolia*** A. Jusieu, Bahia (*W. A. Anderson et al. 37073*, in NY).

***Heteropterys*** sp. Goiás (IBI-16676), Mato Grosso (IBI-16749), Minas Gerais (IBI-), São Paulo (IBI-13821).

*Puccinia barbatula* has been reported also from Belize , Cuba, and Mexico..

Spermogonia on both sides of leaves, in small groupson brownish discolored spots 1-3 mm across, Aecia encircling the spermogonia, 0.2-0.8 mm across, deep in leaf tissue in origin, erumpent, partly covered by broken tissue, somewhat pulperulent, dark cinnamon-brown; aeciospores pedicelate, 39-45 x 25-32 µm, broadly ellipsoid, or obovoid, wall 2-2.5 µm thick, strongly and very sparsely echinulate, the echinulations 2-2.5 µm long colorless; pores 2, equatorial. Uredinia and urediniospores similar to the aecia and aeciospores but scattered and not associated with spermogonia. Telia on the abaxial side of leaves, 0.3-1 mm across, on more or less light colored areas, usually crowded around the uredinia or aecia, whitish or pale brown, usually

long covered by the overarching tissue; teliospores 35-48 x 18-26  $\mu\text{m}$ , oblong or oblong-clavate, rounded above, rounded or slightly narrowed below, somewhat constricted at the septum; wall 1.5-2.5  $\mu\text{m}$  thick, smooth, colorless; pedicel about half length of the spore, 13-15  $\mu\text{m}$  wide.

Traits that help to identify *Puccinia barbatula* include: aecia and aeciospores and uredinia and urediniospores large with walls chestnut-brown, strongly echinulate, with two equatorial germ pores, and teliospores with colorless walls. See under *Puccinia banisteriae* for a key that aids in identification of species of *Puccinia* on Malpighiaceae.

**Puccinia becki** Mayor, Mem. Soc. Neuchatel. Sci. Nat. 5: 509. 1913. TYPE on *Vernonia cotoneaster* (Willdenow) Lessing [*Lepidaploa cotoneaster* (Willdenow) H. Robinson] from **Colombia**, Cundinamarca, near Crus Verde, 15 Oct. 1910, E. Mayor-32. (0?/1?,II/III).

On Compositae:

*Vernonia argyrotichia* Schultz-Bipontius ex Baker [ $\equiv$  *Lepidaploa argyrotichia* (Schultz-Bipontius ex Baker) H. Robinson (, Rio de Janeiro (Jackson, 1932: 110).

*Puccinia becki* has been reported also from Colombia, Ecuador, and Jamaica. Jackson (1932: 110) reported that his identifications of this Brazilian collection and another Holway collection from Ecuador were tentative.

Spermogonia adaxial, sori conspicuous, extending along leaf veins, on yellowish hypertrophied spots, ; few in close groups, subepidermal, yellow or fading to blackish; 125-130  $\mu\text{m}$  high, 112-120  $\mu\text{m}$  wide, globoid and flask-shaped, ostiolar filaments present; 50  $\mu\text{m}$  long. Aecia (*Aecidium* sp.) abaxial; few, in groups opposite the spermogonia, and solitary; peridia cylindrical, membranous, becoming lacerate, peridial cells 26-32  $\mu\text{m}$  long; 16-23  $\mu\text{m}$  width; irregularly polyhedral, walls 1.5-2  $\mu\text{m}$  thick, rugose or prominently verrucose, colorless, white;. aeciospores 23-34  $\mu\text{m}$  long; 16-22  $\mu\text{m}$  wide, somewhat irregular or ellipsoid or globoid, cell wall 2  $\mu\text{m}$  thick, colorless; verrucose or with low warts often arranged in longitudinal lines, especially near either end, germ pores obscure. Uredinia on both sides of leaves or adaxial; irregularly scattered; erumpent or epidermal rupture inconspicuous, 0.2-0.5 mm in diameter; round; naked early and somewhat pulverulent; brown; Urediniospores 22-24 long; 18-22  $\mu\text{m}$  wide, globoid or broadly ellipsoid, wall 2  $\mu\text{m}$  thick; pale cinnamon; moderately echinulate; pores obscure. Telia abaxial; scattered; compact; pulvinate, round, 0.2-0.5 mm in diameter; chestnut brown; erumpent, ruptured epidermis inconspicuous, germinating at maturity; teliospores 58-90  $\mu\text{m}$  long; 13-19  $\mu\text{m}$  wide, fusiform or cylindrical, cell wall 1-1.5  $\mu\text{m}$  thick; cinnamon-brown; smooth; pedicel: fragile; colorless, shorter than spore; up to 40  $\mu\text{m}$  long (Mayor, 1913).

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but three from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

**Puccinia bergii** Spegazzini, Anal. Soc. Cient. Argentina 9: 168. 1880. TYPE on *Poiretia tetraphylla* (Poiret) Berkhart from **Uruguay**, Montevideo, Rio Maciel, date not recorded, *C. Bergs.n.* The host was mistakenly reported originally as *Adesmia punctata*. (?/?,II/III).

On Leguminosae:

*Poiretia tetraphylla* (Poiret) Burkart (= *Poiretia psoraloides* DeCandolle), Rio Grande do Sul (Joerstad, 1959: 74; Lindquist & Costa Neto, 1963: 124).

*Puccinia bergii* has been reported also from Argentina and Uruguay.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaflets, 0.3 mm across, scattered, cinnamon-brown, erumpent, epidermis, urediniospores and teliospores mixed in same sori, without paraphyses: urediniospores 19-29 x 17-23  $\mu\text{m}$ , globoid to irregularly elongate, wall 2-3  $\mu\text{m}$  thick moderately echinulate, reddish honey-colored, pores 3-4, about equatorial. Teliospores [60-85 x 18-20  $\mu\text{m}$  (fide Spegazzini, 1880); 35-68  $\mu\text{m}$  long (fide Dietel, 1937); 39-61 x 15-19  $\mu\text{m}$  (fide Joerstad, 1959) cylindrical to clavate, rounded above, constricted at septum, wall [uniformly thin (fide Spegazzini, 1880); thickened above with a colorless umbo 3-5  $\mu\text{m}$  thick (fide Dietel, 1937); about 1  $\mu\text{m}$  thick at sides, to 4  $\mu\text{m}$  above (Joerstad, 1959)], pale honey-colored or pale brown, pedicel 30 x 6  $\mu\text{m}$ , persistent, colorless (Spegazzini, 1880: Dietel, 1937; Joerstad, 1959).

*Puccinia bergii* may be misplaced in *Puccinia* because true species of *Puccinia* probably do not occur on the family Leguminosae..

*Puccinia berkelyana* De-Toni, see **Puccinia DICHONDRAE** Montagne.

*Puccinia bignoniacearum* Spegazzini, see **PROSODIUM BIGNONIACEARUM** (Spegazzini) Cummins.

*Puccinia biocellata* Vestergren ex Cummins; see **Puccinia OCELLIFERA** Cummins.

*Puccinia bidentis* Dietel & Holway, see **UROMYCES BIDENTICOLA** Arthur.

**Puccinia BOEHMERIAE** P. Hennings, Hedwigia 34: 336. 1895. TYPE on *Boehmeria* sp., Urticaceae, from **Brazil**, Santa Catarina: Blumenau, Nov 1891, *A. Moller s.n.* (?!?, IIpe/III).

*Puccinia boehmeriae* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, often along veins, yellowish-brown, urediniospores 20-30 µm in diameter to 20-32 x 15-22 µm, globoid, subgloboid, to ellipsoid, wall colorless to pale yellow, echinulate. Telia on the abaxial side of leaves, very small to medium size, scattered, pulvinate, brown, teliospores 28-42 x 15-27 µm, clavate, rounded to flattened above, constricted at the septum, narrowed below, wall thickened to 5 µm above, smooth, pedicel to 40 µm long, colorless (Sydow, P. & H Sydow, 1903).

**Puccinia BOMAREAE** P. Hennings, Hedwigia 35: 242. 1896. TYPE on *Bomarea edulis* (Tussac) Herbert from **Brazil**, Santa Catarina: São Francisco, Dec 1883, *Ule-130.* (?!?, IIpe/III).

Anamorph

*Uredo bomareae* Lagerheim, in Patouillard & Lagerheim, Bull. Soc. Mycol. France 11: 215. 1895. TYPE on *Bomarea* sp., **Ecuador**, Quito, Dec 1889, *Lagerheim s n.*

= *Aecidium bomareae* Mayor, Mem. Soc. neuchateloise Sci. Nat. 5: 559. 1913. TYPE on *Bomarea cf. caldasii* (Humboldt, Bonpland & Kunth) Willdenow, from **Colombia**, Cundinamarca, Viota Valley, 24 Oct 1910, *E. Mayor-14.* Kern et al. (1933) report that *Aecidium bomareae* is an *Uredo* sp., not *Aecidium*; but Laundon (1966) places *Aecidium bomareae* as an anamorph of *Puccinia pallor* Arthur & Holway without explanation.

On Alstroemericeae (Amaryllidaceae):

*Bomarea edulis* (Tussac) Herbert, Brazil (Hennings, 1896: 242).

*Bomarea ovata* (Cav.) Mirbel, São Paulo (Jackson, 1926: 155).

*Bomarea* sp., Rio Grande do Sul (Lindquist & Costa Neto, 1967: 60), Rio de Janeiro (IAC-7667), Santa Catarina (Laundon, 1965: 34), São Paulo (Hennings, 1902D: 296).

*Puccinia bomareae* has been reported also from Bolivia, Peru, Ecuador, Colombia, Venezuela, and Mexico. The family of *Bomarea* is sometimes reported as Amaryllidaceae.

Spermogonia and aecia unknown. Uredinia are on the abaxial side of leaves, irregularly scattered, circular, about 0.5 mm or less in diameter, cinnamon but becoming colorless in herbarium specimens, urediniospores are 23-32 x 18-24 µm, broadly ellipsoid to globoid, wall 1.5-2.5 µm thick, evenly echinulate, colorless to pale yellow, pores obscure. Telia stromatic, around the uredinia or scattered singly on abaxial side of leaves, teliospores 34-65 x 18-26 µm, cylindrical or clavate, sometimes angular and truncate above, usually slightly constricted at the septum, wall 1-1.5 µm thick at sides, 4-8 µm thick at apex, yellowish smooth, pores apical and at the septum, pedicels to 10 µm long, dark brown, yellowish, or pale. The telia of *P. pallor*, the only other *Puccinia* on *Bomarea* but not yet reported from Brazil, are non-stromatic and the teliospores have colorless walls (Laundon, 1965).

We found numerous peripheral, capitate, colorless, thin-walled, usually collapsed paraphyses in uredinia of a specimen (Holway-887) from Ecuador.

**Puccinia BONARIENSIS** Spegazzini, An. Soc. Cient. Argentina 9: 169. 1880. TYPE on *Justicia tweediana* Nees [*Poikilacanthus tweedianus* (Nees) Lindau], mistakenly reported originally as on "Labiatae" but corrected by Spegazzini (1925), from **Argentina**, Buenos Aires, Boca del Riachuelo, Jan 1880, *Spegazzini s.n.* (O/Icv, IIpe/III).

On Acanthaceae

*Ruellia graecizans* Baker, São Paulo (IBI-14104, ?85-23).

*Puccinia bonariensis* has been reported before only from Argentina and only on *Justicia* sp.

Spermogonia on both sides of leaves, mostly on abaxial side, 120-140 µm diam, globoid, with paraphyses. Aecia in hypertrophied areas, cylindrical, aeciospores 20-32(-38) µm diam, ellipsoidal, obovoidal, or polygonal; wall thin, densely and coarsely verrucose. Uredinia on abaxial side of leaves, 0.3-0.5 mm diam, irregularly scattered or in concentric groups, very pale; urediniospores 25-32 x 20-25 µm, ellipsoid to obovoid; wall 1-1.5 µm thick, rather strongly echinulate except around the pores, pores difficult to see but apparently 2, equatorial and opposite. Telia on abaxial side of leaves, 0.3-1.0 mm diam, irregularly scattered or in concentric groups in hypertrophied areas, pale yellowish, subepidermal in origin, erumpent; teliospores 42-55 x 17-27 µm, short cylindrical, ellipsoidal to more or less fusiform, elongating and becoming narrower in germination, constricted at the septum, wall 1-2 µm thick, not thickened above, hyaline to pale yellowish, smooth, pedicel up to 50 µm long, persistent, hyaline, smooth. Spores germinating without dormancy.

*Puccinia borrieriae* P. Sydow & H. Sydow. Dietel's (1909: 264) report of *Puccinia borrieriae* on *Borreria* sp. from Belém is based on a misidentification of the rust. The rust is *Puccinia lateritia* Berkeley. *Puccinia borrieriae* is based on an African type.

**Puccinia BOUTELOUAE** (Jennings) Holway, Ann. Mycol. 3: 20. 1905. (?!?≠ **Ipe/III**).

= *Diorchidium boutelouae* Jennings, Bull. Texas Exp. Sta. 9: 25. 1890. TYPE on *Bouteloua curtipendula* from **The United States of America**, Texas: College Station, Fall 1889, Jennings s.n..

= *Puccinia gymnopogonis* P. Sydow & H. Sydow, Mon. Ured. 1: 755. 1903. TYPE on *Gymnopogon foliosus* (Willdenow) Nees from **Brazil**, Pará: Santerem, June 1850, Spruce s.n.

Anamorph

*Uredo chardonii* Kern in Seaver et al., Sci. Surv. Puerto Rico & Virgin Isl. 8: 140. 1932. TYPE on *Bouteloua repens* (Kunth) Scribner [reported as *Bouteloua heterostega* (Trinius) Griffiths] from **Puerto Rico**, Mayaguez, 7 Dec 1931, C. E. Chardon & R. A. S.

On Gramineae:

*Enteropogon mollis* (Nees) Clayton (reported as *Gymnopogon mollis* Nees), Ceará (Hennen & Cummins, 1956: 144; Joerstad, 1959: 61).

*Gymnopogon foliosus* (Willdenow) Nees, Maranhão (Hennen, 1954: 66), Pará (Hennen, 1954: 66).

*Puccinia boutelouae* has been reported also from Northern South America, Central America, The West Indies, and the southwestern United States of America, and has been reported also on several species of *Bouteloua* and *Cathastecum*.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, orange when fresh, without paraphyses, urediniospores (14-)16-23 x (12-)15-19 µm, globoid or obovoid, wall (1.5)2-3 µm thick, colorless or yellowish, echinulate, germ pores obscure, probably 6-8, scattered, amphispores not produced. Telia on both sides of leaves, blackish, pulvinate; teliospores (21-)25-33 x (18-)20-27(-29) µm mostly broadly ellipsoid, mostly diorchidioid, wall 2.5-3 µm thick at sides, 5-7 µm apically, chestnut-brown, smooth; pedicel to 120 µm long, colorless or golden, thin-walled and collapsing (Cummins, 1971).

Hennen and Cummins (1956) reported that the diorchidioid form of the teliospores is the only trait that separated *Puccinia boutelouae* from *Puccinia chloridis*.

See *Puccinia cynanchi* for a possible correlation of *Puccinia boutelouae* with that microcyclic species.

**Puccinia BRACHYPODII** Oth var. **ARRHENATHERI** (Klebahn) Cummins & H. C. Greene,

Mycologia 58: 709. 1966. TYPE on *Arrhenatherum elatius* from **Sweden**, Stockholm, Experimentalfaltet, date not recorded, Eriksson s.n. (0/lev≠ **Ipe/III**).

= *Puccinia hordeicola* Lindquist, Rev. Fac. Agron. La Plata 33: 76. 1957. TYPE on *Hordeum*



*lechleri* (Steud.) Schenk. from **Argentina**, place and date ?, *Hirschhorn*. Cummins (1971) lists ten other teleomorph and two other anamorph synonyms whose types are not from South America.

#### Synanamorphs

On Gramineae

***Uredo paulensis*** P. Hennings, Hedwigia 41: 297. 1902. TYPE on *Calamagrostis* sp. from **Brazil**, São Paulo: São Paulo, Botanical Garden, Dec 1901, *Puttemans-462*.

On Berbericaceae

***Aecidium*** sp. Cummins and Greene (1966) report two inoculation experiments using basidiospores that resulted in *Aecidium* sp.: one on *Berberis* sp. in Europe and another on *Mahonia* sp. in North America. Infections are locally systemic.

On Gramineae:

***Calamagrostis montevidensis*** Nees, Rio de Janeiro (Cummins & Greene, 1966).

***Calamagrostis*** sp. Brazil (Cummins, 1971: 168), São Paulo (Cummins & Greene, 1966).

***Phalaris angustata*** Nees, Rio Grande do Sul (Cummins & Greene, 1966).

***Phalaris*** sp., Rio Grande do Sul (Cummins & Greene, 1966).

***Phleum pratense*** Linnaeus, Rio Grande do Sul (Cummins & Greene, 1966, this record was published originally by Lindquist & Costa Neto, 1963, as *Puccinia poae-nemoralis* Otth).

*Puccinia brachypodii* var. *arrhenatheri* is circumglobal, especially in temperate and cooler areas, and occurs on at least 16 genera of grasses. Cummins (1971) reported ten other teleomorph synonyms and two anamorph synonyms.

Spermogonia and aecia localized or systemic, on *Berberis*; aeciospores (20-)23-27(-29) x (16-)19-23(-24) µm, wall 1-1.5 µm thick, colorless, verrucose. Uredinia on adaxial side of leaf, cinnamon-brown or paler, with abundant, mostly clavate or clavate-capitate, colorless paraphyses, (7-)13-20(-23) µm wide apically, to 120 µm long, the "neck" constricted or not, wall uniformly (1-)2-4(-7) µm thick; urediniospores (24-)26-33(-36) x (18-)21-26(-29) µm, ellipsoid, broadly ellipsoid, or obovoid, wall (1-4-5-2(-2-5) µm thick, pale yellowish to cinnamon-brown, closely echinulate, pores obscure, 8-12 scattered. Telia mostly on abaxial surface, blackish, covered by epidermis, brownish paraphyses usually scanty but sori sometimes loculate; teliospores (30-)36-50(-80) x (12-)15-22(-27) µm, variable but mostly oblong or oblong-obovoid, wall 1-1.5 µm thick at sides, (2-)3-5(-7) µm apically, chestnut-brown, smooth; pedicels 15 µm or less long, brownish (Cummins, 1971).

Cummins (1971) divided the *Puccinia brachypodii* complex into four varieties, these sometimes difficult to distinguish because of the more or less continuous morphological variations. *Puccinia brachypodii* var. *arrhenatheri* has non-seriate sori and differs from var. *brachypodii* additionally because of longer urediniospores and teliospores. It has longer, usually browner urediniospores than var. *poae-nemoralis*. Traits that help to identify *Puccinia brachypodii* var. *arrhenatheri* include: sori not seriate as in *Puccinia brachypodii* var. *brachypodii*, uredinial paraphyses present, mostly capitate, walls of the stipe 2-5 µm thick, walls thicker in the head than in the stipe, urediniospores echinulate, pores 8-12, scattered but obscure; telia long covered by the epidermis, teliospores brown.

The systemic aecial habit of the *Arrhenatherum* rust fungus is not unique. Mains (Mycologia 25:407-417. 1933.) reported a similar development on *Berberis fendleri* Gray when infected by basidiospores from *Koeleria cristata* but the systemic habit is not typical of the North America fungus. In southern South America there are numerous systemic and localized aecia on *Berberis*. Their relationship is not known but it is suggestive that var. *arrhenatheri* is common on several genera of grasses in the area. Systemic aecia also occur in India and Pakistan. (Cummins, 1971)

#### **PUCCINIA BRACHYPODII** Otth var. **POAE-NEMORALIS** (Otth) Cummins & H.C. Greene,

Mycologia 58: 705. 1966. (**0/Icv** ≠ **IIpe/III**).

≡ *Puccinia poae-nemoralis* Otth, Mitth. Natur. Ges. Bern 1870: 113. 1871. TYPE on *Poa nemoralis* from **Switzerland**, Bremgartenwald, date? *Otth-s.n.*

= *Puccinia pygmaea* Dietel, Hedwigia 36: 29. 1897. TYPE on *Poa annua* L., **Brazil**, Santa Catarina: Tubarão, *Ule-1032*. Not *Puccinia pygmaea* Erickson, 1895.

≡ *Puccinia exigua* Dietel, Hedwigia 36: 299. 1897, *nom. nov.* for *Puccinia pygmaea* Dietel.

Cummins (1971) lists ten other teleomorph and six other anamorph synonyms whose types are not from South America.

#### Synanamorphs

On Gramineae: *Uredo poae-sudeticae* Westendorp, Bull. Roy. Acad. Belg. II. 650. 1861.  
 On Berberidaceae: *Aecidium* sp. Cummins (1971) reported that the *Aecidium* infections are localized, not systemic as in *P. b.* var. *arrhenatheri*, but he reported no taxa names for this anamorph.

On Gramineae:

*Poa annua* Linnaeus, Rio de Janeiro (PUR-F3802), Santa Catarina (Dietel, 1897: 299, Holway-111).

*Puccinia brachypodii* var. *poae-nemoralis* is circumglobal in temperate climates and at high altitudes in the tropics, and occurs on at least 18 genera of grasses. Cummins (1971) lists ten other teleomorph and six other anamorph synonyms whose types are not from South America.

Traits that help to identify *Puccinia brachypodii* var. *poae-nemoralis* include: uredinial paraphyses mostly capitate, walls of the stipe 2-5 µm thick, walls thicker in the head than in the stipe, urediniospore walls echinulate, pores scattered; telia long covered by the epidermis, teliospores brown (Cummins, 1971).

**Puccinia BRACHYPODII-PHOENICOIDIS** Guyot & Malencon var. **CHISOSANA** (Cummins)

Cummins in Cummins & H.C. Greene, Mycologia 58: 719. 1966. (?? ≠ **Ipe/III**).

≡ *Puccinia pygmaea* Eriksson var. *chisosana* Cummins, Southw. Nat. 8: 189. 1964. TYPE on *Bromus anomalus* Rupr. from **The United States of America**, Texas: Big Bend National Park, 28 May 1962, *Cummins-62-415*.

On Gramineae:

*Bromus brachyanthera* Doell., Paraná (Cummins & Greene, 1966: 720; Cummins, 1971: 163).

The *Puccinia brachypodii-phenicoidis* complex includes three varieties: *P. b.* var. *brachypodii-phenicoidis*, *P. b.* var. *davisii*, and *P. b.* var. *chisosana*, the latter reported from Brazil, Mexico, and Texas. Variety *chisosana* differs from the other two because of more densely echinulate urediniospores and shorter teliospores (Cummins, 1971).

Spermogonia and aecia unknown. Uredinia on adaxial side of leaf, yellowish brown, with abundant, capitate or clavate paraphyses, to 17 µm wide in the head, wall 1 µm thick below, 1-5-4(-6) µm at apex, colorless; urediniospores (26-)28-33(35) x (21-)23-26(-27) µm, wall 1.5-2 µm thick, dull cinnamon-brown, densely echinulate, echinulae spaced 0.7-1.5 µm, pores obscure, 8-10(-12?), scattered. Telia as in the species, teliospores 30-38(-42) x (13-)15-20(-23) µm, wall 1-1.5 µm thick at sides, 3-5 µm at apex (Cummins, 1971).

The *Puccinia brachypodii-phenicoidis* complex has paraphyses with walls thin (about 1 µm) in the stipe but abruptly thickened 3-7 µm apically, while the *Puccinia brachypodii* complex has paraphyses with walls 2-5 µm thick in the stipe (Cummins, 1971)..

*Puccinia brachypus* Spegazzini var. *loliiphila* Spegazzini, see **Puccinia HORDEI** Otth.

*Puccinia brittoi* Rangel, see **Puccinia PSIDII** Winter.

? **Puccinia BUCHNERAE** Cummins, (as "nom. nov." Cummins), Mycologia 33: 385. 1941. TYPE on *Buchnera cf. urticifolia* R. Brown from **New Guinea**, Boana, 15 May 1940, *M. S. Clemens* s.n. (??, **II/III**). Cummins described telia in Latin based on the specimen cited here as the type, so the name is treated as a new species named by Cummins.

Anamorph

*Uredo cumula* Arthur, Bull. Torrey Bot. Club 49: 195. 1922. TYPE on *Buchnera elongata* Swartz from **Cuba**, 24 March 1921, *J. R. Johnston-2530*.

On Scrophulariaceae:

*Buchnera lobelioides* Chamisso & Schlechtendahl, São Paulo (Viégas, 1945B: 567; IAC-4832).

Apparently, *Puccinia buchnerae* has been reported only from four widespread collections, the type of the teleomorph and an anamorph collection from New Guinea, the type of the anamorph from Cuba, and Viégas' collection from São Paulo. The identification of the Brazilian collection needs to be confirmed.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, somewhat grouped or scattered, 0.1-0.4 mm across, flattened, ruptured epidermis noticeable, powdery, cinnamon-brown; urediniospores 22-25 x 18-20 µm, broadly ellipsoid or obovate; wall 1 µm or less thick, finely echinulate, pale cinnamon-brown, pores 2, equatorial, indistinct (Arthur, 1922). Telia not seen; teliospores 28-38 x 10-13 µm, ellipsoid, more or

less rounded above and below, slightly constricted at the septum; wall about 0.5  $\mu\text{m}$  thick at sides, 2-2.5  $\mu\text{m}$  apically, pale cinnamon-brown, smooth; pedicel shorter than the spore, colorless, fragile (Cummins, 1941).

The genus name of the host, *Buchnera*, is also used as a genus name for certain gamma-Protobacteria which are symbionts in specialized cells, bacteriocytes, in species of the insect group, aphids. The genomes of these Protobacteria are among the simplest known.

*Puccinia burmeisteri* Spegazzini, see **Puccinia GYMNOTHRICHIS** P.Hennings.

*Puccinia cabo-friensis* P. Hennings, see **Puccinia ARAUJAE**.

**Puccinia CACABATA** Arthur & Holway in Arthur, Proc. Amer. Phil. Soc. 64: 179. 1925. TYPE on *Chloris ciliata* Swartz from **Bolivia**, Nor Yungas: Hacienda Anacuri, 5 June 1920, *E.W.D. Holway & M.M. Holway-721*. (**0/Icv $\neq$  IIpe/III**).

= *Puccinia stakmanii* Presley in Presley & King, Phytopathology 33: 385. 1943. Type on *Bouteloua rothrockii* from Arizona by inoculation. A specific specimen not cited.

Synanamorphs

On Gramineae:

**Uredo chloridis-berroi** Spegazzini, Rev. Argentina Bot. 1: 135. 1925. TYPE on *Chloris berroi* Arechavaleti from **Argentina**, near La Plata, May 1920, *C. Spegazzini*.

= *Uredo chloridis polydactylidis* Viégas, Bragantia 5: 82. 1945. TYPE on *Chloris elata* Desv. (= *Chloris barbata* Swartz) [reported as *Chloris polydactyla* (Linnaeus) Swartz] from **Brazil**, Paraíba: Exp. Sta.de Alagoinha, Alagoinha, Oct 1939, *J. Deslandes-259*.

On Malvaceae:

**Aecidium gossypii** Ellis & Everhart, Erythea 4: 3. 1896. TYPE on *Gossypium hirsutum* from **Mexico**, Baja California: San Jose del Cabo, September, 1893, *T. S. Brandegee & Mary K. Brandegee-s.n.*.

On Gramineae:

**Chloris elata** Desv. (= *Chloris barbata* Swartz) [reported as *Chloris polydactyla* (Linnaeus) Swartz *Chloris polydactyla* (:Linnaeus) Swartz, Minas Gerais (Arthur, 1925: 180), Paraíba (Viégas, 1945: 82; Hennen & Cummins, 1956: 132).

*Puccinia cacabata* has been reported also on species of *Bouteloua* and *Cathestichum* and from Argentina to Texas and Arizona in The United States of America.

Spermogonia and aecia, *Aecidium gossypii*, on species of *Gossypium*; aeciospores 16-21 x 15-16  $\mu\text{m}$ , wall 1-1.5  $\mu\text{m}$  thick, verrucose. Uredinia on both sides of leaves, cinnamon-brown; urediniospores (22-)24-30(-32) x (17-)19-23(-25)  $\mu\text{m}$ , obovoid or broadly ellipsoid, wall 1.5-2  $\mu\text{m}$ , cinnamon-brown, often darker apically, echinulate, pores 3, rarely 4, equatorial. Telia on both sides of leaves and on stems, early exposed, blackish, pulvinate; teliospores (27-)34-40(-44) x (17-)20-24(-26)  $\mu\text{m}$ , ellipsoid, oblong, or broadly ellipsoid, wall 2-3(-4)  $\mu\text{m}$  thick laterally, 4-9  $\mu\text{m}$  apically, mostly chestnut-brown, smooth; pedicels usually to about 90  $\mu\text{m}$  long, much longer in occasional collections, thick-walled, not collapsing, colorless to golden (Hennen & Cummins, 1956; Cummins, 1971).

Traits that may help to identify *Puccinia cacabata* include: urediniospores walls echinulate, cinnamon-brown, and 3 or rarely 4 equatorial germ pores. Teliospores resemble those of *Puccinia exasperans*, *P. vexans*, and *P. opuntiae* in having thick-walled, non-collapsing pedicels.

*Puccinia cacabata* Arthur & Holway is now known to be a long cycle heteroecious rust that produces spermogonia and aecia on *Gossypium* spp., Malvaceae, and uredinia and telia on several genera of grasses (Poaceae) in the Tribe Chlorideae. In Brazil the spermogonia and aecia have never been found but uredinia and telia have been recorded on *Chloris polydactyla* from Minas Gerais and São Paulo states. In North America this rust was studied extensively in the states of Arizona and Texas in the United States of America and in adjacent northern states of Mexico. In these regions this rust has caused much damage to cultivated cotton.

T. S. Brandegee and his wife Mary K. Brandegee collected a rust on cotton, *Gossypium hirsutum*, in San Jose del Cabo, Baja California, Mexico in September, 1893. They sent the specimen to the mycologists Ellis and Everhart in New Jersey who named the rust *Aecidium gossypii* in 1897. For a long time *Aecidium*

*gossypii* was mistakenly thought to belong to the life cycle of *Puccinia schedonnardi*, another heteroecious rust that produces spermogonia and aecia on several other genera of Malvaceae, i.e. *Althea* and *Hibiscus*. *Puccinia schedonnardi* produces uredinia and telia on several grasses such as *Muhlenbergia* spp. After severe outbreaks of a rust on cotton in Arizona and Texas in the 1940's and 1950's two plant pathologists, Presley and King, working in Arizona discovered that the uredinia and telia of the cotton rust occur on species of the grass genus, *Bouteloua*. They determined that it was not *P. schedonnardi*. They made reciprocal inoculation experiments and proved the connection between the spermogonia and aecia on cotton and the uredinia and telia on *Bouteloua* spp. They believed the rust to be a new species and in 1943 named it *Puccinia stakmanii* in honor of Dr. E. C. Stakman, famous cereal plant pathologist at the University of Minnesota. Later, J. F. Hennen and G. B. Cummins published in 1956 the results of their comparative morphological study all of the rusts on species in the grass tribe Chlorideae, the tribe of *Bouteloua* and its close relatives. They determined that the basic morphology of *P. stakmanii* was the same as that of another rust, *Puccinia cacabata*, that had already been named by J. C. Arthur and E. W. Holway in 1925 from a rust specimen collected by Holway on *Chloris ciliata* from Bolivia. Thus, Hennen and Cummins' study provided the basis for assigning the name *Puccinia cacabata* to this rust that attacks cotton because it had been published first.. Then, Presely's name, *Puccinia stakmanii*, became a taxonomic synonym of *Puccinia cacabata*. This rule of "priority" of publication is one of the basic principles of the Code of Botanical Nomenclature.

This brief history of a rust on cotton is a relatively simple one that demonstrates how names of rust species may change as new information becomes available.

**Puccinia CALEAE** Arthur var. **CALEAE**, Bot. Gaz. (Crawfordsville) 40: 201. 1905. TYPE on *Calea axillaris urticaefolia* Robinson & Greenman from **Mexico**, Jalisco: Sayula, 8 Oct 1903, *Holway-5126*. (0/Icv,IIpe/III).

Anamorph

*Uredo caleae* Mayor, Mem. Soc. Neuchatel. Sci. Nat. 5: 598. 1913. TYPE on *Calea glomerata* Klatt. from **Colombia**, a lectotype needs to be chosen from the three collections listed by Mayor, (*Mayor-195*, *-195a*, *-195b*).

On Compositae:

*Calea cuneifolia* DeCandolle, São Paulo (Jackson, 1932: 161).

*Calea* sp., São Paulo (Jackson, 1932: 161).

*Calea uniflora* Lessing, Rio Grande do Sul, (Joerstad, 1956: 467).

*Puccinia caleae* var. *caleae* has been reported on *Calea* spp. from Brazil to Mexico and on *Viguiera* sp. from nearby Texas in The United States of America. Parmelee (1967) separates those collections with urediniospores with smooth spots around the two equatorial pores as *P. caleae* var. *cuernavaca* Parmelee, all of which are from Mexico and Central America.

Spermogonia on adaxial side of leaf. Aecia on abaxial side in small groups, peridium cylindrical, lacerate; aeciospores 23-29(-33) x 19-24 µm, globoid or nearly so; wall colorless, about 1 µm thick, verrucose with flat warts 1 µm diam. Uredinia on both sides of leaves, cinnamon brown; urediniospores (23-)26-32(-37) x (18-)20-25 µm, obovoid or ellipsoid; wall (1-)1.5-2 µm thick, uniformly echinulate with spines spaced 2-4(-4.5) µm, dark cinnamon-brown; pores 2, equatorial in slightly flattened sides, with caps. Telia on both sides of leaves or on adaxial side, exposed, becoming pulverulent, blackish brown; teliospores (36-)40-50(-54-)x (24-)26-30(-34) µm, ellipsoid tending obovoid; wall smooth, (1.5-)2-3(-3.5) µm thick at sides, dark chestnut brown, (3-)4-6(-7.5) µm over pores as a slightly paler, low umbo, pore apical in upper cell, next to septum in lower cell; pedicels 100 µm or less long, colorless except yellowish near hilum (Cummins, 1978).

Traits most useful for identification include: telia early exposed, teliospore walls smooth, dark brown, apical wall thickened as a low umbo, pore of lower cell at septum, teliospore pedicel persistent, mostly thick-walled and not collapsing; urediniospores (23-)26-32(-37) x (18-)20-25 µm, broadly ellipsoid, wall evenly echinulate, with two equatorial pores with conspicuous caps; aecial morphology as the genus *Aecidium* (Cummins, 1978).

Kern et al. (1933B) first connected *Uredo caleae* to *P. caleae* but Parmelee (1967) and Cummins (1978) made no reference to this connection.

**Puccinia CALLOSA** Joerstad, Ark. Bot., Serie 2, Band 3: 474. 1956. TYPE on *Vernonia obtusata* Lessing [= *Lessingianthus obtusatus* (Lessing) H. Robinson, Compositae, from **Brazil**, Mato Grosso: Santa Ana de Chapada, 27 May 1903, *G. O. Malme s.n.* (??,IIpe/III).

*Puccinia callosa* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves, scattered, cinnamon-brown, pulverulent; urediniospores 29-36 x 28-35  $\mu\text{m}$ , globoid to subovoid, wall more or less evenly 5-6  $\mu\text{m}$  thick, pale brown, sparsely echinulate, pores 4, equatorial; telia as the uredinia but dark-black and subpulverulent; teliospores 42-55 x 29-40  $\mu\text{m}$ , broadly ellipsoid to obovoid, mostly rounded above and below, not to slightly constricted at the septum, wall 5-9  $\mu\text{m}$  thick, not or only slightly thickened (to 10.5  $\mu\text{m}$ ) at the apex, chestnut-brown, minutely verrucose, apical pore slightly depressed, pedicel to 60  $\mu\text{m}$  long, colorless, fragile (Joerstad, 1956).

*Puccinia callosa* is very similar to *Puccinia insculpta* but *P callosa* has larger and thicker-walled urediniospores and teliospores (Joerstad, 1956).

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but three from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

*Puccinia camargoi* Puttemans, see **Puccinia psidii** Winter.

*Puccinia cambucae* Puttemans, see **Puccinia psidii** Winter.

*Puccinia cameliae* (Mayor) Arthur, see **Phakopsora cameliae** (Arthur) Buriticá

*Puccinia cannae* (Winter) P. Hennings, see **Puccinia thaliae** Dietel.

*Puccinia capsici* Mayor, see **Puccinia pampeana** Spegazzini.

*Puccinia capsici* Averna-Sacca, see **Puccinia pampeana** Spegazzini.

*Puccinia capsici* Mayor, not that of Averna-Sacca, 1917, see **Puccinia pampeana** Spegazzini.

**Puccinia cavatica** H. S. Jackson & Holway in Jackson, Mycologia 24: 68. 1932. TYPE on *Hyptis carpinifolia* Bentham, Labiatae, from **Brazil**, Minas Gerais: Belo Horizonte, 22 Nov 1921, *Holway-1325*. (?/?, IIcv/III).

*Puccinia cavatica* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia and aecia unknown. Uredinia probably *Caecoma*-like, on both sides of leaves, mostly locally systemic along veins and on stems, 0.5-0.75 mm in diameter, covered by the overarched epidermis, peridium absent or difficult to see; urediniospores catenulate, 20-24 x 20-22  $\mu\text{m}$ , globoid to ellipsoid, wall 1.5-2  $\mu\text{m}$  thick, coarsely verrucose, colorless. Telia on abaxial side of leaves, scattered, 0.2-0.4 mm in diameter, pulvinate, pale cinnamon-brown at first, then grayish-white by germination, ruptured epidermis not conspicuous; teliospores 54-75 x 14-21  $\mu\text{m}$ , cylindrical, fusoid to oblong-lanceolate, obtuse above, mostly narrowed but rounded below, upper cell wider above and constricted lower down, wall about 1  $\mu\text{m}$  or less thick, smooth, pale cinnamon-brown, pedicel as long as or shorter than the spore, colorless (Jackson, 1932).

The uredinia have the morphology of the anamorph genus *Caecoma*, although Jackson reported cells among the urediniospores that might be peridial cells, these 27-30  $\mu\text{m}$  in diameter, globoid, wall 1.5-3  $\mu\text{m}$  thick, closely verrucose. Jackson (1932) reported that *Uredo hammari* P. Hennings, which also has the morphology of *Caecoma*, may be an anamorph of *Puccinia cavatica*.

*Uredo hammari* P. Hennings also has *Caecoma*-like sori and may belong here.

#### Key to help identify species of *Puccinia* on *Hyptis*, Lamiaceae, in the Americas

##### Only anamorph spores considered

Anamorph spores pedicellate

Urediniospore pores 4 or 5, near hilum

*Puccinia fidelis* (0?Icv/IIpe,IIIsmhyal).

Urediniospore pores obscure, 2, supraequatorial.....*Puccinia gibertii* (?/Icv,IIpe/IIIsm-IIIver).

Urediniospore pores equatorial

- Urediniospore pores 3 ..... *Puccinia insititia* (?/?<sub>2</sub>, IIpe/IIIsm).
- Urediniospore pores 2  
 Teliospore wall umbonate at apex..... *Puccinia hyptidis-mutabilis*  
 Teliospore wall uniform at apex  
 Teliospores 45-84 µm long ..... *Puccinia neohyptidis*  
 Teliospores 30-40 µm long..... *Puccinia medellinensis*
- Urediniospore pores subequatorial, near the hilum  
 Urediniospore pores 1 to 3 ..... *Puccinia parilis*  
 Urediniospore pores 4 or 5 ..... *Puccinia fidelis* (0?Icv, IIpe, IIIhyal)  
 Anamorph spores catenulate, *Caecoma*-like  
*Puccinia cavatica* (?/?<sub>2</sub>, IIcv/III).  
*Puccinia fidelis* (0?Icv/IIpe, IIIsmhyal)  
*Puccinia neohyptidis* (0/Ica, IIpe/IIIsm).
- Only teleomorph spores considered**
- Teliospore walls verrucose ..... *Puccinia distorta* (0/-, -/III).  
*Puccinia neohyptidis* (0/Ica, IIpe/IIIsm).
- Teliospore walls smooth  
*Puccinia fidelis* (0?Icv, IIpe, IIIhyal)  
*Puccinia gibertii* (?/Icv, IIpe/IIIsm-IIIver).
- Teliospore wall umbonate at apex..... *Puccinia hyptidis-mutabilis*  
 Teliospore wall uniform at apex  
 Teliospores 45-84 µm long ..... *Puccinia neohyptidis*  
 Teliospores 30-40 µm long..... *Puccinia medellinensis*

\***Puccinia cenchri** Dietel & Holway in Holway, Bot. Gaz. (Crawfordsville) 24: 28. 1897. var. **CENCHRI**. TYPE on *Cenchrus multiflorus* J. Presl from **Mexico**, Jalisco, Guadalajara, 12 Oct 1896, Holway. (?/?<sub>2</sub> IIpe/III).

Anamorph

*Uredo cenchrophila* Spegazzini, Anal. Mus. Nac. Buenos Aires 19: 316. 1909. TYPE on *Cenchrus myosuroides* Kunth from **Argentina**, Tucumán, April 1906, Spegazzini s.n.

On Gramineae:

*Antheophora hermaphrodita* (Linnaeus) Kuntze, Paraiba (Viégas, 1945: 19; IAC-2688).

*Cenchrus echinatus* Linnaeus, Minas Gerais (Thurston, 1940: 297), Paraiba (Viégas, 1945: 19; IAC-2686), Penambuco (Batista & Bezerra, 1960: 21), Rio de Janeiro (Dietel, 1899:249), São Paulo (IBI-17602).

*Cenchrus* sp., Minas Gerais (Thurston, 1940: 297).

*Puccinia cenchri* var. *cenchrus* has been reported from Argentina to the West Indies, the Southern United States of America, some Pacific Islands, and Japan (Ryuku Isl.). It has also been reported on *Pennisetum* sp. in Colombia. *Puccinia cenchri* var. *africana* Cummins from Uganda differs because its urediniospores have 4-5 equatorial germ pores instead of 2-3.

Spermogonia and aecia unknown. Uredinia on both sides of leaves or mainly on adaxial side of leaf, cinnamon-brown; urediniospores (27-)31-34(-37) x (20-)24-27(-31) µm, mostly broadly ellipsoid or ellipsoid, wall 2-3 µm thick, prominently echinulate, cinnamon-brown, germ pores 2 or sometimes 3, equatorial. Telia on abaxial side of leaf, covered by the epidermis, blackish brown, inconspicuous; spores 37-44(-51) x (17-)20-24 µm, mostly oblong or clavate, wall 1.5 µm thick at sides, 3-7 µm apically, golden or chestnut-brown, smooth; pedicels to 15 µm long, thin-walled, colored (Cummins, 1971).

*Puccinia cestri* Dietel & P. Hennings, see **CHRYSOCYCLUS CESTRI** (Dietel & P.Hennings) H. Sydow.

**Puccinia chaetochloae** Arthur, Bull. Torrey Bot. Club 34: 585. 1907. TYPE on *Setaria macrosperma* (reported originally as *Chaetochloa macrosperma*) from **The United States of America**, Florida: Miami, 25 Mar 1903, Holway s.n. (?/?<sub>2</sub> IIpe/III).  
 = *Puccinia maublancii* Rangel, Arch. Mus. Nac. Rio de Janeiro 18: 159. 1916. TYPE on

*Paspalum densum* Poiret from **Brazil**, Rio de Janeiro: Cubango near Niteroy, April 1914, Rangel-1162.

Anamorph:

*Uredo chaetochloae* Arthur, Bull. Torrey Bot. Club 33: 518. 1906. TYPE, the same collection as for *Puccinia chaetochloae* Arthur.

On Gramineae:

*Paspalum densum* Poiret, Rio de Janeiro (Rangel, 1916: 159; Cummins, 1942: 678; 1971: 85).

*Paspalum paniculatum* Linnaeus, Rio Grande do Sul (Lindquist & Costa Neto, 1967: 55).

*Paspalum* sp., Mato Grosso do Sul (IBI-1404).

*Puccinia chaetochloae* has been reported from Brazil to the southern United States of America and on the grass genera *Ixophorus*, *Paspalum*, *Pennisetum*, and *Setaria* (Cummins, 1971).

Spermogonia and aecia unknown. Uredinia on both sides of leaves, rather long capped by the epidermis, cinnamon-brown, paraphyses inconspicuous, colorless or yellowish, thin-walled; urediniospores (26-)30-42(-50) x (19-)22-28(-30)  $\mu\text{m}$ , mostly oval or oblong and commonly angular, wall 2  $\mu\text{m}$  thick, golden or cinnamon-brown, echinulate, pores 3 or 4, equatorial. Telia blackish, covered by the epidermis, without paraphyses; teliospores (28-)32-40(-45) x (17-)20-26  $\mu\text{m}$  mostly clavate or oblong-ellipsoid, usually angular, wall 1.5  $\mu\text{m}$  thick at sides, 2-4  $\mu\text{m}$  apically, chestnut-brown, smooth, pedicels to 25  $\mu\text{m}$  long, yellowish or golden, thin-walled and commonly collapsing, persistent (Cummins, 1971).

Traits that help to identify *Puccinia chaetochloae* include: uredinia with inconspicuous, colorless or yellowish, thin-walled paraphyses, urediniospores 30-40  $\mu\text{m}$  long, wall echinulate, germ pores 3-4 equatorial, telia long covered by the epidermis, teliospores mostly 32-40  $\mu\text{m}$  long.

*Puccinia chauensis* (sic) Ellis & Everhart (name misspelled), see **PUCCINIA OAHUENSIS** Ellis & Everhart.

*Puccinia chichenensis* Mains, see **PUCCINIA GUARANITICA** Spegazzini.

**PUCCINIA CHLORIDIS** Spegazzini, Rev. Argentina Hist. Nat. 1: 172. 1891. TYPE on *Chloris* sp. from **Paraguay**, Paraguari, Feb 1884, *Balansa-4310*, -4312. Not *Puccinia chloridis* Dietel, 1892.

(0/Icv<sup>2</sup> IIpe/III).

= *Puccinia bartholomei* Dietel, Hedwigia 31: 290. 1892. TYPE on *Bouteloua gracilis* (Kunth) Lag. ex Griffiths (reported as *Bouteloua oligostachia* from the **United States of America**, Kansas: 4 March 1892, *E. Bartholomew-522*).

= *Puccinia trichloridis* Spegazzini, An. Mus. Nac. Buenos Aires 19: 298. 1909. TYPE (Lectotype) on *Trichloris crinita* (Lagasca) Parodi (reported as *Trichloris mendocina* (Phil.) Kurtz) from **Argentina**, Salta: Perico, 22 Feb 1906, *Spegazzini-sn*.

Anamorphs

On Asclepiadaceae, aecia not reported for South America.

**Aecidium brandegei** Peck, Bot. Gaz. Crawfordsville 3: 34. 1878. TYPE on *Asclepias verticillata* Linnaeus from **The United States of America**, Colorado: place and date not reported, *Brandeggee-s.n.*

= *Aecidium jamesianum* Peck, Bot. Gaz. Crawfordsville 5: 34. 1880. TYPE on *Asclepias jamesii* from **The United States of America**, New Mexico, place and date not reported, *Brandeggee-s.n.*

= *Puccinia jamesiana* (Peck) Arthur, Bot. Gaz. Crawfordsville 35: 18. 1903. Basionym based on an *Aecidium* anamorph.

On Gramineae

*Eustachys distichophylla* (Lagasca) Nees (reported as *Chloris distichophylla* Lagasca, São Paulo (Hennen, 1954: 74.).

*Eustachys uliginosa* (Hackel) Herter (reported as *Chloris dusenii* Ekman), Paraná (Joerstad, 1959: 61).

*Chloris* sp., Rio Grande do Sul (Lindquist & Costa Neto, 1963: 113).

*Puccinia chloridis* has been reported from Argentina to the Central United States of America, and on species of *Bouteloua* and *Trichloris*. An *Aecidium* sp. anamorph connection is unknown in South America.

Spermogonia and aecia, *Aecidium brandegei* Peck., on species of *Asclepias*, *Matelea*, and *Sarcostoma*; aeciospores 18-26 x 16-23 µm, wall colorless, 2-3 µm thick at sides, 7-10 µm at apex. Uredinia mostly on adaxial side of leaves, orange when fresh; urediniospores 18-23 x 16-22 µm, mostly broadly obovoid or globose, wall 1.5-2.5 µm, colorless or yellowish, echinulate, pores obscure, 5-8, scattered. Telia mostly on adaxial surface, blackish, pulvinate; teliospores 26-40 x 16-25 µm, mostly oblong-ellipsoid, wall 1.5-2.5 µm at sides, 5-9 µm apically, chestnut, smooth; pedicels up to 100 µm long, golden brown, thin-walled, usually collapsing (Hennen and Cummins, 1956; Cummins, 1971).

Based on morphological differences, Hennen and Cummins (1956) divided *Puccinia chloridis* Spegazzini into *Puccinia dietelii* Saccardo & Sydow - urediniospore wall apically thickened, and *Puccinia chloridis* Spegazzini - urediniospore wall uniformly thin. Other traits of *Puccinia chloridis* include uredinia without paraphyses, urediniospores echinulate with scattered or indistinct pores, and teliospores with pedicels that are thin-walled and collapse laterally.

*Puccinia dietelii* has been reported on *Chloris* and *Dactyloctenium* and from North America, Africa, and only Argentina in South America.

*Puccinia chrysanthemi* Roze, see **Puccinia TANACETI** DeCandolle var. **TANACETI**.

**Puccinia CIRCINANS** Dietel, Hedwigia 36: 30. 1897. TYPE on undetermined Compositae genus from **Brazil**, Minas Gerais: Oro Preto, Mar 1892, *Ule-1856*. (?!/?,?/III).

*Puccinia circinnans* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Telia small, pulvinate, chestnut-brown, on abaxial side of leaves, irregularly scattered on young leaves or in small concentric circles up to 3 mm across on older leaves, on indeterminate yellowish spots; teliospores 27-33 x 18-24 µm, ellipsoid, ends rounded to narrowed at the base, not constricted at the septum, wall more or less evenly 3-5 µm thick, yellowish-brown, smooth, pedicel about as long as the spore, colorless, firm (Sydows, 1902).

Teliospores may germinate in situ without a dormancy period. The habit of the telia suggest that the species is microcyclic.

*Puccinia circinata* Arthur, see **Puccinia INSUETA** Winter.

**Puccinia CLAVIFORMIS** Lagerheim, Tromso Mus. Aarsh 17: 53. 1895. TYPE on *Solanum* sp. from **Suriname**, date and collector not reported. (-/-,-/III).

≡ *Dicaeoma claviformis* (Lagerheim) Kuntze, Rev. Gen. 3(3): 468. 1898.

= *Puccinia huallagensis* P. Hennings, Hedwigia 43: 158. 1904. TYPE on *Solanum* sp. from **Peru**, Cerro de Ponasa, January 1902, *Ule-3243*.

= *Puccinia solanicola* Mayor, Mem. Soc. Neuch. Sci. Nat. 5: 505. 1913. TYPE. A lectotype needs to be chosen from the four specimens collected in 1910 from **Colombia** on *Solanum* spp. and listed by Mayor.

On Solanaceae:

**Solanum** sp., Amapá (Sotão 910219), Pará (Dietel, 1909: 265).

*Puccinia claviformis* has also been reported from Ecuador, Colombia, Venezuela, Surinam, Trinidad, and Panama.

Kern (1933) published a key for the nine microcyclic species of *Puccinia* that are known on *Solanum* spp. from the Neotropics. These are known mostly from the western cordilleras. Some are difficult to separate by their morphology. *Puccinia claviformis* is the most common of these. *Puccinia solani-tristis* is another microcyclic species of *Puccinia* on *Solanum* sp. that has been reported from Brazil. Kern (1933) uses the following traits for identifying *Puccinia claviformis*: Telia in groups, not distributed evenly over large areas, teliospores mostly two-celled, clavate to ellipsoid-clavate, more or less constricted at the septum, 30-55 µm long, wall 1.5-2 µm thick laterally, and 4-7 µm thick at the apex.

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**Puccinia CNICI-OLERACEI** Persoon ex Desmazieres, Catal. Pl. Omis. p. 24. 1823. TYPE on

*Cnicus oleraceus* Linnaeus (*Cirsium oleraceae*) from northern **France**. (-/-,-/III).

Synonyms based on types mostly from the Americas are given here.



- = *Puccinia xanthii* Schweinitz, Schr. Nat. Ges. Leipzig 1: 73. 1822. TYPE on *Xanthium* sp. from **The United States of America**, North Carolina: Salem and Pennsylvania: Bethlehem, dates not reported, *Schweinitz s.n.*
- = *Puccinia asteris* Duby, Bot. Gall., p.288. 1830. TYPE information not found.
- = *Puccinia argentina* Spegazzini, Anal. Soc. Cient. Argentina 9: 169. 1880. TYPE on *Picrosia longifolia* D. Don (or ? *Hieracium* sp. fide Farr, 1973) from **Argentina**,  
= *Puccinia picrosiae* P. Sydow & H. Sydow, Mon. Ured. 1:31. 1904. TYPE on *Picrosia longifolia* D. Don, Compositae, **Brazil**. Locality, date of collection, and collector not reported.
- = *Puccinia doloris* Spegazzini, Annal. Soc. Cient. Argentina 12-68. 1881. TYPE on *Erigeron bonariensis* from **Argentina**, Doloris, Dec 1880, *Spegazzini-s.n.*
- = *Puccinia spilanthis* P. Hennings (published as *P. spilanthis*), Bot. Jahrb. Syst. 15: 14. 1892. Type on *Spilanthes salzmanni* DeCandolle from **Brazil**, locality and date not recorded, *Martius-438*.
- = *Puccinia melampodii* Dietel & Holway in Holway, Bot. Gaz. (Crawfordsville) 24: 32. 1897. TYPE on *Melampodium divaricatum* (Rich.) DeCandolle from **Mexico**. Morelos: Cuernavaca, 25 Sept 1896, *Holway*.
- = *Puccinia synedrellae* P. Hennings, Hedwigia 37: 277. 1898. TYPE on *Synedrella nodiflora* Gaertner from **Jamaica**, Port Antonio, 21 Feb 1893, *Humphry s.n.*
- = *Puccinia emiliae* P. Hennings, Hedwigia 37: 278. 1898. TYPE on *Emilia sagittata* DeCandolle from **Jamaica**, Bog Walk, 3 April 1893, *Humphrey s.n.*
- = *Puccinia acanthospermi* P. Hennings, Hedwigia 41: 296. 1902. TYPE on *Acanthospermum xanthioides* DeCandolle, **Brazil**, São Paulo: São Paulo, Hort. botan. *Puttemans-424*.
- = *Puccinia zinniae* P. Sydow & H. Sydow, Monogr. Ured. I: 188. 1903. TYPE on *Zinnia tenuiflora* from **Mexico**, Jalisco: Chapala, date not reported, *Holway*.
- = *Puccinia acanthospermi* H. Sydow & P. Sydow, Ann. Mycol. 1: 17. 1903. TYPE on *Acanthospermum xanthoides* from **Venezuela**, Caracas, date not reported, *Moritz s.n.*
- = *Puccinia diaziana* Arthur, Bot. Gaz. 40: 203. 1905. TYPE on *Verbesina encelioides* A. Gray (*Ximensia encelioides* Cav.) from **Mexico**, Coahuila: Porfirio Diaz, 10 Oct 1900,
- = *Puccinia eleutherantherae* Dietel, Ann. Mycol. 7: 354. 1909. TYPE on *Eleutheranthera ruderalis* Schultz-Bipontius from **Brazil**, Pará, Museum Goeldi in Belém, December, 1907, *C. F. Baker sn.*
- = *Puccinia wedeliae* Mayor, Mem. Soc. Neuchatel. Sci. Nat. 5: 528. 1913. TYPE on *Wedelia trichostephia* DdCandolle from **Colombia**, Antioquia: Medellin, 6 Augst 1910, Mayor-237.
- = *Puccinia ordinata* H. S. Jackson & Holway, in Arthur, Am. Jour. Bot. 5: 530. 1918. TYPE on *Calea insignis* from **Guatemala**, Quezaltenango,
- = *Puccinia semota* H. S. Jackson & Holway, in Arthur, Am. Jour. Bot. 5: 531. 1918. TYPE on *Hymenostephium cordatum* (reported as *Gymnolomia subflexuosa* B. & H.) from **Guatemala**, Solola, 28 Jan 1915, *Holway-146*.
- = *Puccinia tetranthi* H. Sydow, Ann. Mycol. 17: 33. 1919. TYPE on *Tetranthus litalis* from **Haiti**, Tete de l'Acuil du Sud, 7 Sept ("7.9")1908, *E. Christ-1987*.

## On Compositae:

*Acanthospermum australe* (Loefling) Kuntze, Minas Gerais (Thurston, 1940: 296; Viégas, 1945: 15; IAC-4138), Paraíba (Viégas, 1945: 15; IAC-3674), Rio de Janeiro (Jackson, 1932: 160; Viégas, 1945: 15; IAC-3682); São Paulo (Jackson, 1932: 160; Viégas, 1945: 15; IAC-1440, IBI-1895).

*Acanthospermum xanthioides* DeCandolle, São Paulo (Hennings, 1902D; 296; 1904A: 79).

*Acanthospermum* sp., Rio de Janeiro (Hennings, 1904A: 79), São Paulo (*Puttemans-424*).

*Eleutheranthera ruderalis* Schultz-Bip., Amapá (*Sotão-920203*), Pará (Dietel, 1909B: 354).

*Emilia sonchifolia* DeCandolle, Amapá (*Sotão-930110*), Bahia (84-239/IBI15309), Ceará (IBI 17596), Maranhão (IBI-14066), Mato Grosso (IBI 16130), Mato Grosso do Sul (IBI-14379), Minas Gerais (IBI 13496), Pará (Albuquerque, 1971: 148; IAN-460, IBI 13240), São Paulo (IBI 14171).

*Emilia* sp., Pará (Dietel, 1909: 263).

*Melampodium* sp., Amapá (*Sotão-920226*).

*Picrosia longifolia* D. Don, Brazil (P. Sydow & H. Sydow, Mon. Ured. 1:31. 1904. Locality,

date of collection, and collector not reported).

*Spilanthes acmella* Murray, Acre (IBI 17687), Minas Gerais (Thurston, 1940: 304), Paraíba (Viégas, 1945: 49; IAC-2672, -2916), São Paulo (IBI-15461).

*Spilanthes ocyimifolia* A.H. Moore, Minas Gerais (Thurston, 1940: 304), Rio de Janeiro (Jackson, 1932: 168).

*Spilanthes oleracea* Linnaeus, Amazonas (IAN-501), Pará (Albuquerque, 1971: 149; 85-4/15479), São Paulo (Viégas, 1945: 49; IAC-3480, IBI-277).

*Spilanthes uliginosa* Swartz, Maranhão (85-157/15162), Rio de Janeiro (Jackson, 1932: 168).

*Spilanthes sp.*, Amapá (Sotão-920211A), Minas Gerais (IBI 15885).

*Stenachaenium megapotanicum* Baker, Rio Grande do Sul (Joerstad, 1956: 471).

*Puccinia cnici-oleracei* is a microcyclic, cosmopolitan, collective rust species that has been reported by one or another of its synonyms on at least 20 genera of Compositae. Although there may be rust populations within this collective species that are specialized on different host populations, on all hosts this rust has the same basic morphology. The many names that have been applied to one or more parts of this complex are based mostly on finding the rust on a different host species. In the Americas it has been reported often as *Puccinia melampodii*.

*Puccinia cnici-oleracei*, or one of its synonyms, has been reported on the following genera of Compositae: *Acanthosperma*, *Ambrosia*, *Baccharis*, *Calea*, *Eclipta*, *Eleutheranthera*, *Elvira*, *Emilia*, *Erigeron*, *Hymenostephium*, *Melampodium*, *Millieria*, *Parthenium*, *Senecio*, *Spilanthes*, *Stenachaenium*, *Synedrella*, *Tetranthus*, *Tridax*, *Verbesina*, *Wedelia*, and *Xanthium*.

Spermogonia, aecia, and uredinia absent. Telia on abaxial side of leaves, or rarely on both sides, often on yellowish and finally dead spots, in small compact circular groups, often spreading when infecting vascular tissue, blackish brown becoming grayish by germination from the center of the group. Teliospores (32-)37-50(-55) x (13-)15-20(-23)  $\mu\text{m}$ , narrowly obovoid to obovoid or oblong, constricted at septum, wall (1-)1.5(-2.5)  $\mu\text{m}$  at sides, (4-)6-10(-16)  $\mu\text{m}$  at apex, yellow-brown to redish-brown, smooth, not laminate, pore apical in upper cell, at septum in lower cell, pedicel 15-55  $\mu\text{m}$  long, light to dark yellow-brown. (Parmelee, 1967; Cummins, 1978).

Except for the numerous one-celled teliospores *Puccinia spilanthicola* could be placed in *Puccinia cnici-oleracei*.

*Puccinia argentina* on *Picrosia* sp. has been reported from Argentina. From Brazil it was reported as *Puccinia picrosiae*, the latter has been reported only from the type. Lindquist (1983) concluded that *Puccinia picrosiae* is a synonym of *P. argentina* and suggested that this species is part of the *Puccinia cnici-oleracei* complex.

Cummins (1978) and Parmelee (1967) recorded *Puccinia xanthii* as a separate species based only on host. They listed 14 other rust names as synonyms of *Puccinia melampodii* that we include as synonyms of *P. cnici-oleracei*. In North America Cummins (1978) noted that "numerous binomials have been consigned to the synonymy of *P. melampodii* and others keyed here are scarcely separable on morphological bases". In this Catalogue we place all of these names as synonyms of *Puccinia cnici-oleracei*, which we believe is the oldest name that applies to this collective morphological species world wide.

*Puccinia barranquillae* (Mayor, 1913) reported as on *Spilanthes* from Colombia and Venezuela probably also belongs here.

Arthur (1934) reported *Puccinia xanthii* as a microcyclic species correlated with the long cycle, heteroecious species *Puccinia canaliculata*, which produces uredinia and telia on many species of *Cyperus*, Cyperaceae, and spermogonia and aecia on species of *Ambrosia* and *Xanthium*, and other genera of Compositae. We suggest that all of the populations of *Puccinia cnici-oleracei* on its many different hosts are short cycle derivatives of rusts on Cyperaceae. Besides *Puccinia canaliculata* at least six other species of *Puccinia* in North America have been reported on Cyperaceae whose spermogonia and aecia are on species of Compositae. Perhaps some of these are also parental species of certain populations of *Puccinia cnici-oleracei*.

The term "lepto-form" has been applied to *Puccinia cnici-oleracei* and other rust species whose teliospores germinate *in situ* without a dormancy period. In short-cycle species the telial sori become a characteristic gray-white color, termed cinerious, after germination. However, Figueiredo et al. (1991), using populations of *P. cnici-oleracei* on *Emilia* and *Spilanthes*, reported experimental results that showed great variability in the germination of teliospores over time within a given telium. They concluded that the term lepto-form should be used only as a very general term that indicates only that at least some or perhaps a majority of teliospores germinate without dormancy.

The occurrence of *Puccinia cnici-oleracei* (and *P. spilanthisicola*) on *Spilanthes* spp., “jambú”, is of special interest in Brazil because the leaves of these species are used widely in regional cooking for flavoring. See *Puccinia obrepita* for a key to other species of rusts on *Wedelia*.

**Puccinia COCCOCYPSELI** H. S. Jackson & Holway in Jackson, Mycologia 24: 98. 1932. TYPE on *Coccocypselum condalia* Persoon, Rubiaceae, from **Brazil**, São Paulo: Campos do Jordão, 27 April 1922, Holway-1777. (-I,-/III).

*Puccinia coccocypseli* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia, aecia, and uredinia not formed. Telia on yellowish spots on abaxial side of leaves in densely crowded, often concentric groups 3-8 mm across; sori 0.2-0.4 mm. across, soon naked, pulvinate, cinnamon- to pale chestnut-brown, ruptured epidermis mostly inconspicuous, teliospores 24-34 x 10-13 µm, ellipsoid, to oblong-fusoid, rounded or often obtuse above, rounded or sometimes narrowed below to pedicel, slightly or not constricted at septum, wall 1-1.5 µm thick, not or slightly thickened to 3 µm above, smooth, hyaline to pale golden-brown, pedicel as long as spore or frequently shorter, hyaline, fragile (Jackson, 1932).

*Puccinia codonanthes* H. Sydow & P. Sydow, see **Puccinia GESNERACEARUM** Dietel.

**Puccinia COMMELINAE** Holway, Ann. Mycol. 2: 393. 1904. TYPE on *Commelina* sp. from **Mexico**, Jalisco: Guadalajara, 28 Sept 1903, Holway-5061. (?/?,II/III).

On Commelinaceae

*Commelina* sp., Minas Gerais (IBI-16315), Rio de Janeiro (IBI-13056), São Paulo (IBI-12016).

*Puccinia commelinae* Holway has been reported also from Mexico, and The West Indies.

*Uromyces commelinae* Cooke and *Puccinia commelinae* are difficult to separate in the uredinial stage, the stage most often collected. Jackson (1926) reported *Uromyces commelinae* on *Tradescantia elongata* from Tremembé, São Paulo and Gavea, Rio de Janeiro. But he suggested that because telia were not present the identifications may be incorrect. We have studied these collections in PUR and reidentified them as *Puccinia commelinae*. Our study of uredinia of these two species indicated that they may be tentatively separated by the following comparison:

1. Urediniospore wall chestnut-brown, 2-2.5(-3) µm thick, with more or less smooth spots around the two equatorial pores. *Uromyces commelinae* Cooke.
  2. Urediniospore wall cinnamon-brown, 1.5-2 µm thick, more or less uniformly echinulate, not or only rarely with smooth spots around the two equatorial pores.. *Puccinia commelinae* Holway.
- Durrieu (1979, Mycotaxon 9: 484) named a very similar rust from Nepal *Puccinia commelinae* Durrieu. If this rust proves to be different from *Puccinia commelinae* Holway, it will require a new name.

*Puccinia compacta* Kuntze, see **Puccinia CONCRESCENS** Ellis & Everhart.

*Puccinia compressa* Arthur & Holway, see **PHAKOPSORA COMPRESSA** (Arthur & Holway) Buriticá & Hennen.

*Puccinia compressa* Dietel, see **PROSPODIUM COMPRESSUM** (Dietel) Cummins.

**Puccinia CONCRESCENS** Ellis & Everhart in Arthur, Mycologia 7: 240. 1915. Nom. nov. for *Puccinia compacta* Kunze. (-I,-/III).

≡ *Puccinia compacta* Kuntze in Bubak, Hedwigia Beibl. 92: (30). 1903. TYPE on *Asclepias curassavica* Linnaeus (reported originally as unidentified) from **Surinam**, Weigelt Exsiccati. Not *P. compacta* Berkeley, 1855; or DeBary, 1858.

On Asclepiadaceae:

*Asclepias curassavica* Linnaeus, Minas Gerais (Jackson, 1931: 493), São Paulo (IBI-3539).

*Puccinia concrescens* has been reported also from northern South America, Puerto Rico, and Cuba, also on *Calotropis* and *Funastrum*.

Spermogonia, aecia, and uredinia not produced. Telia on abaxial side of leaves in orbicular groups on discolored spots, pulvinate, crowded but distinct, becoming confluent at the center into a cushion-like mass 2-4 mm across, chestnut-brown, often darker in the center of the groups and paler at edges; teliospores 20-40

x 10-20 µm, oblong-elliptic, often irregular, rounded or obtuse at both ends, or often somewhat narrowed below, slightly or not constricted at the septum, septum occasionally oblique; wall uniformly 1.5-2 µm thick or slightly thicker at apex; pedicel as long as or longer than the spore, usually deciduous. (Arthur, 1922).

*Puccinia cynanchi* (*Puccinia obliqua*), the most common microcyclic species on Asclepiadaceae, differs because its teliospores are globoid or broadly obovoid.

**Puccinia CONFORMATA** H. Sydow, Ann. Mycol. 30: 91. 1932. TYPE on *Aspilia setosa* Baker, Compositae, from **Brazil**, Rio Grande do Sul: Neu Wurttemberg, Estanzia Lourenzo Gomez, 25 April 1905, A. Bornmueller-517. (?/?, Ipe/III).

*Puccinia conformata* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil. Lindquist (1982) did not include this species.

**Puccinia CONGESTA** Berkeley & Broome. 1871. TYPE on *Polygonum chinense* (originally reported as unidentified) from **Sri Lanka**, Habgala, Jan 1868, ? collector. (-/or?, -orII?/III).  
= *Puccinia consimilis* P. Hennings, Hedwigia 34: 10. 1895. TYPE on *Polygonum* sp. from **Java**, Sakawana1, 4 Jan 1884, Graf Solms-Laubach. Not *P. consimilis* Ellis & Everhart, 1891.  
= *Puccinia solmsii* P. Hennings ex Saccardo, TYPE on *Polygonum* sp., Syll. Fung. 11: 196., 14: 357. 1899.

On Polygonaceae:

*Polygonum acuminatum* Humboldt, Bonpland & Kunth, Brazil (Sydow, P. & H., Mon. Ured. 1: 568. 1907).

*Puccinia congesta* has been reported as widespread in southeast Asia, China, and Japan. It was reported from Brazil by the Sydows (1907) but no specimen was cited. New specimens are required to clarify the identity of this rust in Brazil.

Spermogonia unknown. Aecia and uredinia questionable. Telia on abaxial side of leaves, 0.2-0.6 mm across, on large roundish dark brown to purplish spots 2-10 mm across, clustered in roundish groups 1-9 mm across, fused with each other, soon naked, solid, erumpent, cinnamon-brown; teliospores 30-50 x 15-24 µm, ellipsoid to clavate, roundish at both ends, wall 1.5-2.5 µm thick at sides, not or slightly thickened at apex or thickened to 3-4 or rarely to 6 µm, germ pores apical in upper cell, at septum in lower cell, the two cells easily separating, pedicels to 110 µm long, persistent, hyaline. One celled and 3-celled spores also produced (Hiratsuka, N. et al., 1992).

Hiratsuka et al. (1992) reported that the correct name for this Asian fungus is *Puccinia congesta* Berkeley & Broome, 1871, and synonyms include *Puccinia consimilis* P. Hennings (not *P. consimilis* Ellis & Everhart), and *P. solmsii* P. Hennings. The life cycle seems to be microcyclic but some authors have reported uredinia and even aecia associated with telia.

*Puccinia consimilis* Ellis & Everhart, see **Puccinia CONGESTA** Berkeley & Broome

**Puccinia CONSPERSA** Dietel var. **CONSPERSA**, Hedwigia 36: 30. 1897. TYPE on *Salvia* sp. from **Brazil**, Santa Caterina: Serra Geral, April, 1891, Ule-1776. (0/Icv, Ipe/III).  
= *Puccinia uliginosa* Spegazzini, Anal. Mus. Nac. Hist. Nat. Buenos Aires 23: 26. 1912. TYPE on *Salvia uliginosa* from **Argentina**, Buenos Aires, June 1910, Spegazzini s.n. Not *Puccinia uliginosa* Juel, 1894.

On Labiatae:

*Salvia arenaria* Saint-Hilaire, São Paulo (Jackson, 1932: 74; Baxter, 1953: 122).

*Salvia calanstrina* Pohl, Minas Gerais (Joerstad, 1959: 70).

*Salvia itatiaiensis* Dusen, Rio de Janeiro (Joerstad, 1959: 70).

*Salvia sellowiana* Bentham, Rio de Janeiro (Joerstad, 1959: 70), São Paulo (Jackson, 1932: 74; Baxter, 1953: 122).

*Salvia splendens* Sellow, Rio de Janeiro (Jackson, 1932: 74; Baxter, 1953: 122).

*Salvia* sp., Rio de Janeiro (Jackson, 1932: 74; Baxter, 1953: 122.), São Paulo (Jackson, 1932: 74; Baxter, 1953: 122), Serra Geral (Dietel, 1897: 30).

*Puccinia conspersa* var. *conspersa* has been reported also from Argentina and *Puccinia conspersa* var. *paramensis* (Mayor) Baxter on *Salvia carnea* Kunth in Colombia and on *Salvia killipiana* Epling in Venezuela (Baxter, 1953).

Spermogonia epiphyllous, in groups, subepidermal, globoid, cinnamon-brown, 85-165  $\mu\text{m}$  in diameter. Aecia amphigenous, scattered or in groups up to 2 mm. across or up to 3 mm. in length along the veins; peridial cells 20-27 x 27-43  $\mu\text{m}$  in surface view, elliptical or oblong, hyaline, inner wall 2-4  $\mu\text{m}$ , coarsely verrucose, the tubercles forming conspicuous ridges, outer wall 6-10 finely verrucose; aeciospores catenulate, 16-23 x 23-33  $\mu\text{m}$ , globoid or ellipsoid, occasionally angularly ellipsoid or oblong.; wall 1-2  $\mu\text{m}$  thick, pale yellow, finely verrucose. Uredinia hypophyllous, 0.1-0.7 mm. in diameter, scattered. round, pulverulent, cinnamon-brown, orange or yellowish; urediospores 16-23 x 20-26(-30)  $\mu\text{m}$ , asymmetrical, broadly ellipsoid or obovoid with the pores in surface view, narrower and more nearly oblong with the pores in optical section; wall about 1  $\mu\text{m}$  thick, pale cinnamon, echinulate, pores 2, equatorial. Telia hypophyllous, occasionally also caulicolous, scattered or in groups, 0.1-0.5 mm. in diameter on leaves, 0.5-1.5 mm. across and up to 3 mm. long on stems, up to 2 mm. across, round or elliptic, pulvinate, somewhat compact, chestnut-brown; teliospores 17-23(-28) x 26-40(-43)  $\mu\text{m}$ , ellipsoid or oblong., rounded at both ends, not or slightly constricted at the septum, germinating without a resting period; wall cinnamon-brown or yellowish, smooth below, verrucose or nearly smooth above, 1-1.5  $\mu\text{m}$  thick, thickened to 2-3  $\mu\text{m}$  at the angles of the septum, pore of upper cell apical, of lower next to the septum, each capped by a hyaline umbo 2-4  $\mu\text{m}$  thick; pedicel about 1/2 the length of the spore, occasionally up to 65  $\mu\text{m}$  long, hyaline, thin-walled, fragile, frequently breaking away completely (Baxter, 1953).

The teliospores of *Puccinia conspersa* are somewhat like those of *P. soledadensis* in general appearance, but are much smaller. The urediospores are characteristically asymmetrical with the pores located in the flattened sides. *Puccinia conspersa* seems to be the most common rust on *Salvia* in Brazil.

"This species was described as having; aecia and telia only. All our specimens show uredinia or urediniospores in the telia. *Puccinia uliginosa* Speg. was described with uredinia and later with aecia. Our material fits the measurements and description of both species very well, though no previous collections have been seen. *P. conspersa* was originally collected at Serra Geral, Brazil. In some collections careful examination shows that the spores are minutely and very inconspicuously verrucose above".(Jackson, 1931).

Examination of the type specimen of *P. uliginosa* Speg. shows that Jackson (1931) was correct in listing this species as a synonym of *P. conspersa* (Baxter, 1953).

**PUCGINIA CONSULTA** H. S. Jackson & Holway in Jackson, Mycologia 24: 140. 1932. TYPE on *orgyalis* DeCandolle from **Brazil**, Rio de Janeiro: Teresopolis, 30 Sept 1921, *Holway-1176*. (0/Icv,IIcv/III).

Anamorph

*Caeoma* sp., unnamed.

On Compositae:

*Baccharis orgyalis* DeCandolle, Rio de Janeiro (Jackson, 1932: 140; PUR-F8175).

*Baccharis pauciflosculosa* DeCandolle, São Paulo (Jackson, 1932: 140; PUR-F8178).

*Baccharis schultzei* Baker, Minas Gerais (Jackson, 1932: 140), São Paulo (Jackson, 1932: 140).

*Baccharis* sp., Rio de Janeiro (Jackson, 1932: 140).

*Puccinia consulta* has been reported only from Brazil.

Spermogonia loosely grouped on pale yellow spots on adaxial side of leaves, numerous, 90-120  $\mu\text{m}$  high, 75-90  $\mu\text{m}$  wide, deeply immersed, golden-yellow at first turning brown, periphyses extending 30-45  $\mu\text{m}$  above the ostiole. Aecia with the morphology of *Caeoma* sp., 0.5-1.0 mm across, on the abaxial side of leaves, mostly single but also in groups of 2-4, eruptent; aeciospores 30-40 x 20-26  $\mu\text{m}$ , subglobose to narrowly ellipsoid, wall 1-1.5  $\mu\text{m}$  thick, minutely but conspicuously verrucose-rugose, verrucae often confluent but not striate, colorless. Uredinia, if present, like the aecia but without spermogonia. Telia on abaxial side of leaves, scattered or in groups, often between the anamorph sori, 0.2-0.5 mm across, compact, pulvinate, pale chestnut-brown, turning gray by germination, ruptured epidermis not conspicuous; teliospores 45-60 x 18-24  $\mu\text{m}$ , clavate, ellipsoid to oblong, rounded above, rounded to narrowed below, not or slightly constricted at the septum, wall 1  $\mu\text{m}$  (1.5-2  $\mu\text{m}$  fide Lindquist, 1958) thick at sides, 5-8  $\mu\text{m}$  thick at apex, pale cinnamon- to golden-brown, smooth, at times apical pore with a small papilla; pedicel equal to or up to twice the length of the spore, mostly shorter, colorless (Jackson, 1932).

Both Jackson (1932) and Lindquist (1958) report that *Puccinia montoyae* Mayor from Colombia differs because it has teliospores that are strongly constricted at the septum and only slightly thickened to 4  $\mu\text{m}$  at the apex, this thickening often only at the sides of the germ pore, and anamorph spores that are smaller, 26-30 x 21-26  $\mu\text{m}$ , and their walls have verrucae arranged in longitudinal rows.

Species of *Puccinia* are known to parasitize species of *Baccharis* only in the Americas. Lindquist (1957) reported at least 55 of these species. Thus, *Baccharis* has more *Puccinia* species than any other host genus in the Americas.

**Puccinia CONVULVULI** Castagne, Obs. 1: 16. 1842. TYPE on *Convolvulus arvensis* L. from **Europe. (O/Icv,IIpe/III).**

Synanamorphs

*Uredo bete* var *convolvuli* Persoon, Syn. Method. fung. p. 221, 1801.

*Aecidium calyptegiae* Desm. Ann. sc. nat. Ser. III, Bd. VIII, p14. 1847.

On Convolvulaceae:

*Convolvulus* sp., Rio de Janeiro (Jackson, 1931: 495).

*Puccinia convolvuli* has been reported from South America only this one time from Brazil but has been reported frequently from Europe, Africa, Japan, The Middle East, and North America. New collections are needed to confirm that it occurs in Brazil.

Urediniospores 23-33 x 18-26  $\mu\text{m}$ , walls 2-2.5  $\mu\text{m}$  thick, echinulate, cinnamon-brown, germ pores (2-)3 equatorial or slightly superequatorial, pores are illustrated in European literature as supraequatorial with smooth areas on the walls below the pores. Teliospores 42-55 x 23-31  $\mu\text{m}$ , oblong-ellipsoid, walls 1.5-2.5  $\mu\text{m}$  thick at sides, 5-5.5(-9)  $\mu\text{m}$  thick at apex, smooth, chestnut-brown.

In addition to *Convolvulus*, *Puccinia convolvuli* has been reported on species of *Calystegia* (a synonym of *Convolvulus* by some authors), *Ipomoea*, and *Solidanella*. Other synonyms of this rust are given in Sydow & Sydow (1902) and Arthur (1907), mainly from European collections.

**Puccinia CONYZAE** P. Hennings, Hedwigia 35: 239. 1896. TYPE on *Conyza triplinervia* Lessing from **Brazil**, Santa Catarina: Blumenau, April 1888, *Ule-900. (??,II/III).*

= *Puccinia baccharidis-triplinervis* P. Hennings, Hedwigia 35: 241. 1896. TYPE on *Conyza triplinervia* Lessing (reported originally as *Baccharis triplinervis*) from **Brazil**, Santa Catarina: Blumenau, ? date, *Ule-96, Ule-1449.*

= *Puccinia sordida* Dietel, Hedwigia 36: 31. 1897. TYPE on *Conyza triplinervia* Lessing (reported originally as *Baccharis triplinervis*) from **Brazil**, Santa Catarina, Itajahy, Serra Geral, Nov 1885, *Ule-1700.*

On Compositae:

*Conyza triplinervia* Lessing [host binomial transferred as *Baccharidastrum triplinervium* (Lessing) Cabrera, 1937], Minas Gerais (Jackson, 1932: 128; Joerstad, 1956: 460), Rio de Janeiro (Jackson, 1932: 128), Santa Catarina (Hennings, 1896: 241; Dietel, 1897: 31), São Paulo (Jackson, 1932: 128).

*Puccinia conyzae* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia scattered on brownish leaf spots mostly on the abaxial side, minute, long covered by the epidermis, pale brown to whitish, urediniospores 18-35 x 16-22  $\mu\text{m}$ , subglobose, ellipsoid, to ovoid, wall echinulate, nearly colorless; telia scattered on yellowish leaf spots on the abaxial side, minute, pulvinate, dark brown, teliospores 40-52 x 19-27  $\mu\text{m}$ , oblong, occasionally ellipsoid to irregular, rounded or rarely narrowed above, very slightly constricted at the septum, rounded to narrowed below, wall thickened to 8  $\mu\text{m}$  and paler above, smooth, cinnamon-brown, pedicel as long as the spore, colorless. (P. Sydow & H. Sydow, 1903).

**Puccinia CORDIAE** Arthur, Mycologia 8: 17. 1916. TYPE on *Cordia alliodora* (Ruis & Pavon) Chamisso, Boraginaceae, from **Puerto Rico**, Ponce, January 1911, *Holway. (O/Icv,IIcv/III).*  
= *Bullaria cordiae* (Arthur) Arthur & Mains, North American Flora 7: 429. 1921.

Anamorph

*Caecoma cordiae* (P. Hennings) J. Hernández & J. Hennen, ? inedit. = *Uredo cordiae* P. Hennings, Hedwigia 43: 163. 1904. TYPE on *Cordia* sp. from **Peru**: Tarapoto, Oct 1902, *Ule-3241.*

We transfer *Uredo cordiae* to the anamorph genus *Caecoma* because the spores are catenulate and there is no peridium. The anamorph name *Caecoma cordiae* applies to both aecia and uredinia. The sori that are intimately associated with spermogonia are probably aecial in function and are locally systemic and induce witches brooms.

On Boraginaceae:

*Cordia trichotoma* Velloso, Paraíba (Viégas, 1945: 20; IAC-3799).

*Cordia* sp., São Paulo (IBI-15761).

*Puccinia cordiae* has been reported also from Argentina, Peru, Central America, Mexico, and The West Indies.

The best traits to use for identifying *P. cordiae* are its verrucose anamorph spore walls together with the larger size of the anamorph and teleomorph spores. Three other closely related species of *Puccinia* occur on *Cordia* spp. in the Neotropics. The teliospores of these species are similar. In the long cycle species both the urediniospores and aeciospores are catenulate. The following key shows the differences between the species of *Puccinia* on *Cordia* in the Neotropics.

**Key to help identify species of *Puccinia* on *Cordia*, Boraginaceae, in the Americas**

1. Short cycle species, only telia *P. corticola* Arthur & J. R. Johnston (produces large perennial galls on stems and trunks of infected hosts). Reported only from Trinidad.
1. Long cycle species.
  2. Urediniospores echinulate *P. johnstonii* Arthur. (synonyms include *P. bulbilipes* Hennen & Cummins and *P. gerascanthus* Urban). Known from Mexico, Central America, and Caribbean Islands.
  2. Urediniospores verrucose. 3.
  3. Urediniospores 20-27 x 16-20  $\mu\text{m}$  teliospores 28-38 x 18-26  $\mu\text{m}$ , pedicels not swollen. Known only from Belize. *P. ciliata* Mains.
  3. Urediniospores 28-35 x 21-25  $\mu\text{m}$  teliospores 34-55 x 19-26  $\mu\text{m}$ , pedicels swollen. Widespread from Mexico to Argentina, *P. cordiae* Arthur.

*Puccinia cordiae* Vestergren, *Micromycetes rar. sel. Fasc. LV no. 1374*. 1909. *nomen nudum*. This name was on the exsiccate label issued by Vestergren but a description of the rust was never published. The specimen was reported to be on leaves and stems of *Cordia gerascanthus* from Jujuy Province, Argentina collected by R. E. Fries, 13 June 1901.

Hennen et al. (1982) mistakenly placed *Uromyces cordiae* P. Hennings as a synonym of *Puccinia cordiae* Arthur. See **UROMYCES DOLICHOSPORUS** Dietel & Holway.

**Puccinia coronata** Corda, *Icon. Fung. I: 6*. 1837. TYPE on "*Luzula albida* (= error for *Calamagrostis arundinacea* (L.) Roth. or *C. villosa* (Chaix) J. F. Geml." from ? **Czech Republic**, "Liberec, Reichenberg". (0/Icv<sup>2</sup> IIpe/III).

= *Puccinia rhamnii* (Persoon) Wettstein, *Verh. Zool.-Bot. Wien* 35: 545. 1886.

Cummins (1971) reports 15 binomials as synonyms for *Puccinia coronata*.

On Gramineae:

*Avena sativa* Linnaeus, Minas Gerais (Thurston, 1940: 303; IBI-2015), Paraná (Fontoura & Nowacki, 1967/70: 116), Rio Grande do Sul (IBI-4715), São Paulo (Viégas, 1945: 21; IAC-395; IBI-1773; *Puttemans-360*).

*Lolium perenne* Linnaeus, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 113), São Paulo (Viégas, 1945: 21; IAC-2705; IBI-17742).

*Lolium multiflorum* Lamarck, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 113; IAN-727).

*Puccinia coronata* occurs circumglobally on nearly 50 genera of grasses. Cummins (1971) reported variety *avenae* (Fraser & Ledingham *Sci. Agr.* 13:322. 1933) on *Avena* spp. and three other varieties, but states that the varieties are not very distinct.

Aecia (*Aecidium rhamnii* Persoon) have been reported on species of *Berchemia*, *Rhamnus*, and *Elaeagnus* (incl. *Shepherdia*) in the Northern Hemisphere; aeciospores 16-24 x 15-19  $\mu\text{m}$ , wall 1-1.5  $\mu\text{m}$  thick, verrucose. Uredinia on both sides of leaves or mainly on adaxial side, brownish yellow to yellow (when fresh), with a few peripheral, colorless, more or less cylindrical, mostly thin-walled paraphyses, these rarely abundant; urediniospores (17-)19-25(-28;-30) x (14-)17-21(-25)  $\mu\text{m}$ , mostly ellipsoid or broadly ellipsoid, wall 1.5-2  $\mu\text{m}$  thick, pale yellowish to nearly colorless, germ pores 8-10, scattered, obscure. Telia on both sides of leaves, long covered by the epidermis or only tardily exposed, blackish; brownish paraphyses present but seldom abundant and the sori scarcely loculate; teliospores (30-)36-65(-70,-80) x (12-)14-19(-22)  $\mu\text{m}$  excluding digitations, wall 1-1.5(-2)  $\mu\text{m}$  thick at sides, about 2-4  $\mu\text{m}$  apically excluding digitations, golden to chestnut-brown, apex coronate with digitations (0-)3-10(-14)  $\mu\text{m}$  long; pedicels short, yellowish to brownish (Cummins, 1971).

The teliospores of *Puccinia coronata* are characteristic because of their apical appendages from which the specific epithet "coronata" is derived. The rust can cause much damage to cultivated oats under epiphytotic conditions.

*Puccinia costi* (P. Hennings) H. Sydow & P. Sydow, see **Puccinia DICHORISANDRAE** (P. Hennings) Hennen et al.

**Puccinia CRASSIPES** Berkeley & Curtis, Grevillea 3: 54. 1874. TYPE on *Ipomoea tricolor* S. Elliot from **The United States of America**, South Carolina, Santee Canal, *Ravenel-1656*. (??,IIcv/III).

= *Puccinia opulenta* Spegazzini, Anal. Soc. Cient. Argentina 9: 170. 1880. TYPE on *Ipomoea acuminata* from **Argentina**, la Boca del Riachuelo, Buenos Aires, 1880, ?*Spegazzini-s.n.*

= *Puccinia macrocephala* Spegazzini, Revista Argentina Hist. Nat. 1: 173. 1891. Type on *Ipomoea* sp., reported originally as an undetermined genus of Convolvulaceae, from **Paraguay**, Caaguazu, January 1882, *Balansa-3564*.

= *Puccinia ipomoeae* Cooke in Lagerheim, Tromso Mus. Aarsch. 17: 61. 1895. TYPE on *Ipomoea* sp. from **The United States of America**, South Carolina, place not recorded, *Ravenel sn.*

= *Allodus crassipes* (Berkeley & Curtis) Arthur, Result. Sci. Congr. Bot. Vienne p.345. 1906.

Anamorph

Uredinia:

**Aecidium ipomoeae** Spegazzini, Anal. Soc. Cient. Argentina 9: 173. 1880. TYPE on *Ipomoea acuminata* from **Argentina**, Buenos Aires, Boca del Riachuelo, April, 1880, *Spegazzini s.n.*  
= *Aecidium convolvulinum* Spegazzini, Revista Argentina Hist. Nat. 1: 398. 1891.

TYPE on *Ipomoea* sp. from Paraguay, Posta-cue, date not recorded, *Balansa-4316*.

On Convolvulaceae:

*Ipomoea asarifolia* Roemer & Schultes, Paraná (Joerstad, 1956: 477).

*Ipomoea dichotoma* Choisy, São Paulo (Viégas, 1945: 35; IAC-95).

*Ipomoea floribunda* Moricand, São Paulo (Viégas, 1945: 21; IAC-2815).

*Ipomoea grandiflora* (Danner) O'Donnell, Rio Grande do Sul (Lindquist & Costa Neto, 196: 136).

*Ipomoea polymorpha* Riedel, São Paulo (Jackson, 1931: 495).

*Ipomoea purpurea* Lamarck, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 136; IBI-17417).

*Ipomoea trifida* Danner, Amazonas (PUR-F7135).

*Ipomoea triloba* Linnaeus, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 136).

*Ipomoea tweediei* Hooker, Minas Gerais (PUR-F15200).

*Ipomoea* sp., Bahia (Hennings, 1908: 267), Federal District, IBI-15583), Goiás (Hennings, 1895A: 92), Minas Gerais (Jackson, 1931: 498; Thurston, 1940: 297; IAC-5488; IBI-162237), Rio Grande do Sul (PUR-F17731), Rio de Janeiro (Dietel, 1899: 250; Jackson, 1931: 495, 498), Santa Catarina (Hennings, 1896: 257), São Paulo (Viégas, 1945: 35; IAC-1585; IBI-16181).

**Quamoclit coccinea** Moench., Rio Grande do Sul (Lindquist & Costa Neto, 1963: 136).

**Genus undetermined**, Minas Gerais (Dietel, 1897: 29).

*Puccinia crassipes* has been reported from many collections from Argentina to the southern United States of America. Reports of *P. crassipes* and *Puccinia ipomoeae-panduranae* from Africa probable refer to *P. batatae*, a very similar species which is known only from Africa.

Most collections consist only of uredinia which belong to the anamorph genus *Aecidium*. In the older literature the uredinia of this species are referred to as aecia (or some variation of the spelling of this word) because the uredinial sori have the morphology of the anamorph genus *Aecidium* (peridiate, cupulate sori with catenulate, verrucose spores). Spermogonia and aecia as defined by ontogeny have never been reported. Experimental inoculations with basidiospores are needed to determine if spermogonia are produced.

We examined the type specimen of *Puccinia opulenta* from Argentina and confirmed Lindquist's (1982) conclusion that it is a synonym of *P. crassipes* because the urediniospores are thin-walled (1-)1.5-2 µm) and without smooth spots just as in *P. crassipes*. Previous reports of *Puccinia opulenta* from Brazil refer to either a new species or a new variety of *P. crassipes* identified by having urediniospores with thicker walls (1.5-)3-4(-5) and with smooth spots. We include these reports below as an unnamed variety of *Puccinia crassipes*.



Uredinia (*Aecidium ipomoeae*) mainly in groups on the abaxial side of leaves, and often distributed over much of the leaf, cupulate to short cylindrical, peridial cells 30-42 x 14-21 µm, rhomboidal, outer wall 3-4 µm thick, finely striate, inner wall 3-6 µm thick, coarsely verrucose; urediniospores catenulate, 19-28 x 16-23 µm, globose, wall (1-)1.5-2 µm thick, finely verrucose, colorless, without a smooth spot or refractive granules. Telia on both sides of leaves, 0.2-0.4 mm in diameter, circular in outline, grouped by the uredinia, or less commonly scattered, or developing in the old uredinia, often confluent, early naked, pulvinate, dark chocolate-brown, slightly pulverulent, ruptured epidermis conspicuous; teliospores 39-75 x 24-40 µm, ellipsoid, usually rounded at both ends, wall 3-5.5 µm thick at sides, 6-11 µm above, chestnut-brown with a semicolorless umbo, conspicuously and coarsely verrucose, pedicel up to 1.5 times length of spore, tinted next to spore. (Arthur, 1921).

*Puccinia ipomoeae-panduratae* (Schweinitz) P. Sydow & H. Sydow, Monogr. Ured. 1: 323, 1902, which is based on *Aecidium ipomoeae-panduranae* Schweinitz, was used by some early authors for *P. crassipes* but this name cannot be used for a rust because the fungus in Schweinitz specimen is *Albugo ipomoeae-panduranae* (Schweinitz) Swingle, not rust.

The following names are based on *Albugo* sp., they are not rust:

1. *Aecidium ipomoeae-panduranae* Schweinitz, Syn. Fg. Carol., Schr. Nat. Ges. Leipzig 1: 69. 1822.
2. *Caeoma convolvulatum* Schweinitz, Trans. Am. Phil. Soc. II. 4: 292.
3. *Aecidium convolvulinum* Schweinitz, Trans. Am. Phil. Soc. II. 4: 309. 1832.

**Puccinia CREPIDIS** Schroeter, in Cohn, Krypt.-Fl., III, 1 p. 319. 1887. TYPE on *Crepis* sp. from Europe. (**0/Icv,IIpe/III**). or ? *Puccinia crepidis-japonicae* Dietel.

On Compositae

*Youngia japonica* (Linnaeus) DeCandolle, São Paulo (Piracicaba, IBI-18380, and Peruipe, IBI-18775).

*Puccinia crepidis* is a species complex with many synonyms. We follow Joerstad (1958) by using the oldest name given to the group. We have not attempted to unravel the nomenclatural complexities that have developed from the works of various Europeans.

Pereira et al (2002) reported this rust as *Uredo crepidis-japonicae* Lindroth, teleomorph *Puccinia crepidis-japonicae* Dietel from uredinial infections on weedy *Youngia japonica* (= *Crepis japonica* Linnaeus) from Viçosa, Minas Gerais. These are the first records of *Puccinia crepidis* in the Western Hemisphere. Only uredinia have been found on these collections. The host is a widespread herbaceous weed. A synonym of the host is *Crepis japonica* Benth.

*Puccinia cressae* Lagerheim, see **Puccinia TUYUTENSIS** Spegazzini.

**Puccinia CUCUMERIS** P. Hennings, Bot. Jahrb. Syst. 14: 371. 1891. TYPE on *Cucumis ficifolius* from Keren, Eritrea, 14 March 1891, *Schweinfurth s.n.* (**?/Icv,IIpe/III**).

On Cucurbitaceae:

*Cucumis anguria* Linnaeus, Alagoas (IBI-14037), Ceará (Albuquerque, 1971: 148; IAC-2668; IBI-17579), Pará (IAN-518), Pernambuco (IBI-4343), Rio Grande do Norte (IBI-2783), Rio de Janeiro (IAC-4656), São Paulo (IBI-2901; IAC-4024; Viégas, 1945: 22).

*Cucumis* sp., Minas Gerais (Viégas & Teixeira, 1945: 50:IAC-50; IBI-15528).

*Puccinia cucumeris* has been reported from several countries in Africa including Kenya, Malawi, and Nyassaland and on the host genera *Cephalandra*, *Coccinia*, *Cucumis*, and *Momordica* all in the Cucurbitaceae.

*Puccinia cucumeris* may infect the cultivated *Cucumis anguria* (maxixe, xixú, muxuxa, or xuxú silvestre) on which it forms dark, almost black telial sori on the leaves.

All sori are without peridia or paraphyses, aecia pale yellowish, spores catenulate, 18-28 x 14-26 µm, subglobose to ellipsoid, walls pale yellow and very finely verruculose appearing almost smooth; uredinia pale brownish, urediniospores pedicellate, 20-28 x 18-24 µm, globose, walls, moderately to finely echinulate, pale cinnamon-brown, pores 2, large, equatorial. Telia blackish, teliospores (28-)30-46 x (22-)26 x 35 µm, broadly ellipsoid, rounded above and below, not or only slightly constricted at the septum, wall more or less evenly 6 µm thick, in some spores obviously rugose when immature and not pigmented but only obscurely rugose when mature and fully pigmented, but some mature spores appeared smooth, pore 1 in each cell, next

to the septum in both the upper cell and lower cell, pedicel persistent and colorless (Cummins, 1952, reported traits from a specimen from Nyassaland; Viégas, 1945, from specimens from Brazil).

*Puccinia cumula* Arthur & Cummins, see **Puccinia PILOCARPI** Cooke.

**Puccinia CUNILAE** Dietel, Hedwigia 38: 251. 1899. TYPE on *Cunila angustifolia* Benth., Labiatae, from **Brazil**, Santa Catarina: Serra Geral, April 1891, *Ule-1722*. (?/?,?IIcv/III).  
*Puccinia cunilae* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

*Puccinia cuticulosa* (Ellis & Everhart) Arthur, see **PROSPODIUM APPENDICULATUM** (Winter) Arthur.

**Puccinia CYNANCHI** Berkeley & Curtis, J. Philadelphia Acad. Sci., ser. 2, 2: 281. 1853. TYPE on *Cynanchum* from **Surinam**, date of collection and collector not reported, probably *Weigelt s.n.*(-/,-/III).

- = *Puccinia obliqua* Berkeley & Curtis in Berkeley, Jour. Linn. Soc. 10: 356. 1869. TYPE on *Metastelma penicillatum* Grisebach from **Cuba**, *C. Wright 281*. The identification of the host of the type collection was first reported by Arthur, 1922.  
= *Micropuccinia obliqua* (Berkeley & Curtis) Arthur & H. S. Jackson, in Arthur, Bull. Torrey Bot. Club 48: 42. 1921.
- = *Puccinia gonolobi* Ravenel in Berkeley, Grevillea 3: 54. 1874. TYPE on *Gonolobus* sp. from **The United States of America**, South Carolina, Santee Canal, date not reported, *Ravenel-1671*.
- = *Puccinia cynanchi* Lagerheim, Bol. Soc. Brot. 7: 129. 1889. TYPE on ?, information not available.
- = *Puccinia subcolapsa* Ellis, J. Mycol. 7: 275. 1893. TYPE on undetermined Asclepiadaceae, from **Paraguay**, place and date not reported, *Th. H. Morong-s.n.*
- = *Puccinia kunzeana* P. Hennings, Hedwigia 33: 230. 1894. TYPE on unidentified Asclepiadaceae from **Surinam**, date not reported, *Kegel s.n.*
- = *Puccinia hemipogonis* P. Hennings, Hedwigia 34: 92. 1895. TYPE on *Hemipogon setaceus* Decaisne from **Brazil**, Goiás: Vargem Grande, Sept 1892, *Ule-1961* (isotype *Ule-1960*).
- = *Puccinia ditassae* P. Hennings, Hedwigia 35: 236. 1896. LECTOTYPE, chosen here, on *Ditassa* sp. from **Brazil**, Santa Catarina: Laguna, March 1889, *Ule-1220*.
- = *Puccinia metastelmatis* P. Hennings, Hedwigia 35: 236. 1896. TYPE on *Metastelma odoratum* Decaisne from **Brazil**, Santa Catarina: place not reported, June 1884, *Ule-144*.
- = *Puccinia oxypetalis* P. Hennings, Hedwigia Beiblatt 38: (129). 1899. TYPE, on *Oxypetalum banksii* R. A. S. from **Brazil**: Rio de Janeiro: Copacabana, *Ule-2373*.
- = *Puccinia rhyssostelmatis* Spegazzini, An. Mus. Nac. Buenos Aires 8 (ser. 3, v. 1): 64-65. 1902. TYPE on *Rhyssostelma nigricans* Decne. from **Argentina**, Córdoba, April 1901, *T. Stuckert-s.n.*
- = *Puccinia sphaeroidea* P. Hennings, Hedwigia Beiblatt 42: (107). 1903. TYPE on *Funastrum* sp., Asclepiadaceae, originally identified mistakenly as *Jussiaea* sp., Onagraceae, from **Mexico**, Baja California: San Jose de Cabo", 1902, *C. A. Purpus-s.n.*
- = *Puccinia sphaerospora* H. Sydow & P. Hennings, in H. Sydow & P. Sydow, Ann. Mycol. 1: 327. 1903. TYPE on *Metastelma schlechtendalii* from **St. Croix Island**, *A. E. Ricksecker s.n.*
- = *Puccinia amphistelmae* P. Hennings, Hedwigia 47: 267. 1908. TYPE on *Metastelma* sp. (reported as *Amphistelma* sp.) from **Brazil**, Bahia: Maracás, Sept 1906, *Ule-3326*.
- = *Puccinia valenzueliana* Spegazzini, An. Mus. Nac. Hist Nat. Buenos Aires 31: 388-389. 1922. TYPE on *Ditassa* sp. from **Paraguay**, near Puerto Sajonia, near Asuncion, Oct 1919, *Spegazzini-Fung. Parag. #117*. [Lindquist (1982) does not accept *Uredo valenzueliana* Spegazzini on *Metastelma diffusum* Descne. from Ya-cao, Paraguay as an anamorph of *Puccinia valenzueliana* as reported by Spegazzini ( ) and Farr (1973)].
- = *Puccinia densissima* Spegazzini, Rev. Argent. Bot. 1: 113. 1925. TYPE on *Metastelma*

*diffusum* Decne. from **Argentina**, "summer", 1880, a lectotype needs to be chosen from specimens studied by Spegazzini that came from Buenos Aires, La Plata, Tucumán, or Salta.

On: Asclepiadaceae.

*Calotropis* sp., Minas Gerais (Fit. Bras. 19:(suppl. 290), 1994).

*Ditassa adnata* Fournier, Mato Grosso (Joerstad, 1956: 450).

*Ditassa refescens* Decaisne, Pará (Joerstad, 1956: 450), São Paulo (Joerstad, 1956: 450).

*Ditassa* sp., Santa Catarina (Hennings, 1896: 236).

*Metastelma odoratum* Decaisne, Santa Catarina (Hennings, 1896: 236).

*Metastelma* sp., Brazil (Sydow, Mon. Ured. 1: 882. 1903).

*Oxypetalum arnotianum* Buek, Rio Grande do Sul, (Joerstad, 1956: 450), Paraná (Joerstad, 1956: 450), São Paulo (Joerstad, 1956: 450).

*Oxypetalum banksee* Roemer & Schultes, Rio de Janeiro (Hennings, 1899B: 129, 1904A: 79; Maublanc & Rangel, 1915: 13; HNR-836).

*Oxypetalum paraense* Malme, Paraná (Joerstad, 1956: 450).

**Gen. undetermined**, Rio de Janeiro (Jackson, 1931: 494), São Paulo (Jackson, 1931: 494).

*Puccinia cynanchi*, or as one of its synonyms, has been reported from Argentina to the United States of America on at least seven genera of Asclepiadaceae and probably also on some Apocynaceae. See *Puccinia araujae* Lèveillé for a comparison key of *Puccinia cynanchi* (*P. obliqua*), *P. araujae*, and *P. rouliniae*. These are closely related species and difficult to separate in some collections.

Spermogonia, aecia, and uredinia unknown. Telia scattered or in groups on abaxial side of leaves or on stems, sometimes on "witches brooms", dark brown but may become grayish white by germination; teliospores mostly broadly ellipsoid to nearly globoid, up to 36  $\mu\text{m}$  long and up to 23(-25)  $\mu\text{m}$  wide, walls 2-2.5(-4)  $\mu\text{m}$  thick, cinnamon-brown, pedicel often more or less obliquely inserted ("diorchidioid").

We use *Puccinia cynanchi* Berkeley & Curtis (1853), which seems to be the oldest name with priority, for this microcyclic species. *Puccinia obliqua* has been used more often for this species in the past. We have placed *Puccinia hemipogonis* P. Hennings as a synonym with some reservation. It has been reported only from the type collection. More collections on *Hemipogon* are needed to determine this placement with certainty. However, the description of the type comes within the circumscription of *Puccinia obliqua*.

Arthur (1934) reported that *Puccinia cynanchi* (*Puccinia obliqua*) is a microcyclic form derived from *Puccinia bartholomaei* Dietel, a North American, long cycle, heteroecious rust with spermogonia and aecia on several genera of Asclepiadaceae and uredinia and telia on several species of *Bouteloua* (Gramineae). But Hennen (1954) reported that "The teliospores of *Puccinia cynanchi* (*P. obliqua*) resemble much more closely those of *P. boutelouae*. It may be that *Puccinia boutelouae* is the correlated long cycle species."

Jackson (1931) reported the following on Apocynaceae. *Puccinia mandevillae* on *Mandevilla mandoni* Rusby from Sorata, Bolivia and another rust collection from Colombia reported to be on *Mesachites trifida* (Jacquin) Muell.-Arg., both hosts in the Apocynaceae, probably belong to this group of species on Asclepiadaceae.

*Puccinia mandevillae* Jackson & Holway in Jackson, Mycologia 23: 492. 1931 TYPE on *Mandevilla mandoni* Rusby, Apocynaceae, from **Bolivia**, Sorata., Apr. 19, 1920, Holway-556.

Spermogonia, aecia, and uredinia unknown, probably not formed. Telia hypophyllous, gregarious in small groups 1-4 mm. across, irregularly rounded, commonly confluent, early naked, compact, becoming pulvinate and cinereous through germination, cinnamon brown, ruptured epidermis at first noticeable; teliospores 29-38 x 14-18  $\mu\text{m}$ , ellipsoid, clavate or oblong., rounded above, rounded or narrowed to pedicel below, slightly or not constricted at septum, which is ordinarily transverse, occasionally oblique; wall colorless or slightly tinted golden brown, 1-1.5  $\mu\text{m}$  thick, thickened to 3  $\mu\text{m}$  at apex, smooth; pedicel colorless, once to twice the length of the spore, 6-7  $\mu\text{m}$  broad at point of attachment, soon collapsing.

While somewhat like *Puccinia obliqua* Berkeley & Curtis, which occurs on members of the Asclepiadaceae, this micro-form seems sufficiently distinct morphologically, and occurs on a different host family. The septum is only rarely oblique.

It is especially interesting to note that the teliospores germinate with a two celled basidium. Elsewhere (Mem. Torrey Club 18: 22-27. 1931) I have reviewed the available knowledge with reference to the occurrence of two celled basidia in micro- and endo-forms, and have discussed the probable significance of this phenomenon. The two celled basidium provides an easily determined external indication of a

simplified nuclear history. Species in which the spores germinate in this way should be well worth investigating cytologically.

*Puccinia cynanchi* Lagerheim, see **Puccinia CYNANCHI** Berkeley & Curtis.

*Puccinia cynoctoni* Lèveillé, see **Puccinia ARAUJAE** Lèveillé.

**Puccinia CYNODONTIS** Lacroix ex Desmazieres, Pl. Crypt. France II, N. 655. 1859. TYPE on *Cynodon dactylon* (Linnaeus) Persoon from **Europe**, “St. Romain-sur-Vienne Arrondissement de Châtellerault”, month not reported, 1857, *De Lacroix-s.n.* (**O/Icv**  $\cong$  **IIpv/III**).

On: Gramineae (only **II/III**):

*Cynodon dactylon* (Linnaeus) Persoon, Minas Gerais (Thurston, 1940: 298; IBI-15815), São Paulo (Viégas, 1945: 23; IAC-2535; IBI-17657).

*Puccinia cynodontis* is circumglobal in warm regions on *Cynodon* spp. Spermogonia and aecia have been reported from southern Europe on at least seven host families but not elsewhere.

Spermogonia and aecia (*Aecidium plantaginis* Ces.) occur on Euphorbiaceae, Plantaginaceae, Ranunculaceae, Saxifragaceae, Scrophulariaceae, Valerianaceae, and Violaceae; aeciospores 15-24 x 16-29  $\mu$ m, wall 1.5-2  $\mu$ m thick, colorless, verrucose. Uredinia mostly on abaxial side of leaves, without paraphyses, cinnamon-brown; urediniospores globoid, 20-26 x 19-23  $\mu$ m, wall 2-3  $\mu$ m thick, cinnamon-brown, verrucose, pores 2 or 3, equatorial. Telia mostly abaxial, early exposed, blackish, pulvinate; teliospores 30-55 x 16-22  $\mu$ m, mostly ellipsoid, often acuminate apically, wall 1.5-2.5  $\mu$ m thick at sides, 6-12  $\mu$ m apically, chestnut-brown; pedicels to 80  $\mu$ m long, yellow or colorless, thin-walled (Cummins, 1971).

**Puccinia CYPERI** Arthur, Bot. Gaz. (Crawfordsville) 16: 226. 1891. TYPE on *Cyperus schweinitzii* (Cyperaceae) from **The United States of America**, Iowa: Decorah, 25 Nov 1886, *Arthur & Holway s.n.* (**O/Icv**<sup>s</sup> **IIpe/III**).

Anamorph

Aecia on Compositae

*Aecidiolum eregerontis* Spegazzini, An. Mus. Nac. Buenos Aires, Argentina 19: (ser. 3, v. 12) : 323. 1909. TYPE on *Erigeron sordidus* Gill. ex Hooker, from **Argentina**, Jujuy, Jan 1906, *Spegazzini s.n.*

= *Aecidium australe* Spegazzini, An. Soc. Cient. Argentina 17: 125. 1884. (not Berkeley, 1843). TYPE on *Erigeron bonariensis* from **Paraguay**, Paraguari, 22 Nov 1882, *Sub 3753*.  $\equiv$  *Aecidium spegazzinii* DeToni in Saccardo, Syll. Fung. 7: 802. 1888. Nom. nov. for *Ae. australe* Spegazzini.

= *Aecidium erigerontis* Kern & Whetzel, Jour. Dept. Agric. Puerto Rico 14: 342. 1930. TYPE on *Erigeron bonariensis* Linnaeus from **Colombia**, El Valle, near San Pedro near Buga, 4 June 1929, *Chardon & Torro-424*.

= *Aecidium obsoletum* Spegazzini, Rev. Argentina Bot. 1: 98. 1925. TYPE on *Conyza serpentaria* Grisebach from **Argentina**, Salta: near Rio de Las Piedras, Jan 1905, *Spegazzini s.n.*

On Compositae: (**0/I**).

*Conyza bonariensis* (Linnaeus) Cronquist (*Erigeron bonariensis* Linnaeus), Minas Gerais (IBI-14931), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 141), São Paulo (IBI-14866).

*Erigeron laxiflorus* Baker, Minas Gerais (PUR-F5165).

*Erigeron maximus* Otto ex DeCandolle, São Paulo (Hennings, 1902B: 296).

*Erigeron* sp. Rio de Janeiro (Hennings, 1904A: 80).

On Cyperaceae: (**II/III**).

*Cyperus cayennensis* (Lamarck) Britton, São Paulo (Jackson, 1926: 140; PUR-F517).

*Cyperus distans* Linnaeus, Rio de Janeiro (Dietel, 1899: 249).

*Cyperus flavus* (Vahl) Nees, Pará (Albuquerque, 1971: 148; IAN-567).

*Cyperus haspan* Linnaeus, Rio de Janeiro (Jackson, 1926: 140; IBI-1668).

*Cyperus lenticularis* (Schrader) Steudel, São Paulo (Jackson, 1926: 140; PUR-

F5171).

*Cyperus olfersianus* Kunth, Minas Gerais (Jackson, 1926: 140).

*Cyperus* sp., Minas Gerais (Viégas, 1945: 23; IAC-2541), Paraíba (Viégas, 1945: 23; IAC-3856), Rio de Janeiro (Jackson, 1926: 140), São Paulo (Viégas, 1945: 23; IAC-2973).

**Cyperaceae, gen. undetermined**, Rio de Janeiro (Viégas, 1945: 23; IAC-3533).

*Kylinga pumila* Michaux, Minas Gerais (Joerstad, 1956: 481).

*Rhynchospora micrantha* Vahl, Alagoas (Viégas, 1945: 23; IAC-3615).

*Puccinia cyperi* has been reported from Argentina to the United States of America and from Africa, Asia, and Australia, on *Cyperus* spp. The report on *Rhynchospora* from Alagoas needs to be confirmed. See *Uredo kylingiae* P. Hennings for the placement of *Puccinia kylingiae-brevifoliae* Miura, which has been suggested to have a connection to *Puccinia cyperi* by some authors.

Arthur (1934) reported the one known inoculation experiment that demonstrated the connection between the spermogonia / aecia and uredinia / telia. It was done with material from the state of Wisconsin in the United States of America.

Aecia on abaxial side of leaves in groups with spermogonia, cupulate, aeciospores 21-31 x 15-21  $\mu\text{m}$ , obovoid or ellipsoid, often angular and narrowed above, wall 1.5-2  $\mu\text{m}$  thick at sides, much thicker above 4-7  $\mu\text{m}$ , colorless, finely verrucose. Uredinia dehisce with a longitudinal slit, not by an irregular rupture, urediniospores 24-35 x 18-24  $\mu\text{m}$ , ellipsoid to obovoid, wall 1.5-2  $\mu\text{m}$ , light cinnamon-brown, moderately and finely echinulate, germ pores usually 3 equatorial, but occasionally 2 or 4. Telia mostly on abaxial side of leaves, in groups 1-6 mm long, or scattered, individual sori linear, 0.1-0.2 mm wide, without paraphyses or occasionally only slight development of a stroma, somewhat tardely eruptent, ruptured epidermis conspicuous; teliospores 35-61 x 18-26  $\mu\text{m}$ , broadly clavate-oblong, rounded or truncate above, narrowed below, slightly constricted at septum, wall chestnut-brown, paler below, 1-1.5  $\mu\text{m}$  thick at sides, 7-12  $\mu\text{m}$  above, pedicel colored, short. (Kern & Whetzel, 1930; Arthur, 1920).

Joerstad (1956) working with several collections from Africa reported that *Puccinia cyperi* is characterized "by comparatively large, thin-walled urediniospores [ (20-)24-36 x 15-20  $\mu\text{m}$ , wall 1.5-2(-2.5)  $\mu\text{m}$  thick], with usually 3-4 approximately equatorial germ-pores; the telia are stromatic (very small, 110-130  $\mu\text{m}$  in diameter consisting of single pockets surrounded by brown paraphyses), although the stroma may be poorly developed (teliospores 38-51 x 13-23  $\mu\text{m}$ , apex thickened to 12  $\mu\text{m}$ ).

Lindquist (1982) characterized *Puccinia cyperi* as having small punctiform telia with no or very few stromatic paraphyses, teliospores [40-58 x 12-18  $\mu\text{m}$ , cylindrical or oblong-clavate, truncate or conical above, narrowed below, wall 1.5-2  $\mu\text{m}$  thick at sides, 5-6  $\mu\text{m}$  above, smooth, pedicel short, hyaline, fragile] that are rarely 3-4-celled, urediniospores 24-35 x 15-22  $\mu\text{m}$ , ellipsoid to obovoid, wall 1.5-2  $\mu\text{m}$  thick, echinulate with echinulae well spaced] with 3(-4) equatorial germ pores, and aeciospores with walls 2-2.5  $\mu\text{m}$  thick laterally and 3-5  $\mu\text{m}$  thick apically, verrucose with large verrucae that easily come off in the lower third of the spore..

See the notes under *Uredo kylingiae*, and *Puccinia cyperi-tagetiformis* about the status of *Uredo cyperi-tagetiformis*. Joerstad (1956) reported that *Uredo cyperi-tagetiformis* P. Hennings was an anamorph of *Puccinia cyperi* Arthur, not *Puccinia cyperi-tagetiformis* Kern. The complete synonymy of *Puccinia cyperi* requires more study.

**Puccinia cyperi-tagetiformis** Kern [ as "*(P. Henn.) comb. nov.*" ] Mycologia 11: 138. 1919.

TYPE (Lectotype chosen here) on *Cyperus distans* Linnaeus from **Puerto Rico**: Mayaguez, July 1915, *F. L. Stephens-2128* in PUR. (?/? = **Ipe/III**).

On Cyperaceae:

*Cyperus* sp., Alagoas (Viégas, 1945: 24; IAC-3813), Paraíba (Viégas, 1945: 24), Pernambuco (Batista & Bezerra, 1960: 23, IBI-15544).

*Puccinia cyperi-tagetiformis* has been reported from Brazil to Texas in The United States of America and from Africa and Asia.

Kern (1919) listed *Uredo cyperi-tagetiformis* P. Hennings (Bot Jahrb. 34: 598. 1905. TYPE on *Cyperus tagetiformis* from **Japan**, Jan 1903, *Yoshinaga-16*) as the basionym of this species but he described telia on specimens from Puerto Rico. Thus, we have chosen one of these as the lectotype as shown above. Joerstad (1956) reported that *Uredo cyperi-tagetiformis* was an anamorph of *Puccinia cyperi*.

The correct status of *Uredo cyperi-tagetiformis* P. Hennings is uncertain. Hiratsuka et al. (1992) do not include it as being from Japan.

Arthur (1920) characterized *Puccinia cyperi-tagetiformis* as parasitizing *Cyperus* spp., and especially by its urediniospores which are broadly ellipsoid or slightly obovoid, 19-26 x 15-21  $\mu\text{m}$ , walls 1.5-2.5  $\mu\text{m}$  thick but often thicker and more lightly pigmented above, otherwise dark cinnamon-brown, verrucose or verrucose-echinulate, the markings more pronounced above, the pores 2, equatorial; and telia with well developed blackish brown paraphyses forming loculate sori. Kern (1919) reported that the thickness of the urediniospore walls, and especially the apical thickness, were especially important in identifying this species. Other authors (i.e. Viegas, 1945) record the urediniospore apical walls 3(-5)  $\mu\text{m}$  thick.

**Puccinia DEFORMATA** Berkeley & Curtis, Jour. Linn. Soc. 10: 357. 1869. TYPE on *Olyra latifolia* Linnaeus, from **Cuba**, specific location not reported, January 1869, *C. Wright-284*. (?/?? **IIpe/III**).  
On. Gramineae:

*Olyra* sp., Maranhão (IBI-15575), Brazil (Cummins, 1971: 228).

*Puccinia deformata* has been reported also on *Olyra* spp. from Central America, The West Indies, Venezuela, West Central Africa, and Uganda (Cummins, 1971).

Spermogonia and aecia unknown. Uredinia on both sides of leaves and in inflorescence, pale yellowish, probably bright yellow when fresh; urediniospores (24-)27-32(-36) x (19-)21-27(-30)  $\mu\text{m}$ , mostly obovoid, wall 1.5-2  $\mu\text{m}$  thick, occasionally slightly thicker at apex, yellowish, echinulate, germ pores, 2 or 3 (4?), obscure. Telia on both sides of leaves and in inflorescence, early exposed, chocolate-brown, moderately compact; teliospores (26-)30-40(-44) x (19-)21-28(-30)  $\mu\text{m}$ , variable but mostly ellipsoid or obovoid, varying from puccinoid to diorchidioid, mostly with only a somewhat oblique septum, wall (1.5-)2.5-3.5(-4)  $\mu\text{m}$  at sides, (2.5-)3-6(-8)  $\mu\text{m}$  apically, golden brown or chestnut-brown, smooth; pedicels yellowish or colorless, thin-walled and collapsing, to 150  $\mu\text{m}$  but often less than 100.

Teliospores from leaves have slightly thinner and paler walls than those from inflorescences but urediniospores do not differ (Cummins, 1971).

See *Phakopsora phakopsoroides* for a key to species of rusts on *Olyra*.

*Puccinia densissima* Spegazzini, see **Puccinia CYNANCHI** Berkeley & Curtis.

**Puccinia DEPRECANEA** H. S. Jackson & Holway in Jackson, Mycologia 24: 111. 1932. TYPE on *Vernonia* sp., Compositae, from **Brazil**, São Paulo: Juqueri, 12 June 1922, *Holway-1962*.  
(0/Icv,IIpe/III).

*Puccinia deprecanae* has been reported only from the type.

Spermogonia adaxial; sori few; deep-seated; 85-95  $\mu\text{m}$  wide; flask-shaped; 110-125  $\mu\text{m}$  high (thick). Aecia; on both sides of leaves (both sides); densely grouped; close to spermogonia; in faded or discolored spots, white, lacerate; peridia cells 26-30  $\mu\text{m}$  long; 20-23  $\mu\text{m}$  width, irregularly polyhedral; aeciospores 26-30  $\mu\text{m}$  long; 20-24  $\mu\text{m}$  wide, ellipsoid or globose; cell wall 1.5-2.5  $\mu\text{m}$  thick, colorless; verrucose-rugose or verrucose-tuberculate; uredinia abaxial; densely grouped or widely scattered, 0.2-0.5 mm in diameter; round; erumpent, epidermal rupture inconspicuous; pulverulent; cinnamon brown; paraphyses peripheral; copious; 110-175  $\mu\text{m}$  long, 20-30  $\mu\text{m}$  wide. club shaped or barely curved or cylindrical; urediniospores 23-28 long; 20-23  $\mu\text{m}$  wide, obovoid; cell wall 1-1.5  $\mu\text{m}$  thick; colorless; finely echinulate; pores obscure. Telia abaxial; chestnut brown; becoming ashy-gray in color; pulvinate; teliospores 50-65  $\mu\text{m}$  long; 20-26  $\mu\text{m}$  wide, clavate or obovoid; rounded at apical end; rounded or narrowed at pedicel, slightly or not constricted at septum; cell wall 1-1.5  $\mu\text{m}$  thick, thickened at apex; smooth; germ pores apical and adjacent to septum. pedicel shorter than spore, deciduous, colorless (Jackson, 1932).

*Puccinia deprecanae* is distinguished from other *Vernonia* rusts by the presence in the uredinial sori of abundant, conspicuous, thin-walled paraphyses, and the light colored, smooth and thin-walled teliospores appreciably thickened at the apex (Jackson, 1932). New collections are needed to determine if this rust still occurs in Brazil.

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but five from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

*Puccinia destruens* P. Hennings, Hedwigia 34: 92. 1895. Probably **PROSPODIUM** sp. on Vebenaceae or Bignoniaceae, but reported to be on Euphorbiaceae, Goiás (Hennings, 1895A: 92).

*Puccinia diaziana* Arthur, see **PUCGINA CNICI-OLERACEI** Persoon ex Desmazieres.

*Puccinia dichondrae* Berkeley, see **PUCGINA DICHONDRAE** Montagne.

**PUCGINA DICHONDRAE** Montagne in C. Gay, Hist. Fis. Polit. Chile 8: 46. 1852. TYPE on *Dichondra sericea* Swartz [*D. repens* Forster var. *sericea* (Swartz) Choisy] from **Chile**, place and date not reported, Gay s.n. (-/-, -/III), or (?-/? , IIcv/III).  
= *Puccinia dichondrae* Berkeley, J. Linn. Soc. 13: 173. 1872.  
≡ *Puccinia berkelyana* De-Toni, in Sacc., Syll. Fung. 7:717. 1888. Nom. nov. for *Puccinia dichondrae* Berkeley.

On Convolvulaceae:

*Dichondra repens* Forster, Rio Grande do Sul (PUR-F7151).

*Dichondra sericea* Swartz, São Paulo (Hennings, 1896: 230), Brazil (Rick, 1911: 178).

*Dichondra* sp., Rio Grande do Sul (Juel, 1897: 19; Lindquist & Costa Neto, 1963: 127), Rio de Janeiro (Pazschke, 1896: 52), Santa Catarina, Serra Geral (Dietel, 1897: 30).

*Puccinia dichondrae* has been reported on *Dichondra* spp. from Argentina to the United States of America, and from South Africa, Australia, and New Zealand.

The life cycle has not been determined with certainty. *Aecidium dichondrae* Hariot (Bull. Soc. Myc. France 7: 149. 1891. TYPE on *Dichondra* sp. from **Chile**, location and date not reported, *Poeppig* s.n. Syn. *Aecidium dichondrae* Neger, 1896, p. 51) has been found with telia in some collections but no spermogonia are known. The function of the *Aecidium* has not been determined. Possibly they could function as uredinia, or as aecia, or as both, or they could be an *Endophyllum*.

McAlpine (1906) illustrated unicellular and variously shaped multicellular teliospores that he found in Australian specimens.

*Puccinia digitariae* Pole-Evans, see **PUCGINA OAHUENSIS** Ellis & Everhart.

*Puccinia digitariae-velutinae* Viennot-Bourgin, see **PUCGINA OAHUENSIS** Ellis & Everhart.

**PUCGINA DICHORISANDRAE** (P. Hennings) Hennen et al., *stat. nov.* (This catalogue), basionym

*Uromyces dichorisandrae* P. Hennings, see below. (?/? , ?/III).

≡ *Uromyces dichorisandrae* P. Hennings, Hedwigia 34: 91. 1895. TYPE on *Costus pumilus* fide Hennings, 1895: 320, not Commelinaceae as originally reported by Hennings, 1895: 91, from **Brazil**, Goiás, Feb. 1893, *Ule*-1987.

≡ *Uromyces costi* P. Hennings, Hedwigia 34: 320. 1895. A later unnecessary *nom. nov.* for *U. dichorisandra* P. Hennings. Type same as for *U. dichorisandrae*.

≡ *Puccinia costi* (P. Hennings) H. Sydow & P. Sydow, Ann. Mycol. 6: 141. 1908.

On Zingiberaceae:

*Costus pumilus* Petersen, Goiás (Sydow, 1908: 141).

*Costus* sp., São Paulo (Hennen & Hernández-98-86).

Hennings (1895) published the host of *Uromyces dichorisandrae* as *Dichorisandra* sp. in the Commelinaceae. He found and described only one-celled teliospores, thus he used the genus name *Uromyces*. Hennings soon discovered that the host genus was *Costus*, not *Dichorisandra*. So the same year he published a correction that the host was *Costus* sp. in the Zingiberaceae. At the same time he published a new name for the rust, *Uromyces costi* P. Hennings, to conform with the new identification of the host. However, The Code does not permit this kind of name change for the rust. *Uromyces costi* P. Hennings is then, an unnecessary new name for *Uromyces dichorisandrae*. Later, the Sydows (1908) found that the type specimen of *U. dichorisandrae* had both one-celled and two-celled teliospores. They described the teliospores and transferred the name *U. costi* P. Hennings to *Puccinia* as *P. costi* (P. Hennings) H. Sydow & P. Sydow. Unfortunately, the Sydows used *Uromyces costi* Hennings as the basionym, not *U. dichorisandrae* P. Hennings the name that has priority. Thus, the correct name for this rust should be *Puccinia dichorisandrae* (P. Hennings) Hennen et al.

*Puccinia dietelii* Saccardo & Sydow, see **PUCGINA CHLORIDIS** Spegazzini.

**Puccinia dioicae** P. Magnus, Amt. Ber. 50 Versammt. D. Naturf. Ärzte München, p. 199. 1877.

TYPE ? information not available. (**0/Icv** ≠ **Ipe/III**).

= *Puccinia extensicola* Plowright, British Uredinales and Ustilaginales, p. 181. 1889.

= *Puccinia fusiformis* Dietel, Hedwigia 36: 29. 1897. TYPE on *Carex* sp. from **Brazil**, Santa Catarina, Jan 1891, *Ule-1760*.

= *Puccinia caricis* Rebent. A *nomen ambiguum* fide Wilson and Henderson (1966). Not *Puccinia caricis* (Schum.) Schroet. which is a synonym of *Puccinia caricina* DeCandolle.

Anamorph host

**Aecidium erigeronatum** Schweinitz, Trans. Am. Phil. Soc. II. 4: 292. 1832.

On Compositae:

**Erigeron** sp. Serra do Mel, Rio Branco (Sydow, H. & P. 1916: 71).

Teleomorph hosts

On Cyperaceae:

**Carex straminea** Schenk, Santa Catarina (PUR-F5266).

**Carex** sp., Santa Catarina, Serra Geral (Dietel, 1897: 29).

*Puccinia dioicae* has been reported worldwide especially in temperate areas. Hyalander et al. (1953) and Cummins (1962) reported that *Puccinia dioicae* is a species complex that includes a number of synonyms that were previously in use. For North America Arthur (1934) used the name *Puccinia extensicola* for this rust under which he included ten varieties based on presumed aecial host specialization. Six of these varieties were on genera of the Compositae, and one each on Onagraceae, Phrymaceae, Valerianaceae, and Thymelaceae. Wilson and Henderson (1966) included five varieties of *Puccinia dioicae* in Great Britain all with spermogonia and aecia on genera of Compositae.

Arthur (1934) reported *Uromyces perigynius* Halstead as a correlated heteroecious species in North America that has genera of Compositae for its spermogonial and aecial hosts. Arthur also included two microcyclic species of *Uromyces* and three microcyclic species of *Puccinia* on Compositae, and one microcyclic species of *Puccinia* on Onagraceae as correlated taxa.

Important traits for identification of *Puccinia dioicae* sensu lato include: urediniospores 20-26 x 15-20 µm, mostly broadly ellipsoid, walls 1-1.5 µm thick, pale cinnamon-brown, echinulate, with two supraequatorial germ pores. If only telia are present, identification is very difficult. Some populations apparently persist only in the uredinial stage.

*Puccinia caricina* DeCandolle, often reported by the name *Puccinia caricis* (Schum.) Schroeter is another wide ranging species complex on *Carex* spp. It has been reported from Argentina and Chile but not yet from Brazil. It differs from the *Puccinia dioicae* complex mainly because its urediniospores have 3(-4, -5) equatorial germ pores. Wilson and Henderson (1966) included 15 varieties of *Puccinia caricina* in Great Britain alone based on presumed host specialization and some micromorphology.

*Puccinia discolor* Fuckel, see **TRANZSCHELIA DISCOLOR** (Fuckel) Tranzschel & Litvinov.

*Puccinia dispersa* Erikson & Hennings, see **Puccinia RECONDITA**.

*Puccinia distenguinda* H. S. Jackson & Holway, see **Puccinia PUTA** H. S. Jackson & Holway.

*Puccinia ditassae* P. Hennings, see **Puccinia CYNANCHI** Berkeley & Curtis.

*Puccinia doloris* Spegazzini, see **Puccinia CNICI-OLERACEI** Persoon ex Desmazieres.

**Puccinia DOLOSA** Arthur & Fromme var. **DOLOSA**, Torreyia 15: 262. 1915. TYPE on *Paspalum tenellum* Willdenow from **Mexico**, Guadalajara, September, 1903, *Holway* (distributed in the Excicatti "Sydow-Uredineen, number 1986" as *Puccinia substriata* Ellis & Everhart).

(**/?/?** ≠ **Ipe/III**).

On Gramineae

**Paspalum mandiocanum** Trinius, Rio Grande do Sul (Lindquist & Costa Neto, ?1967: 56), São Paulo (Cummins, 1942: 681).

**Paspalum multiflorum** Doell, São Paulo (Cummins, 1942: 681).

**Paspalum paniculatum** Linnaeus, Rio Grande do Sul (Lindquist & Costa Neto, ?1967: 56); Rio



de Janeiro (Cummins, 1942: 681); São Paulo (Cummins, 1942: 681).

*Paspalum plicatulum* Michaux, Minas Gerais (Cummins, 1942: 681), Rio Grande do Sul (Lindquist & Costa Neto, 1967: 56), São Paulo (Cummins, 1942: 681).

*Paspalum regnelli* Mez, São Paulo (PUR-F4928).

*Paspalum riograndense* Barreto, Rio Grande do Sul (Lindquist & Costa Neto, 1967: 56).

*Paspalum usteri* Hackel, São Paulo (Cummins, 1942: 681).

*Paspalum virgatum* Linnaeus, São Paulo (PUR-F4936).

*Paspalum virgatum* var. *conspersum* (Schrader) Doell (reported originally as *Paspalum conspersum* Schrader), Rio Grande do Sul (Lindquist & Costa Neto, 1967: 56).

*Paspalum* sp., Amapa (IBI-16590), Rio de Janeiro (Cummins, 1942: 681), São Paulo (Cummins, 1942: 681).

*Puccinia dolosa* var. *dolosa* has been reported on *Paspalum* spp. also from Argentina, Venezuela, Central America, Mexico, The West Indies, and The United States of America.

Spermogonia and aecia unknown. Uredinia on both sides of leaves or mostly on abaxial surface, pale cinnamon-brown; paraphyses mostly cylindrical, colorless, inconspicuous; urediniospores (19-)24-29 x (17-)20-24 µm, mostly obovoid, triangular in end-view, wall 1-1.5 µm thick, golden or pale cinnamon-brown, finely echinulate, germ pores 3, equatorial, in the angles. Telia covered by the epidermis, blackish brown, inconspicuous; teliospores (27-)34-40(-44) x (17-)23-26 µm, variable and often angular, mostly oblong or oblong-clavate, wall 1-1.5 µm thick at sides 2-4 µm apically, very brittle chestnut-brown, smooth; pedicels yellowish, thin-walled and mostly collapsing, to 45 µm long, often broken much shorter. (Cummins, 1971).

Traits that help to identify *Puccinia dolosa* var. *dolosa* include: uredinia with paraphyses inconspicuous, these often hard to find, cylindrical, wall thin and colorless, urediniospores (19-)22-27(-29) x (17-)20-24 µm, obovoid, often triangular in end view, wall 1-1.5 µm thick, golden or pale cinnamon, echinulate, pores 3, more or less equatorial; telia minute, blackish, long covered by the epidermis, teliospores variable, (27-)30-40(-44) x (17-)23-26 µm, brittle and easily crushed, pedicel to 25 µm long, usually shorter, yellowish or colorless.

Cummins (1971) included four varieties of *Puccinia dolosa*, only two of which have been reported from Brazil. *Puccinia dolosa* var. *catervaria* which occurs on *Setaria geniculata* (Lamarck) Beauvois in Bolivia, has urediniospores with four equatorial germ pores and *P. d.* var. *biporula*, which occurs on *Setaria grisebachii* Fourn. in Mexico, has urediniospores with two equatorial germ pores. The long covered, small telia and the brittle and easily crushed teliospores help separate *Puccinia dolosa* from *Puccinia huberi*, *P. puttemansii*, *P. substriata*, *P. arguata*, and *P. levis*. The urediniospores of *Puccinia dolosa* var. *dolosa* are easily confused with those of *Uromyces setariae-italicae*.

The following reports of *Puccinia dolosa* Arthur & Fromme var. *dolosa* on *Panicum* spp. are probably *Uromyces setariae-italicae*, because Cummins and Ramachar, 1965; and Cummins, 1971 record *P. dolosa* var. *dolosa* as infecting only species of *Paspalum*. *P. dolosa* var. *circumdata* is recorded as infecting only species of *Panicum*.

*Panicum maximum* Jacquin, Mato Grosso (PUR-F19029), Paraná (PUR-F19028), Rio de Janeiro (PUR-F19026), São Paulo (PUR-F19019).

*Panicum* sp., São Paulo (PUR-F19025).

**PUCCINIA DOLOSA** Arthur & Fromme var. **CIRCUMDATA** Ramachar & Cummins, Mycopathol.

Mycol. Appl. 25: 13. 1965. (?!? ≠ **IIpe/III**).

≡ *Puccinia circumdata* Mains, Carnegie Inst. Wash. Publ. 461: 101. 1935. TYPE on *Panicum fasciculatum* Swartz from **Mexico**, Yucatan: Uxmal, 20-21 July 1932, Swallen-2592.

On Gramineae:

*Panicum parvifolium* Lamarck, Bahia (Cummins, 1971: 89).

*Puccinia dolosa* var. *circumdata* has been reported also from Central America, some West Indian islands, Mexico, and Texas in The United States of America.

*Puccinia dolosa* var. *circumdata* has smaller teliospores [(25-)27-34 x (17-)20-24 µm] and larger urediniospores [(23-)25-29(-32) x (17-)19-22(-23) µm] than *P. d.* var. *dolosa*.

*Puccinia dominicana* Gonzales-Fragoso & Cifferi, see **PUCCINIA LEONOTIDICOLA** P. Hennings.

**Key to help identify species of *Puccinia* on *Piptocarpha* and *Vanilosmopsis*, Asteraceae**

1. Paraphyses absent, teliospores (43-)45-60(-72)  $\mu\text{m}$  long, urediniospores with (3-)4 scattered germ pores.  
*Puccinia pipitocarphae* (?/?, IIpe/III).
1. Paraphyses present in uredinia and telia
  2. Paraphyses 3-4 multiseptate, teliospores 46-64 x 24-28  $\mu\text{m}$ , urediniospores --  $\mu\text{m}$ --  
*Puccinia macumbae* (0/I, IIpe/III).
  2. Paraphyses not septate or septate only at base.
    3. Paraphyses wall thickened only at apex, teliospore walls reticulate
    4. Paraphyses --- $\mu\text{m}$  thick at apex, -- $\mu\text{m}$  long.  
*Puccinia manoelae* (?/?, IIpe/III).
    3. Paraphyses wall thickened unilaterally or not thickened, teliospore walls reticulate or smooth.
      4. Teliospore walls reticulate or minutely verrucose-punctate
        5. Teliospore wall reticulate. *Puccinia pipta* (?/?, IIpe/III).
        5. Teliospore wall minutely verrucose-punctate.  
*Puccinia valentula* (?/?, IIpe/III).
      4. Teliospore walls smooth
        6. Teliospores 50-120 x 16-26  $\mu\text{m}$ , cylindrical to oblong, paraphyses --  $\mu\text{m}$  long, wall unilaterally thickened.  
*Puccinia seorsa*. ?(1/2cv, 3pe /4)

**Key to help identify species of *Puccinia* on *Piptocarpha* based mainly on paraphyses**

1. Paraphyses absent or not reported.
  2. Teliospores 27-34  $\mu\text{m}$  wide. Teliospores 45-60 x 27-34  $\mu\text{m}$ , ellipsoid to oblong, rounded above and below, constricted a little at the septum, wall not thickened at apex, smooth, yellow-brown, uredinia unknown  
*Puccinia leptoderma*
  2. Teliospores (17-)19-26(-27)  $\mu\text{m}$  wide
    3. Pore apical in upper cell, depressed to the lower half in the lower cell. Teliospores 34-46(-52) x 18-25  $\mu\text{m}$ , ovoid to oblong, broadly rounded above, constricted at septum, mostly rounded obtusely below, wall 1-1.5  $\mu\text{m}$  thick, smooth, pore apical in upper cell, depressed to the lower half in the lower cell  
*Puccinia jahnii*
    - 3 Pore apical in both upper and lower cell, Teliospores (30-44) 45-58(-60) x (17-)19-26(-27)  $\mu\text{m}$ , oblong-clavate, rounded at apex, constricted at septum, wall a little thicker at apex, smooth, yellowish brown, pedicel short hyaline, urediniospores 26-32  $\mu\text{m}$  in diameter, globose to subglobose, wall yellow-brown, echinulate, pores 3-4, scattered.  
*Puccinia pipitocarphae*.
1. Paraphyses present in uredinia
  4. Paraphyses multiseptate, cells in rows  
*Puccinia macumbae*.
  4. Paraphyses not multiseptate or septate only at the base
    5. Paraphyses uniformly thin-walled.
      6. teliospores 45-60 x 27-34  $\mu\text{m}$   
*Puccinia leptoderma*.
      6. Paraphyses (35-)40-60(-90) x 8-10  $\mu\text{m}$ , cylindrical or irregularly cylindrical, wall ca 1  $\mu\text{m}$  thick or less, sometimes thickened at apex, teliospores 31-40 x 34-37  $\mu\text{m}$   
*Puccinia douradae*
    5. Paraphyses wall thickened unilaterally or apically.
      7. Paraphyses wall mostly unilaterally thickened. *Puccinia seorsa*.
      7. Paraphyses wall mostly apically thickened
        8. Paraphyses wall variable from not to greatly thickened apically.  
*Puccinia manoelae*
        8. Paraphyses wall not or only in some paraphyses greatly thickened apically.
          9. Paraphyses apical wall not or only in some paraphyses greatly thickened.  
9 *Puccinia valentula*,
          9. *Puccinia pipta*

*Puccinia dubia* Mayor, see **Puccinia SPEGAZZINI** DeToni.

*Puccinia elegans* Schroeter, see **PROSPODIUM ELEGANS** (Schroeter) Cummins.

*Puccinia eleutherantherae* Dietel, see **PUCCINIA CNICI-OLERACEI** Persoon ex Desmazieres

*Puccinia elongata* Spegazzini, see **PUCCINIA VERBENIPHILA** Lindquist.

*Puccinia elytrariae* P. Hennings, see **PUCCINIA LANTANAE** Farlow.

*Puccinia emaculata* Schweinitz, Amer. Phil. Soc. II. 4: 295. 1832.

Albuquerque (1971: 148) reported *P. emaculata* on *Panicum maximum* Jacquin, Gramineae, from Pará. Cummins (1971) records *P. emaculata* only from Mexico and the United States of America. Many recent collections of rust on *Panicum maximum* from Brazil are all *Uromyces setariae-italicae*. We regard the report by Albuquerque as *Uromyces setariae-italicae*.

*Puccinia emiliae* P. Hennings see **PUCCINIA CNICI-OLERACEI** Persoon ex Desmazieres.

*Puccinia enecta* Spegazzini, see **PUCCINIA LITHOSPERMI** Ellis & Kellerman.

*Puccinia ensenadensis* Spegazzini, see **PUCCINIA ASPILIAE** Dietel.

**PUCCINIA ERIANTHICOLA** Cummins, Uredineana 4: 42. 1953. TYPE on *Saccharum angustifolium* (Nees) Trin. (reported as *Erianthus angustifolius* Nees), from **Brazil**, Garluga near Taipas, June 1922, *Holway-1954* (?/?? **Ipe/III**).

Anamorph

*Uredo rubida* Arthur & Holway in Arthur, Proc. Amer. Phil. Soc 64: 216. 1925. TYPE on *Saccharum angustifolium* (Nees) Trin. reported as *Erianthus angustifolius* Nees [reported originally as *Andropogon condensatus* Kunth, = *Schizochyrium condensatum* (Kunth) Ness] from **Brazil**, Rio de Janeiro: Petropolis, Oct 1921, *Holway-1256*.

On Gramineae:

*Saccharum angustifolium* (Nees) Trin. (reported as *Erianthus angustifolius* Nees), Rio de Janeiro (PUR-F5041), São Paulo (PUR-F19053).

*Saccharum asperum* (Nees) Steud. (reported as *Erianthus asper* Nees), Rio de Janeiro (PUR-F5042).

*Puccinia erianthicola* has been reported only from Brazil. The report of Kern et al. (1934) of *Uredo rubida* from Venezuela requires confirmation. Cummins (1953) reidentified the host of the type of *Uredo rubida* as probably *Erianthus angustifolius* (*Saccharum angustifolium* (Nees) Trin.).

Spermogonia and aecia unknown. Uredinia mostly on abaxial side of leaves, without paraphyses cinnamon-brown; urediniospores (20-)23-28 x (17-)20-24  $\mu\text{m}$ , broadly ovoid or globoid, flattened on the pore-bearing sides, wall 2-2.5  $\mu\text{m}$  thick, usually 2-3.5  $\mu\text{m}$  on the side walls that lack the two equatorial pores, cinnamon-brown, echinulate, germ pores 2, equatorial. Telia like the uredinia but pulvinate and blackish brown; teliospores (29-)32-42(-47) x (14-)16-20  $\mu\text{m}$ , mostly ellipsoid or oblong-ellipsoid, wall 2-2.5  $\mu\text{m}$  thick at sides, 5-8  $\mu\text{m}$  apically, clear chestnut-brown, smooth; pedicels to 40  $\mu\text{m}$  long, yellowish or brownish, thin-walled and usually collapsing (Cummins, 1971).

*Puccinia erythroxyli* Viégas, see **MARAVALIA ERYTHROXYLI** (Viégas) Ono & Hennen.

**PUCCINIA ESCLAVENTIS** Dietel & Holway in Holway, Bot. Gaz. (Crawfordsville) 24: 29. 1897

TYPE on *Panicum bulbosum* H. B. K. from **Mexico**, Eslava, 3 Oct 1896 *E.W.D.Holway* var.

**PANICOPHILA** (Spegazzini) Ramachar & Cummins, Mycopathol. Mycol. Appl. 25: 55. 1965. (**0/Icv** **Ipe/III**).

= *Puccinia atra* Dietel & Holway in Holway, Bot. Gaz. (Crawfordsville) 24: 29. 1897 (not that of Sprengel, 1827).

≡ *Puccinia panicophila* Spegazzini, An. Mus. Nac. Buenos Aires 19: 300. 1909. TYPE on

*Digitaria insularis* (L.) Fedde [reported as *Panicum insulare* (L.) G. Mey]. from **Argentina**, Cacheuta, Spegazzini

Anamorph

*Uredo panicophila* Spegazzini, Bol. Acad. Nac. Cienc. Córdoba (Argentina) 29: 149. 1926.

TYPE on *Digitaria sacchariflora* (Nees) Henrard [reported as *Panicum penicilligerum* (Spegazzini) Hackel] from **Argentina**, Sierra de Córdoba, location and date not available, C. Bruch-s.n..

On Gramineae:

*Digitaria insularis* (Linnaeus) Fedde, Minas Gerais (Thurston, 1940: 297), São Paulo (IBI-17683).

*Puccinia esclavensis* var. *panicophila* has been reported from Argentina to the southwestern United States of America. Cummins (1971) recognized *Puccinia esclavensis* var. *esclavensis* on *Panicum* and *Pennisetum*, also widespread from Argentina to the United States, and *Puccinia esclavensis* var. *unicellula* on *Digitaria* from Tamaulipas, Mexico.

Spermogonia and aecia (*Aecidium mirabilis* Dietel & Holway) reported on *Mirabilis* (Nyctaginaceae) in the southwestern United States and northern Mexico; aeciospores 21-28 x 16-19 µm, wall 1-1.5 µm thick, colorless, verrucose. Uredinia mainly on abaxial side of leaves, without paraphyses, cinnamon-brown or darker; urediniospores 26-33(-39) x 19-23(-25) µm, wall (2-)2.5-3.5 µm thick, golden or darker, closely verrucose rugose with wartlets fused into a labyrinthiform pattern, germ pores 4-6, equatorial or scattered in occasional spores. Telia on both sides of leaves, early exposed, pulvinate, blackish brown; teliospores 28-36(-41) x 22-27(-31) µm, mostly ellipsoid, wall 2.5-3.5 µm thick at sides, 4-8 µm apically, deep chestnut-brown, smooth; pedicels to 80 µm long, thick-walled and not collapsing, yellowish (Cummins, 1971).

The urediniospores resulting from infection by aeciospores have thinner and paler walls, perhaps indicating that spores produced later in the season tend to be amphisporic. (Cummins, 1971).

*Puccinia eugeniae* Rangel, see **Puccinia PSIDII** Winter.

**Puccinia EUPATORII** Dietel, Hedwigia 36: 32. 1897. LECTOTYPE on *Eupatorium ballotaefolium* Humboldt, Bonpland & Kunth or from **Brazil**, Santa Catarina, Serra Geral, March 1891, *Ule-1687* (lectotype chosen by Cummins, ). (**0/Ipe,Ipe/III**).

= *Puccinia pachyspora* Dietel, Hedwigia 36: 32. 1897. TYPE on *Eupatorium oblongifolium* (Spreng.) Baker from **Brazil**, Santa Catarina, Serra Geral, April 1891, *Ule-1684*.

= *Puccinia uruguayensis* Spegazzini, Revista Argentina de Botanica 1: 128. 1925. TYPE: Spegazzini listed two collections: on *Eupatorium macrocephalum* Lessing from **Argentina**, Sierra Ventana, Dec 1896, ?Spegazzini s.n.; and on same host species from **Uruguay**, near Arazati, March 1883, ? Spegazzini s.n.

= *Puccinia tinctoria* Spegazzini, Anal. Soc. Cient. Argentina 17: 93. 1884. TYPE on *Eupatorium tinctorii* Pohl ex Baker nom. nud. from **Paraguay**, Cordillera de Peribebuy, July 1883, ?Collector-3892. Lindquist (1982) keeps this as a separate species. It occurs in Argentina and Paraguay.

On Compositae:

*Eupatorium ballotaefolium* Humboldt, Bonpland & Kunth, Santa Catarina (Dietel, 1897: 32).

*Eupatorium betonicaeforme* (DeCandolle) Baker, Santa Catarina (PUR-F18086), São Paulo (Jackson, 1932: 123).

*Eupatorium inulaefolium* Humboldt, Bonpland & Kunth, São Paulo (Viégas, 1945: 25; IAC-1558).

*Eupatorium macrocephalum* Lessing, Rio Grande do Sul (Joerstad, 1956: 463; Lindquist & Costa Neto, 1963: 142), Santa Catarina (PUR-F8027), São Paulo (Jackson, 1932: 123), Serra Geral (Dietel, 1897: 32).

*Eupatorium oblongifolium* (Spreng.) Baker, Santa Catarina (Dietel, 1897: 32; Lindquist, 1953: 141).

*Eupatorium pumilum* Robinson, São Paulo (Jackson, 1932:123).

*Eupatorium purpurascens* Schultz-Bip., Rio de Janeiro (Jackson, 1932: 123), São Paulo (Jackson, 1932: 123).

*Eupatorium squalidum* DeCandolle, Minas Gerais (Thurston, 1940: 298).

*Eupatorium* sp., Mato Grosso (IBI-16759), Mato Grosso do Sul (IBI- 14385), Minas Gerais

(Thurston, 1940: 298; IBI-14493), São Paulo (IBI-13806).

*Puccinia eupatorii* has been reported from Argentina to Mexico on more than a dozen species of *Eupatorium*. Most collections are from Brazil.

Spermogonia on both sides of leaves. Aecia mostly on abaxial side of leaves, grouped around the spermogonia, chestnut brown; aeciospores pedicellate, (30-)33-40(-43) x (26-)28-33  $\mu\text{m}$ , mostly broadly ellipsoid or broadly obovoid, wall (2-)2.5-3  $\mu\text{m}$  thick, nearly chestnut brown, echinulate except an area around pores, pores 2, equatorial in slightly flattened sides. Uredinia mostly on abaxial side of leaves, scattered; urediniospores similar to aeciospores except 28-34(-38) x 25-30(-32)  $\mu\text{m}$  and wall (1.5-2-2.5)  $\mu\text{m}$  thick. Telia mostly on abaxial side of leaves, exposed, blackish brown, rather pulverulent; teliospores (38-)40-52(-56) x (28-)30-34  $\mu\text{m}$ , mostly broadly obovoid or ellipsoid, wall 2(-2.5)  $\mu\text{m}$  thick at sides, smooth, clear chestnut brown except the 4-7  $\mu\text{m}$  thick, pale umbos over pores, pore apical in upper cell, at septum in lower cell; pedicels colorless, to 65  $\mu\text{m}$  long (Cummins, 1978).

Cummins (1978) reported traits that help identify this species as being long cycled, having aeciospores and urediniospores similar in morphology, both produced on pedicels, broadly ellipsoid or broadly obovoid, the wall more or less evenly about 2  $\mu\text{m}$  thick, with two equatorial pores; the telia are not loculate, teliospores 40-50  $\mu\text{m}$  long, teliospore walls smooth, clear chestnut-brown, side walls about 2.5  $\mu\text{m}$  thick or less but thicker near the pores which have a nearly colorless umbo, the pedicels are fragil and collapse laterally.

Nearly 30 species of *Puccinia* have been reported on *Eupatorium*, all from the New World. Only three of these have been reported from Brazil.

**Puccinia EUPATORII-COLUMBIANI** Mayor, Mem. Soc. Neuchatel. Sci. Nat. 5: 514.1913. TYPE on *Eupatorium columbianum* Heering, from **Colombia**. A lectotype needs to be chosen from the two collections with telia made in 1910 listed by Mayor (*Mayor-298, -298a*). (**?/Ipe,IIpe/III**).

On Compositae:

*Eupatorium adenanthum* DeCandolle, Rio de Janeiro (Jackson, 1932: 123; PUR-F8031).

*Eupatorium inulaefolium* Humbolt, Bonpland & Kunth, Rio de Janeiro (Jackson, 1932: 123), São Paulo (Jackson 1932: 123; IBI-14086).

*Eupatorium* sp., Rio de Janeiro (Jackson, 1932: 123), São Paulo (Jackson, 1932: 123).

*Puccinia eupatorii-colombiani* has been reported also from Bolivia, Ecuador, Venezuela, and Trinidad.

Teliospores are 40-47 x 18-21  $\mu\text{m}$ , ellipsoid, rounded above and below but with an apical, colorless papilla up to 7  $\mu\text{m}$  high, wall about 2  $\mu\text{m}$  thick, cinnamon-brown, smooth, pore apical in upper cell and at septum in lower cell, pedicel more or less persistent, up to 48  $\mu\text{m}$  long and 5-7  $\mu\text{m}$  wide near base of spore. Urediniospores are globose, 21-26  $\mu\text{m}$  or ovoid 31-38 x 18-21  $\mu\text{m}$ , the wall evenly about 2  $\mu\text{m}$  thick, cinnamon-brown, minutely echinulate, and with 2 equatorial pores.

Nearly 30 species of *Puccinia* are known on *Eupatorium*, all from the New World. Only three of these are known from Brazil.

**Puccinia EVADENS** Harkness, Bull. California Acad. Sci. 1: 34. 1884. TYPE on *Baccharis pilularis* from **The United States of America**, California: San Francisco, Nov, 1883, *Harkness-3384*. (**0/Icv,IIpe/III**).

= *Coleosporium baccharidis* Cooke & Harkness, Grevillea 9:7. 18880. Not *Eriosporangium baccharidis* Bertero, 1854, nor *Dicaeoma baccharidis* Arthur & H. S. Jackson, 1920.

= *Eriosporangium evadens* Arthur, Result. Sci. Congr. Bot. Vienne p. 343. 1906.

Anamorph

*Caeoma negerianum* Dietel, Bot. Jahrb. 22: 357. 1896.

On Compositae:

*Baccharis calvescens* DeCandolle, Santa Catarina (Hennings, 1896: 242).

*Baccharis dracunculifolia* DeCandolle, Santa Catarina (Hennings, 1896: 242).

*Baccharis platypoda* DeCandolle, Minas Gerais (Jackson, 1932: 143).

*Baccharis* sp., Minas Gerais (Jackson, 1932: 143; Thurston 1940: 298), Rio de Janeiro (Jackson, 1932:143), São Paulo (Sydow, 1907: 354).

*Puccinia evadens* has been reported also from Argentina, Uruguay, Bolivia, Colombia, Mexico, and the Southern United States of America.

Spermogonia and aecia mostly on stems causing fusiform swellings and often witches' brooms; aecia, *Caecoma negerianum*, often columnar, bright yellow when fresh, tan when dry; aeciospores (32-)36-55(-60) x (17-)23-25(-28)  $\mu\text{m}$ , variable but mostly ellipsoid, wall (1.5-)2-3  $\mu\text{m}$  thick at sides, (4-)6-12(-15)  $\mu\text{m}$  at apex, sometimes thickened basally, rugosely verrucose with irregular verrucae that often unite in labyrinthiform patterns, often striate apically, colorless or pale yellowish. Uredinia with *Uredo* sp. morphology, on abaxial side of leaves and on stems and branchlets, colored like the aecia, urediniospores (25-)30-38(-42) x (19-)22-27(-30)  $\mu\text{m}$ , ellipsoid, broadly ellipsoid or obovoid, wall 1.5-2  $\mu\text{m}$  thick, colorless to pale yellowish, echinulate, pores obscure, about 6, scattered or tending to be bizonate. Telia on abaxial side of leaves and branchlets, exposed, pulvinate, dark cinnamon-brown, becoming gray from germination; teliospores (48-)54-74(-80) x (22-)26-30(-33)  $\mu\text{m}$ , mostly oblong ellipsoid, wall (1-)1.5(-2)  $\mu\text{m}$  thick at sides, 3-5(-6)  $\mu\text{m}$  at apex, about golden brown, smooth pore of upper cell apical, of lower cell at septum; pedicels to 160  $\mu\text{m}$  long, colorless (Cummins, 1978).

Although Arthur (1922) included *Caecoma negerianum* as an anamorph name under *Puccinia evadens*, Dietel (1914), Jackson (1932), and Lindquist (1958, 1982) included it as an anamorph name under *Puccinia henningsii*. But Oehrens (198?) working with specimens from the type locality, reported *Caecoma negerianum* as an anamorph of *Puccinia valdiviana* in Chile.

Fifteen species of *Puccinia* have been reported on *Baccharis* in Brazil. At least 53 species of *Puccinia* have been reported to parasitize species of *Baccharis* in the Americas (Lindquist, 1957). Thus, the New World genus *Baccharis*, which itself has about 380 known species, harbors more *Puccinia* species than any other host genus in the Americas.

*Puccinia exigua* Dietel, see **Puccinia BRACHYPODII** Otth var. **POAE-NEMORIALIS** (Otth) Cummins & H.C. Greene.

**Puccinia EXILIS** H. Sydow & P. Sydow, Mon. Ured. 1: 481. 1903. TYPE on *Pavonia leucantha* Garcke from **Brazil**, place and date not published, collector ? *Poeppig* or *Regnell*. (-I-, -III).  
On Malvaceae:

*Pavonia leucantha* Garcke, Brazil (Sydow, 1903: 481).

*Pavonia rosea* Schlechtendahl, Minas Gerais (PUR-F6561), São Paulo (Jackson, 1931: 479).

*Puccinia exilis* has been reported also from Guatemala (Arthur et al., 1922). From Brazil it has been reported only from the three collections cited above.

Sori solitary, compact, whitish, in small yellowish-brown spots on the abaxial side of leaves, teliospores 27-40 x 10-14  $\mu\text{m}$ , oblong-clavate, rounded to slightly acute at the apex, rounded to attenuate at the base, slightly constricted at the septum, wall evenly 1-2  $\mu\text{m}$  thin, not or slightly thickened at the apex 3-4  $\mu\text{m}$ , smooth, subcolorless, the pedicel equal to or a little longer than the spore, thin, subsistent (Sydow, P & H., 1903).

See *Puccinia heterospora* for keys that may help identify microcyclic species of *Puccinia* on Malvaceae.

**Puccinia EXORNATA** Arthur, Bull. Torrey Bot. Club 38: 370. 1911. TYPE on *Baccharis thesioides* Humboldt, Bonpland & Kunth from **Guatemala**, Guatemala City, 2 Feb 1905, W. A. Kellerman-5368. (0/Icv-spiral, Ipe-in lines/III).

On Compositae:

*Baccharis oxyodonta* DeCandolle, São Paulo (Viégas, 1945: 25; IAC-129).

*Puccinia exornata* has been reported also from Costa Rica to Mexico in North America and in South America from Venezuela.

Spermogonia on both sides of leaves in wall groups. Aecia yellowish when dry, bright orange when fresh, without a peridium, opening by irregular rupture of the hosts on abaxial leaf surface; spores (25-)27-32(-35) x (22-)24-27  $\mu\text{m}$ , broadly ellipsoid or obovoid, wall 2-3(-5)  $\mu\text{m}$  thick or thicker apically, colorless, ornamented with warts or more typically with ridges of varying lengths arranged longitudinally or spirally. Uredinia on abaxial surface, yellowish when dry, bright yellow when fresh; spores (24-)26-34(-40) x (19-)21-24  $\mu\text{m}$ , mostly broadly ellipsoid or obovoid, wall 1-1.5  $\mu\text{m}$  thick, pale yellowish, echinulate, pores 3, equatorial, obscure. Telia on abaxial surface, exposed, cinnamon brown becoming gray from germination, compact; spores variable in size in different collections, (40-)44-55(-66;-74) x (17-)20-26(-29)  $\mu\text{m}$ , mostly elongately ellipsoid or more or less oblong ellipsoid, wall 1(-1.5)  $\mu\text{m}$  thick at sides, pale golden brown,

(2-)2.5-4(-4.5)  $\mu\text{m}$  over pores by a nearly colorless, low umbo smooth, pore apical in each cell; pedicel colorless, to 90  $\mu\text{m}$  long but usually shorter. (Cummins, 1978).

For identification of species of *Puccinia* on *Baccharis* using the literature available, both telia and anamorph sori are necessary. But even then, little confidence may be put in the identification. Fifteen species of *Puccinia* have been reported on *Baccharis* in Brazil. Nearly 60 species of *Puccinia* have been reported to parasitize species of *Baccharis* in the Americas (Berndt, 1998; Lindquist, 1957). The New World genus *Baccharis*, with about 380 known species, harbors more *Puccinia* species than any other host genus in the Americas.

*Puccinia extensicola* Plowright, see **Puccinia DIOICAE** P. Magnus

**Puccinia FACETA** H. Sydow, Ann. Mycol. 32: 289. 1934. TYPE on *Olyra fasciculata* Trin. (= *Olyra heliconiae* Lindeman), Gramineae, from **Brazil**, Goiás: Santa Rita do Araguaia, 15 April 1930, A. Chase-12047, holotype lost, isotypes at BPI & PUR. (?? $\neq$  **Ipe/III**).

*Puccinia faceta* has been reported only from the specimens cited here.

Spermogonia and aecia unknown. Uredinia mostly on abaxial leaf surface, about cinnamon-brown; urediniospores (22-)23-26(-28) x (16-)18-20(-21)  $\mu\text{m}$ , mostly ellipsoid or obovoid, wall 1.5-2  $\mu\text{m}$  thick, cinnamon-brown, echinulate, germ pores 4, equatorial. Telia on abaxial surface, blackish brown, early exposed, pulvinate; teliospores (26-)29-35 x (16-)18-20  $\mu\text{m}$ , ellipsoid or oblong-ellipsoid, wall 2-2.5  $\mu\text{m}$  thick at sides (2.5-)3-4  $\mu\text{m}$  apically, clear chestnut-brown, smooth; pedicels to 100  $\mu\text{m}$  long, thin-walled and collapsing, yellowish (Cummins, 1971).

See *Phakopsora phakopsoroides* for a key to rust species reported on *Olyra*.

*Puccinia fallaciosa* Arthur, see *Puccinia fallax* Arthur.

*Puccinia fallax* Arthur in Mains, Carnegie Inst. Washington Publ. 461: 103. 1935. Nom nov, for *Puccinia fallaciosa* Arthur, 1922; not *P. fallaciosa* Thuemen, 1876, or *P. fallaciosa* (Arthur) Arthur, 1917. (??,II/III).

Anamorph

*Uredo fallaciosa* Arthur, Mycologia 7: 323. 1915. TYPE on *Psychotria patens* Swartz from **Puerto Rico**, Maricao, 3 April 1913, Stevens-774.

$\equiv$  *Puccinia fallaciosa* (Arthur) Arthur, Mycologia 9: 84. 1917. (not Thuemen, 1876).

$\equiv$  *Puccinia fallax* Arthur in Mains, Carnegie Inst. Washington Publ. 461: 103. 1935. Nom nov, for *Puccinia fallaciosa* (Arthur) Arthur, 1917; not *P. fallaciosa* Thuemen, 1876.

On Rubiaceae:

*Palicourea guianensis* Aublet, Pará (Albuquerque, 1971: 148; IAN-420).

*Psychotria* sp., Minas Gerais (PUR-F15184).

Specimens in BPI identified as *Puccinia fallax* have been recorded from the Virgin Islands, the Dominican Republic, and Papua, New Guinea.

Spermogonia and aecia unknown. Uredinia 0.1-0.5 mm across, in irregular groups, on somewhat discolored spots, on abaxial side of leaves; without paraphyses; urediniospores 24-29 x 18-23  $\mu\text{m}$ , ellipsoid or obovoid, wall 1-1.5  $\mu\text{m}$  thick, moderately echinulate, pale yellow or light yellow-brown, pores obscure. Telia few, scattered, punctate, small, early naked, pulvinate, surrounding tissues much browned, ruptured epidermis inconspicuous; teliospores 26-31 x 13-16  $\mu\text{m}$ , ellipsoid, rounded or slightly narrowed above and below, moderately constricted at the septum, germinating at maturity; wall uniformly 1-1.5  $\mu\text{m}$  thick, colorless or pale yellow, smooth; pedicel short, colorless (Arthur, 1922).

The species is very similar to *Puccinia palicoureae*. The identification of the Brazilian records need to be confirmed.

Arthur (1917) transferred *Uredo fallaciosa* Arthur to *Puccinia* but without reporting any information about telia except that teliospores ("iii") occur in one collection from **Puerto Rico**, Maricao, 23 March 1913, F. L. Stevens-353. Thus, because Arthur published no telial information, *Puccinia fallaciosa* (Arthur) Arthur, 1917, can apply only to the anamorph *Uredo fallaciosa* Arthur, not to a teleomorph. Arthur (1922) did described telia and teliospores in 1922 but ascribed original publication of the name to his 1917 paper. We

ascribe the publication of the teleomorph name to Arthur (1922), and likewise, we ascribe *Puccinia fallax* Arthur in Mains nom. nov. to *Puccinia fallaciosa* Arthur, 1922.

**Puccinia FARAMEAE** Kern, Ciferri & Thurston, Ann. Mycol. 31: 13. 1933. TYPE on *Faramea occidentalis* (Linnaeus) Richard from **The Dominican Republic**, 23 Aug 1929, *Cifferi-2623. (-I,-/III).*

On Rubiaceae

*Alibertia edulis* (Richard) A. Richards ex DeCandolle, São Paulo (IBI-13389).

*Puccinia farameae* has been reported only from the Dominican Republic and from the Cerradão in Horto Florestal at Mogi-Mirim, São Paulo, Brazil.

Spermogonia, aecia, and uredinia unknown, probably not formed. Telia on the abaxial side of leaves, 0.5-0.8 mm across, confluent, in groups or circles 2-3 mm across, slowly erumpent, ruptured epidermis evident, pulvinate, dark chocolate-brown; teliospores 51-62 x 29-39 µm, broadly ellipsoid, rounded above, saepe narrowed below, not or slightly constricted at the septum, wall 2 layered, 4-6 µm thick, slightly thicker above, chestnut-brown, outer layer not conspicuous, smooth; pedicel as long as or to twice as long as spore, colorless or pale yellow; one celled teliospores 30-55 x 26-35 µm, not numerous (Kern et al., 1933).

We observed that telia begin as shiny bright yellow-orange spots, they increase in size to 2-3 mm across, long covered by the shiny epidermis, remaining shiny bright yellow-orange for a long time, and as they mature they turn black; and are finally erumpent. Kern et al. (1933) reported telia as more or less powdery but we did not observe this in the Brazilian specimens.

*Ramakrishnania ixorae* Ramachar & Bhagyan. on *Ixora* sp., Rubiaceae, from Kerala, India, for which also only telia are known, seems to be very similar. But Cummins and Hiratsuka (2004) included it as a genus separate from *Puccinia*. The main traits of *Ramakrishnania* reported to separate it from *Puccinia* were its greatly elongated teliosporogenous cells, and very long, 1-septate pedicels. Our specimens from Mogi-mirim, S. P. also have elongated sporogenous cells and long pedicels.

**Puccinia FARINACEA** Long, Bull. Torrey Bot. Club 29: 115. 1902. TYPE on *Salvia farinacea* Bentham Labiatae from **The United States of America**, Texas: Austin, 12 Nov 1901, *W. H. Long-833. (0/Ic, IIp/III).*

≡ *Dicaeoma farinaceum* (Long) Arthur, N. Am. Flora 7: 411. 1921.

= *Puccinia prospera* Arthur, Bull. Torrey Bot. Club 46: 118, 1919. TYPE on *Salvia microphylla* from **Mexico**, Hidalgo: Pachuca, 5 Oct 1899, *Holway-3579.*

≡ *Dicaeoma prosperum* (Arthur) Arthur, N. Am. Flora 7: 414.

On Labiatae:

*Salvia* sp., Rio Grande do Sul (Lindquist & Costa Neto, 1963: 135; Rick, 1911: 177).

In North America *Puccinia farinacea*, which Baxter (1951) divided into three varieties, is reported from Guatemala to Texas. In South America it has been reported from Bolivia and Argentina plus the one record for Brazil which is the collection of Rick cited above. Rick identified his specimen, consisting of three small leaves, as *Uredo varia* Dietel on an unidentified species of Acanthaceae. Lindquist and Costa Neto (1963) found uredinia and telia on Rick's specimen which they identified as *Puccinia farinacea* and the host as *Salvia* sp., Labiatae. Additional collections of this rust are needed to confirm that it is present in Brazil.

In addition to the typical pigmented, thick-walled overseasoning spores, the telia of a few specimens contain numerous pale, thin-walled teliospores which germinate without a resting period. The lability exhibited by such collections may be an indication that *P. farinacea* is tending to develop a microcyclic derivative (Baxter, 1951).

**Puccinia FAUSTA** H. S. Jackson & Holway in Jackson, Mycologia 24: 111. 1932. TYPE on *Vernonia macrophylla* Lessing [≡ *Lessingianthus macrophylla* (Lessing) H. Robinson], from **Brazil**, Rio de Janeiro: Teresopolis, 13 Oct 1921, *Holway-1216. (?/?, II/III).*

On Compositae:

*Vernonia macrophylla* Lessing [≡ *Lessingianthus macrophylla* (Lessing) H. Robinson], Rio de Janeiro (Jackson, 1932: 111), São Paulo (PUR-F19408).

*Puccinia fausta* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves, widely scattered or often densely grouped, 0.3-0.5 mm. diam, erumpent, pulverulent, ruptured epidermis inconspicuous, cinnamon-



brown; urediniospores, 24-28 x 20-22  $\mu\text{m}$  globoid, ellipsoid, or obovoid; wall 2-2.5  $\mu\text{m}$  thick, finely echinulate, colorless or pale golden-brown, germ pores 4-6, scattered, obscure. Telia not seen, teliospores found in uredinial sori; teliospores 35-40 x 27-30  $\mu\text{m}$ , broadly ellipsoid, rounded at both ends, not constricted at septum, wall 3-4  $\mu\text{m}$  thick, to 5-6  $\mu\text{m}$  at germ pore of upper cell, obscurely rugose or obscurely verrucose, appearing smooth, chestnut brown, lower cell germ pore in the middle of cell, pedicel short, breaking near spore, colorless (Jackson, 1932).

Jackson reported that *Puccinia fausta* is separable from *P. inaequata* by the nearly smooth walled teliospores and the scattered germ pores in the urediniospores.

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but three from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

**Puccinia FILOPES** Arthur & Holway in Arthur, Mycologia 10: 131. 1918. TYPE on *Byttneria lateralis* Presl, from **Guatemala**: Escuintla, 17 Feb 1916, *Holway-501. (-I-, -/III).*

On Sterculiaceae:

*Byttneria (Buettneria) australis* Saint-Hilaire, São Paulo (IAC-4466).

*Melochia* sp., Amazonas (PUR-F15191).

*Puccinia filipes* has been reported from Guatemala, Costa Rica, and Colombia. The host identifications of the Brazilian records need to be confirmed.

Arthur (1918) reported that *Puccinia filipes* is a microcyclic rust with sori mostly on the abaxial side of leaves, 0.1-0.3 mm across, crowded or confluent in circular groups 2-5 mm across, the groups on larger discolored spots, the sori pulvinate, golden-brown, becoming cinereous by germination, early naked, ruptured epidermis inconspicuous, teliospores 30-40 x 13-16  $\mu\text{m}$ , oblong-obovoid, rounded above, somewhat narrowed below, slightly constricted at septum, wall 1-1.5  $\mu\text{m}$  thick, slightly or not thickened at apex, pale golden-brown, sometimes lighter below, pedicel once to twice length of spore, 7-9  $\mu\text{m}$  in diameter next to spore, slender, tapering downward, colorless.

**Puccinia FIMBRISTYLIDIS** Arthur, Bull. Torrey Bot. Club 33: 28. 1906. TYPE on *Fimbristylis polymorpha* Boeckeler from **Mexico**, Morelos: Cuernavaca, 27 Sept 1898, *Holway-3227. (???) Hpe/III).*

On Cyperaceae:

*Fimbristylis complanata* Link, Rio Grande do Sul (Joerstad, 1956: 483).

*Ascolepis brasiliensis* Benth (Cyperaceae), Minas Gerais (Joerstad, 1956: 483).

*Puccinia fimbristylidis* has been reported on *Fimbristylis* spp. also from Colombia, some islands in the Caribbean, Central America, Mexico, Texas, and from Africa, East Asia, and New Guinea.

Uredinia hypophyllous and caulicolous, 0.5-1 mm long, brownish-yellow, rather tardily naked, opening by a longitudinal slit with the ruptured epidermis noticeable, urediniospores 18-26 x 15-20  $\mu\text{m}$ , broadly ellipsoid to globoid, wall more or less evenly ca 1.5  $\mu\text{m}$  thick, cinnamon- or golden brown, moderately or sparsely and evenly echinulate, pores 2, supra-equatorial.

Telia mostly on the abaxial side of leaves and caulicolous, up to 1.5 mm long, compound with each component sorus round, surrounded by abundant, dark-brown hyphal stroma, tardely naked, finally dehiscent by longitudinal slits, pulvinate, dark chestnut-brown, ruptured epidermis conspicuous; teliospores 34-55 x 16-19  $\mu\text{m}$ , oblong, acute or obtuse above, somewhat narrowed at base, slightly constricted at the septum; wall 1.5-2.5  $\mu\text{m}$  thick laterally, 4-9  $\mu\text{m}$  at apex, cinnamon-brown, smooth, pedicel usually about as long as spore, tinted (Arthur, 1920).

*Puccinia fimbristylidis* could be confused with *Puccinia angustatoides* or *Puccinia dioicae*, because they each have urediniospores with two supraequatorial germ pores. Joerstad (1956) was uncertain about the identification of the rust listed above on *Ascolepis* because only uredinia were present.

*Puccinia flaccida* Berkeley & Broome in Berkeley, Jour. Linn. Soc. 14: 91. 1873. See **Puccinia ABNORMIS** P. Hennings.

**Puccinia FLAVO-VIRENS** H. S. Jackson & Holway in H. S. Jackson, Mycologia 18: 142. 1926. TYPE on *Cyperus ferax* L. C. Richard from **Equador**, Quito, 17 August 1920, *Holway-908. (???) Hpe/III).*

On Cyperaceae

*Cyperus diffusus* Vahl., Amapá (Sotão-910222a).

*Cyperus* sp., Amapá (IBI-16090), São Paulo (IBI-14284).

*Puccinia flavo-virens* was not reported in the first edition of this work but has been reported from Mexico and Ecuador.

Spermatogonia and aecia unknown. Uredinia on yellow leaf spots the abaxial side of leaves, sori 0.5-3 mm across, scattered or gregarious, elliptic, tardely naked, powdery, long covered by the golden-yellow epidermis, urediniospores 24-28 x 16-18 µm, ellipsoid, wall evenly 1-1.5 µm thick, colorless or nearly so, very finely and moderately echinulate, pores obscure, probably 2 or 3, equatorial. Telia hypophylous, scattered or confluent and covering large areas 1-5 mm across, often surrounded by the old uredinia, blackish brown, long covered by the epidermis; teliospores 32-48 x 12-14 µm, ellipsoid, clavate, or cylindrical, apex obtuse, base rounded or narrowed to the pedicel, scarcely constricted at the septum, wall 1-1.5 µm thick laterally, 3-6 µm thick at the apex, light greenish yellow, smooth, pedicel about as long as the spore, about the same color as the spore (Jackson, 1926).

*Puccinia flosculosorum* var. *hieracei* Roehling, see **Puccinia hieracei** (Roehling) Martius, var. **HIERACII**.

*Puccinia foveolata* (Schweinitz) Berkeley & Curtis, see **DASYSPORA GREGARIA** (G.Kunze) P. Hennings.

**Puccinia fuchsiae** H. Sydow & P. Sydow & Holway in Sydow, Ann. Mycol. 4: 30. 1906. TYPE on *Fuchsia thymifolia* from **Mexico**, Amecameca, 10 Oct 1903, *Holway-5210*. (-/-/III).

On Onagraceae:

*Fuchsia* sp., Brazil (Silveira, 1951: 221).

*Puccinia fuchsiae* has been reported only from the type from Mexico and this Brazilian record that requires confirmation.

*Puccinia fuirenicola* Arthur, see **Puccinia fuirenicola** Kern, Ciferri & Thurston.

**Puccinia fuirenicola** Kern, Ciferri & Thurston (as "*Puccinia fuirenicola* Arthur"), Ann. Mycol. 31: 13. 1933. TYPE on *Fuirena umbellata* Rottboel from **The Dominican Republic**, Puerto Plata Province: Cabarete, 31 March 1930, *Ekman-3426*. (?!/?= II/III).

Kern et al. described telia from the specimen cited above. Thus, it automatically becomes the type and the name is to be ascribed to Kern et al., not to Arthur who did not describe telia.

Anamorph

*Uredo fuirenae* P. Hennings, Hedwigia Beiblatt 38: (70). 1899. TYPE on *Fuirena umbellata* Rottboel from **Brazil**, Santa Catarina: near São Francisco, 10 Sept 1884, *Ule-15*.

≡ *Puccinia fuirenicola* Arthur, Bull. Torrey Bot. Club 46: 109. 1919. TYPE same as for *Uredo fuirenae* P. Hennings (the name based on an anamorph).

≡ *Dicaeoma fuirenicola* Arthur, N. Amer. Fl. 7: 349. 1920. Based on *Puccinia fuirenicola* Arthur.

On Cyperaceae:

*Fuirena umbellata* Rottboell, Minas Gerais (Joerstad, 1956: 483), Santa Catarina [Hennings, 1899A: (70)]; São Paulo (Joerstad 1956: 483).

*Puccinia fuirenicola* has been reported also from The West Indies, The Philippines, and Taiwan.

Arthur (1920) reported uredinia on the abaxial side of leaves, scattered, 0.5-1 mm long, elliptic or oblong, tardily dehiscent by a longitudinal slit, ruptured epidermis conspicuous, cinnamon-brown; urediniospores 23-27 x 18-23 µm, broadly ellipsoid, globose, or obovoid; wall 2-2.5 µm thick, golden- or cinnamon-brown, echinulate, the pores 2, approximately equatorial. Kern et al. (1933) report telia as on the abaxial side of leaves, scattered, oblong, dark brown, paraphyses absent; teliospores 40-56 x 13-19 µm, cylindrical, ellipsoid, or clavate, rounded or somewhat pointed above, and usually narrowed below, constricted at septum; wall 1-1.5 µm thick laterally, 4-7 µm thick at apex, cinnamon-brown, upper cell somewhat darker; pedicel about the length of the spore or shorter, slightly pigmented.

**Puccinia fundata** H. S. Jackson & Holway in Jackson, Mycologia 24: 112. 1932. TYPE on *Vernonia discolor* (Sprengel) Lessing [= *Vernonanthura discolor* (Sprengel) H. Robinson] from **Brazil**, Rio de Janeiro, 12 Nov 1921, *Holway-1294*. (?/?,II/III).

On Compositae:

*Vernonia discolor* (Sprengel) Lessing [= *Vernonanthura discolor* (Sprengel) H. Robinson], Rio de Janeiro (Jackson, 1932: 112; PUR-F7935).

*Vernonia* sp., Rio de Janeiro (Jackson, 1932: 112).

*Puccinia fundata* has been reported only from the two specimens listed above, both from Brazil.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves, 0.4-0.8 mm across, few, widely scattered or densely grouped, pale cinnamon-brown, becoming naked, powdery, ruptured epidermis inconspicuous, paraphyses 60-90 x 15-20 µm, curved or straight, numerous, peripheral, wall uniformly 1 µm or less thick, colorless or slightly tinted; urediniospores, 26-30 x 19-23 µm, obovoid or broadly ellipsoid, wall 1-1.5 µm thick, colorless or pale golden-brown, closely and finely echinulate, pores obscure. Telia on abaxial side of leaves, 0.2-0.5 mm across, compact, pulvinate, ruptured epidermis inconspicuous, densely grouped and widely scattered, few, pale chestnut-brown, becoming ashy-gray in color by germination, paraphyses like those in uredinia. Teliospores 44-65 x 24-28 µm, clavate to broadly ellipsoid, rounded above, rounded or narrowed below, not or slightly constricted at septum, wall 1-1.5 µm thick at sides, 6-9 µm at apex, cinnamon-brown, smooth; pedicel equal to spore or shorter, fragile, colorless (Jackson, 1932).

Distinguishable from other *Vernonia* rusts by the presence of thin walled paraphyses and thin walled, light colored teliospores broadly thickened at apex (Jackson, 1932).

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but three from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

*Puccinia fusiformis* Dietel, see **Puccinia dioicae** P. Magnus.

**Puccinia gesneracearum** Dietel, Ann. Mycol. 6: 96. 1908. TYPE on an unidentified woody, climbing species of Gesneriaceae from **Brazil**, Pará: Belém, botanical garden of Museu Goeldi, Dec 1907, *Baker-101*. (?/?,?/III).

? = *Puccinia codonanthes* H. Sydow & P. Sydow. 1916. Ann. Mycol. 14: 67. 1916. TYPE on *Codonanthe formicarum* Fritsch, Gesneriaceae, from **Peru**, Rio Acre: Seringal Aristella, May 1911, *Ule-3420*. Known only from the type.

*Puccinia gesneracearum* has been reported only from the type. Dietel (1909: 264) published the same species again in 1909. New collections are needed to determine if this rust still occurs in Brazil.

The description of *Puccinia codonanthe* from Peru is almost identical to that of *Puccinia gesneracearum*. We list it tentatively as a synonym.

Dietel (1908) records *Puccinia gesneracearum* as having telia on the abaxial side of leaves in large round, occasionally confluent, yellow or dark brown spots, sori punctiform, very numerous, crowded together in groups up to 1 cm across, but not confluent, naked, pulvinate, dark chestnut-brown, teliospores two-celled but with numerous one-celled spores (mesospores), two-celled spores 22-35 x 17-25 µm, ellipsoid, rounded at both ends, or wedge-shaped below, wall presumably smooth, pale brown, apex darker, and moderately thickened, pedicel sometimes inserted obliquely, firm, moderately long, mesospores 18-27 x 15-25 µm, obovate or clavate. Soon germinating.

**Puccinia gibertii** Spegazzini, An. Soc. Cient. Argentina 9: 9. 1880. TYPE on *Hyptis fasciculata* Bentham from **Uruguay**, *B. Gibert-s.n.*. (?/Icv,IIpe/IIIsm & IIIver).

= *Puccinia hyptidis* Tracy & Earle, Bull. Miss. Exp. Sta. 34: 86. 1895. Based on telia of *Puccinia gibertii* fide Laundon, 1975, p. 154. [Not *Puccinia hyptidis* (Curtis) Tracy & Earle, 1895, which is a synonym of *Puccinia gibertii*. = *Gymnoconia hyptidis* Lagerheim [as " (Curt.) Lagerheim], Tromso Mus. Aarsh. 17: 83. 1895. Lagerheim was first to describe telia. TYPE, Lagerheim reported two collections: from **The United States of America** on *Hyptis radiata*: Alabama, date not reported, *M. A. Curtis*; and South Carolina, date not reported, *Ravenel* (type of *Uredo hyptidis* Curtis).

= *Argoteliium hyptidis* (Tracy & Earle) Arthur in Laundon, Mycotaxon 3: 154. 1975.

= *Puccinia hyptidicola* P. Sydow & H. Sydow, Monogr. Ured. 1: 280. 1904. TYPE on *Hyptis*

*fasciculata* from **Uruguay**, Concepcion, date not recorded, *G. P. Lorentz-s.n.*  
 = *Puccinia perfuncta* H. S. Jackson & Holway, in Jackson Mycologia 24: 70. 1932. TYPE on  
*Hyptis fasciculata* Bentham from **Brazil**, Juqueiri, 2 Feb 1922., *Holway-1527*.

Synanamorphs

*Uredo gibertii* Spegazzini, An. Soc. Cient. Argentina 10: 10. 1880. TYPE on *Hyptis fasciculata*  
 Bentham from **Uruguay**, date not reported, *Gibert-s.n.* The type specimen is the same as  
 for *Puccinia gibertii* Spegazzini.  
*Aecidium tucumanense* Spegazzini An Soc. Cient. Argentina 12: 80. 1881. not Saccardo &  
 Sydow, 1902. TYPE on *Hyptis spicata* Poit. from **Argentina**, Tucumán, date not reported,  
*Lorentz and Hieronymus-s.n.*  
 = *Eriosporangium tucumanensis* (Spegazzini) Arthur, (in part) N. Am. Flora 7: 212.  
 1912. Uredinia and telia described by Arthur but not from the type of *Aecidium*  
*tucumanense*.  
 ≡ *Puccinia tucumanense* (Spegazzini) Arthur, Mycologia 8: 247. 1916. Arthur reported  
 a few uredinia and telia present in the type of *Aecidium tucumanensis* but did not  
 give a description of the telia. Therefore, the name must be placed as a  
 nomenclatural synonym of *Aecidium tucumanensis* Spegazzini..  
 = *Aecidium hyptidis* P. Hennings, Hedwigia 34: 337. 1895. TYPE on *Hyptis* sp. from  
**Brazil**, Santa Catarina: Blumenau, July 1888, *Ule-897*.

On Labiatae

*Hyptis fasciculata* Bentham, Rio de Janeiro (Jackson, 1932:70), São Paulo (Jackson, 1932:70).  
**Hyptis** sp., Rio de Janeiro (Jackson, 1932:70), Santa Catarina (PUR-F7276,). São Paulo  
 (Spegazzini, 1919: (84) as "*Aecidium tucumanense*"). [Spegazzini, C. 1919. Reliquiae  
 Mycologicae Tropicae. Bol. Acad. Nac. Cienc. Córdoba, Argentina 23: (84).].

*Puccinia gibertii* has been reported also from Argentina, Paraguay, Uruguay and Ecuador.

Spermogonia not reported. Aecia on galls and malformations on locally systemic infections. Aecia  
 cupulate, peridium well developed, fragile; aeciospores 24-37 x 18-24 µm, ellipsoid, wall 1.5-2.5 µm, pale  
 yellow or colorless, coarsely verrucose. Uredinia on abaxial side of leaves, yellowish or cinnamon-brown;  
 urediniospores 18-24 µm in ndiameter, globose; wall 1-1.5 µm thick, echinulate, yellow or pale cinnamon-  
 brown, germ pores 2, usually obscure, equatorial or mostly supra-equatorial. Telia of two sorts, in one  
 teliospores 29-36 x 15-21 µm, ellipsoid, constricted at septum, wall 1-1.5 µm thick, smooth, colorless or  
 yellowish, germinate without dormancy; in the other teliospores 26-39 x 19-25 µm, ellipsoid or oblong,  
 slightly constricted at septum, wall 1.5-3 µm, chestnut- or cinnamon-brown, finely and closely verrucose,  
 pore of the upper cell apical, of lower next to the septum, pedicel short or occasionally up to 50 µm long,  
 usually breaking away near the point of attachment, colorless, thin-walled, remain dormant for a period of  
 time. Some sori have both kinds of teliospores (Baxter, 1962; Lindquist, 1982).

*Puccinia giberti* and *P. neohyptidis* may be separated by the following comparison:

*P. giberti*: aecia with well developed peridia; teliospores 35-45 x (15-)18-25 µm, ellipsoid to oblong  
 ellipsoid, two different forms, some with wall colorless and smooth, others with wall pigmented and  
 verrucose.

*P. neohyptidis*: aecia without peridia or only a few peridial cells; teliospores 70-80 x 16-18 µm,  
 fusiform or oblong fusiform.

*Puccinia gnaphalii* Spegazzini, see **PUCCINIA GNAPHALLICOLA** P. Hennings.

*Puccinia gnaphalii* (Spegazzini) P. Hennings, see **PUCCINIA GNAPHALLICOLA** P.  
 Hennings.

**PUCCINIA GNAPHALLICOLA** P. Hennings, Hedwigia Beiblatt 38: (68). 1899. TYPE on *Gnaphalium*  
 sp from **Brazil**, Rio de Janeiro, published as "9 January 1896, *Ule-2162*" but  
 recorded on type packet in B as "9 September 1896, *Ule-2126*". (??, **Ipe/III**).  
 = *Puccinia gnaphalii* Spegazzini, Anal. Mus. Nac. Buenos Aires 19: 309. 1909. TYPE on  
*Gnaphalium purpureum* Linnaeus from **Argentina**, Patagonia, Lago Blanco, March 1903,  
*C. Spegazzini s.n.*

Anamorph

- Uredo gnaphalii* Spegazzini, Anal. Soc. Cient. Argentina 12: 73. 1881. TYPE on *Gnaphalium americanum* Greene or Mill., from **Argentina**, ?LaPlata, "Chacarita", "vere" 1880, C. Spegazzini s. n.  
 = *Puccinia gnaphalii* (Spegazzini) P. Hennings, Hedwigia Beiblatt 41: (66). 1902.  
 = *Uredo facelidis* Spegazzini, An. Soc. Cient. Argentina 12: 73. 1881. TYPE on *Facelis apiculata* Cass., from **Argentina** ?LaPlata, "Chacarita", "hieme", 1880, C. Spegazzini s. n.

On Compositae:

*Gnaphalium purpureum* Linnaeus, Minas Gerais (Thurston, 1940: 299), Paraná (Joerstad, 1956: 471), São Paulo (Jackson, 1932: 157).

*Gnaphalium* sp., Rio de Janeiro (Hennings, 1899A: 68; Dietel, 1899: 251), São Paulo (Hennings, 1902D: 295; Puttemans-342, IBI-15240).

*Puccinia gnaphaliicola* has been reported from Southern Argentina to the Southeastern United States of America and from New Zealand and Australia.

Spermogonia and aecia unknown. Uredinia mostly on abaxial leaf surface and stems; cinnamon brown; spores (21-)22-25(-27) x (19-)21-24  $\mu\text{m}$ , broadly obovoid or globose, wall (1.5-)2(-2.5)  $\mu\text{m}$  (2.5-3  $\mu\text{m}$  fide Joerstad, 1947) thick, uniformly echinulate, yellowish brown, pores 2, rarely 3, equatorial or slightly above, in slightly or not flattened sides, with slight or no caps. Telia like the uredinia but blackish brown, exposed, compact; spores (32-)35-50(-55) x (17-)19-23(-25)  $\mu\text{m}$  oblong ellipsoid or elongately obovoid, wall 1-1.5(-2)  $\mu\text{m}$  thick at sides, (4-)5-7(-10)  $\mu\text{m}$  at apex, uniformly golden or clear chestnut brown, smooth, pore apical in each cell; pedicels to about 65  $\mu\text{m}$  long, colorless (Cummins, 1978).

See *Puccinia achyroclines* for comparison.

*Puccinia gonolobi* Ravenel in Berkeley & Curtis, see **PUCGINIA CYNANCHI** Berkeley & Curtis.

**PUCGINIA GOUANIAE** Holway, Ann. Mycol. 3: 21. 1905. TYPE on *Gouania polygama* (Jacquin) Urban (reported originally as *Gouania tomentosa* Jacquin) from **Cuba**, Gebara, 15 March 1903, Holway (isotypes distributed in the exciccata by Bartholomew-N. Am. Ured. 544). (**0/Ipe,IIpe/III**).

On Rhamnaceae:

*Gouania corylifolia* Raddi, São Paulo (Jackson, 1931: 474).

*Gouania polygama* (Jacquin) Urban, Minas Gerais (Thurston, 1940: 299), Rio de Janeiro (Jackson, 1931: 474).

*Gouania* sp., Goiás (IBI-13351), Minas Gerais (IBI-13199). São Paulo (IBI-13974).

*Puccinia gouaniae* has been reported also from Ecuador, Colombia, Venezuela, Trinidad, The West Indies, Central America, Mexico, and Africa (Hansford, C. G., 1937).

Spermogonia on small gall-like thickenings 1-4 mm across on leaves. Aecia 0.2-0.7 mm across, surround the spermogonia, without paraphyses, aeciospores similar to the urediniospores, 26-32 x 21-27  $\mu\text{m}$ , obovoid to triangular-obovoid, wall 2.5-4  $\mu\text{m}$  thick, echinulate (with smooth spots?), cinnamon-brown, pores 2, equatorial. Uredinia usually scattered on abaxial side of leaves, 0.1-0.3 mm across, powdery, dark cinnamon-brown, paraphyses 50-80 x 12-18  $\mu\text{m}$ , peripheral, numerous, cylindrical or somewhat clavate, rounded above, usually 1-septate, wall uniformly 1  $\mu\text{m}$  thick or less, colorless, smooth; urediniospores 24-30 x 21-26  $\mu\text{m}$ , obovoid or triangular obovoid, wall 1-2.5  $\mu\text{m}$  thick, dark cinnamon-brown, strongly and sparsely echinulate, pores 2, equatorial, opposite, in smooth spots (at least in the Brazilian collections), reported as occasionally 3, supraequatorial in North America. Teliospores 34-45 x 24-32  $\mu\text{m}$ , broadly ellipsoid, rounded at both ends, not constricted at the septum, wall uniformly 3-5  $\mu\text{m}$  thick, moderately and rather coarsely verrucose, dark chestnut-brown, pedicel about the length of the spore, fragile, colorless but tinted next to spore (Arthur et al., 1907-1940, p. 487).

Viennot-Bourgin (1953) reviewed six species of *Puccinia* known to infect *Gouania*: *Puccinia gouaniae*, *Puccinia gouaniicola*, *Puccinia invaginata*, and *Puccinia paraensis* occur in the warmer regions of the New World; *Puccinia gouaniae-tilliaefoliae* Sydow in the Philippines, and *Puccinia gouaniae*, *Puccinia incallida* and *Puccinia paraensis* in Africa.

*Puccinia gouaniicola* Spegazzini (Lindquist, 1982) is a microcyclic species that has been reported from far Northwest Argentina on *Gouania latifolia* Reiss. Spermogonia and telia occur on galls 0.2-0.5 cm across on stems and leaves. Teliospores are 38-52 x 25-31  $\mu\text{m}$ , ellipsoid to broadly ellipsoid, rounded above and below, not constricted at the septum, wall uniformly 5-7  $\mu\text{m}$  thick, laminate, coarsely verrucose, golden

yellow, pores not visible; pedicel short, fragil, sometimes on side of spore. This species is probably a microcyclic derivative of *Puccinia gouaniae*.

*Puccinia goyazensis* P. Hennings, see **PUCCINIA LEVIS** var. **GOYAZENSIS** (P. Hennings) Ramachar & Cummins.

**PUCCINIA GRAMINELLA** Dietel & Holway in Dietel, Erythea 3: 80. 1895. TYPE on *Stipa lepida* Hitchcock (reported as *Stipa eminens*) from **The United States of America**, California: Berkeley, May 1894, *Holway & Blasdale s.n. (?/?? IICv/III)*, or *(?/Icv,IIcv/III)*. Previously reported as *(-/Icv,-/III)*.

Anamorph

*Aecidium graminellum* Spegazzini, Anal. Soc. Cient. Argentina 12: 77. 1881. TYPE on *Stipa* sp. from **Argentina**, Buenos Aires: Buenos Aires, Spring 1880, *Spegazzini s.n.* This anamorph name may serve for either aecia or uredinia.

≡ *Allodus graminella* (Spegazzini) Arthur, Result. Sci. Congr. Bot. Vienne p. 345. 1906.

On Gramineae:

**Gen. undetermined**, Santa Catarina (Hennings, 1896: 256, as *Aecidium graminellum*, Ule-504).

Although the type of *Puccinia graminella* is on *Stipa* sp. from California in The United States of America, this rust is best known from Argentina and Chile (Cummins, 1971). In addition to *Stipa*, its host genera include *Nassella* and *Piptochaetium*. Only the one collection has been reported from Brazil.

Spermogonia and aecia unknown. Uredinia with the morphology of *Aecidium*, loosely grouped or scattered, cylindrical or tongue-shaped, peridium whitish or yellowish, variously lacerate or breaking basally, urediniospores (16-)20-23(-28)x(18-)22-25(-33) μm, mostly globoid, wall (2-)3-4.5(-6) μm thick, colorless or yellowish, finely and labyrinthiformly verrucose or rugose. Telia on adaxial side of leaves, mostly associated with the uredinia, pulvinate, chestnut to chocolate, elliptical, attaining 3 mm in length, teliospores variable, tending to be dimorphic, resting type (23-)26-30(-33)x31-)37-43(-51) μm, mostly broadly ellipsoid, wall 2-3 μm thick at sides, 6-18 μm thick apically, mostly golden in both types; pedicel colorless, or pale yellowish, thick-walled, and not collapsing, attaining 200 μm in length (modified from Greene & Cummins, 1958)

Using the morphological system of life cycle terminology, *Puccinia graminella* has traditionally been reported to have only aecia and telia in its life cycle and no spermogonia or uredinia. The sori that were interpreted as aecia belong to the anamorph genus *Aecidium*. They are scattered over the infected grass leaves, and if telia are present, the telia are closely associated with the *Aecidium graminellum* sori. We know of no experimental observations that support the interpretation that these *Aecidium graminellum* sori are aecia as defined by ontogeny. We use the ontological definitions of the life cycle stages and propose that the species could be either: 1. heteroecious, the *Aecidium graminellum* sori are uredinia, and that spermogonia and aecia are unknown on some other non-grass host, or 2. autoecious, and spermogonia are unknown or not produced and aecia and uredinia are morphologically identical. Inoculation experiments are required to determine which hypothesis is correct.

**PUCCINIA GRAMINIS** Persoon, Syn. Meth. Fung. p. 288. 1801. See Cummins, 1971, for complete synonymy. *(0/Icv? IIpe/III)*.

On Gramineae:

*Avena sativa* Linnaeus, Rio Grande do Sul (IBI-657), Rio de Janeiro (IAC-4654), São Paulo (Viégas, 1945: 26; IBI-1772).

*Briza* sp., Rio Grande do Sul (PUR-F17719).

*Calamagrostis monteseensis* Nees, Rio Grande do Sul (Lindquist & Costa Neto, 1967: 56).

*Hordeum vulgare* Linnaeus, Paraná (Fontoura & Nowacki, 1967/70), Rio Grande do Sul (IAN-723).

*Lolium multiflorum* Lamarck, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 114).

*Secale cereale* Linnaeus, São Paulo (IAC-?113).

*Triticum aestivum* Linnaeus, Minas Gerais (Thurston, 1949: 299; IBI-3611), Paraná (Fontoura & Nowacki, 1967/70: 137), Rio Grande do Sul (IAN-724), São Paulo (Viégas, 1945: 26; IAC-83, IBI-17503).

*Triticum sphaerococcum* Percival, Rio Grande do Sul (IAN-707).

*Puccinia graminis* is a species complex, cosmopolitan in distribution, with many gradations of specialization for at least 50 genera of grasses, nearly all, if not all, belong to the grass subfamily Pooideae.

Spermogonia and aecia (*Aecidium berberidis* Persoon) occur on species of *Berberis*, sori cupulate or cylindrical, in groups; aeciospores 16-23 x 15-19 µm, globoid or more or less oblong, wall 1-1.5 µm thick at sides, 5-9 µm apically, verrucose. Uredinia on both sides of leaves or most commonly on sheaths and stems, about cinnamon-brown; urediniospores (22-)26-40(-45) x (13-)16-22(-24) µm, mostly oblong ellipsoid,

wall mostly 1.5-2 µm, rarely to 3 µm or even 4 µm, the apex usually thicker, yellowish to golden brown, echinulate, strongly so toward the ends and usually less so equatorially, germ pores (3)4 or 5, equatorial. Telia most commonly on sheaths and stems, early exposed, blackish brown, compact; teliospores (33-)40-60(-66;-76) x (13-)16-23(-25) µm, ellipsoid, or narrowly obovoid, wall (1-)1.5-2(-2-5) µm thick at sides, (5-)7-10(-12) µm apically, chestnut-brown, smooth; pedicels usually brownish, usually collapsing, to 80 µm long, usually about 50 µm long (Cummins, 1971).

Spermogonia and aecia occur on *Berberis* spp. in the Northern Hemisphere but there are no reliable records for infections on *Berberis* in the Southern Hemisphere.

Wild, close relatives of some of our most important cereals as well as the domesticated cereals themselves are hosts for this rust. *Puccinia graminis* is best known by its populations that are pathogens of wheat, *Triticum aestivum*. Other cereals that are attacked include oats, barley, and rye. This is the most studied of all rust species and has been used extensively as an example for teaching in classes of botany, mycology, and plant pathology. Important general concepts learned from research using *Puccinia graminis* include 1. how small genetic changes in one or a few genes in a pathogen may result in new races or populations that can attack formerly resistant hosts, and 2. for plant pathology the long distance dissemination of spores by wind currents and the subsequent development of plant disease epidemics (epiphytotic) that may develop in wheat growing regions of the world.

Cummins (1971) followed Urban (Ceska Mykol. 21:12-16. 1967) in recognizing two subspecies, *P. g. ssp. graminis* and *P. g. ssp. graminicola* Urban Ceska Mykol. 21:14. 1967, based primarily on the length of the urediniospores. The subspecies are reasonably distinct, but there is some intergradation. The species itself is remarkably distinctive, despite variability in spore sizes.

Within *P. g. ssp. graminis* Urban, again based on the sizes of urediniospores, recognized var. *graminis*, with spores (20-)26-36(-45) x (13-)16-21(-22)µ and var. *stakmanii* Guyot, Massen. & Saccas, with spores (20-)33-36(-39) x (13-)14-21(-23)µ. The rust of *Triticum*, *Aegilops*, and *Elymus*, is *ssp. graminis* var. *graminis*, that of *Avena*, *Hordeum*, *Secale*, and various other genera, is *ssp. graminis* var. *stakmanii*.

**PUCCINIA GRANCHACOENSIS** Joerstad. 1956, Ark. Bot. ser. 2, 3:464. 1956. TYPE on *Mikania* sp. from

**Bolivia**, Gran Chaco: Tatarenda, 2 April 1902, *R. E. Fries*-s. n. (??,IIpe/III).

*Puccinia granchacoensis* has been reported only from the type.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, scattered or confluent to 0.4 mm across, powdery, cinnamon-brown, ruptured epidermis inconspicuous; urediniospores 28-32 x 23-27 µm, subgloboid, clavate, to broadly ellipsoid; wall 1.5-2 µm thick, loosely echinulate, cinnamon-brown, pores 2, near the hilum. Telia scattered on the abaxial side of leaves, to 0.4 mm across, blackish, subcompact, ruptured epidermis inconspicuous; teliospores 36-47 x 26-33 µm, broadly ellipsoid to obovoid, rounded at both ends, not or slightly constricted at the septum; wall smooth, 2-3 µm thick at sides, with a pale umbo to 8 µm thick over pores, pore in upper cell apical, pore in lower cell at septum; pedicel to 45 µm long, deciduous, colorless (Joerstad, 1956).

Joerstad (1956) reported that this species is very similar to *Puccinia eupatorii* except that the urediniospore pores are near the hilum, not equatorial as in *P. eupatorii*. We believe the host may be *Eupatorium*, not *Mikania*.

See *Chrysocyclus mikaniae* for a key to help identify rusts on *Mikania* in the Neotropics.

*Puccinia gregaria* G. Kunze, see **DASYSPORA GREGARIA** (G. Kunze) P. Hennings.

**PUCCINIA GRISELINIAE** Pazschke, Hedwigia 35: 52. 1896. TYPE on *Griselinia ruscifolia* Taubert from **Brazil**, Rio de Janeiro: Serra do Itatiaia, "Argulhas Negras", March 1894, *Ule-2101*. (-/-,III).  
On Cornaceae:

*Griselinia ruscifolia* Taubert, Rio de Janeiro (Pazschke, 1896: 52), São Paulo (Jackson, 1931:

490), Santa Catarina (Dietel, 1897: 28).

*Puccinia griseliniae*, known only from the collections from Brazil listed above, is a microcyclic rust characterized by large, circular telia that are 2-3 mm across, long covered by the epidermis, then erumpent and surrounded by the ruptured epidermis, pulvinate, and blackish brown, the sori are on pale circular spots 2-4 mm across, scattered on the abaxial side of leaves. Teliospores are 53-68 x 13-16 µm, clavate or fusiform, rounded at the apex, narrowed below and constricted at the septum; the wall is not thickened at the apex, smooth, brownish yellow; the pedicel 50-60 µm long, colorless, and persistent.

Few other rusts are known on the family Cornaceae, none others in South America. *Puccinia porphyrogenita* Curtis on *Cornus* spp., another microcyclic rust from North America and Northeast Asia, is the only other species of *Puccinia* known on Cornaceae.

*Puccinia grumizamae* Rangel, see **Puccinia PSIDII** Winter.

**Puccinia GUARANITICA** Spegazzini, Anal. Soc. Cient. Argentina 26: 12. 1888. TYPE on *Gouinia latifolia* (Grisebeck) Vasey (reported originally as *Tricuspis latifolia* Grisebeck) from **Paraguay**: Guarapi, Oct 1888, *B. Balansa-3966*. (?/?<sup>5</sup> **Ipe/III**).

= *Puccinia chichenensis* Mains, Carnegie Inst. of Washington Publ. 461: 100. 1935. TYPE on *Gouinia latifolia* var. *guatemalensis* (Hackel) J.J.Ortiz (reported as *Gouinia ramosa* Swallen from **Mexico**, Yucatan: Chichenitza, 7-13 July 1932, *Swallen-2484*).

On Gramineae:

*Gouinia latifolia* (Grisebeck) Vasey, "Guarapi, Brasiliae" (Sydow, 1904: 819).

*Puccinia guaranítica* has been reported from Paraguay and Bolivia to Mexico. All collections are on species of *Gouinia*.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, cinnamon-brown, without paraphyses; urediniospores (few seen) 20-25(-27) x (15-)17-21(-23) µm, broadly ellipsoid or obovoid, wall (2-)2.5-3.5(-4) µm, pale yellow to cinnamon-brown, echinulate, pores 4 or 5 equatorial or 4-6 scattered. Telia on both sides of leaves, early exposed, blackish, compact; teliospores (26-)28-31(-33) x 20-23(-25) µm, broadly ellipsoid, (tending to be diorchidioid on *Gouinia virgata*), wall 2-3(-4) µm laterally, 4-7 µm apically, chestnut-brown, smooth; pedicels attaining a length of 100 µm, thin-walled and collapsing, golden (Hennen and Cummins, 1956; Cummins, 1971).

**Puccinia GYMNOPOGONICOLA** Hennen in Hennen & Cummins, Mycologia 48: 134. 1956.

TYPE on *Gymnopogon burchellii* (Munro ex Döll) Ekman from **Brazil**, São Paulo: Mandaqui, 25 May 1922, *E.W.D. Holway and Mary M. Holway 1888*. (?/?<sup>2</sup> **Ipe/III**).

On Gramineae:

*Gymnopogon burchellii* (Munro ex Döll) Ekman, São Paulo (Hennen & Cummins, 1956: 134; *Reliquiae Holwayanae* number 146, as *Puccinia gymnopogonis*).

*Gymnopogon spicatus* (Spring.) Kuntze, Goiás (Joerstad, 1959: 62), Mato Grosso (Hennen & Cummins, 1956: 134), Minas Gerais (Hennen & Cummins, 1956: 134), Paraná (Joerstad, 1959: 62).

*Puccinia gymnopogonicola* has been reported also from Argentina.

Spermogonia and aecia unknown. Uredinia on adaxial side of leaves, without paraphyses, yellow; urediniospores 16-22 x 13-16 µm, ovoid or nearly globoid, wall 1.5-2 µm thick, colorless or yellowish, finely echinulate, pores obscure, probably scattered. Telia on both sides of leaves, blackish, early exposed, pulvinate; teliospores (26-)28-41 x (16-)18-22 µm, ellipsoid or oblong-ellipsoid, wall 3-5 µm thick laterally, 4-6 µm apically, golden or clear chestnut-brown, bilaminar, smooth; pedicels to 80 µm long, thin-walled, collapsing, colorless or brownish (Hennen and Cummins, 1956; Cummins, 1971).

The thick, golden- to clear chestnut-brown, bilamellate wall of the teliospores is a useful trait that helps to identify this species.

*Puccinia gymnopogonis* P. Sydow & H. Sydow, see **Puccinia BOUTELOUAE** (Jennings) Holway.

**Puccinia GYMNOTHRICHIS** P. Hennings, Hedwigia 35: 242. 1896. TYPE on *Pennisetum*

*latifolium* Sprengle, (reported originally as *Gymnothrix latifolia* Schultz ) from **Argentina**, Tucumán: Sierra de Siambón, March 1872, *P. G. Lorentz s.n.* (?/?<sup>2</sup> **Ipe/III**).



= *Puccinia burmeisteri* Spegazzini, An. Mus. Nac. Buenos Aires. 6: 222. 1899. TYPE on *Pennisetum tristachyum* Sprengel from **Argentina**, Buenos Aires: La Plata., autumn 1888, Spegazzini-s.n.

On Gramineae:

*Pennisetum latifolium* Sprengel, Paraná (PUR-F4954), Rio Grande do Sul (Lindquist & Costa Neto, 1967: 57; IAN-722), São Paulo (PUR-F4951).

*Pennisetum tristachyum* (Kunth) Sprengel, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 114).

*Pennisetum* sp., São Paulo (IBI-1677).

*Puccinia gymnothrichis* has been reported also on *Pennisetum* spp. from Argentina, Bolivia, and Ecuador (Cummins, 1971).

Spermogonia and aecia unknown. Uredinia on both sides of leaves, cinnamon-brown or paler; urediniospores (24-)26-32(-34) x (20-)22-26 µm, ellipsoid, broadly ellipsoid, or obovoid, wall 1.5-2 µm thick, golden or cinnamon-brown, echinulate, germ pores 3 or 4, equatorial. Telia on both sides of leaves, early exposed, compact, blackish brown; teliospores (26-)32-45(-52) x (14-)16-21(-26) µm, mostly ellipsoid or narrowly ellipsoid with a differentiated, pale, apical umbo, wall 2 µm thick at sides, (4-)5-9(-13) µm apically, golden or chestnut-brown, smooth; pedicels to 80 µm long, colorless, thin-walled and collapsing (Ramachar and Cummins, 1965; Cummins, 1971).

A trait that especially helps to identify *Puccinia gymnothrichis* is the presence of a pale, well differentiated umbo on the apex of most teliospores.

*Puccinia hedysari-paniculati* Schweinitz, see **UROMYCES HEDYSARI-PANICULATI** (Schweinitz) Farlow.

**Puccinia HELIANTHI** Schweinitz, Schr. Naturf. Ges. Leipzig 1: 73. 1822. TYPE: Neotype designated by Parmelee, 1967. *Puccinia helianthorum* Schweinitz, Trans. Amer. Phil. Soc. II. 4: 296. 1832. On *Helianthus tuberosus* Linnaeus from **The United States of America**, Pennsylvania: Bethlehem, date not available, Schweinitz-s.n. **(0/Icv,IIpe/III)**.

= *Puccinia viguierae* Peck, Bull. Torrey Bot. Club 12: 35. 1885. TYPE on *Helianthus* sp. fide Arthur(1905), reported misrtakenly as on *Viguiera* sp., from **The United States of America**: New Mexico, April, year not reported, *M. E. Jones*.

= *Puccinia xanthifoliae* Ellis & Ever. J. Mycol. 6:120. 1891.

On Compositae:

*Helianthus annuus* Linnaeus, Minas Gerais (IBI-14458), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 142; IAN-726; IBI-13050), São Paulo (IBI-6109).

*Puccinia helianthi*, originally from North America and reported to infect at least 32 species of *Helianthus* there, is now circumglobal and occurs nearly everywhere *Helianthus annuus* is grown. It has been reported also on *Heliopsis* sp., *Iva* sp., and *Xanthium* sp.

*Puccinia helianthi* may be very destructive in cultivated fields of girassol. Up to now no spermogonia and aecia have been reported from Brazil although the species is autoecious. These stages have been reported from North America.

Spermogonia mostly on adaxial leaf surface. Aecia on abaxial surface in groups, peridium short; spores (16-)20-25(-30)x (13-)16-21(-23) µm ellipsoid or globose, wall (0.5-)1-1.5(-2.5) µm thick, colorless, minutely verrucose. Uredinia mostly on abaxial side of leaves, cinnamon-brown; urediniospores (23-)26-33(-38) x (14-)18-28(-32) µm, broadly ellipsoid or obovoid with pores in face view, oblong ellipsoid or narrowly obovoid with pores lateral, wall 1-1.5-2 µm thick, cinnamon-brown, echinulate except around pores, pores 2, equatorial, in flattened sides; telia on both sides of leaves or mostly on abaxial side, compact, blackish brown; teliospores (33-)38-60(-70) x (18-)21-30(-33) µm, oblong ellipsoid or elongately obovoid; wall (1-)1.5-2(-2.5) µm thick at sides, clear chestnut-brown or golden-brown, (5-)7-10(-12) µm at apex, and at pore of lower cell, the umbos pale, smooth, pore of each cell apical; pedicel to 170 µm long but commonly less than 100 µm, colorless (Cummins, 1978).

**Puccinia HELICONIAE** Arthur [as “(Diet.) *comb. nov.*”], Bull. Torrey Bot. Club 45: 144. 1918.

TYPE on *Heliconia latispatha* Benth [as "*Bihai latispatha* (Benth.) Griggs"] from **Panama**, Canal Zone: Montelinio, 4 March 1913, *E. Bethel s.n.* Arthur described telia from the specimen cited here as type. (?/?,II/III).

Anamorph

*Uredo heliconiae* Dietel, Hedwigia 36: 35. 1897. TYPE on *Heliconia* sp. from **Brazil**, Rio de Janeiro: Corcovado, Dec 1891, *Ule-1823*.

On Heliconiaceae:

*Heliconia* sp., Amazonas (Hennings, 1904B: 165), Pará (IBI-16053), Paraíba (Viégas, 1945: 83, IAC-3831), Rio de Janeiro (Dietel, 1897: 35).

*Musa textilis* Nees, São Paulo (Viégas, 1945: 83; IAC-3032).

*Puccinia heliconiae* has been reported also from Ecuador, Colombia, Venezuela, Trinidad, West Indies, Central America, and Mexico.

Spermogonia and aecia unknown. Uredinia on on brown discolored spots on abaxial side of leaves, sori 0.2-0.5mm across, roundish, numerous, closely grouped or confluent, sometimes in circles, rather early naked, pulverulent, cinnamon-brown, ruptured epidermis noticeable; urediniospores 23-32x18-24  $\mu\text{m}$ , broadly ellipsoid or obovoid, wall 1.5-3  $\mu\text{m}$ , cinnamon-brown, moderately and noticeably echinulate, the pores obscure, probably 2, equatorial. Telia scattered on abaxial side of leaves, 0.3-0.5mm across, round, soon naked, ruptured epidermis evident, cinnamon-brown; teliospores 15-19x60-72  $\mu\text{m}$ , elongate-clavate, rounded above, not or slightly constricted at septum, wall 1  $\mu\text{m}$  thick at sides, thickened 9-13  $\mu\text{m}$  above, pale cinnamon-brown, smooth; pedicel short, colorless.

The teliospores that have nearly colorless, very thin, lateral walls and very thick apical walls helps to identify *P. heliconiae*.

**Puccinia HELIOCARPI** P. Sydow & H. Sydow., Mon. Ured. 1: 447. 1903. TYPE on *Heliocarpus americanus* Linnaeus from **Ecuador**, Puente de Chimbo, date not published, *Lagerheim s.n.* (-I,-/III).

On Tiliaceae:

*Heliocarpus americanus* Linnaeus, Minas Gerais (Joerstad, 1959: 90).

*Puccinia heliocarpi* has been reported also from Argentina and Venezuela.

Spermogonia, aecia and uredinia not produced. Teliospores 38-52 x 13-16  $\mu\text{m}$ , oblong to oblong clavate, often narrowed to acute at the apex, narrowed at the base, slightly or not constricted at the septum, wall 1-1.5  $\mu\text{m}$  thick, not or slightly thicker at apex, smooth, pale yellow, pedicel up to 80  $\mu\text{m}$  long.

*Puccinia hemipogonis* P. Hennings, see **Puccinia CYNANCHI** Berkeley & Curtis.

**Puccinia HENNINGSII** Dietel, Hedwigia 36: 31. 1897. TYPE on *Baccharis dracunculifolia* DeCandolle from **Brazil**, Santa Catarina: Blumenau, Aug 1888, *Ule-910*. (0/Icv,?/III) or ?(0/Icv,IIcv/III).

Anamorph

? *Caecoma negerianum* Dietel, in Dietel P. and F. Neger. 1896. Engler's bot. Jahrb. 22: 357.

TYPE on *Baccharis elaeoides* Remy, **Chile**, near Valdivia (Corral), ? date, *Neger s.n.*

On Compositae:

*Baccharis calvescens* DeCandolle, Santa Catarina (PUR-F8121).

*Baccharis dracunculifolia* DeCandolle, Minas Gerais (Jackson, 1932: 144; PUR-F8125), Santa Catarina (Dietel 1897: 31), São Paulo (Jackson, 1932: 144; Lindquist, 1958: 20).

*Baccharis genistelloides* (Lamarck) Persoon, Minas Gerais (Thurston, 1940: 299), Rio Grande do Sul (Lindquist & Costa Neto, 1967: 64).

*Baccharis* sp., Rio de Janeiro (Jackson, 1932: 144), São Paulo (Jackson, 1932: 144).

*Heterothalamus brunioides* Lessing, Minas Gerais (Thurston, 1940: 299).

*Puccinia henningsii* has been reported with certainty only from Brazil but the anamorph *Caecoma negerianum* has been reported from Argentina and Chile.

Spermogonia globoid with emerging periphyses, in groups on the adaxial side of leaves. Aecia, *Caecoma negerianum*, on abaxial side of leaves or more frequently on swollen, fusiform areas of branchlets, covered by the ruptured epidermis, yellowish, powdery; aeciospores 28-56x16-22  $\mu\text{m}$ , fusiform, ellipsoid, ovoid, or irregularly polygonal; wall 1.5-2  $\mu\text{m}$  thick, verrucose in irregular rows or at times reticulate.

Uredinia, if present, like the aecia but without spermogonia. Telia on abaxial side of leaves, small, somewhat elevated, cinnamon-brown, turning gray by germination; teliospores 47-65x22-25  $\mu\text{m}$ , ellipsoid to oblong-ellipsoid, rounded above, narrowed or rounded below, at times slightly curved, constricted at the septum, wall 2-2.5  $\mu\text{m}$  thick at sides, 3-3.5  $\mu\text{m}$  thick above, smooth; pedicel to one and a half times length of spore, colorless (Lindquist, 1982).

Lindquist (1982) did not record uredinia in the life cycle. Probably uredinia are present and have the morphology of the *Caecoma*. Anamorph sori are frequently on stems in slightly swollen, fusiform areas up to 7 cm long. The main traits are telia early exposed, teliospores mostly more than 50  $\mu\text{m}$  but less than 65  $\mu\text{m}$  long, walls 2-2.5  $\mu\text{m}$  thick laterally, 3-3.5  $\mu\text{m}$  thick at the apex, smooth, yellowish or almost colorless, anamorph spores catenulate, 28-56 x 16-22  $\mu\text{m}$ , fusoid, ellipsoid, ovoid or irregularly polygonal, wall 1.5-2  $\mu\text{m}$  thick, verrucose with verrucae in striae or forming a reticulum-like pattern.

Although Arthur (1922) included *Caecoma negerianum* as an anamorph of *Puccinia evadens*, Dietel (1914), Jackson (1932), and Lindquist (1958, 1982) reported that *Caecoma negerianum* is an anamorph of *Puccinia henningsii*. But Oehrens (1970), working with specimens from the type locality in Chile, determined that *Caecoma negerianum* Dietel is part of the life cycle of *Puccinia valdiviana* Oehrens (1970), which has been reported only from Chile. [in Dietel & Neger, Bot. Jahrb. Syst. 22: 357. 1896. TYPE on *Baccharis elaeoides* Remy from **Chile**, Valdivia: near Corral, date not reported, *Neger s.n.*]

Fifteen species of *Puccinia* have been reported on *Baccharis* in Brazil. At least 53 species of *Puccinia* have been reported to parasitize species of *Baccharis* in the Americas (Lindquist, 1957). Thus, the New World genus *Baccharis*, which itself has about 380 known species, harbors more *Puccinia* species than any other host genus in the Americas.

**Puccinia heteropteridis** Thuemen, Mycotheca Univ. no. 839. 1877. TYPE on *Heteropteris angustifolia* Grisebach from **Argentina**, Concepcion del Uruguay, April 1876, *Lorentz s.n.*  
(0/Ipe, IIpe/III).

Anamorph

*Uredo uleana* Dietel, Hedwigia 36: 36. 1897. TYPE on *Heteropteris* sp. (reported as undetermined Malpighiaceae) from **Brazil**, Minas Gerais: Caraca, March 1892, *Ule-1833*.  
Telia are present on the type but they were not described.

On Malpighiaceae:

*Heteropteris angustifolia* Grisebach, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 131).

*Heteropteris coriacea* Jussieu, Minas Gerais (Thurston, 1940: 306).

*Heteropteris* sp., São Paulo (Hennings, 1908: 2; Spegazzini 1908: 8; Jackson, 1913: 361; IBI-17198).

**Gen. undetermined**, Minas Gerais (Dietel, 1897: 36), São Paulo (Viégas, 1945: 91; IAC-2633).

*Puccinia heteropteridis* has been reported also from Argentina and Uruguay.

Spermogonia on both sides of leaves in groups of 10-20 on spots about 1 mm across, subepidermal in origin, globoid, honey-yellow when fresh. Aecia on both sides of leaves surrounding the spermogonia, irregular to oval in outline but becoming confluent and surrounding the spermogonia, cinnamon-brown, aeciospores like the urediniospores. Uredinia on both sides of leaves, scattered or in circinnate groups, irregularly oval to circular in outline, 0.3-0.5 mm across, blister-like at first and covered by the raised epidermis that splits irregularly, powdery, cinnamon-brown; urediniospores 30-37(-40) x 20-28  $\mu\text{m}$ , mostly ellipsoid or broadly ellipsoid, sometimes slightly flattened on sides, wall mostly 1.5-2(-2.5)  $\mu\text{m}$  thick, cinnamon-brown but lighter in the equatorial region, more or less evenly moderately to sparsely echinulate with echinulae 1.5-3  $\mu\text{m}$  apart, germ pores 2-3(-4), more or less equatorial, often with slightly raised cuticular caps. Telia on both sides of leaves, oval to circular in outline, 0.2-0.8 mm across, blackish-brown, ruptured epidermis usually remaining, powdery, without paraphyses; teliospores (40-)46-54 x 28-33  $\mu\text{m}$ , ellipsoid to fusiform-ellipsoid, usually narrowed into an acute to acuminate rostrate apex, rounded or narrowed below, not constricted at septum, wall ca 5  $\mu\text{m}$  thick at sides, 7-12  $\mu\text{m}$  thick at apex, chestnut brown but paler at apex, two-layered, inner layer darker than outer layer, outer layer reticulate-pitted, germ pores obscure, pedicel 35-70(-90)  $\mu\text{m}$  long, sometimes slightly thicker below, persistent or not, mostly colorless.

Traits that help identify *Puccinia heteropteridis* include: teliospores with a rostrate apex, walls thick, bilaminate with punctate-reticulate sculpture, pedicels lacking a bulbous swelling; urediniospore walls relatively thin, echinulations small dot-like, germ pores 2-3(-4), equatorial. See under *Puccinia banisteriae* for a key that aids in identification of species of *Puccinia* on Malpighiaceae.

Spermogonia and aecia, which were not reported before, occur on the exsiccati “Sydow, Uredineen, n. 2621”.

- PUCINIA HETEROSPORA** Berkeley & Curtis, Jour. Linn. Soc. Bot. 10: 356. (1868) 1869. TYPE on Malvaceae, genus undetermined, **Cuba**, *C. Wright-283. (-I-, -III).*  
 = *Uromyces malvacearum* Spegazzini, Anal. Soc. Ci. Argentina 12: 72. 1881. TYPE on *Abutilon mendoncae* E. G. Baker from **Argentina**, Sierra Chica, January 1877, *G. Hieronymous s.n.*  
 = *Uromyces malvicola* Spegazzini, Anal. Soc. Ci. Argentina 17: 94. 1884. TYPE on *Abutilon* sp. from **Argentina**, Guarapi, July 1883, *Spegazzini 3885.*  
 = *Uromyces pavoniae* Arthur, Bull. Torrey Bot. Club 31: 1. 1904. TYPE on *Pavonia racemosa* Linnaeus, **Puerto Rico**, between Mayaguez and Joyua, 1901, *L. M. Underwood 193.*  
 = *Micropuccinia heterospora* (Berkeley & Curtis) Arthur & H. S. Jackson, Bull. Torrey Bot. Club 48: 41. 1921.  
 = *Puccinia mikania-micranthae* Viégas, Bragantia 5: 37: 1945. TYPE on Malvaceae, genus undetermined (originally identified mistakenly as *Mikania* sp., Compositae) from **Brazil**, Paraíba, Guarabira, December 1939, *J. Deslandes 586.*

On Malvaceae:

- Abutilon molle* Sweet, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 131).  
*Abutilon pauciflorum* Saint-Hilaire, Bahia (IAC-7888), Rio de Janeiro (Joerstad, 1959: 78).  
*Abutilon pedunculare* Humboldt, Bonpland & Kunth, Bahia (PUR-F6527).  
*Abutilon permolle* Sweet, Espírito Santo (IBI-4658).  
*Abutilon tiubae* Schumann, Paraíba (Viégas, 1945: 28; IAC-3243).  
*Abutilon umbelliflorum* Saint-Hilaire, Santa Catarina (Joerstad, 1959: 78).  
*Abutilon* sp., Alagoas (IAC-3654), Ceará (Viégas, 1945: 28; IAC-3659, -3841), Paraíba (Viégas, 1945: 28), Rio de Janeiro (Hennings, 1904A: 79; IAC-4672, São Paulo (Hennings, 1902C: 105; Viégas, 1945: 28; IAC-2560).  
*Gaya guerkeana* K. Schumann, São Paulo (Joerstad, 1959: 78).  
*Gaya pilosa* K. Schumann, São Paulo (Joerstad, 1959: 78).  
*Hibiscus tiliaceus* Linnaeus, Minas Gerais (Thurston, 1940: 299).  
*Pseudabutilon* sp., Maranhão (IBI-5474), Pará (IBI-6884).  
*Sida cordifolia* Linnaeus, Bahia (IBI-3006), Rio de Janeiro (Viégas, 1945: 28; IAC-3000, -4084), São Paulo (Jackson, 1931: 479; Viégas, 1945: 28; IAC-130).  
*Sida glutinosa* Cavanilles, Rio de Janeiro (Joerstad, 1959: 78).  
*Sida paniculata* Linnaeus, Rio de Janeiro (Jackson, 1931: 479).  
*Sida spinosa* Linnaeus, Minas Gerais (Thurston, 1949: 299), Paraíba (Viégas, 1945: 28; IAC-3439), Rio Grande do Sul (PUR-F19130), Santa Catarina (Joerstad, 1959: 78).  
*Sida tomentosa* Miquel (?*S. cordifolia* Linnaeus), Minas Gerais (IBI-3653), Rio de Janeiro (Jackson, 1931: 479).  
*Sida urens* Linnaeus, Minas Gerais (Thurston, 1940: 299), Paraíba (Viégas, 1945: 28; IAC-3728), São Paulo (Jackson, 1931: 479; IAC-113).  
*Sida* sp., Goiás (Hennings, 1895A: 93), Minas Gerais (IAC-5381), Paraíba (Viégas, 1945: 28; IAC-3641, -3664). Pernambuco (Batista & Bezerra, 1960: 27), Rio de Janeiro (Hennings, 1896: 233; Dietel, 1897: 28; Dietel, 1899: 250), São Paulo (PUR-F19131).  
*Wissadula contracta* (Link) R.E. Fries, Rio de Janeiro (Joerstad, 1959: 78).  
*Wissadula hernandioides* (L'Heritier) Garcke, Bahia (PUR-F6550), Minas Gerais (Jackson, 1931: 479), São Paulo (Viégas, 1945: 28; IAC-598).  
*Wissauduula hirsuta* Presl, Paraíba (Viégas, 1945: 28; IAC-2666).  
*Wissadula periplacifolia* (Linnaeus) Presl, Mato Grosso (Joerstad, 1959: 78), Paraíba (Viégas, 1945: 28; IAC-3640).  
*Wissadula spicata* Presl, Minas Gerais (Thurston, 1940: 299).  
*Wissadula* sp., Amapá (Sotão 910225); Paraíba (IAC-3647), São Paulo (Viégas, 1945: 28; IAC-2759), Sergipe (Viégas, 1945: 28; IAC-3639), Serra do Mel, Rio Branco (Sydow, 1916: 67).  
**Malvaceae gen. undetermined**, Alagoas (IAC-3644), Paraíba (IAC-3848).  
*Triumfetta* sp. (Tiliaceae), São Paulo (IAC-7411).

*Puccinia heterospora* has been collected relatively frequently and is widespread in the warmer areas of the Western Hemisphere. It has also been reported from Africa, Australia, and Asia. See *Puccinia*

*arechavaletae* for notes about similarity to *Puccinia heterospora* and *P. lantanae*. See *Puccinia schedonnardi* for possible correlation with that heteroecious species.

*Puccinia heterospora* is similar to several other microcyclic species of *Puccinia* on various genera of Malvaceae. The following comparison key, modified from Lindquist (1982), may help identify these species.

**Key to help identify microcyclic species of *Puccinia* on Malvaceae**

1. Spermogonia absent, only teliospores in the life cycle
  2. Teliospores mostly one-celled
    3. Spores oblong to fusiform, wall pale to cinnamon. *Puccinia platyspora*
    3. Spores narrowly ellipsoid, ellipsoid to broadly ellipsoid, wall pale chestnut-brown or darker. *Puccinia heterospora*
  2. Teliospores mostly two-celled.
    4. Spores 30-40 x 18-26  $\mu\text{m}$ , ellipsoid to narrowly ellipsoid *Puccinia lobata*.
    4. Spores 41-70 x 14-25  $\mu\text{m}$ , fusiform to oblong-fusiform *Puccinia malvacearum*.
    4. Spores 37-52 x 17-22  $\mu\text{m}$  ovoid to ellipsoid. *Puccinia anodae*
1. Spermogonia present, teliospores fusiform or linear with many irregular shapes because of pressures within the sorus. *Puccinia modiolae*.

Arthur et al. (1922) reported the following key to help identify microcyclic species of *Puccinia* on Malvaceae in North America.

1. Teliospores large, 38-75  $\mu\text{m}$  long
  2. Telia usually light-brown, scattered *Puccinia malvacearum*.
  2. Telia usually dark-brown, in tight groups
    3. Teliospores up to 75  $\mu\text{m}$  long, wall moderately thick, 1.5-4  $\mu\text{m}$  *Puccinia sherardiana*.
    3. Teliospores up to 48  $\mu\text{m}$  long, wall very thick, 3-5  $\mu\text{m}$  *Puccinia sidalceae*.
1. Teliospores small, 18-45  $\mu\text{m}$  long
  4. Telia usually dark-brown
    5. One-celled teliospores predominating *Puccinia heterospora*.
    5. One-celled teliospores rare or absent *Puccinia lobata*.
  4. Telia usually light-brown to nearly colorless
    6. Teliospore-wall thick, 2-3  $\mu\text{m}$ , much thicker above *Puccinia anodae*.
    6. Teliospore-wall thin, 1-2  $\mu\text{m}$ , scarcely thicker above *Puccinia exilis*.

The above keys include three species not yet recorded from Brazil: *Puccinia anodae*, widespread in the Americas, *Puccinia sidalceae* from the western United States of America, and *Puccinia platyspora* from Argentina and Bolivia.

**Puccinia hieracei** (Roehling) Martius, var. **HIERACII** Prodr. Fl. Mosq. Ed. 2, p. 227. 1817. (0/Ipe, Ipe/III).

≡ *Puccinia flosculosorum* var. *hieracei* Roehling, Deutsch Fl. Ed. 2. III 3: 131. 1813. TYPE on *Hieracium* sp. from Germany (Cummins, 1978).

= *Puccinia taraxici* Plowright, Mon. Ured. 1889: 186.

On Compositae:

*Cichorium endiva* Linnaeus, São Paulo (IBI-18567).

*Taraxacum officinale* Weber, Rio Grande do Sul (Lindquist & Costa Neto, 1967: 64).

*Taraxacum* sp., Brazil (Sydow, Mon. Ured. 1: 164. 1904).

*Puccinia hieracei* is a species complex, probably with specialized populations on at least 20 genera of Compositae, mostly in the tribe Cichorieae. The complex is circumglobal in distribution, but occurs mostly in the Northern Hemisphere. Some populations have been described as separate species that has resulted in many synonyms (see Cummins, 1978). Heavy infections may cause leaf death and discoloration of almeirão, a plant that is used in salads and cooking in Brazil.

Aeciospores and urediniospores are morphologically alike, sori on both sides of leaves, scattered; spores (21-)24-30(-35) x (17-)19-25(-29)  $\mu\text{m}$ , broadly ellipsoid or obovoid with pores in face view, wall 1.5-2  $\mu\text{m}$ , thick, cinnamon-brown, echinulate except below each pore, pores 2 (3), from supra equatorial to almost near the apex in flattened sides, with slight or no caps. Telia on both sides of leaves, exposed, blackish-brown, pulverulent, teliospores (26-)30-40(-45) x (17-)20-26(-29)  $\mu\text{m}$ , ellipsoid or oblong ellipsoid, wall uniformly (1-)1.5-2(-3)  $\mu\text{m}$ , chestnut brown, verrucose with verrucae spaced about 2-2.5  $\mu\text{m}$ , pore of upper

cell apical or depressed, pore of lower cell usually depressed 1/2 or more, with slight or no caps, pedicel always broken near the hilum, colorless (Cummins, 1971).

*Puccinia holcina* Erikson, see **Puccinia HORDEI** Otth.

**Puccinia HORDEI** Otth, Mitt. Naturf. Ges. Bern 1870: 114. 1871. (**0/I?** **Ipe/III**). See Cummins (1971) for citations of 28 synonyms.  
 = *Puccinia brachypus* Spegazzini var. *loluphila* Spegazzini, Revista Argentina Bot. 1: 109. 1925.  
 = *Puccinia holcina* Erikson, Ann. Sci. Nat. 8 ser. 9: 274. 1899. NEOTYPE on *Holcus lanatus* Linnaeus from "Kohlhausenbrueck p. Berolinum" (Sydow, Uredineen No. 1876), designated by Greene & Cummins, 1967).

Anamorph

*Aecidium ornithogaleum* Bubak on *Allium* sp., *Ornithogalum* sp., and *Sedum* sp. in the Mediterranean region.

On Gramineae:

*Hordeum vulgare* L., Paraná (IBI-15467), Rio Grande do Sul (Lindquist, 1982: 243).

*Vulpia bromoides* (Linnaeus) Dunal, Rio Grande do Sul (PUR-F17718).

*Puccinia hordei*, a species complex more or less like *Puccinia recondita*, is circumglobal especially in littoral climates. At least 20 genera of grasses are hosts, but the only records for Brazil are listed above (Cummins, 1971). Greene and Cummins (1967) regarded *Puccinia holcina* as a separate species but Cummins (1971) included it as a synonym of *Puccinia hordei*.

Spermogonia and aecia, *Aecidium ornithogalum* Bub., occur on *Allium*, *Ornithogalum* and *Sedum* in the Mediterranean region, cupulate, in groups; aeciospores (18-)20-26(-29) x (15-)18-21(-22) µm, wall 1.5(-2) µm thick, colorless, finely verrucose. Uredinia mostly on adaxial side of leaves, yellow or brownish yellow; urediniospores (18-)21-30(-32) x (15-)18-25(-28) µm, ellipsoid or obovoid, wall (1-)1.5-2(-2.5) µm thick, yellowish to very pale brownish, echinulate, pores 7-9, obscure, scattered. Telia on both sides of leaves or mostly abaxial, covered by the epidermis, blackish, loculate with abundant brown paraphyses; teliospores (36-)45-63(-74) x (15-)19-25(-32) µm, mostly elongate obovoid or oblong-clavate, often angular, wall 1-1.5(-2) µm thick in lower cell, side wall of upper cell (1-)1.5-2.5(-3.5) µm thick, usually gradually thickened to (3-)4-7(-10) µm thick at apex, deep golden brown or clear chestnut-brown, often paler basally, commonly with surface ridges, otherwise smooth, 1-celled spores common, 3-celled spores occasional; pedicels 20 µm or less long, yellowish (Cummins, 1971).

**Puccinia HORIANA** P. Hennings, Hedwigia Beiblatt 40: (25). 1901. TYPE on *Chrysanthemum morifolium* Ramat. from **Japan**, Tokyo: Nishigahara, Kita-ku, 28 July 1895, *S. Hori*(-I,-/III).

On Compositae:

*Chrysanthemum* sp., Minas Gerais (IBI-14586), Rio Grande do Sul (IBI-17451), São Paulo (IBI-12217).

*Puccinia horiana*, known as the white rust of *Chrysanthemum*, recently introduced into Brazil probably from Argentina, is now widespread in Brazil. The rust is probably native of Japan, has become distributed circumblobally by international trade, and is an important disease of the cut flower industry. Infected plants cannot legally be sold in the international market.

Spermogonia, aecia, and uredinia not produced. Telia whitish, very compact, anastomose together with an irregular pulvinate appearance; teliospore walls thin, colorless; spores germinate without dormancy. There seems to be no yellow-orange carotenoid pigments in the protoplasm.

*Puccinia huallagensis* P. Hennings see **Puccinia CLAVIFORMIS** Lagerheim.

**Puccinia HUBERI** P. Hennings, Hedwigia Beiblatt 39: (78). 1900. TYPE on *Panicum trichoides* Swartz (mistakenly reported at first as *Panicum ovalifolium*) from **Brazil**, Pará: Belém, botanical garden, 1896, *Huber*-3. (?/?**?** **Ipe/III**).

On Gramineae:

*Panicum trichoides* Swartz, Amapá (IBI-15560), Pará (Hennings, 1900: 76; Cummins, 1942: 692).

*Puccinia huberi* has been reported also from Venezuela, Costa Rica, Honduras, Jamaica, and Puerto Rico. Eboh (1978) reported *Puccinia huberi* from Nigeria on *Panicum* sp.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, pale cinnamon-brown; urediniospores (20-)24-27 x (17-)20-24  $\mu\text{m}$ , mostly obovoid or broadly ellipsoid, wall 1.5  $\mu\text{m}$  thick, pale cinnamon-brown or golden, echinulate, germ pores 3 or 4, equatorial. Telia on both sides of leaves, exposed, blackish brown, compact; teliospores (27-)31-39 x (17-)20-26  $\mu\text{m}$ , mostly ellipsoid or ellipsoid-clavate, wall 2  $\mu\text{m}$  thick at sides, 3-5  $\mu\text{m}$  apically, chestnut-brown, smooth, pedicels to 15  $\mu\text{m}$  long, golden, thin-walled but mostly not collapsing, frequently inserted somewhat laterally; 1-celled spores numerous (Ramachar and Cummins, 1965; Cummins, 1971).

Cummins (1971) stated that the sori of *Puccinia huberi* are always located in brown necrotic spots.

**Puccinia hydrocotyles** Cooke [as "*Puccinia hydrocotyles* (Mont.)"], Grevillea 9: 14. 1880.

TYPE on *Hydrocotyle* sp. from **South Africa**, Natal: Inanda, date not reported, *J. M. Wood-450*. Cook described telia for the first time so the name is ascribed to Cooke alone, not as a transfer of *Uredo hydrocotyles* Montagne. (?/?**IIpe/III**) or (?0/?**Icv,IIpe/III**).

Anamorph

*Caecoma hydrocotyles* Link, in Willdenow, Sp. Pl. ed. 4, 6: 22. 1825. TYPE (information not available)

= *Uredo hydrocotyles* Bertero ex Montagne, Anal. Sci. Nat. II, 3: 356. 1835. TYPE (information not available).

= *Uredo bonariensis* Spegazzini, Anal. Soc. Cient. Argentina 9: 171. 1880. TYPE on *Hydrocotyle bonariensis* from **Argentina**, Buenos Aires: Buenos Aires, spring 1880, *Spegazzini-s.n.*

On Umbelliferae:

*Hydrocotyle barbarosa* Chamisso & Schlechtendahl, São Paulo (Viégas, 1945: 30; IAC-2846).

*Hydrocotyle bonariensis* Lamarck, Rio de Janeiro (Jackson, 1931: 486; PUR-6897).

*Hydrocotyle leucocephala* Chamisso & Schlechtendahl, Rio de Janeiro (PUR-F6905), Santa Catarina (Pazschke, 1892: 96).

*Hydrocotyle quinqueloba* Ruiz & Pavon, Rio de Janeiro (PUR-F6909), São Paulo (Viégas, 1945: 30; IAC-2847).

*Hydrocotyle umbellata* Linnaeus, Bahia (IBI-13696), Rio de Janeiro (Viégas, 1945: 30; IAC-4083), Santa Catarina (Pazschke, 1892: 96), São Paulo (Viégas, 1945: 30; IAC-1587).

*Hydrocotyle* sp., Mato Grosso (IBI-16774); Paraná (IBI-12149), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 133, IBI-13983), Rio de Janeiro (Dietel, 1899: 250; Sydow, 1907: 354; Jackson, 1931: 486), Santa Catarina (IBI-13983); São Paulo (Saccardo & Berlese, 1885: 156; Hennings, 1902C: 106; Sydow, 1907: 354; Jackson, 1931: 486; IAC-2527; IBI-12095; *Puttemans-264*).

*Puccinia hydrocotyles* occurs circumglobally mostly in warmer regions and has been reported on more than 20 species of *Hydrocotyle*.

Spermogonia and aecia known with certainty only from New Zealand. Uredinia on both sides of leaves but mostly on the abaxial side, scattered, cinnamon-brown, urediniospores 24-32x19-28  $\mu\text{m}$ , globoid, wall 1.5-2.5  $\mu\text{m}$  thick, echinulate, spines 2-6  $\mu\text{m}$  apart, the pores 2, equatorial, conspicuous; telia on both sides of leaves or only on the abaxial side, dark chestnut-brown, teliospores 30-42x19-26  $\mu\text{m}$ , ellipsoid, rounded at both ends, slightly constricted at the septum, wall 2-2.5  $\mu\text{m}$  thick, a little thicker above, smooth, cinnamon-brown, smooth (with a few coarse warts in New Zealand collections), pore apical or slightly depressed in the upper cell, variable in lower cell, near septum to much depressed, each pore with a small colorless papilla, pedicel short, colorless, fragile (Arthur, 1934; Joerstad, 19xx).

Most collections of *Puccinia hydrocotyles* contain only uredinia. The spermogonial and aecial stages have been reported only rarely, with certainty only from New Zealand, and reports of these stages in the Western Hemisphere require confirmation.

*Puccinia hymenochaetoides* Schroeter, see **PROSPODIUM ELEGANS** (Schroeter) Cummins.

? *Puccinia hyptidis* (Curtis) Tracy & Earle, see **Puccinia gibertii** and also **Puccinia neohyptidis** Laundon.

**Puccinia hyptidis-mutabilis** Mayor, Mem. Soc. Neuchatel. Sci. Nat. 5: 496. 1913. TYPE on

*Hyptis mutabilis* (Richards) Briq. from **Colombia**, Dept. Magdalena: El Banco, 27 July 1910, *Mayor-121*. (0/I,IIpe/Xps/III).

≡ *Dicaeoma hyptidis-mutabilis* (Mayor) Arthur, N. Am. Flora 7: 410. 1921.

≡ *Eriosporangium hyptidis-mutabilis* (Mayor) H. Sydow, Ann. Mycol. 20: 121. 1922.

= *Puccinia amphiospora* Cummins, Bull. Torrey Bot. Club 67: 67. 1940. [as "(Jacks. et Holw.) *comb. nov.*"]. TYPE on *Hyptis spicata* from Bolivia, Cochabamba, 25 Feb 1920, E. W. D. Holway and Mary M. Holway-324. Cummins found and described telia from the Holway type of *Uredo amphiospora*.

#### Anamorph

*Uromyces dubiosus* P. Hennings, Hedwigia 34: 91. 1895. TYPE on *Hyptis* sp., originally reported mistakenly as *Lantana* sp., from **Brazil**, Goiás: Corumbá, Aug 1892, *Ule-1900*. The stage described by Hennings is that of an anamorph. This name must be transferred to an anamorph genus.

= *Uredo amphiospora* H. S. Jackson & Holway in Jackson, Mycologia 24: 72. 1932.

TYPE on *Hyptis spicata* Poir. from **Bolivia**, Cochabamba, 25 Feb 1922, E.W.D. Holway and Mary M. Holway-324.

#### On Labiatae:

*Hyptis dubia* Pohl, São Paulo (Jackson, 1932: 70).

*Hyptis lutescens* Pohl, Mato Grosso (Joerstad, 1959: 71).

*Hyptis mutabilis*, São Paulo (IBI-14591).

*Hyptis pectinata* Poiteau, Rio de Janeiro (Jackson, 1932: 70).

*Hyptis suaveolens* (Linnaeus) Poiteau, São Paulo (Jackson, 1932).

*Hyptis umbrosa* Selzmann, Rio de Janeiro (Jackson, 1932: 70).

*Hyptis* sp., Goiás (Hennings, 1895: 91), Minas Gerais (Jackson, 1932: 70), Rio de Janeiro (Jackson, 1932: 70); São Paulo (PUR-F19060).

*Puccinia hyptidis-mutabilis* has been reported from Florida in the United States of America, Central America, South America, and Africa (Baxter, 1961).

The species is characterized by its urediniospores that are oblate-spheroid or globoid, 23-26  $\mu\text{m}$  wide x 17-23  $\mu\text{m}$  high, with walls that are cinnamon-brown or yellowish, 1-2  $\mu\text{m}$  thick, echinulate, and with 2 equatorial pores. Its amphispores are broadly ellipsoid or globoid, 20-25 x 25-29  $\mu\text{m}$ , with walls that are chestnut- or cinnamon-brown, 2-3(-4)  $\mu\text{m}$  thick, obscurely echinulate or frequently nearly smooth, with 2 equatorial pores. Teliospores are cylindrical, clavate or narrowly ellipsoid, 16-20 x 27-57  $\mu\text{m}$  with walls that are smooth, ca 1  $\mu\text{m}$  thick, yellowish, and with the pore of the upper cell apical and that of the lower cell at the septum, each capped with a colorless umbo 2-5  $\mu\text{m}$  thick. The pedicel is thin-walled, colorless, and up to 25  $\mu\text{m}$  long.

The amphispores are similar to teliospores of *Uromyces*.

**Puccinia ICHNANTHI** Mains, Bull. Torrey Bot. Club 66: 619. 1939. TYPE on *Ichnanthus hirtus* (Raddi) Chase [reported as *Ichnanthus candicans* (Nees) Doell] from **Brazil**, Rio de Janeiro: Tijuca, 28 April 1930, *Chase-12143A*. (?/?= IIpe/III).

#### On Gramineae (Paniceae):

*Ichnanthus axillaris* (Nees) Hitchcock & Chase, São Paulo (PUR-F19052).

*Ichnanthus hirtus* (Raddi) Chase [reported as *Ichnanthus candicans* (Nees) Doell], Rio de Janeiro (Mains, 1939: 619).

*Ichnanthus tenuis* (Presl) Hitchcock & Chase, São Paulo (IBI-15569).

*Puccinia ichnanthi* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia mostly on the abaxial side of leaves, cinnamon-brown, without paraphyses; urediniospores (29-)32-38(-42) x 23-27(-29)  $\mu\text{m}$ , broadly obovoid or ellipsoid. wall 1.5-2  $\mu\text{m}$  thick, golden or cinnamon-brown, echinulate, germ pores 2 or 3, equatorial. Telia on abaxial side of leaves, yellowish, early exposed, teliospores 28-34 x 12-14  $\mu\text{m}$ , nearly ellipsoid, or fusoid, wall uniformly 0.5-1  $\mu\text{m}$  thick, colorless, smooth, pedicels to 30  $\mu\text{m}$  long, thin-walled, and collapsing but usually broken short, the spores germinating without dormancy and collapse (Cummins, 1971).

Telial sori are colorless and difficult to find. Teliospores are very delicate, have colorless, thin walls, and germinate without dormancy, traits very unusual for *Puccinia* on Gramineae.

Cummins (1971) reported that *Puccinia panici-montani* Fujikuro, which has been reported only in Asia from New Guinea to the Ryukyu Islands in Japan and is on *Panicum* and *Setaria* species, is very similar



but differs by having urediniospores that are slightly wider (31-)34-37(-42) x (22-)26-29(-31)  $\mu\text{m}$  and obovoid to obovoid-triangular.

**Puccinia illatabilis** Jackson & Holway in Jackson, Mycologia 24: 112-113. 1932. TYPE on *Vernonia scorpioides* (Lamarck) Persoon [= *Cyrtocymura scorpioides* (Lamarck) H. Robinson] from **Bolivia**, Nor Yungas: Coroico, 11 June 1920, *Holway-729*.

Compositae

*Vernonia* sp. Sao Paulo (? 75-64).

*Puccinia illatabilis* has been reported with certainty only from the type. The identification of the specimen cited here is preliminary.

Spermogonia on discolored, slightly hypertrophied spots the adaxial side of leaves, few, in groups, periphyses few. Aecia on adaxial side of leaves, large, cylindrical to saccate; peridial cells in face view 36-54 x 20-28  $\mu\text{m}$ , wall closely minutely verrucose; aeciospores 24-48 x 20-23  $\mu\text{m}$ , irregularly ellipsoid to globoid, wall 1.5-2  $\mu\text{m}$  thick, to 3-5  $\mu\text{m}$  thick at apex, pale golden brown, closely verrucose-tuberculate with large prominent tubercles. Uredinia on abaxial side of leaves, scattered, 0.2-0.4 mm. diam. powdery, tardily naked, cinnamon-brown, ruptured epidermis evident, without paraphyses; urediniospores 26-30 x 21-24  $\mu\text{m}$ , ellipsoid to obovoid, wall 1.5-2  $\mu\text{m}$  thick, closely and minutely echinulate, dark cinnamon- to pale chestnut-brown, pores 3, about equatorial. Telia on the abaxial side of leaves, scattered, 0.2-0.3 mm. diam., soon naked, pulvinate, chestnut-brown, ruptured epidermis inconspicuous; teliospores 54-90 x 15-24  $\mu\text{m}$ , cylindrical to clavate, rounded to obtuse above, rounded to narrowed below, mostly constricted at the septum, wall irregularly 1-1.5  $\mu\text{m}$  thick at sides, 6-12  $\mu\text{m}$  thick at apex, smooth, cinnamon-to chestnut-brown, pedicel a little shorter than the spore, colorless (Jackson, 1932).

Distinguished from other *Vernonia* rusts by the epiphyllous aecia, the long narrow teliospores strongly thickened above and the entire absence of paraphyses. The teliospores are much like those of *P. veniabilis*. The pore of the upper cell is at one side of the thickened apex and that of the lower cell at the septum is not in line with the upper pore but in a plane at right angles so that the two pores are not in view at the same time (Jackson, 1932).

**Puccinia imaculata** Juel, Bih. Skvenska Vet.-Akad. Handl. 23: 20. 1897. TYPE on *Jobinia hernandifolia* Fourier, Asclepiadaceae, from Rio Grande do Sul, place and date not published, *S. Martins-s.n. (-I-, -/III)*.

*Puccinia imaculata* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia, aecia, and uredinia not produced. Telial infections locally systemic, telia cover the whole abaxial side of leaves without noticeable discoloration of the leaf, sori ca 0.33 mm in diameter, equally spaced, not confluent, punctiform, and blackish-brown; teliospores 22-29 x 14-19  $\mu\text{m}$ , ellipsoid, rounded at both ends, not or slightly constricted at the septum; wall not or only slightly thickened at the apex, smooth, pale brown; pedicel up to 50  $\mu\text{m}$  long, colorless but brownish at point of attachment, flexuous, often obliquely inserted, mesospores intermixed (Juel, 1897, Sydow, 1902).

The type specimen of *Puccinia imaculata* (1897) needs to be studied to determine if it is a synonym of *Puccinia roulineae* (1896).

**Puccinia impetrabilis** H. S. Jackson & Holway in Jackson, Mycologia 24: 113. 1932. TYPE on *Vernonia* sp. from **Brazil**, Rio de Janeiro: Petropolis, 1 Nov 1921, *Holway-1265*. (??, **Ipe/III**).

On Compositae:

*Vernonia sericea* Richard [= *Lepidaploa sericea* (Richard) H. Robinson], Rio de Janeiro (Jackson, 1932: 113).

*Vernonia* sp., Rio de Janeiro (Jackson, 1932: 113), São Paulo (PUR-F18948).

*Puccinia impetrabilis* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on both sides of leaves or more often abaxial; widely scattered; erumpent, ruptured epidermis conspicuous; 0.5-0.8 mm in diameter; round; becoming naked, pulverulent; cinnamon brown; urediniospores 28-32  $\mu\text{m}$  x 26-28  $\mu\text{m}$ , broadly ellipsoid or globoid; wall 3-4  $\mu\text{m}$  thick; pale cinnamon or somewhat colorless; sparsely but strongly echinulate; pores obscure. Telia on abaxial side of leaves; widely scattered; few; small; round; 0.4-0.6 mm in diameter; pale chestnut-brown, ruptured epidermis not visible, pulvinate, becoming ashy-gray in color by germination; teliospores: 65-95 x

15-18  $\mu\text{m}$ , cylindrical; narrowing at apical end, truncate at base; scarcely constricted at septum; wall 1-1.5  $\mu\text{m}$  thick; not thickened at apex, cinnamon-brown; smooth; pedicel equal to spore or shorter, fragile; colorless (Jackson, 1932).

Jackson reported that *Puccinia impetrabilis* is similar to *P. erratica* but may be distinguished from it and others by the narrow, 15-18  $\mu\text{m}$  wide teliospores, and the urediniospores with walls 3-4  $\mu\text{m}$  thick, sparsely and strongly echinulate, and the absence of paraphyses.

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but three from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

**PUCCINIA IMPROCERA** H. S. Jackson & Holway in Jackson, Mycologia 24: 145. 1932. TYPE on *Baccharis anomala* DeCandolle from **Brazil**, São Paulo, Campos do Jordão, 20 April 1922, *Holway-1740*. (**0/Icr,IIpe/III**).

On Compositae:

*Baccharis anomala* DeCandolle, Paraná (Jackson, 1932: 145), Rio Grande do Sul (Lindquist & Costa Neto, 1967: 64), São Paulo (IBI-17852; Jackson, 1932: 145).

*Puccinia improcera* has been reported only from Brazil where it is relatively common on *Baccharis anamola* in the Mata Atlântica in São Paulo state where the host is a common roadside weed in moist areas.

Spermogonia on the adaxial side of leaves, 95-110  $\mu\text{m}$  high, 90-100  $\mu\text{m}$  wide, few, on yellowish to discolored spots, globoid to ellipsoid, with a fascicle of periphyses 30-45  $\mu\text{m}$  long. Aecia (*Caeoma* sp.), on the abaxial side of leaves, 0.5-0.8mm across, single or in groups of 2-4 opposite the spermogonia, deeply immersed, tardily erumpent, pulverulent; whitish, aeciospores 22-30x18-24  $\mu\text{m}$ , ellipsoid, wall prominently but moderately rugose. Uredinia usually on the adaxial side of leaves, sometimes on stems, , 0.2-0.4mm across, rounded to elongate, pale cinnamon-brown, pulverulent, ruptured epidermis noticeable, urediniospores 21-26x18-20  $\mu\text{m}$ , ellipsoid, to obovoid, wall 1-1.5  $\mu\text{m}$  thick, sparsely and finely echinulate, with smooth areas around the 2 equatorial pores. Telia on the abaxial side of leaves, 0.2-0.4mm across, scattered, dark cinnamon-brown to pale chestnut-brown, turning gray by germination, pulvinate, ruptured epidermis not visible; teliospores 30-46x15-20  $\mu\text{m}$ , ellipsoid, oblong to clavate, rounded to obtuse above, rounded to narrowed below, usually constricted at septum, wall 1-1.5  $\mu\text{m}$  thick at sides, 3-4 $\mu$  thick above, smooth; pedicel about equal to or shorter than the spore (Jackson, 1932).

Fifteen species of *Puccinia* have been reported on *Baccharis* in Brazil. At least 53 species of *Puccinia* have been reported to parasitize species of *Baccharis* in the Americas (Lindquist, 1957). Thus, the New World genus *Baccharis*, which itself has about 380 known species, harbors more *Puccinia* species than any other host genus in the Americas.

**PUCCINIA IMPROVISA** H. S. Jackson & Holway in Jackson, Mycologia 24: 114. 1932. TYPE on *Vernonia subsquarrosa* DeCandolle [= *Lepidaploa subsquarrosa* (DeCandolle) H. Robinson], from **Brazil**, Rio de Janeiro, 23 August 1921, *Holway-1064*. (**0/Icv,IIpe/III**).

On Compositae:

*Vernonia eriolepis* Gardner [= *Lepidaploa eriolepis* (Gardner) H. Robinson], Rio de Janeiro (Jackson, 1932: 114).

*Vernonia subsquarrosa* DeCandolle [= *Lepidaploa subsquarrosa* (DeCandolle) H. Robinson], Rio de Janeiro (Jackson, 1932: 114).

Spermogonia on discolored spots on adaxial side of leaves; sori 2-5, closely grouped; deep-seated; 140-150  $\mu\text{m}$  wide; punctiform and subgloboid, periphyses short. Aecia few, on the abaxial side of leaves; opposite the spermogonia; 0.2-0.4 mm in diameter; cylindrical to saccate, white to yellowish, peridial cells 45-60  $\mu\text{m}$  long; 20-26  $\mu\text{m}$  wide, irregularly polygonal, inner facing wall closely and finely but prominently verrucose; white or pale yellow; aeciospores in tightly packed vertical rows, spores 30-36  $\mu\text{m}$  long; 22-26  $\mu\text{m}$  wide, broadly ellipsoid, obtuse to subacute above; wall 2-3  $\mu\text{m}$  thick, prominently yet finely verrucose-tuberculate, colorless. Uredinia usually on abaxial side of leaves, few; widely scattered or densely grouped; epidermal rupture conspicuous; 0.5-1 mm in diameter; round; becoming naked, pulverulent; cinnamon brown; paraphyses not present; urediniospores 28-32  $\mu\text{m}$  long; 24-28  $\mu\text{m}$  wide, obovoid or broadly ellipsoid; wall 2-3  $\mu\text{m}$  thick; almost colorless or pale cinnamon, sparsely but strongly echinulate, pores obscure. Telia on abaxial side of leaves, numerous, widely scattered and in groups, 0.2-0.5 mm in diameter; chestnut-brown, turning gray with germination, epidermal rupture not visible. Teliospores 58-88 x 18-26  $\mu\text{m}$ , cylindrical,

oblong, and ellipsoid; rounded or obtuse above; rounded at pedicel; slightly constricted at septum; wall uniformly 1-1.5  $\mu\text{m}$  thick; smooth, cinnamon-brown; pedicel equal in length to spore or shorter, colorless (Jackson, 1931).

Jackson reported that *Puccinia improvisa* is similar to *P. impetrabilis* but differs in the length and width and in shape of the teliospores. The apex is usually rounded in *P. improvisa* while in *P. impetrabilis* the upper cell usually tapers gradually to the apex.

A comparison has been made with *P. membranacea* Dietel. Our species differs markedly in the size and character of the aecia. In *P. membranacea* the peridium is lacerate, not highly developed, and the wall markings are distinctly rugose.

The collection on *V. eriolepis* is placed here provisionally. The aeciospores are somewhat more strongly marked and it may prove to be better assigned elsewhere. The teliospores are narrower and more like those of *P. allaudabilis*, but the urediniospores correspond better with this species (Jackson, 1931).

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but three from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

**Puccinia INAEQUATA** H. S. Jackson & Holway in Jackson, Bot. Gaz. (Crawfordsville) 65: 309.

1918. TYPE on *Vernonia patens* Humboldt, Bonpland & Kunth [= *Vernonanthura patens* (Kunth) H. Robinson] from **Guatemala**, Esquintla, 17 Feb 1916, Holway-502. **(0/Ipe,IIpe/III)**.

= *Bullaria inaequata* (H. S. Jackson & Holway) Arthur & Mains, N. Am Fl. 7: 498. 1922.

On Compositae:

*Vernonia paludosa* Gardner [= *Vernonanthura paludosa* (Gardner) H. Robinson], São Paulo (Jackson, 1932: 115).

*Vernonia westiniana* Lessing [= *Vernonanthura westiniana* (Lessing) H. Robinson], Paraná (IBI-1681), São Paulo (Jackson, 1932: 115).

*Vernonia* sp., São Paulo (Jackson, 1932: 115; IBI-2366).

*Puccinia inaequata* has been reported also from Ecuador and Central America.

Spermogonia on the adaxial side of leaves. Aecia mostly on the adaxial side of leaves around the spermogonia, cinnamon-brown, like the uredinia. Uredinia on both sides of leaves, 0.2-0.5 mm in diameter, scattered, cinnamon-brown, powdery; urediniospores pedicelate, (21-)23-26(-28) x (17-)18-21(-23)  $\mu\text{m}$ , obovoid to broadly ellipsoid; wall 1.5-2.5(-3)  $\mu\text{m}$  thick, uniformly echinulate, cinnamon-brown, pores 2 or mostly 3, with slight caps, about equatorial. Telia on both sides of leaves, exposed, blackish brown, becoming powdery; teliospores (29-)33-38(-41) x (20-)22-25(-27)  $\mu\text{m}$ , broadly ellipsoid to oblong ellipsoid, wall 2.5-3  $\mu\text{m}$  thick at sides, 4-5  $\mu\text{m}$  at apex as a low scarcely defined umbo, rugose or pseudo reticulate, tending to be bilaminate, chestnut-brown, pore of the upper cell apical, of lower cell in lower half; pedicel to 50  $\mu\text{m}$  long, but usually broken short, colorless (Cummins, 1978).

Jackson reported that *Puccinia inaequata* is easily separated from all other species of *Puccinia* on *Vernonia* by the the small 30-38 x 22-26  $\mu\text{m}$  teliospores with walls slightly thickened at the apex and their distinct rugose sculpture. Urban reported that only the specimen PUR-7946 on *Vernonia westiniana* is *Puccinia inaequata*, the others differ in having finely punctate teliospore walls. Their identification needs clarification.

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but three from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

**Puccinia INCLITA** Arthur, Bull. Torrey Bot. Club 46: 115. 1919. TYPE on *Ichnanthus pallens* (Sw.)

Munro ex Benthham from **Puerto Rico**, El Yunque, 12 April 1916, Whetzel & Olive-397.

**(?/?= Ipe/III)**.

On Gramineae:

*Ichnanthus glaber* (Raddi) Hitchcock, São Paulo (PUR-F4974).

*Ichnanthus hirtus* (Raddi) Chase [reported as *Ichnanthus candicans* (Nees) Doell], Rio de Janeiro (PUR-F4973).

*Ichnanthus pallens* (Sw.) Munro ex Benthham [reported as *Ichnanthus axillaris* (Nees) Hitchcock & Chase], São Paulo (IBI-13002).

*Ichnanthus* sp., Rio de Janeiro (IBI-1680).

*Puccinia inclita* has been reported from Brazil, Ecuador, Central America, and the West Indies on *Ichnanthus* and *Oplismenus* species.

Spermogonia and aecia unknown. Uredinia mostly on abaxial leaf surface, yellowish, probably brightly so when fresh; urediniospores (25-)27-34(-40) x (20-)22-26(-28)  $\mu\text{m}$ , ellipsoid or broadly obovoid, wall 1-1.5  $\mu\text{m}$  thick, colorless, echinulate, germ pores 3, equatorial, obscure. Telia mostly on abaxial surface, blackish brown, exposed; teliospores 35-42(-50) x (23-)26-29  $\mu\text{m}$ , mostly broadly ellipsoid or broadly obovoid, wall 2-3(-3.5)  $\mu\text{m}$  thick at sides, 3-5(-6)  $\mu\text{m}$  apically, chestnut-brown, smooth; pedicels to 60  $\mu\text{m}$  long but usually broken short, brownish, thin-walled and collapsing;; 1-celled and incompletely septate spores are common in the type (Cummins, 1971).

*Puccinia incomposita* H. S. Jackson & Holway, see **PUCGINIA ITATIAYENSIS** Lindquist.

**PUCGINIA INCONSPICUA** Dietel, Hedwigia 36: 33. 1897. TYPE on undetermined Compositae genus (? *Aspilia*) from **Brazil**, Santa Catarina: Serra Geral, Feb (? or March) 1891, *Ule-1694*. (??,IIpe/III).

*Puccinia inconspicua* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

**PUCGINIA INDAGATA** H. S. Jackson & Holway in Jackson, Mycologia 24: 146. 1932. TYPE on *Baccharis* sp. from **Brazil**, São Paulo, Alto da Serra, 5 Feb 1922, *Holway-1537*. [**0/Ice,(IIce?),III**]. On Compositae:

*Baccharis* sp., Rio Grande do Sul (IBI 12946), Santa Catarina (IBI 12946), São Paulo (Jackson, 1932: 146; IBI 12100).

The aecia have the morphology of the anamorph genus *Caeoma*. The sori are without a peridium, and deep seated in origin. The aeciospores are produced catenulately but do not remain in columns. Unlike many species of *Caeoma*, whose spores have verrucose walls, the aeciospore walls of this species are strongly echinulate. Uredinia have not been seen with certainty. If they occur in the life cycle they are almost certain to resemble the aecia. Teliospores germinate in situ with little or no dormancy.

Fifteen species of *Puccinia* have been reported on *Baccharis* in Brazil. At least 53 species of *Puccinia* have been reported to parasitize species of *Baccharis* in the Americas (Lindquist, 1957). Thus, the New World genus *Baccharis*, which itself has about 380 known species, harbors more *Puccinia* species than any other host genus in the Americas.

**PUCGINIA INFUSCANS** Arthur & Holway in Arthur, Am. Jour. Bot. 5: 463. 1918.

TYPE on *Bothriochloa saccharoides* (Schwartz) Rydberg (mistakenly reported originally as *Imperata brasiliensis*) from **Guatemala**: Guatemala City, 3 Jan 1915, *Holway-15*. (?/?\* IIpe/III). = *Puccinia meridensis* Kern Mycologia 30:547. 1938. TYPE on *Bothriochloa alta* (Hitchcock) Henrard (reported as *Andropogon altus* Hitchcock) from **Venezuela**, Mérida: Bailadores, 8 May 1934, *Kern & Toro-1798*.

On Gramineae:

*Bothriochloa exaristata* (Nash) Henrard (reported as *Bothriochloa hassleri* Hackel), Rio Grande do Sul (Lindquist & Costa Neto, 1967: 57).

*Puccinia infuscans* has been reported also from Mexico, Guatemala, and Venezuela on species of *Bothriochloa*.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaf, cinnamon-brown or paler, urediniospores 25-29(-32) x (19-)21-24(-26)  $\mu\text{m}$ , mostly globoid or broadly ellipsoid, wall 2.5-3(-3.5)  $\mu\text{m}$ , thick, golden-, or cinnamon-brown finely and closely verrucose, germ pores 3-5, equatorial or sometimes with 1 or 2 extra-equatorial. Telia on abaxial side of leaf, exposed, pulvinate, chocolate-brown; teliospores (26-)30-40(-46) x (16-)18-21(-23)  $\mu\text{m}$ , mostly ellipsoid or oblong-ellipsoid, wall 1.5-2(-3)  $\mu\text{m}$  thick at sides, (3-)5-7(-9)  $\mu\text{m}$  apically golden or clear chestnut-brown, smooth; pedicels to 60  $\mu\text{m}$  long, thin-walled and collapsing, colorless or yellowish; 1-celled teliospores relatively common (Cummins, 1971).

*Puccinia infuscans* has larger urediniospores and more variable and paler teliospores than *Puccinia ellisiana*, but otherwise is similar. *Puccinia ellisiana* occurs from the southern United States of America northward to Canada east of the Continental Divide on species of *Andropogon*. *Puccinia infuscans*, whose

teliospores are usually not more than 20 µm wide, and *Puccinia ellisiana* are in Cummins' grass rust morphological group VII whose traits are: sori without paraphyses, and urediniospore walls verrucose with equatorial germ pores (Cummins, 1953).

**Puccinia INRECTA** H. S. Jackson & Holway in Jackson, Mycologia 23: 361. 1931. TYPE reported to be on *Banisteria campestris* Juss. but the host may be *Peixotoa* sp. from **Brazil**, São Paulo, Jardim da Aclimação, 15 Apr 1922, *Holway-1734*. (?!?,II/III).

On Malpighiaceae:

*Banisteria campestris* Jussieu (identification needs to be confirmed), São Paulo (Jackson, 1931: 361).

*Peixotoa* sp., Goiás (IBI-16680), Mato Grosso (IBI-16700), Minas Gerais (IBI-14882), São Paulo (IBI-14086-104, 81-50).

*Puccinia inrecta* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, 0.3-0.5 mm in diameter, cinnamon-brown, early naked, pulverulent, ruptured epidermis conspicuous, urediniospores 20-24 x 28-34 µm, ellipsoid or obovoid, wall 1.5-2.5 µm thick, cinnamon-brown, sparsely, prominently, and rather sharply echinulate, pores 4, commonly scattered or at times equatorial.

Telia like the uredinia but more commonly on the adaxial side of the leaves, blackish brown, teliospores 32-38 x 25-29 µm, somewhat irregularly ellipsoid, slightly constricted at the septum, wall 2.5-3 µm thick, slightly thickened to 4.5 µm over the pores, chestnut-brown, evenly and closely rugose-reticulate, the depressions often arranged in longitudinal rows, pedicel usually attached on one side of lower cell or near the septum, colorless, apex swelling considerably in water, usually deciduous below the swelling (Jackson, H. S. 1931).

See under *Puccinia banisteriae* for a key that aids in identification of species of *Puccinia* on Malpighiaceae.

**Puccinia INSITITIA** Arthur, Mycologia 7: 248. 1915. TYPE on *Hyptis lantanaefolia* Poiteau from **Brazil**, Amazonas: Manaus, 1901, *Ule-7*. (?!?,Ipe/III).

≡ *Dicaeoma insititia* (Arthur) Arthur, N. Am. Flora 7: 409. 1921.

On Labiatae:

*Hyptis lantanaefolia* Poiteau, Amazonas (Arthur, 1915: 248).

*Puccinia insititia* has been reported also from the West Indies.

Spermogonia and aecia unknown. Urediniospores with walls cinnamon-brown or yellowish, finely verrucose-echinulate, germ pores 3, equatorial. Teliospores 16-24 x 48-55 µm, narrowly ellipsoid to clavate, walls about 1 µm thick laterally, 2-3 µm at the apex, cinnamon-brown, yellowish, or occasionally colorless, the pore of the upper cell apical, pore of the lower cell at the septum (Baxter, 1961).

**Puccinia INSUETA** Winter, Hedwigia 26: 27. 1887. TYPE on *Stigmaphyllon* sp., Malpighiaceae, from **Brazil**, Santa Catarina: São Francisco, April (? or June) 1885, *Ule-66*.

(0/Ipe?,Ipe/III).

≡ *Diorchidium insuetum* Magnus, Ber. Deutsch. Bot. Ges. 9: 192. 1891.

= *Puccinia circinata* Arthur, Amer. J. Bot. 6: 471. 1918. [as "(Schwein.) *comb. nov.*", but Arthur reported that he described telia from the *Kellerman-5457* specimen, not from Schweinitz' herbarium]. TYPE on *Stigmaphyllon* sp. from **Guatemala**, Dept. Zacapa, Gualan, 28 Dec 1905, *Kellerman-5457*.

Anamorph

*Uredo circinata* Schweinitz in Berkeley & Curtis, Jour. Acad. Philadelphia 2: 282. 1835. TYPE on *Stigmaphyllon* sp., Malpighiaceae, from **Surinam**, originally reported as on "some unknown plant", *Weigelt s.n.*

= *Uredo insueta* Pennington, Annal. Soc. Cient. Argent. 53: 268. 1902. TYPE the same specimen as that cited above for *Puccinia insueta* Winter.

On Malpighiaceae:

*Stigmaphyllon acuminatum* Jussieu, Rio de Janeiro (Jackson, 1931: 362).

*Stigmaphyllon affine* Jussieu, São Paulo (Jackson, 1931: 362).

*Stigmaphyllon ?affine* Jussieu, Rio de Janeiro (PUR-F19121), Santa Catarina (PUR-F19122).  
*Stigmaphyllon jatrophifolium* Jussieu, Rio de Janeiro (Hennings, 1896: 230).  
*Stigmaphyllon lalandianum* Jussieu var. *grisebachianum* Netz, São Paulo (Joerstad, 1959: 77).  
*Stigmaphyllon littorale* Jussieu, Rio de Janeiro (Puttemans-1664).  
*Stigmaphyllon tomentosum* Jussieu, Rio de Janeiro (Jackson, 1931: 362).  
*Stigmaphyllon vitifolium* Saint-Hilaire, Rio de Janeiro (Jackson, 1931: 362; IBI-1682; IAC-4416).  
*Stigmaphyllon* sp., Amapá (87-98) Brazil (Winter, 1887: 27), Minas Gerais (Thurston, 1940: 299), Rio de Janeiro (Dietel, 1897: 29; Jackson, 1931: 362; IBI-1683), Pará (Albuquerque, 1971: 148; IAN-642), Santa Catarina (Pazschke, 1892: 96; Hennings, 1896: 230), São Paulo (Viégas, 1945: 31; IAC-4053).

*Puccinia insueta* has been reported also from Argentina, Uruguay, Bolivia (Jackson, 1931), Surinam, and from Central America and the West Indies (Joerstad, 1959).

Spermogonia and aecia rarely collected. Uredinia scattered or in groups on both sides of leaves on irregular or indefinite yellowish or pale brownish, often confluent spots, occasionally involving the whole leaf; sori up to 0.75 mm diam., erumpent, surrounded by the ruptured epidermis, powdery, brownish; urediniospores (26-)28-38(-44) x (22-)26-31(-36) µm, globoid, subgloboid, or broadly ellipsoid; wall 2-layered, swelling in liquid, 3-6.5 µm thick around sides, 4-9 µm apically, outer layer pale, strongly and sparsely echinulate, inner wall pale brownish, smooth, pores obscure, 2(-3), more or less equatorial. Telia similar to the uredinia but blackish, teliospores 35-45(-47) x (24-)26-33(-34) µm, broadly ellipsoid, rounded at both ends, slightly constricted at septum, wall 2-6.5 µm thick, slightly thickened over pores, densely reticulate, dark chestnut-brown to blackish; pedicel usually attached laterally, about equal to the spore in length, inflated 17-24 µm just below spore, hyaline (Sotão et al., 2001).

Traits that help to identify *Puccinia insueta* include teliospores reticulate, teliospore wall usually dark chestnut-brown, not smokey black as in *Puccinia picturata*, pedicel swollen greatly just below the spore, urediniospore outer wall swelling greatly, echinulations large and widely spaced.

See under *Puccinia banisteriae* for a key that aids in identification of species of *Puccinia* on Malpighiaceae.

**PUCGINIA INVAGINATA** Arthur & J.R. Johnston, Mem. Torrey Bot. Club 17: 146. 1918. TYPE on *Gouania lupuloides* (Linnaeus) Urban, Rhamnaceae, from **Cuba**, Isle of Pines, Caleta Cocodrilos, 8 March 1916, *Wilson & Leon-15275*. (**0/Ipe,IIpe/III**).

Anamorph

*Uredo gouaniae* Ellis & Kelsey, Bull. Torrey Bot. Club 24: 209. 1897. TYPE on *Gouania lupuloides* (Linnaeus) Urban, from **Saint Croix Island**, 1896, *Ricksecker s.n.*

On Rhamnaceae:

*Gouania* sp, Goais (IBI-13351), Mato Grosso do Sul (IBI-14398), Minas Gerais (IBI-15340), São Paulo (Jackson, 1931; 474; IBI-14714).

*Puccinia invaginata* has been reported also from The West Indies, Guatemala, Mexico, and The United States of America (Florida).

Spermogonia and aecia unknown. Uredinia scattered on the abaxial side of the leaves, early naked, cinnamon-brown, powdery, paraphyses peripheral, 29-45 x 9-16 µm, cylindric or clavate, often branched at the base, some slightly incurved, wall thin, colorless, smooth; urediniospores with pore in optical section 26-31 x 16-19, reniform to obovoid reniform, with pore in face or surface few 26-31 x 19-23 µm, obovoid, wall more or less evenly 1.5-2 µm thick, cinnamon-brown, moderately echinulate, pore one, equatorial in the concave or flattened side. Telia on both sides of leaves, scattered, early naked, powdery, dark chocolate- to blackish-brown, ruptured epidermis inconspicuous, teliospores, 29-37 x 26-29 µm, broadly ellipsoid or broadly obovoid, rounded at both ends, slightly or not constricted at the septum, wall uniformly 3-4 µm thick, dark chestnut-brown, moderately verrucose, pedicel 19-50 µm long, colorless, fragile.

This is one of the few species of *Puccinia* in which the urediniospores are reported to have only one germ pore. It is located equatorially on the slightly concave or flattened side of the spore.

**PUCGINIA INVESTITA** Schweinitz, Trans. Am. Phil. Soc., Ser. 2, 4:309. 1832. NEOTYPE on *Gnaphalium obtusifolium* Linnaeus from **The United States of America**, New York: Shelter Island. 20 Oct 1905, *Farlow s.n.* Cummins (1978) designated a neotype because the original specimen was lost. (**0/Icv,?Icv/III**).

*Puccinia investita* has been reported on *Gnaphalium* and ?*Achyrocline*. Includes *Caeoma* (*Aecidium*) *gnaphaliatum* Schweinitz, and *Puccinia gnaphaliata* (Schweinitz) Arthur & Bisby.

*Puccinia investita* has not yet been reported from Brazil but is to be expected. Reported from Argentina, Ecuador, Bolivia, and Peru on *Achyrocline* and from North America on *Gnaphalium*. See *Puccinia achyroclines* and *P. gnaphaliicola* for comparison.

Urediniospores if produced *Aecidium*-like (sori cupulate, peridiate, spores catenulate, verrucose), spores (19-)20-26(-29) x (16-)18-22(-24)  $\mu\text{m}$ , wall 1-1.5  $\mu\text{m}$  thick, finely verrucose. Teliospores (36-)40-53(-58) x 14-)18-23(-25)  $\mu\text{m}$ , lateral walls (1-)1.5(-2)  $\mu\text{m}$ , apical walls (5-)8-10(-13)  $\mu\text{m}$ .

*Puccinia ipomoeae* Cooke, see **Puccinia CRASSIPES** Berkeley & Curtis.

*Puccinia ipomoeae-panduratae* (Schweinitz) P. Sydow & H. Sydow, Mon. Ured. 1: 323. 1902.

The basionym, *Aecidium ipomoeae-panduranae* Schweinitz, is based on *Albugo* sp, not a rust. See **Puccinia CRASSIPES** Berkeley & Curtis.

**Puccinia IRREGULARIS** Dietel, Hedwigia 36: 33. 1897 (Feb). TYPE on *Verbesina subcordata* DeCandolle from **Brazil**, Santa Catarina: Serra Geral, March 1891, *Ule-1691*. Not *Puccinia irregularis* Ellis & Tracy, 1897 (June), on *Solidago* sp. (??, **Ipe/III**).

Anamorph

*Uredo affinis* Spegazzini, An. Soc. Cient. Argentina 10(1): 10. 1880. TYPE on *Verbesina auriculata* DeCandolle from **Argentina**, near Chacarita, May 1880, ? *Spegazzini s.n.*

On Compositae:

*Verbesina subcordata* DeCandolle, Santa Catarina, Serra Geral (Dietel, 1897: 33).

*Verbesina deslandesii* Toledo, Alagoas (Viégas, 1945: 51; Lindquist, 1982: 450).

*Puccinia irregularis* Dietel has been reported also from Argentina, Bolivia, Paraguay, Uruguay, Colombia, and Central America. The specimens reported by Viégas (1945: 51) on *Verbesina deslandesii* Toledo, Compositae, IAC 3616, -3649, from Alagoas as *Puccinia verbesinae* Schweinitz (Schr. Nat. Ges. Leipzig 1: 73. 1822) were identified later by Lindquist (1982) as *Puccinia irregularis* Dietel.

*Puccinia irregularis* Ellis & Tracy (1897, June), was given a new name, *P. tracyi* Saccardo & Sydow, and was placed as a synonym of *Puccinia grindeliae* Peck, which is a common microcyclic species in North America, but does not occur in Brazil.

Uredinia on abaxial side of leaves, pale cinnamon-brown; urediniospores (21-)24-29(-32) x (17-)20-24(-27)  $\mu\text{m}$ , mostly obovoid or ellipsoid; wall (1-)1.5-2(-2.5)  $\mu\text{m}$  thick, about cinnamon-brown, echinulate except a small area around pores, pores 2 equatorial in scarcely or not flattened sides; telia on abaxial side of leaves, covered by the epidermis, tardily exposed, blackish brown; teliospores (35-)40-53(-57) x (18-)22-29(-32)  $\mu\text{m}$ , irregular but mostly ellipsoid or elongately obovoid, wall 1.5-2.5  $\mu\text{m}$  thick at sides, (3-)4-7(-8)  $\mu\text{m}$  at apex, clear chestnut-brown or slightly paler apically, smooth or minutely punctate, pore apical in each cell; pedicel to 70  $\mu\text{m}$  long but usually less than 35  $\mu\text{m}$ , golden. Teliospore walls are reported to be minutely roughened but this trait can be seen only with difficulty under an oil immersion lens (Cummins, 1978).

### *Puccinia verbesinae*

Spermogonia on adaxial leaf surface. Aecia on abaxial surface in groups cylindrical, erose; spores (17-)20-25(-27) x (15-)17-20(-21)  $\mu\text{m}$ , globoid or broadly ellipsoid, wall 1.5  $\mu\text{m}$  thick, colorless, finely and closely verrucose. Uredinia mostly on abaxial surface, cinnamon brown; spores (18-)20-24(-27) x (18-)19-23(-25)  $\mu\text{m}$ , mostly slightly higher than wide, mostly obovoid with pores face view, obovoid or triangularly obovoid with pores lateral, wall 1-1.5  $\mu\text{m}$  thick, cinnamon brown, echinulate except around pores, pores 2, subequatorial. Telia mostly on abaxial surface, exposed, more or less pulverulent, blackish brown; spores (33-)36-42(-45) x (22-)24-28(-30)  $\mu\text{m}$  broadly ellipsoid, wall (1.5-)2-3(-3.5)  $\mu\text{m}$  thick at sides, (5-)6-8(-10)  $\mu\text{m}$  at pores, chestnut brown except a pale umbo over each pore, smooth, pore apical in each cell; pedicel to 65  $\mu\text{m}$  long but usually broken shorter. (Cummins, 1978)

*Puccinia ischaemi* Dietel, see **Puccinia ZOYSIAE** Dietel.

**Puccinia ITATIAYENSIS** Lindquist, Revista Faculd. Agron. (LaPlata) 36: 74. 1960. *Nom. nov.* .

(-/-, -/III).

≡ *Puccinia incomposita* H. S. Jackson & Holway in Jackson, Mycologia 24: 146. 1932, not that of Bartholomew, 1928. TYPE on *Baccharis* sp. from **Brazil**, Rio de Janeiro, Itatiaia, Reserva Florestal, 7 May 1922, *Holway-1814*. (-/-, -/III).

On Compositae:

*Baccharis* sp., Rio de Janeiro (Jackson, 1932; 146; Lindquist, 1960: 74; PUR-F8195).

Fifteen species of *Puccinia* have been reported on *Baccharis* in Brazil. At least 53 species of *Puccinia* have been reported to parasitize species of *Baccharis* in the Americas (Lindquist, 1957). Thus, the New World genus *Baccharis*, which itself has about 380 known species, harbors more *Puccinia* species than any other host genus in the Americas.

*Puccinia jambolana* Rangel, see **PUCCINIA PSIDII** Winter.

*Puccinia jambosae* P. Hennings, see **PUCCINIA PSIDII** Winter.

**PUCCINIA JOANNESIAE** P. Hennings, Hedwigia 35: 229. 1896. TYPE on ? *Joannesia brasiliensis* (*Joannesia princeps* Velloso), Euphorbiaceae, from **Brazil**, Santa Catarina: Blumenau, Oct 1888, *Ule-481b*. (?/?, IIpe/III).

*Puccinia joanesiae* has been reported only from the type.

Traits that help to identify it include: urediniospores 12-22 µm in diameter, globose or subglobose, wall echinulate, brown; teliospores 19-27 x 18-24 µm, ellipsoid, rounded at both ends, or slightly flattened at the apex, slightly constricted at the septum, wall uniform in thickness, chestnut-brown, densely verrucose, pedicel up to 32 µm long, persistent, colorless, with a few short basal appendages.

The Sydow's (1903) description of the morphology of the teliospores suggests that this rust perhaps is a *Prospodium* sp., not a *Puccinia*. If true, then the host is either a member of the Bignoniaceae or Verbenaceae.

**PUCCINIA JOERSTADIANA** Lindquist, Revista Fac. Agron. (La Plata) 36: 138. 1960. TYPE on *Carex phalaroides* Kuekenenthal, **Brazil**, Rio Grande do Sul: Porto Alegre, 18 Sept 1892, *C. A. M. Lindman*. (?/?, ≠ IIpe/III).

On Cyperaceae

*Carex phalaroides* Kuekenenthal, Rio Grande do Sul (Lindquist, 1960: 138).

*Puccinia joerstadiana* has been reported also from one collection from Argentina but nowhere else. Lindquist (1960) reported traits that helped to identify *Puccinia joerstadiana* included mainly that the urediniospores have cell walls that are colorless, without visible germ pores, and swell in the mounting medium to 2.5-3 µm. Otherwise the species is very similar to *Puccinia caricina* DeCandolle, a widespread species in the Northern Hemisphere and reported from Argentina and Chile in South America. Lindquist (1960) reported traits of *Puccinia caricina* as: urediniospores 27-38 x 19-23 µm, globoid, ellipsoid or irregular and variable in shape and size, walls 2.5-3 µm thick, golden-yellow, with variable number of equatorial pores, 3-4(-05); teliospores 36-50 x 12-20 µm, oblong-clavate, obtuse or rounded above, narrowed below, not or only slightly constricted at septum, wall 2-2.5 µm thick at sides, 4-12 µm above, clear chestnut-brown but lighter in the lower cell, pedicel short and fragile.

**PUCCINIA JUNGIAE** P. Hennings, Hedwigia 36: 214. 1897. TYPE on *Jungia floribunda* Lessing from **Brazil**, date not recorded, *Sellow s.n.* (?/?, IIpe/III).

On Compositae:

*Jungia floribunda* Lessing, Brazil (Hennings, 1897: 214), Paraná (IBI-12894), São Paulo (Spegazzini, 1919: 82).

*Puccinia jungiae* has been reported also from Ecuador.

The Sydows (1904) and Sydow (1939) reported traits that may help to identify *Puccinia jungiae* as: uredinia on abaxial side of leaves, >3-1 mm across, golden, to dark brown, urediniospores 29-38 x 27-29 µm, broadly ellipsoid, wall evenly 1.5 µm thick, finely echinulate, dark brown, germ pores 4, equatorial, obvious, with noticeable caps; telia on abaxial side of leaves, scattered, 0.3-0.6 mm across, punctiform, blackish; teliospores (35-)38-50(-56) x (20-)25-30 µm, ellipsoid to obovoid, rounded above and below, not or slightly



constricted at the septum, wall thickened above 5-8  $\mu\text{m}$ , thinner along sides, verrucose (?smooth), brownish; pedicel up to 70  $\mu\text{m}$  long, persistent, thick, colorless.

**Puccinia JUSSIAEAE** Spegazzini, Anal. Soc. Cient. Argentina 12: 68. 1881. TYPE on *Ludwigia longifolia* (DeCandolle) H. Hara (reported originally as *Jussiaea longifoliae* DeCandolle) from **Argentina**, Ensenada, Feb 1881, *Spegazzini s.n.* (0/Icv,IIcv/III).

Anamorph

*Aecidium jussiaeae* Spegazzini, Anal. Soc. Cient. Argentina 9: 174. 1880. TYPE on *Ludwigia longifolia* (DeCandolle) H. Hara (reported originally as *Jussiaea longifoliae* DeCandolle) from **Argentina**, Buenos Aires: dried areas around Rio de la Plata, common in "Aest., 1880". *Spegazzini sn.* This anamorph name is for both aecia and uredinia.

On Onagraceae:

*Jussiaea* sp. (perhaps host is *Ludwigia* sp.), Rio de Janeiro (Hennings, 1904), Brazil (Joerstad, 1959: 81).

*Ludwigia leptocarpa* (Nuttall) H. Hara (reported originally as *Jussiaea leptocarpa* Nuttall), Minas Gerais (Thurston, 1940: 300).

*Ludwigia* sp., Minas Gerais (PUR-F19209), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 133).

*Puccinia jussiaeae* has been reported from Argentina to the the United States of America.

Probably all of the species of *Jussiaea* reported to be hosts of *Puccinia jussiaeae* have been transferred to *Ludwigia*.

Lindquist (1982) reported traits that help to identify *Puccinia jussiaeae* as : life cycle in which both aecia and uredinia have the morphology of *Aecidium jussiaeae*.

**Puccinia JUSTICIAE** Puttemans, Ligeira Contribuição a Phytopatologia Brasileira, p. 15. 1934, e O Campo, p. 24. 1934. TYPE on *Justicia pectoralis* Jacquin from **Brazil**, Rio de Janeiro: Rio de Janeiro, Horto Nacional, 27 July 1910, *Puttemans-1680*. (??,II/III).

Anamorph

*Puccinia diantherae* H. Sydow, Ann. mycol. 37: 299. 1939. TYPE on *Justicia pectoralis* from **Ecuador**, Pinchicha: Mindao, 10 Nov 1937, *H. Sydow*. Only uredinia were described. The name needs to be transferred to an appropriate anamorph genus.

On Acanthaceae:

*Justicia pectoralis* Jacquin, Pará (Albuquerque, 1971: 148; IAN-623), Rio de Janeiro (Puttemans, 1934: 15; *Puttemans-1680* type, 2811).

*Justicia* sp., São Paulo (IBI-15500).

*Puccinia justiciae* has been reported from Brazil, Ecuador, Guatemala, The West Indies, and Texas in The United States of America. Hernández and Hennen (2002) reported uredinia of *Puccinia justiciae* from Tucumán, Argentina on *Chaetothylax umbrosus*, a previously unreported host genus.

Spermogonia and aecia unknown. Uredinia on both sides of the leaves, 0.2-0.5 mm diam, irregularly scattered or often in concentric groups ca 3 mm in diameter, cinnamon-brown; urediniospores 25-30 x 20-26  $\mu\text{m}$  spheroid, ellipsoid to obovoid, wall 1.5-2  $\mu\text{m}$  thick, echinulate, golden-yellow to pale cinnamon-brown, pores 2, equatorial and opposite. Telia mostly on abaxial side of leaves, a few on adaxial side, 0.2-0.5 mm diam, mostly concentrically arranged in groups to 5 mm diam, dark brown to almost black; teliospores 31-44 x 28-33  $\mu\text{m}$ , broadly ellipsoid to short cylindrical, rounded obtuse at both ends, slightly bullate over the pores, not or only slightly constricted at septum, wall 3-5  $\mu\text{m}$  thick at sides, 6-8  $\mu\text{m}$  at the pores, caps 2-4  $\mu\text{m}$  thick, two layered, both layers chestnut-brown, sparsely verrucose or echinulate especially above, pedicel to 40  $\mu\text{m}$  long, persistent, colorless, roughened below (Laundon, 1963).

An important trait for identification is the verrucose to echinulate teliospores. Teliospores of other species of *Puccinia* on Acanthaceae are not echinulate.

*Puccinia kaernbachii* Arthur, see **Puccinia POSADENSIS** Saccardo & Trotter.

*Puccinia kunzeana* P. Hennings, see **Puccinia CYNANCHI** Berkeley & Curtis.

*Puccinia kimurai* N. Hiratsuka f. & Yoshinaga, see **Puccinia LEVIS** (Saccardo & Bizzozero) Magnus

var. **PANICI-SANGUINALIS** (Rangel) Ramachar, & Cummins.

*Puccinia kyllingiae-brevifoliae* Miura, see **UREDIO KYLLINGIAE** P.Hennings.

*Puccinia lagoensis* P. Hennings, see **PUCGINIA ARAUJAE** Lèveillé.

**PUCGINIA LANTANAE** Farlow, Proc. Amer. Acad. 18: 83. 1883. TYPE on *Lantana odorata* from **Bermuda. (-/-, -/III).**

= *Uromyces lantanae* Spegazzini, Anal. Soc. Cient. Argentina 17: 93. 1884. TYPE on *Lantana* sp., *Verbenaceae*, from **Paraguay**, Paraguari, Dec. 1881, *Balansa s.n.*

= *Puccinia elytrariae* P. Hennings, Hedwigia 34: 320. 1895. TYPE on *Elytraria crenata* Vahl, *Acanthaceae*, from **Brazil**, place and date not reported, *Glaziou-14167*.

= *Puccinia accedens* P. Sydow & H. Sydow, Mon. Ured. 1: 309. 1902. TYPE on *Lippia aristata* Schauer, *Verbenaceae*, from **Brazil**, Mato Grosso, date and collector not reported.

= *Uromyces privae* P. Sydow & H. Sydow, Ann. Mycol. 5: 338. 1907. TYPE on *Priva lapulacea*, *Verbenaceae*, from **Cuba**, Baracoa: El Yunque, 10 March 1903, *E.W.D. Holway-s.n.*

= *Uromyces lippiae* Spegazzini, Anal. Mus. Nac. Buenos Aires 19: 313. 1909. TYPE on *Lippia canescens* Humboldt, Bonpland & Kunth, *Verbenaceae*, from **Argentina**, Salta: Rio Sora, April 1905, *Spegazzini s. n.*

On Acanthaceae:

*Elytraria crenata* Vahl, Goiás (Hennings, 1895: 320).

On Verbenaceae:

*Lantana brasiliensis* Link, São Paulo (Jackson, 1932: 63).

*Lantana camara* Linnaeus, Maranhão (15605), Paraíba (Viégas, 1945: 32; IAC-3807), Pernambuco (Viégas 1945: 32; IAC-3671), Rio Grande do Sul (PUR-F17730), São Paulo (Viégas, 1945: 32; IAC-1554).

*Lantana monteseensis* (Sprengel) Briquet, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 134).

*Lantana nivea* Ventenat, São Paulo (IBI-12836).

*Lantana robusta* Schauer, Santa Catarina (PUR-F7177).

*Lantana trifolia* Linnaeus, Minas Gerais (Thurston, 1940: 300), São Paulo (Jackson, 1932: 63).

*Lantana selloiana* Link & Otto, Rio Grande do Sul (IBI-12190).

*Lantana* sp., Bahia (IBI-15289), Minas Gerais (IBI-12782) Paraíba (Viégas, 1945: 32; IAC-36619), Rio de Janeiro (Dietel, 1897: 30; Dietel, 1899: 250; IBI-12836), São Paulo (Viégas, 1945: 32; IAC-1906, IBI-12221).

*Lippia aristata* Schauer, Mato Grosso (Sydow, 1904: 309).

*Lippia rhodocnemis* Martens & Schauer, Rio de Janeiro (Jackson, 1932: 63).

*Lippia* sp., São Paulo (IAC-4398).

*Puccinia lantanae* is widespread in warm regions of Asia, Africa, and the Americas.

Spermogonia, aecia, and uredinia not produced. Telia 0.1-0.5 mm in diameter, mostly on the abaxial side of leaves, erumpent, ruptured epidermis not evident, usually arranged in large dense or occasionally loose irregular to circular groups to nearly 8 mm across, chestnut to almost black, occasionally a few on the adaxial side of leaves, or on stems in elongated groups several cm long, not stromatic; teliospores very irregular, nearly all one-celled, 17-42 x 11-27 µm, spherical, ellipsoid, obovoid, cylindrical, clavate, somewhat angular, obtuse above, slightly constricted when septate, obtuse or sometimes narrowed below; wall 1-5 µm thick at sides, 2-8 µm above, cinnamon- or chestnut-brown, smooth or occasionally finely reticulate; pedicel 10-100 µm long, basal or sometimes lateral, persistent, colorless or colored slightly paler than the spores (Laundon, 1963).

*Puccinia lantanae* is unusual because it parasitizes genera in two host families, the Acanthaceae and the Verbenaceae. Laundon (1963) recorded nine genera of Acanthaceae as hosts worldwide and listed fifteen synonyms. We have included only those synonyms whose types are from the Americas. In the Verbenaceae only species in the genera *Lantana*, *Lippia*, and *Priva* have been reported as hosts.

*Puccinia lantanae* has been considered experimentally as a biological control agent for *Lantana camara*, reported as one of the World's worst weeds (Barreto et al., 1995).

See also *Puccinia arechavaletae* on genera of Sapindaceae and *P. heterospora* on genera of Malvaceae which are very similar microcyclic species that also do not produce spermogonia and have very irregular teliospores that are nearly all one-celled.

**Puccinia lateritia** Berkeley & Curtis, Jour. Acad. Nat. Sci. Philadelphia II,2: 281. 1853. TYPE on probably *Spermacoce laevis* Lamarck [= *Borreria laevis* (Lamarck) Grisebeck; reported originally as *Spermacoce* sp.] from **Surinam**, place, date, collector not reported. (-/-, -/III).  
= *Puccinia spermococes* Berkeley & Curtis, Grevillea 3: 53. 1874.  
= *Puccinia houstoniae* P. Sydow & H. Sydow, Hedwigia Beiblatt 40:(126). 1901.

On Rubiaceae:

*Borreria* sp., Bahia (IBI-2133), Pará (Dietel, 1909: 264).

*Diodia prostrata* Swartz, Minas Gerais (Thurston, 1940: 300).

*Diodia radula* Chamisso & Schlechtendahl, São Paulo (Jackson, 1932: 99; Viégas, 1945: 32; IAC-1559).

*Diodia rigida* Chamisso & Schlechtendahl, Minas Gerais (Jackson, 1932: 22), São Paulo (Jackson, 1932: 99; Viégas, 1945: 32; IAC-4070).

*Diodia teres* Walter, São Paulo (Viégas, 1945: 32; IAC-1436).

*Diodia* sp., Paraíba (Viégas, 1945: 32; IAC-3833), Rio de Janeiro (Dietel, 1897: 29), São Paulo (Viégas, 1945: 32; IAC-2596).

*Hemidiodia* sp., Rio de Janeiro (Dietel, 1897: 29).

*Spermacoce latifolia* Aublet [= *Borreria latifolia* (Aublet) Schumann], Minas Gerais (Thurston, 1940: 300).

*Spermacoce ocymoides* Burm. f. [= *Borreria ocymoides* (Burm. f.) DeCandolle], Pará (PUR-F9518).

*Spermococe verticillata* Linnaeus [= *Borreria verticillata* (Linnaeus) Meyer], Pará (Albuquerque, 1971: 148; IAN-498).

*Spermacoce* sp., Rio de Janeiro (Hennings, 1904A: 79).

**Rubiaceae, gen. undetermined**, Bahia (IBI-12747), São Paulo (IBI-12253).

*Puccinia lateritia* is widespread from Argentina to the Southern United States of America. Arthur (1922) reported it on ten genera of Rubiaceae in North America

Spermogonia, aecia, and uredinia not produced. Telia 0.1-0.4 mm across, mostly on the abaxial side of leaves, erumpent, ruptured epidermis not noticeable, round, compact, sometimes pulvinate, cinnamon- or chestnut-brown, becoming grayish in germinating sori, solitary or more commonly in groups 0.2-10 mm across, often circinnating; teliospores 26-40 x 16-23 µm, broadly ellipsoid, oblong or obovoid, rounded above and below or occasionally somewhat narrowed below, not constricted at septum; wall 2.5-4 µm thick at sides, slightly thickened above 4-7 µm, golden or chestnut-brown; pedicel once to twice the length of the spore, colorless or slightly tinted, usually persistent (Arthur, 1922).

Arthur (1934) reported that *Puccinia lateritia* is correlated with *Uromyces spermococes*, a long cycle species on *Diodia* spp., *Spermococe*, and *Houstonia* (Rubiaceae), widespread in the Southeastern United States of America. Also, there exists an unknown, corresponding long cycle form of *Puccinia*.

*Puccinia lateritia* also has been reported questionably from Africa. *Puccinia bakoyana* Patouillard & Hariot (Journ. de Bot. 1900, p. 237) from Africa was reported as a synonym of *Puccinia lateritia* by Yen (1976) but Eboh (1977) Trans. British Mycol. Soc. 69: 136-137 reported evidence that *Puccinia bakoyana* was a different species with uredinia that had the morphology of *Aecidium* with the anamorph name *Aecidium mitrocarpi* Sydow.

**Puccinia leonotidicola** P. Hennings in H. Baum, Bot. Ergebnisse der Kunene-Sambesi Exped., 2: 157. 1903. TYPE on *Leonotis nepetifolia* from **Angola**, River Longa, 18 April 1800, Baum-826. (?0/?I, IIpe/III).

= *Puccinia dominicana* Gonzales-Fragoso & Cifferri, Bol. R. Soc. Espan. Hist. Nat. 26: 248. 1926. TYPE on *Leonotis* sp. from **The Dominican Republic**. Original not available.

≡ *Dicaeoma leonotidis* Arthur as "(P. Hennings) Arthur", N. Amer. Flora 7: 407. 1921. TYPE same as for *Puccinia leonotidicola* P. Hennings. Arthur described telia from the type of *Puccinia leonotidicola* P. Hennings from Africa.

Synanamorphs

*Aecidium leonotidis* P. Hennings in Engler, Die Pflanzenwelt Ostafrikas, Teil C(3): 52. 1895. TYPE on *Leonotis velutina* from Tanzania, Kilimandjaro, 'Marangu', 10 June 1894, *Volkens-2336a*.

*Uredo leonotidis* P. Hennings in Engler, Die Pflanzenwelt Ostafrikas, Teil C(3):52. 1895. TYPE on *Leonotis velutina* from Tanzania, Kilimandjaro, 'Marangu', 10 June 1894, *Volkens-2336*.  
= *Uredo cancerina* P. Hennings, Hedwigia 38: 330. 1895. TYPE on *Leonotis* sp. from Ethiopia, Erythrea: Mai-Metammet, 27 March 1894, *Schweinfurth s.n.*  
= *Uredo leonoticola* P. Hennings, Hedwigia Beiblatt 38: (69). 1899. TYPE on *Leonotis* sp. from **Brazil**, Santa Catarina: São Francisco, June 1884, *Ule-57*.  
≡ *Puccinia leonotidis* (P. Hennings) Arthur, Mycologia 7: 245. 1915. Telia not described.

On Labiatae:

*Leonotis nepetaefolia* R. Brown, Minas Gerais (Thurston, 1940: 300; Viégas, 1945: 33; IAC-4058), Pernambuco (Batista & Bezerra, 1960: 30), Rio de Janeiro (Hennings, 1904A: 80; Jackson, 1932: 66; IAC-4667), Rio Grande do Sul (Viégas, 1945: 33; Lindquist & Costa Neto, 1967: 62; IAC-2669), Santa Catarina (Hennings, 1899: (69), São Paulo (Jackson, 1932: 66; Viégas, 1945: 33; IAC-224, IBI-13786).

*Puccinia leonotidicola* has been reported from the warmer regions of the New World from Paraguay to Mexico where the weedy host occurs, and also from Africa, and India.

Spermogonia and aecia questionable. Uredinia on both sides of leaves, 0.2-1(-2) mm across, at first covered by the epidermis, erumpent, ruptured epidermis evident, pulverulent, cinnamon-brown; urediniospores 24-30 x 22-28 µm, globoid to oblate spheroid, wall 1-1.5 µm thick, a little thicker above, finely and closely echinulate, cinnamon-brown, pores 3-4(-5), basal around the hilum (Arthur, 1921; Viégas, 1945). Telia on both sides of leaves, about 0.5 mm in diameter, rather pulverulent, brown; teliospores 25-32 x 18-23 µm, rounded at both ends, slightly or not constricted at the septum, wall yellowish-brown, smooth, apex thickened up to 5 µm with a papilla; pedicel as long as spore, colorless (Arthur, 1921).

Telia have been reported for *Puccinia leonotidicola* only from the type specimen from Africa. Aecia have been reported only from the type of *Aecidium leonotidis*. All records from the New World are based on uredinia. The arrangement of the pores around the hilum at the proximal end of the urediniospores is unusual.

*Puccinia leonotidis* (P. Hennings) Arthur, see **Puccinia leonotidicola** P. Hennings.

**Puccinia leptochloae** Arthur & Fromme, Torreyia 15: 263. 1915. TYPE on Gramineae, from Mexico, Sonora: Guaymas, 1887, *E. Palmer-694*. (**0/Icv**↔ **IIep/III**).

Anamorph

*Aecidium talini* Spegazzini Revista Argentina Hist. Nat. 1(6): 399-400. 1891. TYPE on *Talinum patens* (Jacq.) Willdenow (Portulaccaceae) from **Paraguay**, Posta-cué, Feb 1884, *Balansa-4314*.

On Phytolaccaceae: **0,I**

*Phytolacca thyrsoflora* Fenzl ex J. A. Schmidt, Rio Grande do Sul (Lindquist, 1960: 107-108; Lindquist & Costa Neto 1963: 122).

*Puccinia leptochloae* has been reported from Argentina northward to the southern United States of America.

Spermogonia in groups in the center of small leaf spots on the adaxial side of leaves. Aecia in groups or concentric circles on reddish-yellow to yellow-brown spots 0.5-2 cm across on the abaxial side of leaves; short cylindrical; peridial cells 18-24 x 14-16 µm, firmly united, rhomboid, overlapping, outer facing wall 5-7 µm thick, striate, inner facing wall 3 µm thick, verrucose; aeciospores (15-)17-21(24) x 14-16(-18) µm, globoid, subgloboid to broadly ovoid, wall 1 µm thick, finely verrucose, nearly colorless. Uredinia on abaxial side of leaves, cinnamon-brown, urediniospores 19-26 x (16-)18-24 µm, globoid to obovoid; wall 1.5-2.5 µm, verrucose, pores 4-6 scattered. Telia mostly on abaxial side, blackish, early exposed, pulvinate; teliospores 25-34 x 17-24 µm, broadly ellipsoid; wall 2.5-4 µm thick at sides, 4-7 µm apically, dark chestnut, smooth; pedicel up to 95 µm long, thick-walled, usually not collapsing, golden; 1-celled teliospores sometimes are common (P. Sydow & H. Sydow, 1923; Hennen & Cummins, 1956, Lindquist, 1982).

Only spermogonia and aecia have been reported from Brazil but uredinia and telia are expected to be found. *Leptochloa mucronata* (Michaux) Kunth (reported as *Leptochloa filiformis* (Lamarck) Beauvois) is the only host reported for uredinia and telia. Hennen & Cummins (1956) and Joerstad (1959) reported the

morphological similarity between *Puccinia leptochloae* and *Puccinia opuntiae* Arthur & Holway from Bolivia and Peru, the latter with uredinia and telia on *Bouteloua* sp. and spermogonia and aecia on *Opuntia* sp., Cactaceae.

*Puccinia leptoderma* Dietel, see **PUCCINIA PIPTOCARPHAE** P. Hennings.

**PUCCINIA LEUCADIS** P. Sydow & H. Sydow. , Mon. Ured. 1: 281. 1904.

On Labiatae:

*Leucas martinicensis* R. Brown, Rio de Janeiro, (IAC-4662).

**PUCCINIA LEVIS** (Saccardo & Bizzozero) Magnus, Ber. Deutsch. Bot. Ges. 9: 190. 1891.

(?/?≠ **IIpe/III**). See also the varieties listed below.

≡ *Diorchidium leve* Saccardo & Bizzozero, Michelia 2: 648. 1882. TYPE on *Hackelochloa granularis* (reported originally as *Manisuris granularis* Linneus) from **Brazil** (location in Brazil not reported, probably Amazonia, Serra do Mel, Rio Branco, Aug 1909, *Ule-3335*), specimen collected from Herbario Horti Patavini by Bezzozero.

See below under the varieties for additional synonyms.

On Gramineae

(We could not place the following records in a variety of **PUCCINIA LEVIS** that were proposed by Ramachar & Cummins, 1965):

*Panicum rugulosum* Trinius sensu lato Doell, includes reports of *Panicum millegrana* Poirlet, Minas Gerais (Thurston, 1940: 300), São Paulo (IBI-1688); and *Panicum sellowii* Nees, Minas Gerais (Thurston, 1940: 300).

*Panicum* sp., Rio de Janeiro (Dietel, 1899: 249), Santa Catarina (Dietel, 1899: 249).

*Paspalum pilosum* Lamarck, Minas Gerais (Thurston, 1940: 300), São Paulo (IBI-1689, -1691).

*Paspalum plicatum* Michaux, São Paulo (Viégas, 1945: 34; IAC-3902).

*Paspalum urvillei* Steudel, Minas Gerais (Thurston, 1940: 300).

*Urochloa plantaginea* (Link) R. D. Webster (reported as *Brachiaria plantaginea* (Link)

Hitchcock, Minas Gerais (Thurston, 1940: 300), São Paulo (IBI-16947).

*Puccinia levis* occurs circumglobally in warm regions and has been divided into four varieties based on slight morphological differences as shown in the key below (Ramachar and Cummins, 1965). In his study of Holways' collections of grass rusts from South America, Arthur (1925) was the first to report the extensive synonymy of *P. levis*. The principle traits of the species are the sori lack paraphyses, the urediniospores are dark brown, echinulate, with 2-4 equatorial germ pores, and the teliospores are nearly opaque or very dark brown, usually have a near vertical septum (diorchidioid), and have long pedicels. Cummins (1971) recorded the varieties of *Puccinia levis* on about 18 genera of grasses, all in the tribe Paniceae.

#### Key to help identify varieties of *Puccinia levis*, on Poaceae

1. Teliospores mostly exceeding 30 µm high, side wall mostly 3 µm or more thick    2
1. Teliospores mostly less than 30 µm high, side wall mostly less than 2.5 µm thick    other species of *Puccinia* on Paniceae.
  2. Urediniospores with 3 or rarely 4 equatorial pores    *Puccinia levis* var. *panici-sanguinalis*
  2. Urediniospores with 2 pores    3
3. Teliospores mostly 29-35 µm high    *Puccinia levis* var. *goyazensis*
3. Teliospores larger    4
  4. Apical wall of teliospores mostly 7-12 µm thick and much paler externally    *Puccinia levis* var. *levis*
  4. Apical wall of teliospores mostly 5-7 µm thick and nearly concolorous    *Puccinia levis* var. *tricholaenae*

**PUCCINIA LEVIS** (Saccardo & Bizzozero) Magnus var. **LEVIS**. TYPE see *Puccinia levis* above

(?/?≠ **IIpe/III**).

= *Puccinia paspali* Tracy & Earle, Bull. Torrey Bot. Club 22: 174. 1895. TYPE on *Paspalum virgatum* from **The United States of America**, Louisiana: New Orleans, November, 1892, Tracy sn.

On Gramineae:

*Mnesithea granularis* (L.) de Koning & Sosef [*Hackelochloa granularis* (Linnaeus) Kuntze (reported originally as *Manisuris granularis* Linnaeus), Amazonia, Serra do Mel, Rio Branco (Sydow, 1916: 67).

*Paspalum dilatatum* Poirlet, Rio Grande do Sul (PUR-F17727).

*Paspalum geminiflorum* Steudel, (Ramachar & Cummins, 1965: 43).

*Paspalum inaequivalve* Raddi, Goiás (Ramachar & Cummins, 1965:).

*Paspalum pilosum* Lamarck, Minas Gerais (PUR-F9818), São Paulo (Ramachar & Cummins, 1965: 43).

*Paspalum urvillei* Steudel, Minas Gerais (PUR-F9819), Paraná (PUR-F11692), Rio Grande do Sul (PUR-F17726).

*Paspalum* sp., São Paulo (Arthur, 1925: 176).

Also see *Puccinia levis* above.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, dark cinnamon- or chestnut-brown; urediniospores (23-)25-31 x (20-)23-27  $\mu\text{m}$ , globoid or broadly ellipsoid with pores face-view, wall 1.5-2  $\mu\text{m}$  thick, echinulate, cinnamon- or near chestnut-brown, germ pores 2, in flattened sides, equatorial. Telia on both sides of leaves, or mostly on abaxial side, pulvinate, early exposed, blackish brown; teliospores 31-43(-46) x (22-)26-33(-36)  $\mu\text{m}$ , varying from ellipsoid to broadly ellipsoid, usually tending to be diorchidioid and often strongly so, wall (1.5-)2.5-4(-5)  $\mu\text{m}$  thick at sides, (5-)7-12(-14)  $\mu\text{m}$  over pores, dark chestnut or darker except over pores, smooth; pedicels to 175  $\mu\text{m}$  long, colorless, thick-walled and not collapsing (Cummins, 1971).

**Puccinia levis** (Saccardo & Bizzozero) Magnus var. **GOYAZENSIS** (P. Hennings) Ramachar & Cummins, Mycopath. Mycol. Appl. 25: 43. 1965. (?.?.? **Ipe/III**).

≡ “*Puccinia*(*Diorchidium*) *goyazensis*” P. Hennings, Hedwigia 34: 94. 1895. TYPE on *Panicum* sp. from **Brazil**, Goiás: Formosa, Sept. 1892, *Ule-1928*.

≡ *Puccinia goyazensis* (P. Hennings) P. Sydow & H. Sydow, Monogr. Ured. 1: 773. 1904. Based on the above species of Hennings.

On Gramineae:

*Panicum missionum* Mez, São Paulo (Ramachar & Cummins, 1965: 44).

*Panicum rugulosum* Trinius sensu lato includes reports on *Panicum millegrana* Poirlet, Rio de Janeiro (Ramachar & Cummins, 1965: 44), São Paulo (Ramachar & Cummins, 1965: 44).

*Panicum* sp., Goiás (Hennings, 1895A: 94; Sydow, P. Sydow & H. Sydow, 1904:773; Ramachar & Cummins, 1965: 44). Rio de Janeiro (Dietel, 1899: 249), Santa Catarina (Dietel, 1899: 249).

Spermogonia and aecia unknown. Urediniospores 26-31 x 22-24  $\mu\text{m}$  with pores face-view, wall 1.5-2  $\mu\text{m}$  thick, cinnamon- or dark cinnamon-brown, echinulate, germ pores 2, in flattened sides, equatorial. Teliospores (26-)29-35(-42) x (22-)26-30(-32)  $\mu\text{m}$ , broadly obovoid, broadly ellipsoidal cuboidal or rarely ellipsoid, mostly diorchidioid, wall (2-)2.5-3(-4)  $\mu\text{m}$  thick at sides 5-7(-9)  $\mu\text{m}$  over the pores, dark chestnut-brown except over the pores; pedicels thin- or thick-walled, collapsing or not, to at least 150  $\mu\text{m}$  long.

**Puccinia levis** (Saccardo & Bizzozero) Magnus var. **PANICI-SANGUINALIS** (Rangel) Ramachar & Cummins, Mycopath. Mycol. Appl. 25: 44. 1965. (?.?.? **Ipe/III**).

≡ *Uromyces panici-sanguinalis* Rangel, Arch. Mus. Nac. Rio de Janeiro 18: 159. 1916. TYPE on *Digitaria sanginalis* (Linnaeus) Scopeli [reported as *Panicum sanguinale* L.] from **Brazil**, Rio de Janeiro: Cubango near Niteroy, April 12914, *E. Rangel-1103*

= *Puccinia seteriae-viridis* Dietel, Ann. Mycol. 15: 493. 1917. TYPE on *Setaria viridis*

= *Puccinia kimurai* N. Hiratsuka f. & Yoshinaga, Mem. Tottori Agr. Coll. 3: 314. 1935. TYPE on = *Diorchidium digitariae* Ahmad, Biologia 2: 31. 1956. TYPE on

Anamorph

*Uredo paspali-perrottetii* Petch, Ann. Roy. Bot. Gard. Peradeniya 6.216. 1917. TYPE on *Paspalum perrottetii* from Sri Lanka

On Gramineae:

*Digitaria horizontalis* Willdenow, Santa Catarina (PUR-F4885).

*Digitaria sanguinalis* (Linnaeus) Scopeli, Rio de Janeiro (Rangel, 1916; Ramachar & Cummins, 1965: 45).

*Panicum cyanescens* Nees & Trinius, Santa Catarina (Ramachar & Cummins, 1965: 45).

*Panicum demissum* Trinius, São Paulo (Ramachar & Cummins, 1965: 45).

*Paspalum plicatulum* Michaux, São Paulo (Ramachar & Cummins, 1965: 45).

Spermogonia and aecia unknown. Urediniospores (23-)25-28(-30) x (18-)20-25  $\mu\text{m}$ , wall 1.5-2(-3)  $\mu\text{m}$ , dark cinnamon-brown, echinulate, germ pores 3 (rarely 4), equatorial. Teliospores (25-)29-37(-40) x (22-)23-30(-32)  $\mu\text{m}$ , mostly broadly ellipsoid or broadly obovoid, mostly diorchidioid, wall 2-3 $\mu$  thick at sides, (4-)5-7(-9)  $\mu\text{m}$  over the pores, dark chestnut-brown except usually paler over the pores; pedicels to at least 140  $\mu\text{m}$  long, mostly thick-walled and not collapsing (Cummins, 1971).

**Puccinia LEVIS** (Saccardo & Bizzozero) Magnus var. **TRICHOLAENAE** (H. Sydow & P. Sydow)

Ramachar & Cummins, Mycopath. Mycol. Appl. 25: 44. 1965. (?!/? $\neq$  **Ipe/III**).

$\equiv$  *Diorchidium tricholaene* H. Sydow & P. Sydow, Ann. Mycol. 10: 33. 1912. TYPE on *Rhynchelytrum repens* (Willdenow) C.E. Hubbard (reported originally as *Tricholaena rosea* Nees) from **South Africa**, Transvaal: Barberton, 9 June 1903 ("9. 6. 1903"), J. B. Davy (J. B. Pole Evans-286).

$\equiv$  *Puccinia tricholaenae* (H. Sydow & P. Sydow) T. S. Ramakrishnan & K. Ramakrishnan, Proc. Indian Acad. Sci. 28: 63. 1948.

= *Uromyces tricholaenae* Fragoso y Gonzales & Ciferri, Bol. R. Soc. Espan. Hist. Nat. 25: 357. 1925. TYPE on *Rhynchelytrum repens* (Willdenow) C.E. Hubbard (reported originally as *Tricholaena rosea* Nees) from **Dominican Republic**, Haina, date not reported, Ciferri-90. Probably 1-celled teliospores (amphisporae) of *Puccinia* described to give the name *Uromyces*.

On Gramineae:

*Rhynchelytrum repens* (Willdenow) C.E. Hubbard [synonyms include: *Tricholaena rosea* Nees, *Tricholena repens* (Willdenow) Hitchcock, and *Rhynchelytrum roseum* Stapf & Hubbard], Bahia (IBI-15300), Federal District (IBI-12508), Minas Gerais (Thurston, 1940: 300), Paraíba (Viégas, 1945: 34; IAC-3805), Rio Grande do Sul (IAN-729), Rio de Janeiro (Arthur, 1925: 176), São Paulo (Ramachar & Cummins, 1965: 44; IBI-12004).

*Puccinia levis* var. *tricholaenae* occurs circumglobally in warmer areas (Cummins, 1971). Its host, *Rhynchelytrum repens* ("Natalgrass"), is native of Africa but has become widespread and is a common weed of disturbed places in Brazil.

Spermogonia and aecia unknown. Urediniospores (24-)26-33 x (21-)23-27(-29)  $\mu\text{m}$  with pores face view, wall 2  $\mu\text{m}$  thick, dark cinnamon-brown, echinulate, germ pores 2, in flattened sides, equatorial. Teliospores 37-47(-55) x 29-33  $\mu\text{m}$ , wall (2.5-)3-4  $\mu\text{m}$  thick at sides, (4-)5-7(-8)  $\mu\text{m}$  over the pores, chestnut-brown, not much paler over the pores; pedicels to 175  $\mu\text{m}$  long, thick-walled, mostly not collapsing.

*Puccinia l.* var. *tricholaenae* differs from the other varieties because its teliospores are larger, their apical walls are not as greatly thickened, and there are no clearly differentiated umbos over the pores. Urediniospore walls are echinulate but with smooth areas around the two equatorial pores (Ramachar and Cummins, 1965).

**Puccinia LIBERTA** Kern, Mycologia 11: 142. 1919. TYPE on *Eleocharis sp.* from **Nicaragua**,

Granada, Granada, 11 Feb 1903, C. F. Baker-2385. (?!/? $\neq$  **Ipe/III**).

On Cyperaceae:

*Eleocharis nodulosa* (Roth) Schultes, Minas Gerais (Thurston, 1940: 301).

*Puccinia liberta* has been reported also from Argentina, Venezuela, Central America, The West Indies, The United States of America, New Zealand, Australia, and Asia.

Spermogonia and aecia unknown. Uredinia scattered on stems, tardely naked, urediniospores small, 18-27 x 13-21  $\mu\text{m}$ , wall 1-2  $\mu\text{m}$  thick, pores 2, equatorial, telia covered by epidermis, with well developed paraphyses forming sunken locules (Arthur, 1920; Cummins, 1935).

Savile (1972) proposed that the tropical *Puccinia liberta* and temperate North American *Uromyces eleocharidis* formed a correlated complex that may intergrade.

*Puccinia lipipiae* Spegazzini. see **PROSPODIUM LIPPIAE** (Spegazzini) Arthur.

**PUCCINIA LISIANTHI** H. S. Jackson & Holway in Jackson, *Mycologia* 23: 491. 1931. TYPE on *Lisianthus elegans pedunculatus* from **Brazil**, Minas Gerais, Ouro Preto, 8 Dec 1921, *Holway-1372*. (??,II/III).

On Gentianaceae:

*Lisianthus elegans* var. *pedunculatus* Martius (*Eustoma*), Minas Gerais (Jackson, 1931: 491). *Puccinia lisianthi* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia hypophyllous and caulicolous, gregarious, 0.5-1 mm across, round or oval in outline, cinnamon brown, deep seated, tardily naked, pulverulent, long covered by the overarching epidermal and subepidermal tissues; urediniospores 25-34 x 18-21  $\mu\text{m}$ , obovoid or ellipsoid; wall 1-2  $\mu\text{m}$  thick, colorless or slightly tinted golden brown, rather closely and finely echinulate with smooth areas surrounding the pores; pores two, equatorial or slightly superequatorial. Telia like the uredinia, compact, cinnamon brown; teliospores 44-56 x 14-18  $\mu\text{m}$ , cylindrical or elongate terete, obtuse above, narrowed and truncate or less commonly rounded below, constricted at septum; wall 1.5  $\mu\text{m}$  thick, apex thickened 3-4  $\mu\text{m}$ , colorless or slightly tinted golden brown, smooth; pedicel colorless, equalling the spore or longer, broad at point of attachment, 5-6.5  $\mu\text{m}$ , soon collapsing.

An apparently distinct form in which the uredinia appear to be locally systemic. The uredinia are very characteristic, originating quite deeply in the tissues and covered by the epidermis and three or four layers of the rather compact spongy parenchyma. The hymenium of the sorus is flat as in those forms in which the sorus originates just beneath the epidermis. Teliospores are not abundant in this material but occasionally occur in sori essentially like the uredinia and germinate at once (Jackson, 1921).

*Melampsora lisianthi* Patouillard, published in *Rev. Mycol.* 1886: 1, and *Hedwigia* 26: 71. 1887, was reported to be on *Lisianthus elegans* Martius from "Sul do Brasil" but is only an anamorph and not a *Melampsora* (P. Sydow & H. Sydow, *Monogr. Ured.*, vol. 3: 393. 1915). Probably it belongs here.

**PUCCINIA LITHOSPERMI** Ellis & Kellerman, *J. Mycol.* 1: 2. 1885. TYPE on *Evolvulus nuttallianus* Ruis & Pavon from **The United States of America**, Kansas: Manhattan, date and collector not available, not in NY. (0/Icv,IIpe/III).

= *Puccinia enecta* Spegazzini, *An. Mus. Nac. Buenos Aires* 3: 62. 1902. TYPE on *Evolvulus* sp. **Argentina**, Córdoba, March 1901, *T. Stuckert s.n.*

Anamorph

*Uredo evolvuli* Spegazzini, *An. Soc. Cient. Argentina* 12: 72-73. 1881. TYPE on *Evolvulus sericeus* Swartz from **Argentina**, Belgrano, Feb 1881, *Spegazzini s.n.*

On Convolvulaceae:

*Evolvulus nummularius* Linnaeus, Rio Branco, São Marcus, (H. Sydow & P. Sydow, 1916: 72).

*Evolvulus sericeus* Swartz, Rio Grande do Sul (Lindquist & Costa Neto, 1967: 62).

*Evolvulus* sp., Rio de Janeiro (*Carvalho & Hennings-2003-1*).

*Puccinia lithospermi* has been reported also from Argentina to The United States of America and Japan. Joerstad (1956) reported that *Puccinia desertorum* H. Sydow & P. Sydow from southwest Africa and India "does not appear to be very different". *Uredo evolvuli* is included as an anamorph on the basis of Lindquist (1982).

**PUCCINIA LOBATA** Berkeley & Curtis, *Grevillea* 3: 54. 1874. TYPE on *Sida lepidota* A. Gray from **The United States of America**, Texas, (-/-,III).

On Malvaceae

*Sida* sp., Rio de Janeiro (Hennings, 1896: 233).

*Puccinia lobata* has been reported also on species of *Abutilon*, *Althea*, *Fugosia*, *Pseudabutilon*, and *Wissadula*, and from Argentina, Mexico, and The United States of America. Hennings' record (1896) from Brazil cited above was overlooked and not included in the first edition of our Index.

*Puccinia lobata* is similar to several other microcyclic species of *Puccinia* on various genera of Malvaceae. See *Puccinia heterospora* for keys that may help identify microcyclic species of *Puccinia* on Malvaceae.

**PUCCINIA LORENTZII** P. Hennings, *Hedwigia* 35: 239. 1896. TYPE ? on *Vernonia scorpioides*



(Lamarck) Persoon [= *Cyrtocymura scorpioides* (Lamarck) H. Robinson] (reported as "*Vernonia lorentzii* Hieronymus") from **Argentina**, Entre Rios, Feb 1878, *P. G. Lorentz s.n.* (? Lectotype designated by Jackson, 1918). (??,IIpe/III).

On Compositae:

*Vernonia scorpioides* (Lamarck) Persoon [= *Cyrtocymura scorpioides* (Lamarck) H. Robinson], Rio de Janeiro (Hennings, 1896: 239; Jackson, 1932: 116), São Paulo (Jackson, 1932: 116; IBI-17218).

*Vernonia* sp., Santa Catarina (Hennings, 1896: 239).

Although the application of the name *Puccinia lorentzii* P. Hennings is uncertain as explained below, we use this name tentatively for a common rust on *Vernonia scorpioides* in Brazil and Argentina.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, mostly on the abaxial side, 0.2-0.5mm across, scattered or in small circular groups, tan to brown, powdery, ruptured epidermis membranous, remaining around sori; urediniospores 22-28(-30) x (19-)20-24(-25)  $\mu\text{m}$ , globose to subglobose, wall 1.5  $\mu\text{m}$  thick cinnamon-brown, more or less evenly echinulate, echinulae 1.5-2  $\mu\text{m}$  apart, pores 2-3, equatorial, often obscure. Telia mostly on abaxial side of leaves, like the uredinia but dark brown, not pulverulent, teliospores 40-65 x (18-)21-30  $\mu\text{m}$ , oblong, rounded above narrowed below, constricted at septum, wall ca 1-2  $\mu\text{m}$  thick at sides, 4-7  $\mu\text{m}$  thick at apex, chestnut brown, smooth, pore at apex in upper cell, at septum in lower cell but obscure, pedicel to 150  $\mu\text{m}$  long, hyaline (*Hennen-94-6*).

Hennings (1896) listed five collections with the original description, two from Argentina and three from Brazil. Two of the collections from Brazil were collected by Ule and they have only uredinia. Which of the two, or if both of the collections from Argentina have telia and teliospores is not recorded. Hennings described telia as on the abaxial side of leaves, scattered, minute, punctiform and blackish, teliospores as elongate-clavate to oblong, rounded apically, and constricted at the septum, the wall smooth, 4  $\mu\text{m}$  thick, only slightly thickened apically, and chestnut-brown, the pedicel colorless, 8-11  $\mu\text{m}$  thick and up to 150  $\mu\text{m}$  long. The Sydows (1902) also did not record which specimen from Argentina they used for teliospore data but they clarified and gave more information about the species including measurements for teliospores as 40-65 x 21-30  $\mu\text{m}$ , and the wall thickened apically 4-7  $\mu\text{m}$ . For urediniospores the Sydows reported them to be 22-28 x 20-24  $\mu\text{m}$ , globose to subglobose, the walls echinulate, and yellow-brown. Jackson (1918) added the important trait that the urediniospores have three equatorial pores.

We have made more than 100 collections of rust on *Vernonia scorpioides* from Brazil that we have identified as *Puccinia lorentzii* but only one of these has teliospores. These teliospores fit the description given by the Sydows.

Jackson (1918) states that "the type of this species was collected by Lorentz in Argentina, February 1878, on *Vernonia lorentzii* Hieron." However, Jackson states that he did not examine either of the two specimens from Argentina and thus his designation of the Lorentz specimen as "type" was probably based on it being the first listed by Hennings.

Notes in the Arthur Herbarium by Hennen contradict that the walls of the teliospores on the type of *Puccinia lorentzii* are smooth, they state that they are verrucose. A freehand sketch of teliospores labeled as "type" of *Puccinia lorentzii* by Buriticá show the teliospore wall as verrucose and not or only slightly thickened apically. Additionally, paraphyses are noted by Hennen to occur in the uredinia.

To resolve these discrepancies, the two collections from Argentina listed by Hennings need to be reexamined to determine which one has paraphyses in the uredinia and teliospores with walls verrucose and not or only slightly thickened apically. This specimen should be excluded from *Puccinia lorentzii*. The specimen that fits more closely the descriptions by Hennings and the Sydows can then be designated as the lectotype.

*Vernonia scorpioides*, a common weedy plant from Northern Argentina to Central America, is often common along shady roadsides in the eastern part of the state of São Paulo and at least uredinial infections of the rust are common in these areas.

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but three from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

**Puccinia LYGODII** Arthur, Bull. Torrey Bot. Club 51: 55. 1924 [as "(Hariot) *comb. nov.*", but we designate Arthur alone as the author of the teleomorph name because he described telia from the specimen listed here as the type]. TYPE on *Lygodium polymorphum* (Cavanilles) Humboldt,

Bonpland & Kunth, Schizaceae, from **Brazil**, Bahia: 28 May 1915, *Rose & Russell-19664a*.  
(?/?),IIpe/III).

Anamorph

*Uredo lygodii* Hariot, J. Bot. 14: 117. 1900. TYPE on *Lygodium* sp. from Brazil, Pernambuco: date not reported, *Gardener s.n.* (in P, number 1229, fide Faull, 1932).

= *Milesina lygodii* H. Sydow, Mycologia 17: 255. 1925. TYPE on *Lygodium* sp. from **Surinam**, Tumatumari, 11 July 1922, *Stevens-54*.

On Schizaceae (Pteridophyte)

*Lygodium polymorphum* (Cavanilles) Humboldt, Bonpland & Kunth, Bahia (PUR-F3717).

*Lygodium venustum* Swartz, Ceará (IBI-17127), Maranhão (IBI-13621), Mato Grosso (IBI-16768).

*Lygodium volubile* Swartz, Rio de Janeiro (Jackson, 1926: 140; IBI-12839), São Paulo (IBI-12041).

*Lygodium* sp., Amapá (Sotão et al., 2001; IBI-17073), Maranhão (79-147), Mato Grosso (IBI-16768), Pernambuco (Sydow, 1924: 533), Rio de Janeiro (PUR-F19407), São Paulo (IBI-16550).

*Puccinia lygodii* has been reported also from Colombia, Venezuela, Guyana, Central America, and Florida and Louisiana in the United States of America.

Spermogonia and aecia unknown. Uredinia blister-like, subepidermal in origin, erumpent, ruptured epidermis remains partially covering the sorus, a thin, obscure, membranous peridium also breaks open with the epidermis, urediniospores pedicellate, 24-31 x 16-23 µm, mostly obovoid, broadly rounded above, broadly narrowed below, the wall more or less evenly 1 µm thick, golden, echinulate but with 2(-3) irregular, lateral, smooth spots, pores 2(-3), equatorial, mostly with slight, often obscure, cuticular caps. Teliospores in uredinial sori, 22--33 x 19-26 µm, mostly globoid to globoid-ellipsoid, septa mostly perpendicular or oblique, not constricted at septa, wall ca 1-2 µm thick laterally, ca 4.5 µm on top, smooth, colorless, pedicel shorter than the spore (Sotão et al., 2001).

This is the only species of *Puccinia* reported on Pteridophytes. Although the pedicellate, two-celled teliospores with smooth, colorless walls fit well in *Puccinia*, the thin, evanescent uredinial peridium suggests that the correct genus for this species is problematic.

*Puccinia macrocephala* Spegazzini, see **Puccinia CRASSIPES** Berkeley & Curtis.

**Puccinia MACROPODA** Spegazzini, Anal. Soc. Cient. Argentina 10: 8. 1880. TYPE on *Iresine celosoides* from **Argentina**, Buenos Aires: Recoleta, Chacarita, 25 April 1880, *Spegazzini-s.n.* (?/Icv,IIpstr/III).

Synanamorphs:

*Uredo striolata* Spegazzini, Anal. Soc. Cient. **Argentina** 10: 10. 1880. TYPE on *Iresine celosoides* from **Argentina**, "autumo 1880", *Spegazzini s.n.* Anamorph name for uredinia.

= *Puccinia striolata* (Spegazzini) Arthur & J.R. Johnston, Mem. Torrey Bot. Club. 1918. Arthur and Johnston did not describe telia.

= *Uredo saphena* Arthur & Cummins, Ann. Mycol. 31: 44. 1933. TYPE on *Iresine* sp., mistakenly reported originally as *Physalis pubescens* Linnaeus, Solanaceae, from **Cuba**, Oriente: Halguin, 31 Oct 1921, *J. R. Johnston-3513*.

*Aecidium bonariense* Spegazzini, Anal. Soc. Cient. Argentina 9: 174. 1880. TYPE from **Argentina**, Buenos Aires, Riachuelo, Feb 1880, *Spegazzini s.n.* Anamorph name for aecia.

On Amaranthaceae:

*Iresine* sp., Rio de Janeiro (Sydow, 1907: 355).

*Puccinia macropoda* has been reported also from Argentina, Colombia, Cuba, and Puerto Rico. All collections are on *Iresine*.

Spermogonia unknown. Aecia in groups of 20-30 on discolored spots on the adaxial side of leaves, cupulate, peridial cells 22-25 x 14-18 µm, more or less rectangular in face view, outer facing wall smooth, inner facing wall striate verrucose; aeciospores 16-18(-20) x 14-16 µm, µm in diameter, angular spheroid, wall about 1 µm thick, unevenly verrucose, colorless. Urediniospores 25-33 x 20-30 µm, spheroidal or broadly ellipsoid, walls 2-4 µm thick, pale yellowish, striate, lines often sinuous, 1-1.5 µm apart, pores obscure, probably 3, equatorial; teliospores 38-56 x 30-42 µm, broadly ellipsoid to almost spheroid, wall (4-

)6-7  $\mu\text{m}$  thick at sides, 8-10  $\mu\text{m}$  thick above, smooth, chestnut-brown, pedicel to 80  $\mu\text{m}$  long, mesospores sometimes common (Laundon, 1965).

**Puccinia MALVACEARUM** Bertero ex Montagne in Gay, Hist. Fis. y Polit. de Chile 8: 43. 1852.

TYPE on *Althaea officinalis*, from Chile, date and collector not available. (-/-, -/III).

On Malvaceae:

*Alcea rosea* (Linnaeus) Cavanilles, (*Althea*), Minas Gerais (Thurston, 1940: 301).

*Anoda* sp., Brazil (Joerstad, 1959: 79).

*Hibiscus esculentus* Linnaeus, Brazil (Silveira, 1951: 222).

*Malva parviflora* Linnaeus, Minas Gerais (Thurston, 1940: 301), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 131), São Paulo (Viégas, 1945: 36; IAC-1, IBI-2076).

*Malva rotundifolia* Linnaeus, Minas Gerais (Thurston, 1940: 301).

*Malva sylvestris* Linnaeus, Minas Gerais (Thurston, 1940: 301), São Paulo (IBI-1892).

*Malva* sp., Paraná (Fontoura & Nowacki, 1967/70: 147), Santa Catarina (Hennings, 1896: 233), São Paulo (Spegazzini, 1889: 101; Viégas, 1945: 36; IAC-1352).

*Malvastrum coromandelianum* (Linnaeus) Garcke, Minas Gerais (Thurston, 1940: 301; IBI-2238), Rio Grande do Sul (PUR-F17793), São Paulo (Viégas, 1945: 36; IAC-111).

*Sida* sp., Rio Grande do Sul (Lindquist & Costa Neto, 1967: 61), Santa Catarina (Pazschke, 1892: 96).

**Malvaceae, gen indeten.**, Alagoas (Viégas, 1945: 36; IAC-3643).

*Puccinia malvacearum* is widespread on many genera of Malvaceae. It is believed to have originated in the Andean region of South America.

*Puccinia malvacearum* is similar to several other microcyclic species of *Puccinia* on various genera of Malvaceae. See *Puccinia heterospora* for keys that may help identify microcyclic species of *Puccinia* on Malvaceae.

*Puccinia mandevillae* H. S. Jackson & Holway, see **Puccinia CYNANCHI** Berkeley & Curtis.

*Puccinia mariae* H. S. Jackson, see **PROSODIUM PERUVIANUM** (P. Sydow & H. Sydow) Cummins.

**Puccinia MARISCI** Mayor, Mem. Soc. Neuchatel. Sci. Nat. 5: 474. 1913. TYPE on *Mariscus*

*hermaphroditus* (Jacquin) Urban from **Colombia**. A lectotype needs to be chosen from the two collections with telia made by Mayor in 1910: *Mayor-278*, and *-278b*. (?/? $\neq$  IIpe/III).

On Cyperaceae:

*Mariscus flavus* Vahl, Mato Grosso (Joerstad, 1956: 484).

*Puccinia marisci* was reported before only from Colombia.

Mayor (1913) reported traits that may help to identify *Puccinia marisci* as: uredinia on stems, or on the abaxial side of leaves, urediniospores 21-25 x 16-19  $\mu\text{m}$ , subglobose or often ovoid, wall about 2  $\mu\text{m}$  thick, minutely and loosely echinulate, yellowish, pores 2, equatorial; teliospores 28-40 x 14-17  $\mu\text{m}$ , oblong-ellipsoid, rounded at apex, narrowed below, constricted at septum, lateral walls about 1-1.5  $\mu\text{m}$  thick, apical wall thickened up to about 7  $\mu\text{m}$ , dusky, pedicel up to 20  $\mu\text{m}$  long, 5-7  $\mu\text{m}$  wide, deciduous.

*Puccinia maublancii* Rangel, see **Puccinia CHAETOCHLOAE** Arthur.

*Puccinia maydis* Berenger, see **Puccinia SORGHI** Schweinitz.

**Puccinia MEDELLINENSIS** Mayor, Mem. Soc. Neuchatel. Sci. Nat. 5: 497. 1913. TYPE on *Hyptis*

*pectinata* (Linnaeus) Poit. from **Colombia**, Medellin, 26 Aug 1910, *Mayor-295d*. (?/? $\neq$  II/III).

$\equiv$  *Dicaeoma medellinense* Arthur, N. Am. Flora 7: 408.

$\equiv$  *Eriosporangium medellinense* (Mayor) H. Sydow, Ann. Mycol. 20: 122. 1922.

Anamorph

*Coleosporium brasiliense* Dietel, Ann. Mycol. 5: 246. 1907. TYPE on *Hyptis* sp., reported originally as unidentified Labiatae, from **Brazil**, São Paulo: São Paulo, Sept 1906, A. *Usteri* s.n. Only anamorph sori were described. The species needs to be transferred to an appropriate anamorph genus.

= *Uredo atro-rubentis* Mayor, Mem. Soc. Neuch. Sci. Nat. 5: 593. 1913. TYPE on *Hyptis atro-rubens* Poir. from **Colombia**: A lectotype needs to be chosen from the four collections listed by Mayor. (*Mayor-238, -238a, -238b, -238c*).

On Labiatae:

*Hyptis muricata* Schott, Minas Gerais (Thurston, 1940: 301).

*Hyptis verticillata* Jacquin, Minas Gerais (Hennings, 1896: 261).

*Hyptis* sp., Amazonas (Hennings, 1904B: 167), Minas Gerais (Thurston, 1940: 301), Santa Catarina (Hennings, 1895C: 337), São Paulo (Dietel, 1907: 246), Tagua, Serra do Mar (Hennings, 1896: 261).

*Puccinia medellinensis* has been reported also from Central America, The West Indies, and South America on six different species of *Hyptis*.

Urediniospores with two equatorial pores, teliospores 30-40  $\mu\text{m}$  long, walls smooth, and unthickened at the apex of the spore. The morphologically similar *Puccinia hyptidis* has teliospores that are 45-84  $\mu\text{m}$  long (Baxter, 1961).

*Puccinia medusaeoides* Arthur, *nom. nov.* for *Puccinia ornata* Harkness, see **PROSPODIUM APPENDICULATUM** (Winter) Arthur.

*Puccinia melampodii* Dietel & Holway, see **PUCINIA CNICI-OLERACEI** Persoon ex Desmazieres.

**PUCINIA MELANOCEPHALA** H. Sydow & P. Sydow in H. Sydow, P. Sydow, and E. J. Butler, Ann. Mycol. 5: 500. 1907. TYPE on *Erianthus* sp. (probably *E. ravennae*, reported mistakenly as *Arundinaria* sp. in the original publication) from **India**, Wahjain, Khasi Hills, 17 May, 1905, *Butler-512*. (?/?\* **Ipe/III**).

= *Puccinia erianthi* Padwick & Khan, Imp. Mycol. Inst. Kew Mycol. Papers 10-33. 1944. TYPE on *Erianthus fulvus* Nees from **India**, Simla, 23 Sept 1943, *G. W. Padwick-688*.

On Gramineae

*Saccharum officinarum* Linnaeus, Ceará (IBI-17504), São Paulo (IBI-15983).

Cummins (1971) published the corrected identification of the host of the type of *Puccinia melanocephala* as shown above. He also clarified the taxonomy of *P. melanocephala* indicating that it and *Puccinia kuehnii* Butler were two different rust species that attack sugarcane. Koike et al (1979) first reported the occurrence of *Puccinia melanocephala* in the Western Hemisphere, and also reported that *Puccinia kuehnii* had been reported previously from Cuba, Mexico, Central America, and the Dominican Republic but these reports were all based on missidentifications of the rust. Only *P. melanocephala* has been reported in the Western Hemisphere.

*Puccinia melanocephala* was first introduced into Brazil about 1986 and spread rapidly throughout the sugarcane regions. The infections reduce the amount of sugar in the juice. Although many clones and varieties of sugarcane grown in Brazil are resistant, sugarcane plant pathologists must continue to monitor the development of this rust and to test all new clones and varieties for their resistance. This monitoring and testing of varieties and clones is an expensive process and increases the cost of the research needed to produce new improved types of sugarcane. (look up reference in Rev. Bot. Bras. 1992or 93).

**PUCINIA MELANOSORA** Spegazzini, Anal. Soc. Cient. Argentina 9: 170. 1880. TYPE on *Acicarpa tribuloides* Jusseae from **Argentina**, Federal Capital (Buenos Aires): Boca del Riachuelo, Feb 1880, *Spegazzini s.n.* (?/?\* **Ipe/III**).

On Calyceraceae:

*Acicarpa tribuloides* Jussieu, Rio Grande do Sul (Lindquist, 1955: 18).

*Puccinia melanosora* has been reported also from Paraguay and Uruguay. The report of *P. melanosora* on *Trichachne sacchariflora* (Raddi) Nees (Gramineae) from Paraíba (Viégas, 1945: 37) is mistaken.

*Puccinia melicina* Arthur & Holway, see **PUCINIA SCHEDONNARDI** Kellerman & Swingle.

**Puccinia MELANTHERAE** P. Hennings, Hedwigia 36: 214. 1897. TYPE reported originally as on *Melanthera deltoidea* Richard from **Brazil**, Santa Catarina: Blumenau, June 1885, Ule-78. But the label of the isotype specimen in HBG, Ule-78, records the host as *Eupatorium tubarauense* Hieronymus and the collection from São Francisco, Santa Catarina, not Blumenau (?/?,IIpe/III).

On Compositae:

*Eupatorium tubarauense* Hieronymus (?*Melanthera deltoidea* Richard), Santa Catarina (Hennings, 1897).

Presumably known only from the type specimen. Arthur (1918, 1922) reported *Puccinia melantherae* from Guatemala based on the collection Holway-69, but Parmelee (1967) could not confirm the identification and excluded it from North America.

The Sydows (1902) and Parmelee (1967) report traits that may help to identify *Puccinia melantherae* as: uredinia on the abaxial side of leaves, scattered or in groups, minute, cinnamon-brown, urediniospores 20-24 µm in diameter, broadly ellipsoid, wall more or less evenly echinulate, echinulae spaced at 2.1-3.5 µm, pale brown; telia on the abaxial side of leaves, like the uredinia but dark brown, teliospores 32-42 x 24-30 µm, broadly ellipsoid, to subovoid, not constricted at the septum, wall slightly thickened to 5 µm and rounded at the apex, smooth, cinnamon-brown; pedicel short, colorless.

*Puccinia melothriae* Stevens, see **Puccinia SPEGAZZINI** DeToni.

*Puccinia membranacea* Dietel, see **Puccinia BACCHARIDICOLA** P. Hennings.

**Puccinia MENTHAE** Persoon, Syn. Meth. Fung., 227. 1801. TYPE on *Mentha sylvestris* from **Europe**, place and date of collection not available, presumably collected by *Persoon*. Lectotype chosen by Joerstad (1958). (0/Icv,IIpe/III).

On Labiatae:

*Mentha arvensis* Linnaeus, São Paulo (Viégas, 1945: 37; IAC-4224).

*Mentha piperita* Linnaeus, São Paulo (IBI-4817).

*Mentha* sp., Paraná (Fontoura & Nowacki, 1967/70: 150; IBI-10936), São Paulo (IAC-5477; IBI-17595).

*Puccinia menthae* is distributed worldwide on at least 16 genera of the Labiatae (Lamiaceae), subfamily Stachyoideae (Baxter & Cummins, 1953). It is especially common and damaging on cultivated species of *Mentha*. Baxter (1959) organized the morphological variation that had long been recognized in *Puccinia menthae* into four varieties. All of these varieties occur in South America, mainly in the Andean region, but only *Puccinia menthae* var. *menthae* has been reported from Brazil.

*Puccinia metastelmatis* P. Hennings, see **Puccinia CYNANCHI** Berkeley & Curtis.

**Puccinia MEYERI-ALBERTI** P. Magnus, Ber. Deutsch. Bot. Ges. 10: 320. 1892. TYPE on *Berberis* sp. from **Chile**. Lectotype needs to be chosen from the three species listed by Magnus from the high cordillera of Chile. ? (0/Icv,IIcv/III) or ? (III).

Anamorph ?

*Aecidium leveilleanum* P. Magnus, Ber. deutsch. Bot. Ges. 10: 323. 1892. TYPE on *Berberis buxifolia* Lamarck from **Chile**, San Carlos, 19 Dec 1839, Gay.

On Berberidaceae:

Reported as *Aecidium leveilleanum* P. Magnus

*Berberis laurina* Billberg, Thunberg, São Paulo (Jackson, 1927).

*Berberis laurifolia* Billb., Rio Grande do Sul (Lindquist & Costa Neto, 1963: 123).

*Berberis spinulosa* Saint-Hilaire, Santa Catarina (PUR-F19682).

*Berberis* sp., São Paulo (Joerstad, 1957: 46).

Reported as **Puccinia MEYERI-ALBERTI** P. Magnus

*Berberis buxifolia* Lamarck, Santa Catarina (PUR-F6155).

*Berberis laurina* Billbg., Rio de Janeiro (PUR-F18698), São Paulo (Jackson, 1927;64; IBI-12742).

*Berberis spinulosa* Saint-Hilaire, Santa Catarina (PUR-F19684).

*Puccinia meyeri-alberti* has been reported from Southern Argentina and Chile, Uruguay, and Brazil on at least nine species of *Berberis*.

Although Jackson (1927) reported that he found *Aecidium leveillianum* P. Magnus with six of eight specimens of *Puccinia meyeri-albertii* collected by the Holways in South America, he preferred not to connect this anamorph with this teleomorph. Jackson made no mention of spermogonia in his report and stated that inoculation experiments are necessary to establish the connection. The Sydows (1923) reported the presence of spermogonia but Lindquist (1982) stated that he did not see spermogonia in his study of the species. This suggests that this name, *Aecidium leveilleianum*, may apply to both aecia and uredinia of *Puccinia meyeri-albertii*.

Telia on the abaxial side of leaves, scattered singly or in confluent, brownish, compact, groups, on irregular roundish yellow-brown spots; teliospores are 70-95 x 11-16  $\mu\text{m}$ , long narrow, cylindrical, rounded or narrowed at the apex, not or slightly constricted at the septum, slightly narrowed to the pedicel below, walls 1-1.5  $\mu\text{m}$  thick laterally, 4-6(-7)  $\mu\text{m}$  thick at the apex, colorless or very pale brown, smooth; pedicel up to 220  $\mu\text{m}$  long, thick, persistent, colorless. Sometimes one-celled teliospores mixed with the two celled.

*Puccinia berberidis* Montagne, a closely related species reported from Argentina and Chile and not accompanied by an *Aecidium* sp. anamorph, has shorter teliospores with shorter pedicels.

**PUCCINIA MICROSPORA** Dietel, Bot. Jahrb. Syst. 27: 101. 1905. TYPE on *Hemarthria japonica* Roshev. (reported originally as *Rottboellia compressa* var. *japonica*) from **Japan**, Tokyo, 12 Oct 1904, *Namu-s.n.* (?!?≠ Ipe/III).

On Gramineae

*Saccharum angustifolium* (Nees) Trinius (reported as *Erianthus angustifolius* Nees), São Paulo (Cummins, 1953: 13, rust identified originally as *Puccinia kaernbachii* Arthur).

*Saccharum villosum* Steud. (reported as *Erianthus trinii* Hackel), São Paulo (Cummins, 1953: 14).

*Erianthus* sp. (reported originally as "? *Andropogon* sp."), Rio de Janeiro (Cummins, 1953: 13).

*Imperata brasiliensis* Trinius, Rio de Janeiro (Cummins, 1953: 14).

*Imperata tenuis* Hackel, Minas Gerais (Cummins, 1953: 14).

*Puccinia microspora* has been reported also from Argentina, the United States of America, Japan, the Philippines, China, and Borneo, and on *Rottboellia* as another host genus. Cummins examined specimens from diverse regions and host genera but stated that he could find no morphological differences to separate them into more than one recognizable species.

Spermogonia and aecia unknown. Sori mostly on abaxial side of leaves, seriate. Uredinia cinnamon-brown, with colorless or pale golden, capitate paraphyses, the apical wall 6-18  $\mu\text{m}$  thick; urediniospores (21-)23-27(-29) x 16-21(-23)  $\mu\text{m}$ , mostly ovoid or obovoid, wall 1.5-2  $\mu\text{m}$  thick, cinnamon-brown, echinulate, pores 4(5). equatorial. Telia blackish brown, compact, early exposed; teliospores (25-)28-35(-38) x (14-)16-21(-23)  $\mu\text{m}$ , wall 1.5  $\mu\text{m}$  thick at sides, 2-3(-5)  $\mu\text{m}$  thick apically, smooth, chestnut-brown; pedicels to 20  $\mu\text{m}$  long, persistent, brown, thin-walled but usually not collapsing (Cummins, 1971).

**PUCCINIA MIKANIAE** H. S. Jackson & Holway in Jackson, Mycologia 24: 124. 1932. TYPE on *Mikania argyreae* DeCandolle from **Brazil**, Rio de Janeiro, 10 Aug 1921, *Holway-1015*. (?!?,Icv/III).

Anamorph: see below for notes about possible anamorph nomenclature.

On Compositae.

*Mikania argyreae* DeCandolle, Rio de Janeiro (Jackson, 1932:).

*Mikania buddleiaefolia* DeCandolle, Rio de Janeiro (Jackson, 1932: 124).

*Mikania glomerata* Sprengel, Rio Grande de Sul (Lindquist & Costa Neto. 1963: 142).

*Mikania micrantha* Humboldt, Bonpland & Kunth, Paraíba (IAC-3860).

*Mikania pohliana* Schultz-Bipontius, Minas Gerais (PUR-F18270).

*Mikania* sp., Minas Gerais (Jackson, 1932: 124), São Paulo (IBI-18303)..

Spermogonia and aecia not seen. Uredinia (*Aecidium* sp.) on the abaxial side of leaves, in groups 1-8 mm across, cupulate, pale yellowish, the margin erect, erose; peridium cells 28-32 x 14-16  $\mu\text{m}$ , broadly rhomboid, imbricate at ends, outer facing wall transversely striate, inner facing wall coarsely verrucose; urediniospores catenulate, 16-20  $\mu\text{m}$  diam, angularly globoid, wall 1  $\mu\text{m}$  or less thick, verrucose and with

large refractive granules, colorless. Telia on abaxial side of leaves, between and around the uredinia, in groups 2-5 mm across, confluent in blackish, non-erumpent, loculate, stromatic crusts composed of numerous elongate brownish paraphyses; teliospores 30-48 x 12-13  $\mu\text{m}$ , angular clavate to cylindrical, rounded or obtuse above, mostly narrowed at pedicel, not or only slightly constricted at the septum; wall 1.5-2  $\mu\text{m}$  thick at sides, 3-6 at apex, smooth, chestnut brown; pedicel nearly equal to or shorter than the spore, colorless or similar in color next to the spore (Jackson, 1932; Cummins, 1978; Carvalho Jr., A. A. de. 2001).

The telia of *Puccinia mikaniae* are stromatic but those of *Puccinia mikanifolia*, a species also from Brazil, are not. *Uromyces mikaniae* Viégas in which the telia are paraphysate, loculate, and teliospores are all or mostly one-celled, may be a variation of *Puccinia mikaniae*.

See *Chrysocyclus mikaniae* for a key to help identify rusts on *Mikania* in the Neotropics.

**Possible anamorph nomenclature:** Jackson (1932) reported that it is "entirely possible" that *Aecidium mikaniae* P. Hennings is connected to *Puccinia mikaniae*. But Cummins (1978) made no mention of this. Carvalho, Jr. (2001) and Carvalho, Jr. et al. (2002) published photos that clearly demonstrated that the urediniospores (*Aecidium* sp.) of *Puccinia mikaniae* have large refractive granules, a trait not reported before, but one that helps to identify an anamorph of *P. mikaniae*. The type and other specimens previously identified as *Aecidium mikaniae* need to be reexamined to determine if they have similar refractive granules before a connection can be assumed. Some of these specimens also could be the morphologically similar teleomorph *Dietelia portoricensis* (Whetzel & Olive) Buriticá & Hennen, in which the spore walls do not have refractive granules.

The nomenclature and reports of this anamorph are as follows:

***Aecidium mikaniae*** P. Hennings, Hedwigia 35: 261. 1896. TYPE on *Mikania confertissima* Schultz-Bipontius and *Mikania* sp. from **Brazil**, Santa Catarina: Blumenau, Nov. 1888, *Ule-911*; -1435; -146; -314. A lectotype needs to be chosen.  
= *Aecidium expansum* Dietel, Hedwigia 38: 258. 1899.. TYPE on *Mikania scandens*? from **Brazil**, Rio de Janeiro, Mauá, Sept 1896, *Ule-1073*. Not Arthur 1915 & 1925.

On Compositae.

***Mikania confertissima*** Schultz-Bipontius, Santa Catarina (Hennings, 1896: 261).

***Mikania*** sp., Bahia (IBI-13590), Rio Grande do Sul (IBI-12940), Santa Catarina (Hennings, 1896: 261); São Paulo (IBI-16835), Brazil (Rick, 1911: 177); **Peru**, Seringal, São Francisco, Rio Acre (Sydow, 1916: 71).

*Aecidium mikaniae* has been reported from Brazil and Peru northward to Central America and the West Indies. The report of this species from Africa is probably a mistake (Joerstad, 1956).

***Aecidium mikaniae***

Spermogonia epiphyllous, few in the center of epiphyllous spots,

*Puccinia mikania-micranthae* Viégas, see **Puccinia HETEROSPORA** Berkeley & Curtis.

**Puccinia MIKANIFOLIA** H. S. Jackson & Holway in Jackson, Mycologia 24: 125. 1932. TYPE on *Mikania* sp. from **Brazil**, Rio de Janeiro: Itatiaia, 18 May 1922, *Holway-1856*. (0?/-,-/III).

On Compositae:

***Mikania*** sp., Rio de Janeiro (Jackson, 1932: 125), Santa Catarina (IBI-80-113).

*Puccinia mikanifolia* has been reported only from Brazil.

Spermogonia, aecia, and uredinia unknown. Telia on pale spots on abaxial side of leaves, in close groups 1-1.5 mm across; sori 0.2-0.4 mm across, pulvinate, compact, often confluent, ruptured epidermis not evident, chocolate-brown, becoming ashy-gray on germination; teliospores 28-45 x 9-12  $\mu\text{m}$ , slightly irregularly clavate to cylindrical, rounded to obtuse above, narrowed below, slightly constricted at the septum, wall about 1  $\mu\text{m}$  or less thick, apex 3.5-6.6  $\mu\text{m}$ , smooth, cinnamon-brown; pedicel about equal to or shorter than the spore, colorless.

*Puccinia mikanifolia* which has dark chestnut-brown sori, and spores shorter and narrower, and considerably more thickened at the apex, appears to be quite distinct from *P. spegazzinii*, the most common microcyclic species on *Mikania*.

The telia of *Puccinia mikanifolia* are not stromatic and only very rarely has an *Aecidium* been found associated with it. Otherwise it is similar to *Puccinia mikaniae* which has stromatic telia and *Aecidium mikaniae* as an uredinial anamorph.

See *Chrysocyclus mikaniae* for a key to help identify rusts on *Mikania* in the Neotropics.

**Puccinia MILLEGRANAE** Cummins, Bull. Torrey Bot. Club 83: 228. 1956. TYPE on *Panicum millegrana* Poirlet from **Brazil**, Rio de Janeiro, Reserva Florestal Itatiaia, 9 May 1922, *Holway-1834*. (?/? $\neq$  **Ipe/III**).

On Gramineae:

*Panicum rugulosum* Trinius sensu lato includes the report of *Panicum millegrana* Poirlet, Rio de Janeiro (Cummins, 1956: 228; Ramachar & Cummins, 1965: 34).

*Puccinia millegranae* has been reported only from the type.

Spermogonia and aecia unknown. Uredinia on abaxial leaf surface, pale brownish; urediniospores (24-)26-30(-34) x (17-)21-24  $\mu\text{m}$ , ovate or ellipsoid, wall 1  $\mu\text{m}$  thick, colorless or yellowish, finely echinulate, germ pores 3, equatorial. Telia on abaxial surface, exposed, brown; teliospores (30-)35-43(-46) x 15-19(-21)  $\mu\text{m}$ , variable but mostly oblong-ellipsoid or ellipsoid, wall 1  $\mu\text{m}$  thick at sides, 4-7  $\mu\text{m}$  apically, yellow or golden with the apical umbo paler; pedicels to 45  $\mu\text{m}$  long, colorless, thin-walled and collapsing; the teliospores germinate without dormancy (Cummins, 1971).

*Puccinia millegranae* is probably most closely related to *Puccinia puttemansii* but with more elongate and much paler teliospores. The side wall is thinner and the apex is conically papillate rather than broadly rounded and umbonately thickened.

*Puccinia mimosae* Sydow, see **DIORCHIDIELLA AUSTRALIS** (Spegazzini) Lindquist.

**Puccinia MINUTA** Dietel in Atkinson, G. F., Bull. Cornell Univ. (Science) 3: 19. 1897. TYPE on *Carex verrucosa* Muhlenberg, from **United States of America**, Alabama: Auburn, 29 August 1891, *Chieflly-2068*. (?/? $\neq$  **Ipe/III**).

$\equiv$  *Dicaeoma minutum* (Dietel) Arthur, Res. Sci. Cong. Internat. Bot. Vienne p. 344, 1900.

On Cyperaceae

**Genus undetermined**, Amapá, (IBI-16047A), Pará (IBI-13280).

*Puccinia minuta* has been reported before only from the Southeastern United States of America. If the identification of the rust is correct, the host almost surely is *Carex* sp.

Arthur (1934) reported traits that help to identify *Puccinia minuta* as : urediniospores 29-39 x 19-26  $\mu\text{m}$ , broadly ellipsoid or obovoid, walls 1.5-2  $\mu\text{m}$  thick, cinnamon-brown, sparsely and strongly echinulate, pores 3(-4), equatorial; teliospores 32-55 x 16-23  $\mu\text{m}$ , clavate-oblong or cuniate, not or only slightly constricted at septum, usually rounded above, wall 1-1.5  $\mu\text{m}$  thick laterally, 5-9  $\mu\text{m}$  at apex, chestnut-brown, smooth; pedicels about half the length of spore slightly tinted.

**Puccinia MODICA** Holway, J. Mycol. 10: 164. 1904. TYPE on *Arenaria* sp. from **Mexico**, Oaxaca: Etla, month not reported, 1903, *Holway-5401*. (?/? $\neq$  **Ipe/III**).

Anamorph

*Uredo arenariicola* P. Hennings, Hedwigia 35: 353. 1896. TYPE on *Arenaria diffusa* Ell. from **Argentina**, Salta: Nevado del Castillo, 24 Marvh 1873, *G. Hieronymus & Lorentz s.n.* A new name is needed for this anamorph because of *Uredo arenariicola* Plowright, 1887.

$\equiv$  *Puccinia arenariicola* (P. Hennings) H. S. Jackson n. comb. , Mycologia 19: 63. 1927. Telia not described by Jackson. Not *Uredo arenariicola* of Plowright, 1887.

On Caryophyllaceae:

*Arenaria lanuginosa* (Michaux) Rohrbach, São Paulo (Jackson, 1927: 63, IBI-1652; Joerstad, 1956: 458).

*Puccinia modica* has been reported on *Arenaria* spp. from Argentina, Guatemala, and Mexico, and on *Drymaria* sp. from Ecuador. Jackson (1927) found telia on a specimen from Campos do Jordão, São Paulo but did not describe them. His name must be regarded as a synonym of *Uredo arenariicola* P. Hennings. Gallegos & Cummins (1981) report spermogonia and presumably aecia with aeciospores similar to the urediniospores. But their report is not clear about the aecia.

Urediniospores are 19-26 x 18-23  $\mu\text{m}$ , globoid or broadly ellipsoid, wall 1.5-2  $\mu\text{m}$  thick, golden brown, finely and closely verrucose, with 3-6 scattered or sometimes equatorial pores. The teliospores are 29-35 x 23-29  $\mu\text{m}$ , broadly ellipsoid, rounded at both ends, usually not constricted at the septum, the wall 3-4  $\mu\text{m}$  thick laterally, up to 7-8  $\mu\text{m}$  thick at the apex, the pedicel persistent, colorless, up to 120  $\mu\text{m}$  long.



**Puccinia mogiphanis** Arthur, Bot. Gaz. (Crawfordsville) (Crawfordsville) 45: 469. 1918. TYPE on *Achyranthes* sp. from **Peru**, Pasco, 6 Aug 1914, *Dr. & Mrs. J. N. Rose-18804*. We consider this specimen as lectotype because it is recorded to have both uredinia and telia. It is one of two collections with telia recorded by Arthur, the other, also from Peru: Oroya, 14 July, 1914, *Dr. & Mrs. Rose-19498*, recorded to have only telia. (**0/Icv,Ipv/III**).

Anamorph

*Uredo maculans* Patouillard & Gaillard, Bull. Soc. Mycol. France 4: 98. 1888. TYPE on *Alternanthera* sp. (reported originally as nearly *Amaranthaceae*), from **Venezuela**, Caracas, date?, collector? This is the uredinial anamorph. The aecial anamorph belongs to the genus *Aecidium* but has not been named.

= *Uredo mogiphanis* Juel, Bih. K. Svenska Vet.-Akad. Handl. 23: 24. 1897. TYPE on *Mogiphanes* sp. from **Brazil**, Mato Grosso: Cuiba, 17 June 1894, *Lindman s.n.*.

= *Uredo telantherae* Viégas, Bragantia 5: 90. 1945. TYPE on *Alternanthera* sp. from **Brazil**, Parahyba, March 1940, *Deslandes-854*.

= *Uredo panamensis* Arthur, Bull. Torrey Bot. Club 45: 155. 1918. TYPE on *Alternanthera* sp. (originally identified mistakenly as *Phytolacca* sp., *Phytolaccaceae*) from **Panama**, Panama, 7 Dec 1915, *Holway-234*.

On *Amaranthaceae*:

*Achyranthes ramosissima* (Martius) Standley, Rio de Janeiro (PUR-F5962).

*Achyranthes* sp., Rio de Janeiro (Laundon, 1965: 16).

*Alternanthera brasiliensis* Linnaeus Kuntze, Minas Gerais (IBI-12756), São Paulo (IBI-12168).

*Alternanthera dentata* (Moquin) Stuhl., Mato Grosso (Joerstad, 1956: 446).

*Alternanthera moquinii* (Webb ex Moquin) Dusen, Minas Gerais (Laundon, 1965: 16), São Paulo (PUR-F5969).

*Alternanthera puberula* Dietrich, Rio de Janeiro (Jackson, 1927: 57; Laundon, 1965: 16).

*Alternanthera ramosissima* (Martius) Chodat, Rio de Janeiro (Laundon, 1965: 16), São Paulo (Jackson, 1927: 57; Laundon, 1965: 16).

*Alternanthera* sp., Ceará (IBI-14985), Maranhão (IBI-13230), Mato Grosso (Laundon, 1965: 16), Minas Gerais (IBI-12297), Paraíba (Laundon, 1965: 16), São Paulo (IBI-12040).

*Mogiphanes* sp., Mato Grosso (PUR-F5976).

*Telanthera elongata* Moquin, São Paulo (IAC-4076).

*Telanthera* sp., Paraíba (IAC-3851).

*Puccinia mogiphanes* has been reported also from Argentina, Bolivia, Peru, Ecuador, Venezuela, Panama, Costa Rica, and Nicaragua.

Uredinia on both sides of leaves, mostly on the abaxial side of leaves, sometimes caulicolous, up to 1 mm across, cinnamon-brown, powdery, irregularly scattered or in groups, urediniospores 28-43 x 24-40  $\mu\text{m}$ , spheroidal, to broadly ellipsoid, walls 1.5-4  $\mu\text{m}$  thick, densely verrucose-echinulate or densely verrucose, cinnamon-brown, often with a thin paler outer layer, and pores 3-6, often difficult to see, mainly equatorial or scattered. Telia like the uredinia but black and not powdery, teliospores 48-56 x 30-37  $\mu\text{m}$ , ellipsoid, rounded obtusely above, rounded or narrowed below, slightly constricted at septum, wall 3.5-6  $\mu\text{m}$  thick at sides, to 12  $\mu\text{m}$  above, chestnut-brown, smooth, pedicel to 60  $\mu\text{m}$  long, wall yellowish.

Laundon (1965) placed *Uredo maculans* as an anamorph of *Puccinia mogiphanis* but Kern & Thurston (1944) believed it not to belong.

The reports of *Puccinia mogiphanes* on *Achyranthes*, *Mogiphanes*, and *Telanthera* are probably all on *Alternanthera* (Laundon, 1965).

***Puccinia moelleriana*** P. Hennings, Hedwigia 34: 336. 1895. TYPE on *Baccharis* sp., Compositae, from **Brazil**, Santa Catarina: Serra Brassa, 1 Nov 1891, *A. Moeller-s.n.* (**/?/II/III**).

*Puccinia moelleriana* (sometimes spelled "*molleriana*") has been reported only from the type. Lindquist (1958) regards the species as dubious. He examined isotype material from the Stockholm Museum, which consisted of a single leaf, and found only an *Aecidium* sp. Jackson (1932) did not include it in his key to species of *Puccinia* on *Baccharis*.

Fifteen species of *Puccinia* have been reported on *Baccharis* in Brazil. At least 53 species of *Puccinia* have been reported to parasitize species of *Baccharis* in the Americas (Lindquist, 1957). Thus, the New World genus *Baccharis*, which itself has about 380 known species, harbors more *Puccinia* species than any other host genus in the Americas.

*Puccinia mucronata* Persoon, see **PHRAGMIDIUM MUCRONATUM** (Persoon) Schlechtendahl.

**Puccinia NASSELLAE** Arthur & Holway in Arthur, Proc. Amer. Phil. Soc. 64: 196. 1925. TYPE on *Nassella caespitosa* Grisebach from **Bolivia**, Sorata, 12 April 1920, *E. W. D. Holway-508*.  
(?/?/≠ **Ipe/III**).

On Gramineae:

*Nassella sellowiana* (Nees ex Trinius & Ruprecht) Peñailillo [reported originally as *Stipa sellowiana* Nees], Paraná (Joerstad, 1959: 63).

Cummins (1971) reported *Puccinia nassellae* on *Stipa* sp. and *Nassella* sp. and also from Argentina, Chile, Bolivia, and Peru. The *Stipa* spp. reported to be hosts for *P. nassellae* were transferred later to *Nassella* spp.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves, about cinnamon-brown, powdery; paraphyses mostly clavate, curved, colorless to golden, wall 3-5 µm thick apically becoming progressively thinner below; urediniospores (21-)26-30(-36) x (18-)23-26(-31) µm, oval to nearly globoid; wall 1-2 µm thick, echinulate, golden, germ pores, 6-8, scattered. Telia on abaxial side of leaves, blackish brown, compact, pulvinate, exposed; teliospores (30-)36-44(-56) x (18-)21-25(-28) µm, mostly broadly ellipsoid; wall 2-2.5 µm thick at sides, 5-12 µm apically, chestnut-brown, smooth; pedicels to 60 µm long, thick-walled, colorless to golden, non-collapsing, persistent (Cummins, 1971).

**Puccinia NASSELLAE** Arthur & Holway var. *platensis* Lindquist Rev. Fac. Agron. Univ. Nac. La Plata 38: 86-87. 1962. TYPE on *Nassella neesiana* (Trinius & Ruprecht) Barkworth [originally reported as *Stipa neesiana* Trinius] from **Argentina**, Buenos Aires: La Plata, 14 Nov 1947, *Lindquist*.

Lindquist reported that this variety differs because it has both smaller urediniospores (22-28 x 22-25 µm) and teliospores (29-40 x 18-24 µm).

**Puccinia NEGRENSIS** P. Hennings, Hedwigia 43: 159. 1904. TYPE on *Panicum* sp., from **Brazil**, Amazonas: Moura on the Rio Negro, January 1902, *Ule-2788*. (?/?/≠ **Ipe/III**).

= *Triphragmium graminicola* Beeli, Bull. Jard. Bot. Bruxelles 8: 5. 1923. TYPE on unidentified Gramineae, probably *Panicum* sp., from **The Congo**, Nyungu, 1914, *Vanderyst-3357*.

On Gramineae.

*Panicum rugulosum* Trinius sensu lato includes the report of *Panicum millegrana* Poiret, São Paulo (IBI-17888).

*Panicum* sp., Amazonas (Hennings, 1904B: 159).

Cummins (1971) reported *Puccinia negrensis* also from The Congo.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, without paraphyses, cinnamon-brown; urediniospores (19-)24-27 x (15-)17-21 µm, mostly broadly ellipsoid, wall 1.5-2.5 µm thick, golden or cinnamon-brown, echinulate, germ pores 3, equatorial. Telia on abaxial side of leaves, exposed, spores very loosely attached, blackish brown; teliospores (20-)24-26 x (17-)19-22 µm, the septa mostly vertical or oblique, mostly broadly ellipsoid, or globoid, wall 1-1.5 µm thick at sides, 2-4 µm apically, golden or chestnut-brown, smooth; pedicels to 50 µm long but fragile and broken short, colorless, thin-walled and collapsing, (Cummins, 1971).

The dark blackish, almost powdery telia with very loosely attached teliospores that are often irregularly globoid with mostly oblique or vertical septa, help to identify this species.

? **Puccinia NEOHYPTIDIS** Laundon (nom. nov. for *Gymnoconia hyptidis* Lagerheim), Mycotaxon 3: 154. 1975. Not *nom nov.* for *Puccinia hyptidis* (Curtis) Tracy & Earle, 1895, which is a synonym of *Puccinia gibertii* Speggazzini (Laundon, 1975).

≡ *Gymnoconia hyptidis* Lagerheim [as " (Curt.) Lagerheim], Tromso Mus. Aarsh. 17: 83. 1895.

Lagerheim was first to describe telia. TYPE, Lagerheim reported two collections: from **The United States of America** on *Hyptis radiata*: Alabama, date not reported, *M. A. Curtis*; and South Carolina, date not reported, *Ravenel* (type of *Uredo hyptidis* Curtis).

Anamorph

*Uredo hyptidis* Curtis, Amer. J. Sci. II 6: 353. 1848.

On Labiatae

*Hyptis* sp., Santa Catarina (Dietel, 1899: 250).

Previous reports of *Puccinia neohyptidis* have been recorded as *Puccinia hyptidis*. The only record of *Puccinia neohyptidis* in Brazil is that of Ule's (collection number 2534) from Nova Friburgo, Santa Catarina that has only urediniospores (Dietel, 1899). Jackson (1932) stated that this was a doubtful record. Otherwise, *Puccinia neohyptidis* has been reported from Uruguay, Bolivia, Colombia, Guyana, Trinidad, and Central America, The West Indies, The United States of America, and The Phillipines.

Spermogonia and aecia on both sides of leaves. Aecia without peridia, spores catenulate; aeciospores 27-40 x 20-32  $\mu\text{m}$ , ellipsoid or globoid, wall 2-3  $\mu\text{m}$  thick, colorless, coarsely verrucose. Uredinia on abaxial side of leaves, cinnamon-brown; urediniospores 23-30 x 20-26  $\mu\text{m}$ , broadly ellipsoid or globoid; wall 1-2  $\mu\text{m}$  thick, cinnamon-brown, pores 2, equatorial. Telia on abaxial side of leaves, cinnamon-brown or yellowish; teliospores 45-84 x 13-20  $\mu\text{m}$ , cylindrical, fusiform or clavate; wall about 1  $\mu\text{m}$  thick, yellow or colorless, smooth; pore or upper cell apical, of lower next to the septum; pedicel up to 95  $\mu\text{m}$  long, colorless, thin-walled, persistent (Baxter, 1961).

*Puccinia giberti* and *P. neohyptidis* may be separated by the following comparison:

*P. giberti*: aecia with well developed peridia; teliospores 35-45 x 18-25  $\mu\text{m}$ , ellipsoid to oblong ellipsoid, two different forms, some with wall colorless and smooth, others with wall pigmented and verrucose.

*P. neohyptidis*: aecia without peridia or only a few peridial cells; teliospores 70-80 x 16-18  $\mu\text{m}$ , fusiform or oblong fusiform.

**Puccinia NEOROTUNDATA** Cummins, Mycologia 48: 606. 1956. *Nom nov.* for *P. rugosa*

Spegazzini, TYPE same as for *P. rugosa* Spegazzini(-/-,-/III).

$\equiv$  *Puccinia rugosa* Spegazzini, Anal. Soc. Cient. Argentina 17: 92. 1884. TYPE on *Vernonia* sp., from **Paraguay**, Paraguari, December 1881, *Balansa-3433*. (not that of Billings, 1871).

$=$  *Puccinia rotundata* Dietel, Hedwigia 36: 32. 1897. TYPE on unknown Compositae, now identified as *Vernonia* sp. from **Brazil**, Serra Geral, February 1891, *Ule-1686*. (not *Puccinia rotundata* Bonorden, 1860).

On Compositae

*Vernonia brasiliana* (Linnaeus) Druce [ $\equiv$  *Vernonanthura brasiliana* (L.) H. Robinson], Minas Gerais (Thurston, 1940: 303).

*Vernonia ferruginea* Lessing [ $\equiv$  *Vernonanthura ferruginea* (Lessing) H. Robinson], Minas Gerais (Jackson, 1932: 118; Thurston, 1940: 303).

*Vernonia missionis* Gardner [= *Vernonanthura cymosa* (Velloso) H. Robinson], Rio de Janeiro (Jackson, 1932: 118).

*Vernonia petiolaris* DeCandolle [ $\equiv$  *Vernonanthura petiolaris* (DC.) H. Robinson], Rio de Janeiro (Jackson, 1932: 118; PUR-7955), São Paulo (Jackson, 1932: 118).

*Vernonia platensis* (Sprengel) Lessing [ $\equiv$  *Chrysolaena platensis* (Sprengel) H. Robinson], Rio Grande do Sul (Lindquist & Costa Neto, 1963: 143).

*Vernonia polyanthes* Lessing [= *Vernonanthura phosphorica* (Velloso) H. Robinson], Minas Gerais (Viégas, 1945: 46; IAC-4249), Santa Catarina (PUR-F17885), São Paulo (Viégas, 1945: 46; IAC-1362).

*Vernonia westiniana* Lessing [ $\equiv$  *Vernonanthura westiniana* (Lessing) H. Robinson], São Paulo (Jackson, 1932: 118).

*Vernonia* sp., Federal District (IBI 15571), Mato Grosso (88-623/IBI 16732), Mato Grosso do Sul (IBI 14328), Minas Gerais (Jackson, 1932: 18; IBI 12780), Paraná (IBI 12889), Paraíba (Viégas, 1945: 46; IAC-2696), Rio Grande do Sul (12925), Rio de Janeiro (Maublanc & Rangel, 1915: 13; Jackson, 1932: 118; IBI 12837), São Paulo (Sydow, 1907: 354; Viégas, 1945: 46; IAC-302; IBI 13412)

**Gen. undetermined**, Serra Geral (Dietel, 1897: 32).

*Puccinia neorotundata* is common in Southern Brazil and has been reported from Argentina, Paraguay, Colombia, Venezuela, and Costa Rica.

Spermogonia ?, aecia and uredinia not produced. Telia scattered on leaves, along leaf veins, and on petioles and stems, dark brown, powdery, in groups on hypertrophied or small gall-like areas, galls may not occur in all infections. Teliospores 00 x 00  $\mu\text{m}$ , walls uniformly 3-4  $\mu\text{m}$  thick, or slightly thicker over the pores, rugose with small verrucae and ridges of various lengths, these tending to fuse in pseudoreticulate

patterns; germ pore of the upper cell apical or nearly so, of the lower cell depressed midway or below; pedicels fragile, always breaking near the hilum. The reports of spermogonia require confirmation.

Spermogonia, aecia and uredinia lacking. Telia on both sides of leaves, in groups on slightly hypertrophied areas or along the veins, exposed, pulverulent, dark cinnamon brown; spores (30-)35-42(-45) x (20-)22-26(-28)  $\mu\text{m}$ , broadly ellipsoid, wall uniformly 3-4  $\mu\text{m}$  thick or slightly thicker over pores, scarcely bilaminate but decidedly paler externally, rugose with small verrucae and ridges of various lengths, these tending to fuse in pseudoreticulate patterns, golden brown or paler, often almost lemon yellow, pore of upper cell apical or nearly so, of lower cell midway or below; pedicels colorless, fragile, always breaking near hilum (Cummins, 1978).

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but three from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

**PUCCINIA NIEDERLEINII** P. Hennings, Hedwigia 35: 238. 1896. TYPE on *Manettia cordifolia* Martius, reported originally as *Manettia lianthiflora* Grisebach, Rubiaceae, from **Argentina**: Missiones, Esquina del Rio alto Paraná, 29 March, 1883, *J. Niederlein. (-/-, -/III.)*.

On Rubiaceae:

*Manettia bicolor* Poirlet, Santa Catarina (*Ule-1679*, in HBG).

*Manettia cordifolia* Martius, Rio Grande do Sul (Rick, 1911: 176 or 180?, host reported as *Manettia ignata* Schumann; Lindquist & Costa Neto, 1963: 139).

*Puccinia niederleinii* has been reported also from Argentina, and Paraguay on *Manettia* sp. (Juel, 1897) and Cuba on *M. uniflora* Humboldt, Bonpland & Kunth (Joerstad, 1959).

Telia on the abaxial side of leaves, about 0.3 mm across, pulvinate, blackish brown when mature, in concentric groups 2-6 mm wide, teliospores 21-30 x 14-22  $\mu\text{m}$ , broadly ellipsoid to ovoid, rounded above and below or narrowing below, not constricted at the septum, wall 2-2.5  $\mu\text{m}$  thick at sides, not or only 4-6  $\mu\text{m}$  thick above, pale yellowish-brown, smooth, pore of lower cell at the septum, pedicel up to 60(-70)  $\mu\text{m}$  long, one-celled teliospores often abundant (Lindquist, 1982).

**PUCCINIA NOACKII** P. Sydow & H. Sydow. , Ann. Mycol. 5: 352 (?354). 1907. TYPE on *Eupatorium* sp. Compositae, from **Brazil**: São Paulo, "horto botan. São Paulo", April 1898, F. *Noack-374. (?/? , II/III)*.

*Puccinia noackii* has been reported only from the type collection. The Sydows (1907) saw only a few urediniospores and they were in telia. Urediniospores 21-27 x 18-22  $\mu\text{m}$ , ellipsoid to ovoid, the wall 1-1.5  $\mu\text{m}$  thick, shortly echinulate, teliospores were 42-58 x 18-25  $\mu\text{m}$ , oblong to clavate, slightly constricted at the septum, mostly rounded above and somewhat narrowed or rounded below, wall smooth, yellowish, thickened above up to 14  $\mu\text{m}$ , paler or yellowish brown in thickened area; pedicel up to 75  $\mu\text{m}$  long, persistent, thick, colorless to subcolorless (The Sydows, 1907).

Nearly 30 species of *Puccinia* are known on *Eupatorium*, all from the New World. Only three of these are known from Brazil.

**PUCCINIA OAHUENSIS** Ellis & Everhart, Bull. Torrey Bot. Club 22: 435. 1895. TYPE on *Digitaria setigera* Roth [reported as *Digitaria pruriens* (Fisch. ex Trin.) Buse] from **Hawaii**: Oahu Island, summer, 1895, *Heller- 1976* (host identity reported by G. B. Cummins, 1943, and 1965; reported originally as "On some unknown grass resembling *Panicum* or *Holcus*"). (?/?  $\neq$  **Ipe/III**). = *Puccinia digitariae* Pole-Evans, Ann. Bolus Herb. 2: 111. 1917. TYPE on *Digitaria* sp., **South Africa**.

= *Puccinia digitariae-velutinae* Viennot-Bourgin, Bull. Soc. Mycol. France 65: 432. 1951. TYPE on *Digitaria velutinae* (Forssk.) P. Beauvois in West Africa, **Ivory Coast**: Abidjan, Research Station d'Adiopodoume', August 1951, *Viennot-Bourgin-s.n.*

Anamorph.

*Uredo digitariaecola* Thuemen, Mycoth. Univ. No. 2041. 1882. TYPE on *Digitaria sanguinalis* (L.) Scop. from **South Africa**: Cape of Good Hope, Somerset-East, *McOwan s. n.*

= *Uredo digitariae-ciliaris* Mayor, Bull. Soc. Neuchatel. Sci. Nat. 41: 101. 1914. TYPE on *Digitaria ciliaris* (Retz.) Koeler from the **Philippines**.

= *Uredo duplicata* Rangel, Arch. Mus. Nac. Rio de Janeiro 18: 160. 1916. TYPE on

*Digitaria sanguinalis* (Linnaeus) Scopoli from **Brazil**, Rangel 1200.  
 = *Uredo syntherismae* Spegazzini, Anal. Mus. Nac. Hist. Nat. Buenos Aires 31: 398.  
 1951. TYPE on *Digitaria sanguinalis* (Linnaeus) Scopoli, from **Paraguay**,  
 Spegazzini-4750.

On Gramineae:

*Digitaria eriantha* Steud. (reported as *Digitaria decumbens* Stent), Rio Grande do Sul (Lindquist & Costa Neto 1967: 58).

*Digitaria horizontalis* Willdenow, Minas Gerais (Ramachar & Cummins, 1965: 16), São Paulo (PUR-F4886).

*Digitaria sanguinalis* (Linnaeus) Scopoli, Minas Gerais (PUR-F9821); Pará (PUR-F17651), Rio de Janeiro (Rangel, 1916: 160), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 115).

*Digitaria* sp. Rio Grande do Sul (PUR-F19017). São Paulo (IBI-12490).

*Puccinia oahuensis* is circumglobal in warm regions on species of *Digitaria*.

Spermogonia and aecia unknown. Uredinia mostly on abaxial side of leaves, yellowish brown, pulverulent, with colorless, thin-walled, mostly incurved, usually clavate paraphyses; urediniospores (23-)25-32(-40) x (18-)20-25(-28)  $\mu\text{m}$ , mostly ovoid or obovoid, wall 1.5  $\mu\text{m}$  thick, golden or light cinnamon-brown, echinulate, pores (3-)4 or 5(-6), equatorial or in some specimens tending to be scattered. Telia blackish, long-covered, with few peripheral brownish paraphyses; teliospores (27-)35-45(-52) x (12-)16-22(-26)  $\mu\text{m}$ , clavate, obovoid-clavate, or oblong, wall 1-1.5(-2)  $\mu\text{m}$  thick at sides, 2-5(-7)  $\mu\text{m}$  apically, chestnut-brown, smooth; pedicels colorless to brownish, thin-walled and collapsing or not, to 20  $\mu\text{m}$ , persistent (Cummins, 1971).

*Puccinia oblectaneus* H. S. Jackson & Holway, see **UROMYCES OBLECTANEUS** H. S. Jackson & Holway.

*Puccinia obliqua* Berkeley & Curtis, see **PUCGINIA CYNANCHI** Berkeley & Curtis.

**PUCGINIA OBLIQUO-SEPTATA** Viennot-Bourgin, Urediniana 5: 219. 1958. TYPE on *Olyra* sp., [probably *Parodiolyra micrantha* (Kunth) Davidse & Zuluaga; = *O. micrantha* Humboldt, Bonpland & Kunth], from **Brazil**, Rio de Janeiro: Corcovado, 27 July 1913, A *Maublanc*. (?/? ≠ **Ipe/III**).

Anamorph.

*Uredo bambusarum* P. Hennings, Hedwigia 35: 225. 1896. TYPE on *Olyra* sp. from **Brazil**, Santa Catarina: *Ule-866*. (not on *Bambusa* sp. as originally reported).

= *Uredo dentata* Mains, Bull. Torrey Bot. Club. 66: 621. 1939. TYPE on *Parodiolyra micrantha* (Kunth) Davidse & Zuluaga [= *Olyra micrantha* Kunth] from **Brazil**, Rio de Janeiro: 2 Nov 1929, A. *Chase-9981A*.

On: Gramineae.

*Parodiolyra micrantha* (Kunth) Davidse & Zuluaga (= *Olyra micrantha* Kunth), Minas Gerais (Thurston, 1940: 297), Paraná (Joerstad, 1959: 60, as *Puccinia bambusarum* Arthur); Rio de Janeiro (Arthur, 1925: 168, as *Puccinia bambusarum* Arthur; Mains, 1939: 621; IBI-1653); São Paulo (Arthur, 1925: 168, as *Puccinia bambusarum* Arthur; Viégas, 1945: 17; as *Puccinia bambusarum* Arthur; IAC-3099, IBI-1656).

*Parodiolyra* sp. or *Olyra* sp., Amapá (Hennen & Sotão 87-97); Santa Catarina (Hennings, 1896: 255), São Paulo (Sydow, 1907: 356).

*Puccinia obliquo-septata* has been reported also from Paraguay.

Spermogonia and aecia unknown. Uredinia on both sides of leaves or mostly on abaxial leaf surface, cinnamon-brown, with inconspicuous peripheral, cylindrical to capitate, paraphyses, the wall usually thin, yellowish to pale or dark brownish, urediniospores (27-)30-36(-39) x (22-)24-31  $\mu\text{m}$ , broadly ellipsoid or obovoid, wall 2-2.5(-3-5)  $\mu\text{m}$  thick, cinnamon-brown, strongly echinulate, germ pores 3 or 4, equatorial. Telia mostly on abaxial surface, chocolate-brown, early exposed, compact; teliospores (25-)28-40(-44) x (12-)15-20(-23)  $\mu\text{m}$ , mostly ellipsoid or narrowly obovoid, the septum commonly oblique but diorchidioid spores rare, wall 1-1.5  $\mu\text{m}$  thick at sides, 4-8(-10)  $\mu\text{m}$  apically, yellowish to golden brown, smooth; pedicels to 60  $\mu\text{m}$  long but usually shorter, colorless or yellowish, moderately thick-walled but usually collapsing, (Cummins, 1971).

The mature uredinial paraphyses are cylindrical to more frequently broadly capitate, short stalked, with brownish, thin walls. Sori are often hyperparasitized with other fungi. The three other species of *Puccinia* on *Parodiolyra* and *Olyra* do not have paraphyses. *Phakopsora phakopsoroides* also on *Olyra* sp. has uredinia with abundant phakopsoroid paraphyses. See *Phakopsora phakopsoroides* for a key to the species of rusts known on *Olyra*.

**Puccinia OBREPTA** H. S. Jackson & Holway in Jackson, Mycologia 24: 164. 1932. TYPE on *Wedelia isolepis* Blake, Compositae, from **Bolivia**, Sorata, 14 April 1920, *Holway-517*. (0/Icv,IIpe/III).

On Compositae:

*Wedelia hookeriana* Gardner, Paraíba (Viégas, 1945: 38; IAC-3861).

*Puccinia obrepta* has been reported only from two specimens from Bolivia and one from Brazil.

Jackson (1932) characterized *Puccinia obrepta* by its teliospore apical walls thickened 5  $\mu\text{m}$  or more and urediniospores with 5-7 scattered germ pores.

The following key may aid in identifying species of *Puccinia* on *Wedelia* in the Americas.

**Key to help identify species of *Puccinia* on *Wedelia*, Asteraceae in the Americas**

1. Uredinia produced, spores pedicelate
  2. Teliospore walls reticulate, urediniospore pores 2, equatorial with encircled by smooth areas
    1. *Puccinia guatemalensis* Parmelee  
Central America, Mexico, also on *Zexminia*.
  2. Teliospore walls smooth, urediniospore pores 2, aecia a *Caeoma* sp., without peridia
    2. *Puccinia wedeliicola* H. S. Jackson & Holway  
Brazil
  2. Teliospore walls smooth, urediniospore pores 3 or more, aecia where known with well developed peridia
    3. Teliospores not or slightly thickened at apex, 3  $\mu\text{m}$  or less
      4. Teliospores not thickened at apex, germinate without dormancy, urediniospores rare, 3-4 scattered pores
        3. *Puccinia inaudita* H. S. Jackson & Holway  
Central America, Mexico
      4. Teliospores slightly thickened at apex, 3  $\mu\text{m}$  or less, urediniospores with 4 equatorial pores
        4. *Puccinia caracasana* H. Sydow;  
Barbados, Venezuela
    4. Urediniospores with 6 scattered pores
      5. *Puccinia ecuadorensis* Arthur;  
Ecuador
  3. Teliospore appreciably thickened at apex, 5  $\mu\text{m}$  or more
    5. Urediniospores with 5-7 scattered pores
      6. *Puccinia obrepta* H. S. Jackson & Holway  
Bolivia, Brazil
    5. Urediniospores with 3-4 equatorial pores
      6. Urediniospores 18-21 x 24-27  $\mu\text{m}$ , depressed globoid or ellipsoid, wall 1.5-2  $\mu\text{m}$  thick, pale cinnamon to golden brown
        7. *Puccinia aubaquila* H. S. Jackson & Holway  
Bolivia, Peru, Ecuador
      6. Urediniospores 19-22 x 23-26  $\mu\text{m}$ , slightly broadly transversely ellipsoid, wall 1-1.5  $\mu\text{m}$  thick, cinnamon-brown
        8. *Puccinia spegazziniana* De-Toni  
Argentina, Uruguay, Central America
      6. Urediniospores 27-34 x 22-27  $\mu\text{m}$ , mostly globoid, wall 3-3.5  $\mu\text{m}$  thick, chestnut-brown
        9. *Puccinia puntana* Lindquist;  
Argentina
1. Uredinia absent, microcyclic
  10. *Puccinia cnici-oleracei*  
(*Puccinia wedeliae*)  
Colombia  
**Uromyces cuculatus**

If teleomorphic stage belongs to **Uromyces**

**PUCCINIA OBVOLUTA** H. S. Jackson & Holway in Jackson, Mycologia 18: 143. 1926. TYPE on *Cyperus ferax* L. C. Rich. from **Brazil**, Rio de Janeiro, 20 December 1921, *Holway-1414*. (?/?≠ IIpe/III).

On Cyperaceae.

*Cyperus ferax* Richard, Rio de Janeiro (Jackson, 1926: 143).

*Puccinia obvoluta* has been reported from only the two specimens from Rio de Janeiro that were cited by Jackson (1926).

Spermogonia and aecia unknown. Uredinia scattered or in groups on yellowish spots 1-2 mm across on abaxial side of leaves, tardily naked, long covered by the overarching epidermis that splits open on one side, cinnamon-brown, powdery; urediniospores 26-30 x 22-24  $\mu\text{m}$ , globoid or ellipsoid, the wall 1.5-2  $\mu\text{m}$  thick, golden brown, finely and sparsely echinulate, with 2 slightly superequatorial pores. Telia tardely naked, long covered by the epidermis, somewhat pulverulent, blackish brown, teliospores 42-60 x 12-16  $\mu\text{m}$ , irregularly clavate or cylindrical, obtuse or acute above, narrowed below, scarcely constricted at the septum, the wall 1  $\mu\text{m}$  or less thick laterally, rather abruptly thickened at the apex 3-4  $\mu\text{m}$ , smooth, the pedicel commonly less than half the length of the spore, reddish brown (Jackson, 1926).

**PUCCINIA OCELLIFERA** Cummins, Mycotaxon 5: 405. 1977. Nom. nov. for *Dicaeoma pluchaea* Arthur & Jackson. TYPE, lectotype designated by Cummins (1956) on *Pluchia fastigiata* Grisebach, Compositae, from **Argentina**, Jujuy: Quinta near Laguna de la Brea, 13 June 1901, (*Vest. Microm. Rar. Sel. 1368*) in BPI. (?/I?, II/III).

The name *Puccinia pluchae* (Arthur) Cummins stat. nov. cannot be used because the basionym was published by Arthur, 1922, without a description of teliospores.

*Puccinia biocellata* (Arthur) Vestergren, in *Micromycetes rar. Sel.* Nos. 1267, 1368. 1908. Nom nud.

≡ *Dicaeoma pluchae* (Sydow) Arthur & Jackson, in *N. Am. Fl.* 7: 793. 1926.

≡ *Puccinia biocellata* Vestergren ex Cummins, *Mycologia* 48: 606. 1956. Nom. Illegit., telia described but the name a later homonym.

Anamorph

**Uredo pluchae** H. Sydow & P. Sydow, *Ann. Mycol.* 1: 333. 1903. TYPE on *Pluchia camphoratae*, Compositae, **United States of America**, Florida: Eustis, Lake County, *G. V. Nash s. n.*

= *Uredo biocellata* Arthur, *Bull. Torrey Bot. Club* 33: 517. 1906. TYPE on *Pluchia purpurascens* (Linnaeus) DeCandolle from **United States of America**, Florida: Florida Keys, 1898, *C. L. Pollard-143*.

= *Uredo pluchae* Spegazzini, *Anal. Mus. Nac. Buenos Aires* 19: 319. 1909. TYPE on *Pluchea quitoc* from **Argentina**, Salta: Ledesma, April 1905, *Spegazzini s. n. Nom. illegit., a later homonym*.

= *Puccinia pluchae* Arthur, *Bull. Torrey Bot. Club* 49: 194. 1922, teliospores not described.

On Compositae.

**Pluchea quitoc** DeCandolle (Compositae), Rio de Janeiro (Jackson, 1932: 158).

*Puccinia ocellifera* has been reported also from Florida in the United States of America, Mexico, Guatemala, Puerto Rico, and Bolivia and Argentina in South America, only on *Pluchea* spp.

Spermogonia not seen. Aecia on abaxial surface in small groups, peridium fragile; spores 13-17  $\mu\text{m}$  diam. angularly globoid, wall 1  $\mu\text{m}$  thick, colorless, minutely verrucose. Uredinia on both sides of leaves, dark brown; spores (24-)28-33(-35) x (22-)24-27  $\mu\text{m}$  obovoid or broadly ellipsoid, wall 1.5-2  $\mu\text{m}$  thick, echinulate except over pores, cinnamon brown, pores 2, equatorial in the strongly flattened sides of spore, overlaid by large caps. Telia on abaxial leaf surface, exposed, compact, about cinnamon-brown becoming gray from germination; spores (40-)43-55(-67) x (16-)18-24(-26)  $\mu\text{m}$ , ellipsoid or oblong ellipsoid, wall 1(-1.5)  $\mu\text{m}$  thick at sides, golden brown, 5-8  $\mu\text{m}$  thick apically by an abrupt, pale, umbo, smooth, pore of upper cell apical, of lower cell at the septum; pedicels colorless, to 65  $\mu\text{m}$  long but often broken short. (Cummins, 1978)

*Puccinia ocellifera* is characterized by unique urediniospores with two equatorial germ pores, one on each of the two flattened sides, and each pore covered with a large lens-like cap 18-25 µm in diameter, plus the teliospores 43-55 µm long.

The *Aecidium* sp. anamorph described for this species by Cummins (1978) requires confirmation. The only specimen known to have an *Aecidium* sp. believed to be connected to *P. ocellata* was in the Arthur Herbarium (PUR-33900), but it no longer has any of these sori.

*Puccinia offuscata* Arthur, see **PUCCINIA ARACHIDIS** Spegazzini var. **OFFUSCATA** (Arthur) Cummins.

**PUCCINIA OLDENLANDIICOLA** P. Hennings, Hedwigia 47: 267. 1908. TYPE on *Oldenlandia herbacea* DeCandolle, Rubiaceae, from **Brazil**, Bahia: Tambury, Oct 1906, *Ule-3328*. (?/?,?/III). *Puccinia oldenlandiicola* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

**PUCCINIA ONCIDII** Cummins, Bull. Torrey Bot. Club 87: 39. 1960. TYPE on *Oncidium* sp. from **Mexico**, place and month not recorded, 1957, intercepted in customs, Miami, Florida, 21 Aug 1957, inspector A. S. Mills, Miami number 4794. (?/?,Ipe/III).

On Orchidaceae:

*Oncidium* sp., Brazil, state not recorded (PUR-F16440).

Cummins (1960) did not report the above collection of *Puccinia oncidii* from Brazil, which was intercepted by customs, but he did report a collection of from Ecuador, another customs interception in Miami.

Cummins (1960) reported traits of *Puccinia oncidii* as: urediniospores 26-30 x 22-26 µm, mostly broadly obovoid, the wall 2(-3) µm thick, cinnamon-brown, echinulate, and with 2(-3) equatorial germ pores; the teliospores (43-)-46-58(-64) x 20-24 µm, clavate-ellipsoid, rounded at the apex, the wall 2-3 µm thick at the sides, 4-7 µm thick at the apex, chestnut-brown to golden-brown, smooth, the pore apical in the upper cell and at the septum in the lower cell, the pedicel up to 50 µm long, colorless, thin and persistent.

**PUCCINIA OPULENTA** Spegazzini, Anal. Soc. Cient. Argentina 9: 170. 1880. TYPE on *Ipomoea acuminata* from **Argentina**, la Boca del Riachuelo, Buenos Aires, 1880, ?Spegazzini-s.n.

*Puccinia ordinata* H. S. Jackson & Holway, see **PUCCINIA CNICI-OLERACEI** Persoon ex Desmazieres.

*Puccinia ormosiae* Arthur, see **DICHEIRINIA ORMOSIAE** (Arthur) Cummins.

*Puccinia ornata* Harkness, see **PROSPODIUM APPENDICULATUM** (Winter)Arthur.

**PUCCINIA OXALIDIS** Dietel & Ellis in Dietel, Hedwigia 34: 291. 1895. TYPE on *Oxalis* sp. from **Mexico**, place and date not reported, *E. Palmer-s. n.* A specimen recorded in BPI data base as collected by *E. Palmer*, 5 Jan-6 Feb 1892 from Tepic, Nayarit, Mexico perhaps is an isotype. ? (O/Icv<sup>s</sup> Ipe/III), ? (?/??<sup>s</sup> Ipe/III), or ? (?/?,Ipe/III).

Anamorph

*Uredo oxalidis* Léveillé, Ann. Sci. Nat. II, 16: 240. 1841. TYPE on *Oxalis* sp. from **Venezuela**, place, date, and collector not reported.

= *Uredo oxalidearum* Cooke, Grevillea 10: 123. 1882.

≡ *Argomyces* (?) *oxalidis* (Léveillé) Arthur, N. Am. Flora 7:217. 1912. (basonym is an anamorph).

≡ *Dicaeoma oxalidis* (Léveillé) Kuntze, Rev. Ger. 3 (3): 469. 1898. (basonym is an anamorph).

On Oxalidaceae (uredinia and telia):

*Oxalis corymbosa* DeCandolle, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 129), Santa Catarina (Pazschke, 1892: 97; Hennings, 1896: 247).



*Oxalis martiana* Zuccarini, [*Ionoxalis martiana* (Zuccarini) Small], Minas Gerais (Thurston, 1940: 301; Viégas, 1945: 38; IAC-3989), Santa Catarina (PUR-F6289), São Paulo (IAC-4363).

*Oxalis salva* +, Minas Gerais (IBI-552).

*Oxalis* sp., Minas Gerais (IBI-16238), Paraná (Fontoura & Nowacki, 1967/70: 155), Rio de Janeiro (Dietel, 1895: 291; 1899: 250; Jackson, 1931: 359; Viégas, 1945: 38; IAC-4088; IBI-1699), Santa Catarina (IBI-12953), São Paulo (Spegazzini, 1908: 9; Jackson, 1931: 359; Viégas, 1945: 38; IAC-69, IBI-15617).

*Puccinia oxalidis* has been reported throughout tropical and subtropical America from Argentina to the southern United States of America on several species of *Oxalis*. Also, it has been introduced into Australia, New Zealand, Japan, and probably elsewhere.

Spermogonia and aecia uncertain (see below). Uredinia 0.2-0.5 mm across, scattered or closely crowded, sometimes in circles, mostly on abaxial side of leaves, subepidermal in origin, erumpent, powdery, bright golden- to orange-yellow when fresh, without paraphyses; urediniospores 17-24 x 16-19 µm, globose, wall 0.5-1 µm thick, minutely echinulate, colorless, germ pores obscure. Telia on abaxial side of leaves, pale brownish yellow to nearly colorless, teliospores 18-28 x 13-20 µm, oblong, wall, 0.5-0.8 µm, colorless, pedicel about as long as spore or shorter, germinating without dormancy (Arthur, 1934)

Infected leaflets are easily seen because of the many crowded, bright yellow, powdery uredinial sori mostly on the abaxial side of leaflets. Teliospores are not commonly reported but they are easily identified because they germinate without dormancy and their walls are very thin, smooth, and colorless.

Although Long (1917) reported inoculations that indicated that spermogonia and aecia of *P. oxalidis* occur on *Mahonia repens* (Lindley) Don (Berberidaceae) in New Mexico in the United States of America, these results have never been confirmed by additional inoculation experiments nor field observations. Other rusts that have been reported to produce *Aecidium*-like aecia on species of *Mahonia* include, the well known heteroecious *Puccinia graminis* Persoon, and the autoecious, long cycle rust, *Cumminsia mirabilissima* (Peck) Nannfeldt and other species of *Cumminsia*.

Two other heteroecious rusts on Gramineae have been reported to produce spermogonia and aecia on *Oxalis* spp. in the Western Hemisphere: *Puccinia andropogonis*, which produces uredinia and telia on *Andropogon* spp., and *Puccinia sorghi* which produces uredinia and telia on *Zea* spp.

Jackson (1931) mistakenly listed *Aecidium mexicanum* Maublanc (not *Aecidium mexicanum* Dietel & Holway) and *Ae. maublancii* Sydow *nom. nov.* for *Ae. mexicanum* Maublanc as synonyms of *Puccinia oxalidis*.

*Puccinia oxypetali* P. Hennings, see **Puccinia CYNANCHI** Berkeley & Curtis.

*Puccinia pachyspora* Dietel, see **Puccinia EUPATORII** Dietel.

**Puccinia PALICOUREAE** Mains, Carnegie Inst. Washington Publ. 461: 102. 1935. TYPE on *Palicourea triphylla* DeCandolle from **Belize** (British Honduras): Belize, 7 May 1931, H. H. Bartlett-13091. (??, Ipe/III).

Anamorph

See *Uredo psychotricola* which is probably an anamorph of *Puccinia palicoureae*.

On Rubiaceae

*Palicourea coriacea* (Chamisso) K. Schumann, Federal District (IBI-12474), São Paulo (IBI-12609).

*Palicourea guianensis* Aublet, Amapá (Hennen et al., 2001: 139).

*Palicourea marcgravii* A. Saint-Hilaire., Minas Gerais (IBI-14571).

*Palicourea rigida* Kunth, Federal District (IBI-12450), Minas Gerais (IBI-12795). Pará (IBI-13286), Paraná (IBI-12151), São Paulo (IBI-12595).

*Palicourea* sp., Amapá (Hennen et al., 2001: 140; IBI-16012), Minas Gerais (IBI-12795), Pará (IBI-16035), São Paulo (IBI-13854).

*Psychotria* sp., Goiás (IBI-13348), Mato Grosso do Sul (IBI-14340), Pará (S97-427), São Paulo (IBI-16530).

As *Uredo psychotricola*

*Psychotria* sp., Goiás (Hennings, 1895B: 321); Rio de Janeiro (Dietel, 1899: 256; Jackson, 1832:

100), São Paulo (Hennings, 1908B: 2; Jackson, 1932: 100).

*Puccinia palicoureae* has been reported previously only from the type from Belize listed above.

Spermogonia and aecia unknown. Urediniospores (20-)22-32 x (16-)22-24 µm, broadly ellipsoid, obvoid, or subglobose, the wall evenly 1-1.5 µm thick, colorless, pale yellow or cinnamon, somewhat sparsely echinulate, the echinulations prominent, up to 2 µm long and almost as wide at the base, usually with irregular, smooth areas on sides of the spore, the pores obscure, probably 2 associated with the smooth spots. Teliospores from Amapá 24-33 x 13-18 µm, broadly ellipsoid, rounded above and below, slightly constricted at the septum, germinating without dormancy; wall very thin, uniformly 0.5-1 µm, colorless or slightly tinted, smooth; pedicel short (Mains, 1935).

When compared to the closely related *Puccinia fallax* (Mains, 1935), *Puccinia palicoureae* has more pronounced echinulations on the urediniospores and larger teliospores. In the original description, Mains (1935) reported teliospores from Belize as 32-42 x 12-16 µm, and fusiform-oblong.

**Puccinia PALLIDISSIMA** Spegazzini, Anal. Soc. Cient. Argentina 12:69. 1881. TYPE on *Stachys arvensis* from **Argentina**, Córdoba: near San. José. Sierra Chica mountains, date not reported, *Heironymous s.n. (-I-, -/III)*.

= *Puccinia albida* Dietel & Neger, Bot. Jahrb. Syst. 24:160. 1897. TYPE on *Stachys* from On Labiatae:

*Stachys* sp., São Paulo (Hennings, 1902B:105; *Puttemans-267*).

*Puccinia pallidissima* has been reported also from Chile, Bolivia, Ecuador, Colombia, Venezuela, Guatemala, and Mexico.

Spermogonia, aecia, and uredinia not produced. Telia on abaxial side of leaves, minute, numerous in anastomosed groups to 1 mm across, the groups on slightly larger pale leaf spots; teliospores 34-42 x 12-15 µm, elongate-clavate to obovoid-clavate, rounded or abruptly narrowed above, gradually narrowing below, slightly constricted at the septum, wall about 1 µm thick at sides, 2-5 µm thick above, smooth, colorless or pale yellow, pedicel fragile, thin, colorless, about as long as the spore. Teliospores germinate without dormancy with a two-celled metabasidium (Jackson, 1932).

**Puccinia PAMPEANA** Spegazzini, Anal. Soc. Cient. Argentina 10: 290. 1880. TYPE on *Salpichroa organifolia* (Lamarck) Baillon from **Argentina**, Buenos Aires: Chacarita, 2 May 1880, *Spegazzini-s.n. (0/IIIendo/IIIpuccinia)*.

= *Puccinia araucana* Dietel & Neger, Bot. Jahrb. Syst. 24: 159. 1897. LECTOTYPE on *Solanum cyrtopodium* Dun. from **Chile**, Cordillera de Villarica, Jun 1897, *F. Neger* (Exsiccati, Vestergren, Micromycetes rariores selecti, century XII, no. 1160). See also below.

= *Puccinia solanina* Spegazzini, Anal. Mus. Nac. Hist. Nat. Buenos Aires 23: 26.1912.

TYPE on *Acnistus parviflorus* Grisebeck from **Argentina**, Jujuy: Calilegua, Nov 1911, ? *Spegazzini s.n.*

≡ *Dicaeoma pampeana* (Spegazzini) Kuntze, Rev. Gen. Pl. 3: 467, 470. 1898.

= *Puccinia paulensis* Rangel, Arch. Jardim Bot. Rio de Janeiro 2: 70. 1918. TYPE on *Capsicum annum* Linnaeus from Brazil, São Paulo, *Rangel-1530*, & *-1530a*.

= *Puccinia gonzalezii* Mayor (as "Gonzalezi") Mem. Soc. Neuchatel. Sci. Nat. 5: 502. 1913.

TYPE on *Capsicum* sp. **Colombia**, Eastern Andes, El Buqueron de Guachuni, 24 Oct. 1910, *Mayor-365*.

= *Puccinia capsici* Mayor, Mem. Soc. Neuchatel. Sci. Nat. 5:506. 1913. TYPE on *Capsicum cf. baccatum* L. from **Colombia**, Tolima: Central Andes, Soledad, on road to Mariquita, 6 Oct 1910, *Mayor-84*.

= *Puccinia capsici* Averna-Saccá, Molestias Cryptogamicas das Plantas Horticolas, São Paulo, p. 1, 1917, TYPE on *Capsicum* sp. from **Brazil**, São Paulo, no known extant specimens. (not Mayor, 1913).

Second telial stage:

***Endophyllum pampeanum*** (Spegazzini) Lindquist, Bol. Soc. Argentina Bot.10: 114. 1963.

≡ *Aecidium pampeanum* Spegazzini, Anal. Soc. Cient. Argentina 10: 11. 1880. TYPE on *Salpichroa organifolia* (Lamarck) Baillon (originally identified as *S. rhomboidea* Miers), from **Argentina**, Buenos Aires, Chacarita, 2 May 1880, *Spegazzini s.n.*

= *Aecidium capsici* Kern & Whetzel, J. Dept. Agri. Puerto Rico 14: 341. 1930. TYPE on

*Capsicum baccatum* Linnaeus from **Colombia**, Antioquia: Fredonia, 10 Apr 1927, Toro-197.

= *Puccinia capsicola* Kern & Thurston, Mycologia 32: 625. 1940. TYPE on *Capsicum baccatum* L. from **Colombia**, Antioquia: Fredonia, 10 Apr 1927, Toro-197. (no description of teleomorph).

On Solanaceae:

*Capsicum annuum* Linnaeus, São Paulo (Rangel, 1918: 70; IBI-5851).

*Capsicum baccatum* Linnaeus, São Paulo (PUR-F19365).

*Capsicum frutescens* Linnaeus, Minas Gerais (Thurston, 1940: 302; Viégas, 1945: 39; IBI-2017; IAC-4004), São Paulo (Averna-Sacca, 1917: 61; Viégas, 1945: 39; IBI-4955).

*Capsicum microcarpon* DeCandolle, Minas Gerais (Thurston, 1940: 302).

*Capsicum pendulum* Willdenow, São Paulo (IBI-3394).

*Capsicum* sp., Minas Gerais (Thurston, 1940: 297, as *Puccinia capsici* Mayor); Paraná (Fontoura & Nowacki, 1967/70: 120, as *Puccinia capsici* Mayor), São Paulo (Viégas, 1945: 39; IBI-247, IAC-348, -1142).

*Salpichroa rhomboidea* Miers (Solanaceae), Rio Grande do Sul (Joerstad, 1959: 89).

*Salpichroa* sp., Rio de Janeiro (Dietel, 1899; 205).

*Puccinia pampeana* occurs from Argentina to Mexico on species of *Capsicum*, *Salpichroa*, *Solanum* and probably other species of Solanaceae. In older literature it has been reported as *Puccinia paulensis* on species of *Capsicum*. The life cycle of *Puccinia pampeana*, in which there are two teleomorph generations, has been studied in detail by Figueiredo, Hennen, Lopez-Franco, and colleagues (1984, 1990, 1995).

For a detailed discussion of this species, see information given in the section on life cycles.

We prefer to unite *Puccinia araucana* with *Puccinia pampeana* but if it is separated the following arrangement should be followed:

**PUCGINIA ARAUCANA** Dietel & Neger, Bot. Jahrb. Syst. 24: 159. 1897. LECTOTYPE on *Solanum cyrtopodium* Dun. from **Chile**, Cordillera de Villarica, Jun 1897, F. Neger (Exsiccati, Vestergren, Micromycetes rariores selecti, century XII, no. 1160). (?/IIcv/III, but see *Puccinia pampeana*).  
= *Puccinia solanina* Spegazzini, Anal. Mus. Nac. Hist. Nat. Buenos Aires 23: 26.1912. TYPE on *Acnistus parviflorus* Grisebeck from **Argentina**, Jujuy: Calilegua, Nov 1911, ? Spegazzini s.n.

Anamorph

*Aecidium solaninum* Spegazzini, Anales Soc. Ci. Argentina Pug. IV, 12:79. 1881. TYPE on *Acnistus parviflorus* g Grisebeck (host originally missidentified as *Acnistus arborescens* Schlechtendahl) from **Argentina**, Córdoba: Sierra Chica (near San José), 11 Jan 1877, *Hieronymus* s.n.

= *Aecidium solaninum* Spegazzini var. *laevis* Spegazzini. Anales Mus. Nac. Hist. Nat. Buenos Aires 19: 470. 1909. TYPE on *Acnistus parviflorus* Grisebach from **Argentina**, Tucumán, April 1905, Spegazzini ?

On Solanaceae

Reported as *Puccinia solanina*:

*Acnistus breviflorus* Sendtner, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 137; IAN-719).

*Acnistus parviflorus* Grisebach, Santa Catarina (PUR-F7437).

*Acnistus* sp., Santa Catarina (Pazschke, 1892: 95; Hennings, 1896: 260), Goiás (Hennings, 1895A: 103).

*Acnistus* sp., Santa Catarina (Pazschke, 1892: 95, as *Aecidium solaninum*; Hennings, 1896: 260), Goiás (Hennings, 1895A: 103).

Reported as *Puccinia araucana*:

*Acnistus breviflorus* Sendtner, Rio Grande do Sul (BPI-103502).

*Puccinia araucana* has been reported also on *Solanum* spp. and from Argentina, Chile, and Bolivia. Lindquist (1983) reported this species as *Puccinia solanina* but states that he considers it the same as *Puccinia araucana*. He also lists host genera in Argentina as *Cestrum* and *Dunalia*. Perhaps the records from Brazil listed above as on *Acnistus* refer to *Dunalia*.

This species is morphologically almost identical to *Puccinia pampeana* Spegazzini which has an *Endophyllum* stage directly associated with its *Puccinia* stage. No experimental germination of the *Aecidium*-

like spores of *P. araucana* has been done to determine if they function as teliospores as in *P. pampeana*. If they prove to be an *Endophyllum* stage then *P. araucana* should become a synonym of *P. pampeana*.

*Puccinia panici* Dietel, see **Puccinia EMACULATA** Schweinitz.

*Puccinia panicola* Arthur, see **UROMYCES SETARIAE-ITALICAE** Yoshino.

*Puccinia papillifera* Sydow, see **DIORCHIDIUM PUIGGARII** Spegazzini.

**Puccinia PARAËNSIS** Dietel Ann. Mycol. 6: 96. 1908. TYPE on *Gouania pyrifolia* Reiss, from **Brazil**, Pará: Belém, bairro Marco, Dec. 1907, *C. F. Baker-60. (0/Ipe,IIpe/III).*

On Rhamnaceae:

*Gouania blanchetiana* Miguel, Pará (Dietel, 1908; Jackson, 1931); Rio de Janeiro, (Jackson: 1931).

*Gouania cornifolia* Reiss, Pará (Albuquerque, 1971).

*Gouania pyrifolia* Reiss, Amapá, (Hennen et al., 2001: 142), Pará (Sotão, S97-568).

*Gouania* sp., Amapá (Hennen et al., 2001:142 ; IBI-17060), Bahia (IBI-13464), Goiás (IBI-13229), Maranhão (IBI-17105), Pará (IBI-13640).

*Puccinia paraensis* has been reported only from Brazil in the New World. Viennot-Bourgin (1953) recorded *Puccinia paraensis* also from Africa on *Gouania longipetala* Hemsley.

Spermogonia intermixed between the aecia. Aecia on both sides of the leaves on slightly hypertrophied spots, often extending along the veins; aeciospores similar to urediniospores. Uredinia on abaxial side of leaves, without paraphyses, often with both urediniospores and teliospores; urediniospores 29-38 x 24-30 µm, obovoid to subglobose, wall 2-2.5 µ thick, echinulate but with smooth spots near pores, pores 2, equatorial. Teliospores 30-44 x 18-24 µm, ellipsoid to cuneate, rounded above, often narrowed below, constricted at the septum, walls thin, colorless, pedicel thin-walled, colorless, variable in length, metabasidia formed without dormancy (Hennen et al., 2001:142).

Aecia and telia were found but uredinia were not found in specimens from Amapá and Pará.

*Puccinia incallida* Cummins on *Gouania longipetala* from Gold Coast, Africa seems to be a microcyclic derivative of *Puccinia paraensis*.

See also *Puccinia gouaniae*

*Puccinia paraguayensis* Spegazzini, see **PROSPIDIUM PARAGUAYENSE** Spegazzini.

**Puccinia PARANAHYBAE** P. Hennings, Hedwigia 34: 320. 1895. TYPE on *Ruellia* sp. from **Brazil**, Goiás: Paranahyba, Feb 1893, *Ule-2004. (-/-, -/III).*

≡ *Dicaeoma paranahybae* (P. Hennings) O. Kuntze, Revisto Genarum Plantarum 3: 470. 1898.

= *Puccinia fuhrmanii* E. Mayor, Mem. neuchatel Sci. nat. 5: 507. 1913. TYPE probably on *Ruellia* sp. but reported originally as on "*Justicia cf. secunda cf. intermedia*" from **Colombia**, Antioquia: Manizalis area, 1 Oct 1910, *E. Mayor-62.*

On Acanthaceae:

*Ruellia angustifolia* (Nees) Lindmann, Rio Grande do Sul (Joerstad, 1956: 444; IAN-716).

*Ruellia graecizans* Baker, São Paulo (IBI-12522).

*Ruellia longifolia* (Pohl) Grisebach, Santa Catarina (Hennings, 1896: 235), São Paulo (Jackson, 1932: 95).

*Ruellia puri* Martius, Brazil (Joerstad, 1956: 444).

*Ruellia* sp., Goiás (Hennings, 1895B: 320).

*Puccinia paranahybae* has been reported from Argentina, Brazil, and Colombia.

Spermogonia, aecia, and uredinia unknown. Telia mostly on abaxial side of leaves, 0.1-0.4 mm across, dark cinnamon-brown, not stromatic, in dense irregular or more or less circular groups on dried out spots to 5 mm diam; teliospores 30-50 x 16-22 µm, cylindrical to clavate, sometimes ellipsoid, obtuse-rounded above, slightly constricted at septum, narrowed below, wall 0.5-1.5 µm thick at sides, 1-5 µm thick above, pedicel to 70 µm long, colored similar to or paler than the spore, persistent (Laundon, 1963).

*Puccinia parodii* Spegazzini, see **Puccinia PILOCARPI** Cooke.

*Puccinia parthenicola* H. S. Jackson, see **PUCGINIA SCHILEANA** Spegazzini var. **PARTHENICOLA** (H. S. Jackson) J. C. Lindquist.

*Puccinia parthenii* Arthur, Bull. Torrey Bot. Club 37: 570. 1910. TYPE on *Parthenium argentatum* A. Gray, from **Mexico**, Zacatecas: Mazapil, 27 March 1908, *Lloyd s.n.* (?/?,II/III).

The inclusion of this species in the original Index is an error. The report was based on Viégas, 1945:87; IAC-1961, a collection of uredinia on *Parthenium hysterophorus* Linnaeus, Compositae, from Campinas, São Paulo, originally identified as *Uredo parthenii* Spegazzini which is an anamorph of *Puccinia schileana* var. *parthenicola*.

*Puccinia paspali* Tracy & Earle, see **PUCGINIA LEVIS** (Saccardo & Bizzozero) Magnus.

*Puccinia paspalicola* (P. Hennings) Arthur, see **PUCGINIA SUBSTRIATA** Ellis & Bartholomew.

*Puccinia paulensis* Rangel, see **PUCGINIA PAMPEANA** Spegazzini.

**PUCGINIA PELARGONII-ZONALIS** Doidge, Bothalia 2:98. 1926. TYPE, a lectotype needs to be chosen from the specimens on *Pelargonium zonale* L'Heritier from South Africa listed by Doidge in the original publication. A specimen in BPI marked "type" is from **South Africa**, Natal: Scottsburgh, ? 7 May 1913 ("5.7.13"), *Pole Evans-6843*. (?/?,IIpe/III).

On Geraniaceae:

*Pelargonium zonale* L'Heritier, Goiás (IBI-14890), Minas Gerais (IBI-14947), São Paulo (IBI-14562).

*Puccinia pelargonii-zonalis*, native in South Africa, is widely distributed in warmer regions wherever ornamental *Pelargonium* spp. of the zonale type are grown. These plants often are given the common name of "geraniums".

Spermogonia and aecia unknown. Uredinia scattered or often in circles on abaxial side of leaves, subepidermal in origin, erumpent, powdery, cinnamon-brown, urediniospores 21-29 x 19-22 µm, broadly ovoid to subglobose, walls 1.5-2 µm thick, echinulate, pores 2, equatorial. Telia rarely formed, teliospores sometimes mixed in uredinia, 36-50 x 16-24 µm, ellipsoid to clavate, rounded to somewhat narrowed above, rounded or somewhat narrowed at the base, slightly constricted at the septum, lateral walls 1-2-3 µm thick, apical wall up to 5 µm thick, germ pores apical and just below the septum, pedicel up to 40x 7 µm, rather short, persistent, colorless.

If heavily infected, the leaves become yellowish, may die, and the plants may stop blooming. Three other species of *Puccinia* have been named on *Pelargonium*, all from the Southern Hemisphere. *Puccinia granularis* Kalchbrenner & Cooke, from South Africa, has urediniospore walls 3-3.5 µm thick, a trait that separates it from *P. pelargonii-zonalis* with urediniospore walls 1.5-2 µm thick.. Doidge (1926) placed *P. pelargoni* H. Sydow & P. Sydow as a synonym of *P. granularis* and suggested that *Puccinia morrisoni* McAlpine from Australia is very similar and perhaps should also be considered a synonym of *P. granularis*. Spermogonia and aecia with *Aecidium* morphology have been reported for *P. granularis* and *P. morrisoni* but not for *P. pelargonii-zonalis*.

*Puccinia penniseti* Zimmerman, see **PUCGINIA SUBSTRIATA** Ellis & Bartholomew.

**PUCGINIA PEPEROMIAE** Lindquist, Rev. Facult. Agr. La Plata. 29: 41. 1953. TYPE on *Peperomia* sp. from **Argentina**, Tucumán: camino a Tafí del Valle, falda este del Aconquija, 11 Nov 1952, A. T. Hunziker-10085. (?/?,IIpe/III).

Anamorph

*Uredo peperomiae* P. Hennings, Hedwigia Beiblatt 38: (69). 1899. TYPE on *Peperomia* sp. from **Brazil**, Rio de Janeiro: Corcovado, October 1887, *Ule-1500*.

= *Uredo piperis* P. Hennings, Hedwigia Beiblatt 38: (70). 1899. TYPE on *Piper* sp. from **Brazil**, Rio de Janeiro: Rio de Janeiro Museum park, July 1895, *Ule-2159*.

On Piperaceae.

*Peperomia* sp., Rio de Janeiro (Hennings, 1899A: (69)).

*Piper* sp., Rio de Janeiro (Hennings, 1899A: (70); Dietel, 1899: 256; Hennings, 1904A: 79), São Paulo (Hennings, 1902C: 107; Puttemans 266).

In addition to Brazil, an anamorph of *Puccinia peperomiae* has been reported also from Peru, Colombia, and Puerto Rico. Telia have been reported only from Argentina.

*Puccinia perfuncta* H. S. Jackson & Holway, see **Puccinia GIBERTII** Spegazzini.

**Puccinia PERTRITA** H.S. Jackson & Holway in Jackson, Mycologia 24: 116. 1932. TYPE on *Vernonia lessingioides* Schultz-Bipontius [= *Lepidaploa barbata* (Lessing) H. Robinson] from **Brazil**, São Paulo: "Santa Anna", 28 May 1922, *Holway-1901*. (??,II/III).

On Compositae:

*Vernonia cognata* Lessing [= *Chrysolaena platensis* (Spring.) H. Robinson], São Paulo (Jackson, 1932:116).

*Vernonia lessingioides* Schultz-Bipontius [= *Lepidaploa barbata* (Lessing) H. Robinson], São Paulo (Jackson, 1932:116; PUR-F7926).

*Vernonia* sp., São Paulo (Jackson, 1932:116).

*Puccinia pertrita* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on both sides of leaves or more often abaxial; many; widely scattered; erumpent or epidermal rupture conspicuous; 0.3-0.5 mm in diameter; round; pulverulent or naked late; cinnamon brown. Urediniospores globoid; 26-26  $\mu\text{m}$  long; 22-22  $\mu\text{m}$  wide; cell wall 1.5-2  $\mu\text{m}$  thick; cinnamon; closely and finely echinulate; germ pores scattered randomly; 4, 5, and 6. Telia usually abaxial or on both sides of leaves; widely scattered; many; round; 0.3-0.5 mm in diameter; dark brown; powdery; teliospores 45-60 x 30-36  $\mu\text{m}$ , broadly ellipsoid or oblong; umbonate at apex, thickened at apex, or rounded at apical end; rounded at pedicel; slightly constricted at septum; wall 3-5  $\mu\text{m}$  thick; 6-8  $\mu\text{m}$  at germ pores of both cells, wall dark chestnut brown; inconspicuously verrucose-rugose; pedicel shorter than spore, breaking off at spore, colorless (Jackson, 1932).

Jackson reported that *Puccinia pertrita* is separable from other species of *Puccinia* on *Vernonia* by its large, 45-60 x 30-36  $\mu\text{m}$ , essentially smooth and thick-walled teliospores, and large, 22-26  $\mu\text{m}$  diam, globose urediniospores with walls nearly colorless, and finely and closely echinulate with 4-6 scattered pores.

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but three from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

*Puccinia peruviana* Sydow, see **PROSPODIUM PERUVIANUM** (P. & H. Sydow) Cummins.

**Puccinia PESTIBILIS** H.S. Jackson & Holway in Jackson, Mycologia 24: 117. 1932. TYPE on *Vernonia oppositifolia* Lessing [= *Critoniopsis stellata* (Spreng.) H. Robinson], Compositae, from **Brazil**, Rio de Janeiro: Petropolis, 20 Oct 1921, *Holway-1233*. (0/Icv,IIpe/III).

*Puccinia pestibilis* has been reported only from the type.

Spermogonia on adaxial side of leaves, sori few; deep-seated; 105-120  $\mu\text{m}$  wide; in close groups; punctiform and flask-shaped; 120-150  $\mu\text{m}$  high (thick); ostiolar filaments short. Aecia on adaxial side of leaves, few, densely grouped, and surrounding the spermogonia; small; peridial cells irregularly polyhedral, 45-60 x 20-28  $\mu\text{m}$ ; wall prominently verrucose-rugose; aeciospores 30-36 x 20-24  $\mu\text{m}$ , broadly ellipsoid, wall 1.5-2  $\mu\text{m}$  thick, prominently verrucose-tuberculate, colorless. Uredinia on abaxial side of leaves, few; widely scattered, 0.5-0.8 mm in diameter, becoming naked, epidermal rupture inconspicuous, pulverulent; round, pale cinnamon brown; paraphyses 40-50 x 12-15  $\mu\text{m}$ , straight or curved, few, wall uniformly thin, colorless or tinted. Urediniospores 28-34 x 22-27  $\mu\text{m}$ , obovoid, wall 1.5-2.5  $\mu\text{m}$  thick, colorless or pale golden-brown, sparsely but strongly echinulate, pores 4, 5, or 6, scattered, obscure. Telia on abaxial side of leaves, 0.2-0.5 mm across, widely scattered and densely grouped, erumpent, epidermal rupture inconspicuous, pulvinate, chestnut-brown, becoming ashy-gray in color; paraphyses like the uredinial paraphyses; teliospores 50-80 x 23-30  $\mu\text{m}$ , broadly ellipsoid or obovoid; rounded or obtuse apically; narrowed or rounded at pedicel, slightly constricted at septum; wall 1-1.5  $\mu\text{m}$  thick at sides; thickened 4-10  $\mu\text{m}$  at apex and septum of lower cell; smooth, pale cinnamon-brown; pedicel equal to spore or shorter, colorless (Jackson, 1932).

*Puccinia pestibilis* is one of a group having light colored, smooth teliospore walls, thickened at the apex. It differs from *P. fundata* in the character of the markings of the urediniospores and from *P. deprecanea* in aeciospore characters, and in the absence of conspicuous paraphyses. The latter are present, but very poorly developed.

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but three from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

**Puccinia PHRAGMITIS** (Schumacher) Koernicke, Hedwigia 15:179. 1876..

(0/Icv<sup>z</sup> IIpe/III).

= *Uredo phragmitis* Schumacher, Enum. Pl. Saell. 2: 231. 1803. TYPE, Cummins (1971) reported that in this publication "telia described" and designated the NEOTYPE as "Koernicke, on *Phragmites communis*, Waldau (Ostprussen) (B)".

Anamorph

*Aecidium rubellum* Persoon is reported by Cummins (1971) on species of *Fagopyrum*, *Polygonum*, *Reynoutria*, *Rumex*, and *Rheum*, all in Polygonaceae, but not known from South America.

On Gramineae:

*Phragmites australis* (Cav.) Trinius ex Steud. (reported as *Phragmites communis* Trinius), Rio de Janeiro (Silveira, 1977:42).

In South America *Puccinia phragmitis* has been reported also in Argentina and Chile and is widespread otherwise especially in temperate regions of the Northern Hemisphere. The single report known from Brazil requires confirmation.

Spermogonia and aecia, *Aecidium rubellum* Persoon, occur on species of *Fagopyrum*, *Polygonum*, *Reynoutria*, *Rumex*, and *Rheum*; aeciospores 16-23 x 15-19 µm, ellipsoid or broadly so, wall thick, colorless, prominently verrucose, commonly in a band. Uredinia on both sides of leaves, cinnamon-brown; urediniospores (23-)26-33(-36) x 18-)20-24(-26) µm, ellipsoid or obovoid, wall 2.5-4 µm thick, yellow to golden brown, echinulate, germ pores (3)4 or 5(6), equatorial. Telia on both sides of leaves, exposed, large, deeply pulvinate, chocolate-brown; teliospores (36-)40-60(-66-74) x (16-)19-24(-28) µm, ellipsoid, wall (2-)2.5-3.5(-4) µm thick at sides, 5-8(10) µm apically, the apex usually a paler umbo, deep golden brown to clear chestnut-brown, long narrow spores usually are paler than the robust ones, smooth; pedicels to 200 µm long, persistent, colorless or tinted, thick-walled, not collapsing (Cummins, 1971).

Traits that help to identify *Puccinia phragmitis* include sori without paraphyses, urediniospore walls 2.5-4 µm thick, echinulate, germ pores equatorial, mostly 4-5, teliospores mostly less than 24 µm wide [(36-)40-60(-66;-74) x (16-)19-24(-28) µm], apical wall 5-8(-10) µm thick, the apex usually a paler umbo, pedicel thick-walled, not collapsing, colorless to lightly tinted, to 200 µm long.

*Puccinia picrosiae* P. Sydow & H. Sydow, see **Puccinia ARGENTINA** Spegazzini.

**Puccinia PICTURATA** H.S. Jackson & Holway in Jackson, Mycologia 23:363. 1931. TYPE reported as on *Heteropterys* sp. (perhaps the host is *Stigmaphyllon* sp.) from **Brazil**, Minas Gerais: Juis de Fora, 17 Dec 1921, *Holway-1401*. (?/?,II/III).

On Malpighiaceae:

? *Heteropterys* sp. or *Stigmaphyllon* sp., Amapá (IBI-16093), Minas Gerais (Jackson, 1931:363).

*Puccinia picturata* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, mostly on the abaxial side, scattered, cinnamon-brown, round, 0.5-0.8 mm across, tardely naked, ruptured epidermis conspicuous, urediniospores 35-45 x 32-40 µm, broadly ellipsoid, or obovoid, approaching globoid, wall 6-9 µm thick, often gradually thickening toward the apex to 12 µm, 2-layered, the outer nearly colorless, the inner golden-brown, strongly, sparsely, and sharply echinulate, the echinulae spaced 6-8 µm apart, and reaching a height of 2.5 µm. Telia like the uredinia, blackish, teliospores 38-46 x 25-32 µm, ellipsoid or oblong, rounded at either end, slightly or not constricted, wall opaque in water mount, appearing to be of two layers in lacto-phenol, the outer thin, slightly tinted golden-brown, the inner thick, dull blackish brown, 3.5-5 µm thick, slightly thickened to 7.5 µm on side with pores, noticeably rugose-reticulate by anastomosing ridges having an

uneven edge, especially in the upper part of the spore, tending to be smooth on the side to which the pedicel is attached; pedicel colorless, below, inflated to a depressed globoid sack 20-25  $\mu\text{m}$  wide at point of attachment which is usually on one side near the septum, the wall on side of swelling next to the spore often slightly tinted brownish, pedicel usually deciduous at lower side of inflation (Jackson, 1931).

See under *Puccinia banisteriae* for a key that aids in identification of species of *Puccinia* on Malpighiaceae.

*Puccinia pilgeriana* P. Hennings, see **Puccinia SUBSTRIATA** Ellis & Bartholomew.

**Puccinia PILOCARPI** Cooke, Grevillea 9:11. 1880. TYPE on *Pilocarpus sellowanus* from **Paraguay**, place and date not reported, *Balansa-1290*. (-/-, -/III).

= *Puccinia parodii* Spegazzini, Anal. Soc. Cient. Argentina 10:133. 1880. TYPE on *Pilocarpus pinnata* Martius from **Paraguay**, place and date not reported, *Parodi s.n.*

= *Puccinia sebastianiae* (H.) Sydow in Theissen, Ann. Mycol. 8:452. 1910. TYPE on *Pilocarpus pinnatifolius* Lemaire (mistakenly reported originally as on *Sebastiania* sp., Euphorbiaceae) from **Brazil**, Rio Grande do Sul: São Leopoldo, 1907, *Rick-194*.

= *Puccinia cumula* Arthur & Cummins, Ann. Mycol. 31: 41. 1933. TYPE on *Pilocarpus* sp. (mistakenly reported originally as *Eugenia* sp., Myrtaceae) from **Brazil**, Bahia: Toca de Onça, 27-29 June 1915, *J. N. Rose & P. G. Russell-20123*.

On Rutaceae:

*Pilocarpus pinnatifolius* Lemaire, Goiás (Hennings, 1895A:93), Rio Grande do Sul (Lindquist & Costa Ceto, 1963:130).

*Pilocarpus selloanus* Engler, Rio Grande do Sul (Juel, 1897:21; IAN-720).

*Pilocarpus* sp., Brazil (Rick, 1907B:335), Bahia (Arthur & Cummins, 1933: 41).

*Puccinia pilocarpi* has been reported from Argentina, Paraguay, Uruguay, and Brazil.

Spermogonia, aecia, and uredinia not produced. Telia on abaxial side of leaves, compact, firm, blackish, in round groups 2-5 mm across, confluent, surrounded by the ruptured epicermis; teliospores 40-76 x 18-24  $\mu\text{m}$ , oblong to sub clavate, rounded or somewhat narrowed at apex, narrowed or rarely rounded at the base, not or slightly constricted at the septum, wall 3-3.5  $\mu\text{m}$  thick at sides, 4-6  $\mu\text{m}$  thick at apex, dark chestnut-brown, smooth, pedicel up to 200  $\mu\text{m}$  long, persistent, brownish near the spore (The Sydows, 1903; Lindquist, 1982).

Lindquist and Costa Neto (1963) first reported that *Puccinia sebastianiae* was a synonym of *P. pilocarpi*.

**Puccinia PINDORAMAE** Viégas, Bragantia 5:40. 1945. TYPE on *Phytolacca* sp., Phytolaccaceae, from **Brazil**, São Paulo: Pindorama, Agronomy Institute Experiment Station at Pindorama, 20 Jan 1925, *H. P. Krug & A. S. Costa s.n.* (IAC-572). (-/-, -/III).

*Puccinia pindoramae* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Viégas (1945) reported that except for its host, *Puccinia pindoramae* resembles very closely *Puccinia heterospora*, which infects species in the Malvaceae.

Spermogonia, aecia and uredinia not produced. Telia on the abaxial side of leaves, blackish brown, punctiform, usually arranged in dense groups 2-3 mm across, becoming cinerous at maturity by germination, teliospores 25-50 x 15-25  $\mu\text{m}$ , variable in form, often oblong, constricted or not at the septum, wall slightly thickened at the apex, one-celled teliospores present but not numerous, these 25-26 x 20-22  $\mu\text{m}$  (Viégas, 1945).

**Puccinia PINGUIS** Dietel, Hedwigia 36:32. 1897 (February). TYPE on *Vernonia platensis* Lessing [= *Chrysolaena platensis* Llessing] H. Robinson], from **Brazil**, Santa Catarina, Serra Geral, Feb 1891, *Ule-1692*. (?/?/?/III). Not *Puccinia pinguis* Dietel & Holway in Holway, Bot. Gaz. (Crawfordsville) (Crawfordsville) 24: 34. 1897 (July) on *Brickelia* sp. from **Mexico**.

On Compositae:

*Vernonia declivium* Malme, Mato Grosso (Joerstad, 1956:476).

*Vernonia platensis* Lessing [= *Chrysolaena platensis* Llessing] H. Robinson], Serra Geral (Dietel, 1897:32).



The label of Ule's collection number 1692 in HBG states that the month of collection was March but in the publication by Dietel the month is recorded as February.

Spermogonia and aecia unknown. Uredinia cinnamon brown or darker; spores (23-)26-32(-35) x 23-29  $\mu\text{m}$  broadly ellipsoid or obovoid, 18-23(-25)  $\mu\text{m}$  wide, ellipsoid or oblong ellipsoid with pores lateral, wall 2-3(-4)  $\mu\text{m}$  thick, thinner on pore-bearing sides, dark cinnamon brown, echinulate, pores 2. Teliospores (35-)40-52(-60) x 30-37  $\mu\text{m}$ , broadly ellipsoid, wall 4-6(-7)  $\mu\text{m}$  thick at sides, 8-10  $\mu\text{m}$  over pores by a paler umbo, chestnut brown, pore of upper cell apical or subapical, of lower cell midway to hilum, smooth; pedicels to 75  $\mu\text{m}$  long but usually shorter. (Cummins, 1978)

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*Puccinia piptadeniae* P. Hennings, see **DIORCHIDIUM PUIGGARI** Spegazzini.

**PUCCINIA PIPTOCARPHAE** P. Hennings, Hedwigia 35: 240. 1896. LECTOTYPE on *Piptocarpha oblonga* (Gardner) Baker from **Brazil**, Santa Catarina: Blumenau, Nov 1888, *Ule-1317*.  
(0/Icv, IIpe/III).

≡ *Puccinia leptoderma* Dietel, Hedwigia 38: 251. 1899. TYPE on *Piptocarpha* sp. from **Brazil**, Rio de Janeiro, Mauá, August 1896, *Ule-2334*.

On Compositae:

*Piptocarpha axillaris* Baker, São Paulo (Puttemans-1332).

*Piptocarpha cinerea* (Schultz-Bip.) Baker, Rio de Janeiro (Jackson, 1932:103).

*Piptocarpha oblonga* (Gardner) Baker, Brasilia, D.F. (PUR-F18751, as *Puccinia leptoderma*).  
Santa Catarina (Hennings, 1896:240), São Paulo (Jackson, 1932:103).

*Piptocarpha* sp., Amazonas (Hennings, 1904B:158), Minas Gerais (Jackson, 1932:103), Rio de Janeiro (Dietel, 1899: 251, as *Puccinia leptoderma*), São Paulo (Jackson, 1932:103; Puttemans-1322; PUR-F18895, as *Puccinia leptoderma*).

*Puccinia piptocarphae* has been reported only from Brazil.

Sori on abaxial side of leaves, very small, scattered or in small groups, without paraphyses. Uredinia yellow-brown, pulverulent, urediniospores 29-34 x 17-32  $\mu\text{m}$  (Jackson, 1918),  $\mu\text{m}$ , subglobose, ovoid to ellipsoid, wall densely echinulate, pores (3-)4, scattered with hyaline cuticular caps. Telia on yellowish spots mostly on abaxial side of leaves in irregular groups, dark brown, subpulvinate, (Teliospores (30-44) 45-60(-72) x ? 17-26 (26-33)  $\mu\text{m}$ , broadly ellipsoid to clavate to oblong, rounded at apex, constricted at septum, rounded or somewhat narrowed below, smooth, yellowish-brown, pore apical in upper cell, at septum in lower cell, pedicel more or less as long as spore, collapsing, colorless) teliospores 35-58 x 19-27  $\mu\text{m}$  or 45-60 x 27-34  $\mu\text{m}$ , (Sydows, 1902), 45-56(-60) x 26-29  $\mu\text{m}$  (Jackson, 1918, 1932), , clavate, ellipsoid to oblong, rounded above, constricted at septum, rounded or narrowed below, wall 1-2  $\mu\text{m}$  thick, 2-3  $\mu\text{m}$  around pores wall 1  $\mu\text{m}$  or less thick, a little thicker at apex to 2.5  $\mu\text{m}$ , smooth, yellowish-brown, pedicel short, colorless, fragile. (Sydows, 1902; Jackson, 1932).

We place *Puccinia leptoderma*, for which only telia have been reported, as a synonym of *Puccinia piptocarphae* because the size of teliospores of these two taxa overlap.

**PUCCINIA PIPTOCHAETII** Dietel & Neger, Bot. Jahrb. Syst. 27:3. 1899. TYPE on *Piptochaetium* sp. from **Chile**, near Concepcion, *Neger*. (?/? $\neq$  IIpe/III).

On Gramineae:

*Piptochaetium lasianthum* Grisebach, Rio Grande do Sul (Lindquist & Costa Neto, 1963:115).

*Puccinia piptochaetii* has been reported also from Argentina, Chile, Bolivia, and Uruguay.

Spermogonia and aecia unknown. Uredinia mostly on abaxial side of leaves and on sheaths, cinnamon-brown; urediniospores (17-)19-25(-27) x (14-)17-21(-23)  $\mu\text{m}$ , mostly obovoid, wall thick but thicker when immature, cinnamon-brown, echinulate, germ pores (2)3(4), equatorial. Telia mostly on abaxial side of leaves and on sheaths, blackish brown, early exposed, pulvinate; teliospores (25-)30-43(-45) x (14-)16-21(-23)  $\mu\text{m}$ , variable but mostly ellipsoid or narrowly obovoid, the apex usually conical; wall (1-)1.5-2  $\mu\text{m}$  thick at sides, (3-)4-7  $\mu\text{m}$  apically, deep golden or clear chestnut-brown except the conical apex paler, smooth; pedicels to 50  $\mu\text{m}$  long, thin-walled and collapsing, colorless (Cummins, 1971).

*Puccinia pisi* DeCandolle, see **UROMYCES PISI** (DeCandolle) Otth.

**Puccinia PITCAIRNIAE** Lagerheim in Dietel & Lagerheim, Bull. Soc. Myc. France 11:214. 1895.

TYPE on *Pitcairnia* sp. from **Ecuador**: Panoptico near Quito, date not reported, *Lagerheim s.n.*  
On Bromeliaceae:

*Pitcairnia palmeri* S. Watson, Brazil (Silveira, 1951:223).

The occurrence of *Puccinia pitcairniae* in Brazil needs to be confirmed. Cummins and Pollack (1974) listed no specimens from Brazil. They recognized two subspecies: *P. p.* subspecies *pitcairniae* from Ecuador and *P. p.* subspecies *chapelensis* from Mexico.

*Puccinia pithecoctenii* Pazschke, see **PROSPIDIUM PITHECOCTENII** (Pazschke) Cummins.

*Puccinia pittieriana* P. Hennings, Hedwigia 43:147. 1904. TYPE on *Solanum tuberosum* Linnaeus from **Costa Rica**, Volcano Irazu, September 1903, *Pittier-s.n. (-I-, -III)*.

The report of *Puccinia pittieriana* in Brazil on *Lycopersicon esculentum* Miller (Solanaceae) from Espírito Santo by Hennen et al. (1982) was based on a report by Silveira (1951:223). Later we examined the specimen on which the report was based and determined that the host and rust were misidentified. The host is an unidentified genus of Sapindaceae and the rust is *Puccinia arechavaletae* Spegazzini. *Puccinia pittieriana* has been reported on *Solanum* spp. and *Lycopersicon esculentum* in the Andean region of South America, Central America, and Mexico.

*Puccinia pluchae* Arthur, see **Puccinia OCELLIFERA** Cummins.

*Puccinia poae-nemoralis* Otth, see *Puccinia brachypodii* var. *arrhenatheri* (Klebahn) Cummins & H. C. Greene.

**Puccinia POARUM** Nielson, Bot. Tiddsskr. III, 2:34. 1877. LECTOTYPE on *Poa trivialis* from Denmark. Designated by Greene and Cummins, 1967. (**0/I<sup>≠</sup> IIpe/III**).

Anamorph

*Aecidium tussilaginis* Persoon. Reported on seven genera of Compositae by Cummins (1971) but none from South America.

On Gramineae:

*Calamagrostis montevidensis* Nees, Paraná (Arthur, 1925:165; IBI-1706), Rio de Janeiro (Arthur, 1925:165; IBI-1704), São Paulo (Arthur, 1925:165, IBI-1705.).

*Poa annua* Linnaeus, Santa Catarina (Hennings, 1896:244. This record not reported by Greene & Cummins, 1967).

Cummins (1971) reported *Puccinia poarum* on nine genera of grasses and from Europe to China and North and South America and twelve teleomorph synonyms.

Spermogonia and aecia (*Aecidium tussilaginis* Persoon on species of *Brickelia*, *Helenium*, *Liatris*, *Ophryosporus*, *Petasites*, *Senecio*, *Tussilago*, as first demonstrated by Nielsen, loc. cit. Not reported from South America). Aeciospores (18-)20-(-31) x (15-)18-24(-27)  $\mu\text{m}$ , wall 0.5-)1(-1.5)  $\mu\text{m}$  thick, incompletely verrucose-echinulate. Uredinia mostly on adaxial side of leaves, bright orange-yellow when fresh, usually without but occasionally with a few short, capitate, peripheral paraphyses; urediniospores (21-)23-30(-37) x (14-)17-24(-26)  $\mu\text{m}$ , mostly obovoid or ellipsoid, wall 1-5  $\mu\text{m}$  thick, colorless or pale yellowish, echinulate, pores scattered, (4-)5-8, very obscure. Telia mostly on abaxial side of leaves, covered by the epidermis, with variable development of colorless or brownish paraphyses but the sori rarely loculate; teliospores (36-)40-58(-65;-77) x (14-)17-25(-28)  $\mu\text{m}$ , mostly elongately obovoid or oblong-clavate, wall 0.5-1.5  $\mu\text{m}$  thick at sides, (2-)3-6(-8)  $\mu\text{m}$  apically, chestnut-brown above, golden basally; pedicels 15  $\mu\text{m}$  or less long, colorless or yellowish (Cummins, 1971).

*Puccinia poarum* is difficult to distinguish from *P. recondita* but has paler yellow uredinia and urediniospores and usually fewer telial paraphyses. Traits that help to identify *Puccinia poarum* include: uredinia not in chlorotic streaks, usually without paraphyses, urediniospores usually 30  $\mu\text{m}$  or less long [(21-)23-30(-37) x 14-)17-24(-26)  $\mu\text{m}$ ], wall 1.5  $\mu\text{m}$  thick, yellowish, echinulate, germ pores scattered [(4-)5-8, very obscure], telia covered by the epidermis, with variable development of colorless or brownish paraphyses,

not or rarely loculate, teliospores usually more than 42 µm long [36-)40-58(-65;-77) x (14-)17-25(-28) µm], teliospore pedicels less than 40 µm long (15 µm or less long) (Cummins, 1971).

*Puccinia polygoni* Albertini & Schweinitz, see **Puccinia POLYGONI-AMPHIBII** Persoon.

**Puccinia POLYGONI-AMPHIBII** Persoon, Syn. Meth. Fung. p. 227, 1801. TYPE on *Polygonum amphibii* var. *terrestre* from **Europe**. (0/I ≠ II/III).

= *Puccinia polygoni* Albertini & Schweinitz, Consp. Fung. 127. 1805.

≡ *Dicaeoma polygoni-amphibii* Arthur, Proc. Indiana Acad. Sci. 1898: 184. 1899.

Synanamorphs

*Aecidium geranii-maculati* Schweinitz, Schr. Nat. Ges. Leipzig 1: 67. 1822.

*Uredo polygoni* Schumacher; Enum. Pl. Saell. 2: 233. 1803.

On Polygonaceae:

*Persicaria setacea* (Baldw.) Small, Minas Gerais (Thurston, 1940:302).

*Polygonum acre* Humboldt, Bonpland & Kunth, Rio Grande do Sul (Lindquist & Costa Neto, 1967:61), Santa Catarina (Schroeter, 1875: 169, as "*Puccinia polygoni* Pers."; Hennings, 1897: 233 as "*Puccinia polygoni* Pers."), São Paulo (Viégas, 1945:41; IAC-1082).

*Polygonum convolvulus* Linnaeus., Rio Grande do Sul (Lindquist & Costa Neto, 1963:121).

*Polygonum punctatum* Elliott, Rio de Janeiro (Jackson, 1927:55; IBI-1708), Rio Grande do Sul (PUR-F19233).

*Polygonum* sp., Rio de Janeiro (Jackson, 1927:55; IBI-1707).

This nearly cosmopolitan heteroecious species has been reported on many species of *Polygonum*. See Arthur et al. (1907) for a list of thirteen synonyms for this species. At least six varieties have been recognized in the North Temperate zone where spermogonia and aecia occur on species of *Geranium* (Geraniaceae). The variety that occurs in Brazil has not been identified.

**Puccinia POLYPOGONIS** Spegazzini, Anal. Mus. Nac. Buenos Aires 19:300. 1909. TYPE on *Polypogon monspeliensis* (Linnaeus) Desfontaines from **Argentina**, Patagonia: Lago Muster, Dec 1902, *Spegazzini-sn.* (?/I ≠ II/III).

Anamorph

*Uredo polypogonis* Spegazzini, Anal. Mus. Nac. Buenos Aires 6:240. 1899. A LECTOTYPE needs to be chosen from the four or five specimens listed by Spegazzini, from **Argentina**.

On Gramineae:

*Polypogon elongatus* Kunth, Minas Gerais (Thurston, 1940:302; IBI-1709), Rio Grande do Sul (Lindquist & Costa Neto, 1967:58).

*Puccinia polypogonis* has been reported also from Argentina, Uruguay, and South Africa.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves, cinnamon-brown; urediniospores (22-)24-28(-30) x (20-)22-26 µm, broadly ellipsoid or obovoid, wall (1-5-)2-2.5(-3) µm thick, golden or cinnamon-brown, echinulate, germ pores 5-7(-8), with conspicuous caps, scattered. Telia mostly on abaxial side of leaves, exposed, compact, blackish brown; teliospores (35-)40-55(-60) x (17-)20-24(-30) µm, varying from broadly clavate to ellipsoid, wall (2.5)3-4 µm thick at sides, 4-6(-8) µm apically, deep golden brown, smooth; pedicels to 70 µm long but usually broken shorter, colorless to brownish, mostly collapsing (Cummins, 1971).

Cummins (1971) could not confirm the identifications that Arthur (1925) reported as *Puccinia polypogonis* on *Polypogon elongatus* in Holway's collections from Minas Gerais, Rio de Janeiro, and São Paulo. He stated that they are mistaken, but he could not identify the material because it contained only uredinia.

**Puccinia POLYSORA** Underwood, Bull. Torrey Bot. Club 24:86. 1897. TYPE on *Tripsacum dactyloides* from **The United States of America**, Alabama: Auburn, Oct 1891, *Duggar*. (?/I ≠ IIpe/III).

On Gramineae:

*Tripsacum australe* Cutler & Anderson, Pará (Albuquerque, 1971:148; IAN-541).

*Tripsacum laxum* Nash, Rio de Janeiro (PUR-F17289).

*Tripsacum* sp., Pará (IBI-13244), Rio Grande do Sul (Lindquist & Costa Neto, 1967-58).

*Zea mays* Linnaeus, Bahia (IBI-17574), Minas Gerais (IBI-14448), Pará (Albuquerque, 1971:148; IAN-619), Paraná (IBI-15419), São Paulo (IBI-17772).

*Puccinia polysora* is one of the three rusts that infect *Zea mays*. This rust has been responsible for severe epiphytotics in various regions of the world, the most notable is the one in Africa that occurred during the late 1940's and early 1950's. This rust seems to be especially adapted to warmer regions as compared to *Puccinia sorghi*.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, cinnamon-brown; urediniospores 29-36(-40) x (20-)23-29 µm, mostly ellipsoid or obovoid, often angular, wall 1-1.5 µm thick, echinulate, golden or yellowish, germ pores 4 or 5, equatorial. Telia on both sides of leaves, covered by the epidermis, indehiscent, small, blackish brown; teliospores 29-41 x (18-)20-27 µm, usually angularly ellipsoid or oblong but highly variable, wall evenly 1.5 µm thick or very slightly thicker apically, chestnut-brown, smooth, very brittle; pedicels yellow or brownish, thin-walled, to 30 µm long; 1-celled teliospores often abundant (Cummins, 1971).

Cummins (1941) reported traits that clearly separate the three species of rusts that infect *Zea mays*. The two species of *Puccinia* have teliospores with pedicels. *Puccinia polysora* has telia that are covered by the epidermis, unlike those of *Puccinia sorghi* which are erumpent. *Phakopsora zae* has teliospores in vertical rows that form two or three layers of teliospores.

**Puccinia POROPHYLLI** P. Hennings, Hedwigia Beiblatt 39: (153). 1900. TYPE on *Porophyllum ellipticum* Cassini from **Venezuela**, Caracas, June 1899, *Moritz-255* (Prof. Urban). (**0/Icv,IIpe/III**). Anamorph

*Uredo aperta* Winter in Rabenhorst, Hedwigia 26: 24. 1887. TYPE on *Porophyllum ruderale* (Jacquin) Cassini from **Brazil**, Santa Catarina: São Francisco, July 1884, *Ule-56*.

On Compositae:

*Porophyllum ellipticum* (Linnaeus.) Cassini, Minas Gerais (Thurston, 1940:302), Rio Grande do Sul (Lindquist & Costa Neto, 1963:143).

*Porophyllum ruderale* (Jacquin) Cassini, Federal District (PUR-F18107), Rio Grande do Sul (PUR-F17202), Mato Grosso (IBI-16133), Minas Gerais (IBI-14491), Santa Catarina (Pazschke, 1892:96), São Paulo (Viégas, 1945:41, 79; IAC-1444; IBI-12514).

*Puccinia porophylli* has been reported from Argentina to Mexico on at least seven species of *Porophyllum*. Lindquist (1982) found aecia on specimens from Mendoza and Córdoba in Argentina and was first to describe them in detail.

Spermogonia and delicate peridiate aecia have been reported (Davidson, Mycologia 24:227. 1932) but without a description. Uredinia 0.1-1 mm across, scattered mostly on undersides of leaves, blister-like at first, erumpent, ruptured epidermis usually obvious, cinnamon-brown, powdery, a few peripheral paraphyses usually present, these 35-85 x 10-19 µm, narrowly oblong, usually collapsing laterally, wall 0.5-1 µm thick, colorless to pale orange, urediniospores 19-26 (27) x 18-22 µm globoid to broadly ellipsoid, wall 1.5-2.5 µm thick, closely verrucose-echinulate, pale yellow to pale cinnamon-brown, pores usually obscure, or 6-8, scattered or sometimes appearing as in two bands, with slight caps. Telia 0.2-0.9 mm across, mostly on undersides of leaves, sometimes on stems, scattered, circular or sometimes elongate, then up to 2 mm long, blackish-brown, pulvinate, not powdery but not tightly compact; paraphyses sometimes present similar to those in the uredinia, teliospores (33-)35-49 x 25-35 µm, broadly ellipsoid, slightly obovoid to oblong, not or only slightly constricted at the septum, rounded above and below, or sometimes obtuse above, wall (3-)4-10 µm thick above, 3-6 µm thick on sides of upper cell, appearing smooth, very closely verrucose under oil, pore of upper cell apical or slightly to one side, pore of lower cell at septum, both usually obscure, pedicel up to 130 µm long, light yellow, a little darker next to spore, usually not collapsing laterally.

*Puccinia porri* (Sowerby) Winter, see **Puccinia ALLII** Rudolphi.

**Puccinia POSADENSIS** Saccardo & Trotter in Saccardo, Syll. Fung. 21:691. 1912. *nom. nov.* for *Puccinia andropogonicola* Spegazzini. (**0/Icv,IIpe/III**).

≡ *Puccinia andropogonicola* Spegazzini, Anal. Mus. Nac. Buenos Aires 19:299. 1909 (Dec).

TYPE on *Schizachyrium condensatum* (Kunth) Ness (reported as *Andropogon condensatus* Kunth) from **Argentina**, Misiones: Posadas, Jan 1901, *Spegazzini-s.n.* (Not *P. andropogonicola* Hariot & Patouillard, May 1909, from **French Congo**, Africa).

- = *Puccinia venustula* Arthur, Mycologia 10:128. 1918. TYPE on *Schizachyrium brevifolium* (Sw.) Nees ex Buse (reported as *Andropogon brevifolius* Sw. from **Costa Rica**, Orotina, Dec 1915, *Holway-317*).
- = *Puccinia kaernbachii* Arthur, [as " (P. Henn.) comb. nov."] Bull. Torrey Bot. Club 46:110. 1919. The name needs to be ascribed to Arthur alone and not as a "comb. nov." of *Uredo kaernbachii* P. Hennings. A lectotype needs to be chosen from the two specimens on *Schizachyrium scoparium* var. *stoloniferum* (Nash) Wipff. [reported as *Andropogon stolonifera* (Nash) Hitchcock] from Florida, **United States of America**, that Arthur cited and used as the source of data for description of telia. Cummins (1963) reported that *Uredo kaernbachii* P. Hennings {Bot Jahrb. 18: (Beibl. 44:23). 1894] probably belongs to *Puccinia nakanishiki* Arthur, an Old World rust that infects *Cymbopogon citratus*, lemon grass.

## Anamorph

- Uredo andropogonicola* Spegazzini, Anal. Mus. Nac. Buenos Aires 19:315. 1909. TYPE on *Schizachyrium condensatum* (Kunth) Ness (reported as =*Andropogon condensatus* Kunth), from **Argentina**, Tucumán, *Spegazzini-s.n.*
- = *Uredo venustula* Arthur, Mycologia 8:21. 1916. TYPE on *Schizachyrium brevifolium* (Sw.) Nees ex Buse (reported as *Andropogon brevifolius* Sw.) from **Puerto Rico**, Las marías, July 1915, *Stevens-8147*.

## On Gramineae:

- Andropogon bracteatus* Willdenow, Paraná (Joerstad, 1959:64).
- Andropogon macrothrix* Trinius, Minas Gerais (Cummins, 1953:22).
- Andropogon* sp., Minas Gerais (Thurston, 1940:300; São Paulo (Cummins, 1953:22); [*Imperata brasiliensis* Trinius, Minas Gerais (Thurston, 1940:300)].
- [*Imperata contracta* (Kunth) Hitchcock, Rio de Janeiro (Cummins, 1953:22)].
- Schizachyrium condensatum* (Kunth) Ness (reported as *Andropogon condensatus* Kunth), Maranhão (PUR-F11316), Minas Gerais (Thurston, 1940:300; Cummins, 1953:22), Rio de Janeiro (Cummins, 1953:21; IBI-1685), Rio Grande do Sul (Joerstad, 1959:64), São Paulo (Cummins, 1953:22).
- Schizachyrium sanguineum* (Retz.) Alston [reported as *Andropogon semiberbris* (Nees) Kunth], Minas Gerais (Thurston, 1940:300).
- Schizachyrium scabriflorum* (Ruprecht ex Hackel) A. Camus, Ann [reported as *Andropogon scabriliflorus* Ruprecht, Mato Grosso (Cummins, 1953:22).
- Schizachyrium sulcatum* (Ekman) S. T. Blake [reported as *Andropogon sulcatus* Ekman], Mato Grosso (Joerstad, 1959:64).

*Puccinia posadensis* has been reported from Argentina to the Southern United States of America.

The identifications of the hosts reported as *Imperata* sp. may be incorrect. Cummins suggested that they may actually be *Andropogon* sp.

Spermogonia and aecia unknown. Sori mostly in abaxial surface of leaves. Uredinia dark cinnamon-brown, with pale golden to cinnamon-brown, capitate paraphyses, the wall 2.5 µm thick in stipe, 5-10 µm thick in apex; urediniospores (26-)28-33(-35) x 19-25 µm, mostly obovoid, wall 1.5-2 µm thick, cinnamon-brown, usually darker apically, echinulate, pores 4 or 5, equatorial. Telia blackish brown, compact, early exposed; teliospores (33-)36-50(-58) x (15-)17-20(-24) µm, mostly elongate obovoid or oblong-obovoid, wall 1.5-2 µm thick at sides, (4-)6-9 µm apically, chestnut-brown, smooth; pedicels to 20 µm long, usually shorter, thick-walled, not collapsing, brown, persistent (Cummins, 1971).

**Puccinia PRAECULTA** H. S. Jackson & Holway, Mycologia 24: 150-151. 1932. TYPE on *Baccharis* sp. from **Bolivia**, Sur Yungus: San Felipe, 21 May 1920, *Holway-635*. **(0/Ic,IIpe/III)**.

## On Compositae

*Baccharis* sp., Santa Catarina (*Ule-964*, in HBG).

*Puccinia praeculta* has been reported also from Bolivia and Ecuador.

Spermogonia on the adaxial side of leaves along the leaf veins, in small groups, globose to conical, paraphyses 40-60 µm long. Aecia mostly on abaxial or sometimes on adaxial side of leaves, 0.8-1.0 mm long, opening by longitudinal slits, ruptured epidermis evident, without peridia, powdery; aeciospores catenulate, (28-)30-42 x (14-)18-24 µm, narrowly ellipsoid to obovoid; wall (1.5-)2(2.5) µm thick, apex 3-6 µm, with sparse, irregular longitudinal ridges, spaced 3-5 µm apart. Uredinia uncertain, urediniospores in telia,

pedicelate, 20-25 x 18-21  $\mu\text{m}$ , about globoid or broadly ovoid, wall 1-1.5  $\mu\text{m}$  thick, finely and thickly echinulate, brown, pores 2, equatorial. Telia on the abaxial side of leaves, 0.3-0.8 mm across, scattered or in groups, pale chestnut-brown, pulvinate, compact, becoming ashy gray by germination, ruptured epidermis not evident; teliospores 40-50(-54) x 21-30  $\mu\text{m}$ , ellipsoid to clavate or irregular, rounded above, rounded to narrowed to the pedicel, not or slightly constricted at the septum; wall 1.5-2.5  $\mu\text{m}$  thick at sides, 5-10  $\mu\text{m}$  above, smooth, pale chestnut-brown; pedicel about as long as or shorter than the spore, hyaline, sometimes inserted laterally (Jackson, 1932; H. Sydow, 1939; Lindquist, 1958).

This record of *Puccinia praeculta* in Brazil is based on a previously unidentified collection made by E. Ule from Blumenau, Santa Catarina, July 1888 in the Hamburg Botanical Garden Herbarium. The identification is tentative because only a very few rust sori are present.

An old *Caecoma* anamorph sorus has mostly collapsed spores with very distinctive traits as reported by Jackson (1932): walls have sparsely placed longitudinal ridges, these sometimes extending the length of the spore or sometimes they are interrupted elongate markings. They may be strictly longitudinal or oblique, giving a somewhat spiral effect. Teliospores in the Ule collection are around 45-50 x 15-20  $\mu\text{m}$ , narrowly ellipsoid to somewhat clavate, rounded above and narrowed below, often with a paler umbo over both the pore in the upper cell and in the lower cell, lateral wall about 1  $\mu\text{m}$  thick, apical wall including the umbo 4-6  $\mu\text{m}$ , smooth, pale chestnut-brown to cinnamon-brown; pedicel about as long as the spore, thin-walled, colorless.

**Puccinia praedicta** H.S. Jackson & Holway in Jackson, Mycologia 24:152. 1932. LECTOTYPE to be selected from among the collections from São Paulo and Rio de Janeiro reported by Jackson & Holway. (?!?, IIpe/III).

On Compositae:

*Baccharis serrulata* DeCandolle, São Paulo (Jackson, 1932:152).

*Baccharis* sp., Rio de Janeiro (Jackson, 1932:152), São Paulo (Jackson, 1932:152).

*Puccinia praedicta* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia commonly in groups on yellowish spots mostly on adaxial side of leaves, or scattered on both sides of leaves, often arranged concentrically, round, 0.2-0.8 mm. across, yellowish, tardily naked, powdery, ruptured epidermis conspicuous; urediniospores 26-33 x 22-24  $\mu\text{m}$ , obovoid; wall 2-2.5  $\mu\text{m}$  thick, finely and rather sparsely echinulate, colorless or slightly tinted, pores obscure. Telia on abaxial side of leaves, scattered, small, round, 0.2-0.6 mm. across, light chestnut brown, becoming ashy-gray through germination, early naked, appanate becoming pulvinate, ruptured epidermis usually not noticeable; teliospores 33-44 x 20-22  $\mu\text{m}$ , ellipsoid, oblong or subclavate, rounded above, rounded or occasionally narrowed to pedicel below, not or slightly constricted at septum; wall 1-1.5  $\mu\text{m}$  thick at sides, 5-7  $\mu\text{m}$  at apex and at the angles in the upper cell, cinnamon brown, smooth; pedicel equalling the spore or shorter, colorless (Jackson, 1932).

The species suggests *P. montserrates* Mayor, but differs in several characters. The teliospores of that species have thicker, darker colored walls and the urediniospores are considerably larger and the echinulate markings more closely placed.

Although Jackson (1932) placed *Uredo baccharidicola* as an anamorph of *Puccinia praedicta*, Lindquist (1958) reported that it should not be included in that species, but kept as an unconnected anamorph. *Uredo Baccharidis* Spegazzini (1884) was based on two collections on *Baccharis* sp. made by Balansa (3434 and 3437) in Paraguay. This name was found untenable, as there was already a *Uredo Baccharidis* Lév. (1846), and Spegazzini, in 1925, renamed the species *Uredo baccharidicola*. At that time he recorded the above collections and others (one of which was collected in São Paulo, Brazil (Uster 10)) as on *Baccharis serrulata*.

Fifteen species of *Puccinia* have been reported on *Baccharis* in Brazil. *Baccharis*, a New World genus of about 380 known species, harbors at least 53 species of *Puccinia* (Lindquist, 1957), more *Puccinia* species than any other host genus in the Americas.

**Puccinia procerula** H.S. Jackson & Holway in Jackson, Mycologia 24:181. 1932. TYPE on *Senecio pellucidinervis* Schultz-Bipontius from **Brazil**, Rio de Janeiro, Itatiaia, 18 May 1922, Holway-1865. (?!?, II/III).

On Compositae:

*Senecio pellucidinervis* Schultz-Bipontius, Rio de Janeiro (Jackson, 1932: 181; PUR-F8469).

**Puccinia proluviosa** H.S. Jackson & Holway in Jackson, Mycologia 24: 181. 1932. TYPE on *Senecio pellucidinervis* Schultz-Bipontius from **Brazil**, São Paulo: Campos do Jordão, 24 Apr 1922, Holway-1767. (?!?,II/III).

On Compositae:

*Senecio pellucidinervis* Schultz-Bipontius, São Paulo (Jackson, 1932:181)

*Puccinia proluviosa* has been reported also from Argentina and Ecuador.

Spermogonia and aecia unknown. II. Uredosporis epiphyllis, in maculis decoloratis singulatim dispositis, bullatis, castaneo-brunneis, 0.3-0.6 mm. diam., tarde nudis, non conspicue pulverulentis, epidermide inflata diu tectis; uredosporis ellipsoideis vel obovatis, 23-26 x 32-38  $\mu\text{m}$ , tunica pallide castaneo-brunnea 1.5-2  $\mu\text{m}$  cr. sparse prominenterque echinulata et poris 2 aequatorialibus praeditis.

III. Teleutosporis hypophyllis, sparsis vel gregariis, 0.2-0.4 mm. diam., castaneo-brunneis, dein germinando cinereis, mox nudis, applanatis, tandem pulvinatis; epidermide fissa primo visibili; teleutosporis oblongo-clavatis vel ellipsoideis, 22-28 x 45-72  $\mu\text{m}$ , supra rotundatis, infra rotundatis vel contractis, septo constrictis; tunica cinnamomeo- vel pallide castaneo-brunnea, in cellula inferiore 1-1.5  $\mu\text{m}$  cr. sed in cellula superiore leniter paulatimque ad 2-2.5  $\mu\text{m}$  incrassata, levi; pedicello hyalino, sporam aequante vel saepius brevior.

*Senecio pellucidinervis* Sch. Bip. Campos do Jordão, São Paulo, Brazil, Apr. 24, 1922, 1767.

This species, while obviously related to the two preceding, differs markedly from *P. procerula* in that the teliospores are essentially unthickened at the apex, and from *P. majuscula* in the much smaller, narrower teliospores, as well as in urediniospore pore characters.

Whether or not the epiphyllous uredinia in this species are primary could not be determined. They are badly parasitized in our material and no pycnia could be detected.

**Puccinia promatensis** R. Berndt, Mycologia 91: 1046. 1999. type on *Caleaphyllolepis* Baker, Compositae, from **Brazil** Rio Grande do Sul: São Francisco de Paula, Pro Mata, March 1997, W. Maier-s.n. (?!?,IIcv/III).

*Puccinia promatensis* has been reported only from the type. The uredinia have the morphology of the anamorph genus *Aecidium*.

*Puccinia pruni-spinosae* Persoon, see **TRANZSCHELIA DISCOLOR** Tranzschel & Litvinow.

**Puccinia pseudoatra** Cummins, Mycologia 34:688. 1942. TYPE on *Paspalum pallidum* Humboldt, Bonpland & Kunth from **Ecuador**: Quito, 30 Aug 1920, Holway-954.(reported originally as *Puccinia macra* in Holway, *Reliq. Holw.* 100) (?!?≠ IIpe/III).

On Gramineae:

*Digitaria insularis* (Linnaeus.) Fedde, Rio de Janeiro (Ramachar and Cummins, 1965:58).

Ramachar and Cummins (1965) recorded *Puccinia pseudoatra* on *Digitaria* from Brazil and also on *Paspalum* from Argentina, Bolivia, Ecuador, and Peru. But Cummins (1971) did not report this rust from Brazil, only from Argentina, Bolivia, Peru, and Ecuador. New collections are required to confirm the presence of this species in Brazil.

Spermogonia and aecia unknown. Uredinia mostly on abaxial side of leaves, pale cinnamon-brown; urediniospores (23-)24-27(-28) x (21-)23-25(-26)  $\mu\text{m}$ , broadly ellipsoid or globoid, wall 2.5-3  $\mu\text{m}$  thick, golden or cinnamon-brown, closely and finely verrucose, the wartlets often uniting in labyrinthiform patterns, germ pores (5)6-8, scattered. Telia mostly on abaxial side of leaves, blackish brown, early exposed; teliospores (28-)31-37(-39) x (20-)22-25(-26)  $\mu\text{m}$ , wall (2-)2.5-3.5  $\mu\text{m}$  thick at sides, 5-8  $\mu\text{m}$  apically, chestnut-brown, smooth; pedicels to about 90  $\mu\text{m}$  long, colorless, thick-walled or sometimes thin-walled and collapsing (Cummins, 1971).

**Puccinia psidii** Winter, Hedwigia 23: 171. 1884. TYPE on *Psidium guajava* Linnaeus, reported as "*Psidium pomiferum*", from **Brazil**, Santa Catarina, April 1884, Ule-14. All hosts of this rust are in the Myrtaceae. (-I-,IIpe/III).

= *Puccinia jambosae* P. Hennings, Hedwigia 41: 105. 1902. TYPE on *Syzygium jambos*

- (Linnaeus) Alston, reported as "*Jambosa vulgaris* DeCandolle", Myrtaceae, from **Brazil**, São Paulo, 7 May 1901, *Puttemans-223*.
- = *Puccinia cambucae* Puttemans in Rangel, Arch. Mus. Nac. Rio de Janeiro 18: 153. 1916. TYPE on *Marlieria edulis* Niedenzu, Myrtaceae, from **Brazil**, São Paulo, May 1911, *Puttemans-411*.
- = *Puccinia brittoi* Rangel, Arch. Mus. Nac. Rio de Janeiro 18: 154. 1916. TYPE on *Campomanesia maschalantha* (O. Berg) Kiaersk. (reported originally as *Abbevillea maschalantha* O. Berg), Myrtaceae, **Brazil**, Rio de Janeiro, January 1914, *E. S. Britto-1036*.
- = *Puccinia barbacensis* Rangel, Arch. Mus. Nac. Rio de Janeiro 18: 154. 1916. TYPE on undetermined genus of Myrtaceae, *?Eugenia* sp., from **Brazil**, Minas Gerais, *Barbacena, March, 1911, Puttemans-296*.
- = *Puccinia grumixamae* Rangel., Arch. Jard. Bot. Rio de Janeiro 2: 69. 1918. TYPE on *Eugenia brasiliensis* from **Brazil**, Rio de Janeiro, *Rangel-1515*.
- = *Puccinia eugeniae* Rangel, Arch. Mus. Nac. Rio de Janeiro 16: 154. 1916. TYPE on *Eugenia grandis* Wight from **Brazil**, São Paulo, April, 1901, *Puttemans 261*.
- = *Puccinia jambolana* Rangel, Bol. Agr. São Paulo 21: 37. 1920. TYPE on *Syzygium jambolanum* DeCandolle, reported as *Eugenia jambolana* Lamarck, 1912, *Rangel s. n.*
- = *Puccinia camargoi* Puttemans, Bol. Mus. Nac. Rio de Janeiro 6: 314. 1930. TYPE on *Melaleuca leucodendri* Linnaeus from **Brazil**, São Paulo, Campinas, July 1930, *Camargo s.n.*
- = *Puccinia actinostemonis* H. S. Jackson & Holway in Jackson, Mycologia 23: 466. 1931. TYPE on undetermined genus of Myrtaceae, not *Actinostemon* sp., Euphorbiaceae, as originally reported, from **Brazil**, São Paulo: Lapa, 27 February 1922, *Holway-1600. (?/?,II/III)*

## Anamorph

- Caecoma eugeniaram* Link in Linnaeus, Systema vegetabilium plant. 2: 29. 1825. TYPE – literature not available. This seems to be the oldest available valid name for an anamorph of *Puccinia psidii*. If so, it needs to be transferred to a more appropriate genus
- = *Uredo neurophila* Spegazzini, Anal. Soc. Cient. Argentina 17: 122-123. 1884. TYPE on unidentified genus of Myrtaceae from **Paraguay**, Villa Rica, Jan 1882, *Balansa-3466 (Fungi Guaranitica pug. 1, number 143)*.
- ≡ *Puccinia neurophila* (Spegazzini) Spegazzini, Revista Argentina Bot. 1: 120. 1925. Telia not described.
- = *Uredo flavidula* Winter, Hedwigia 24: 260. 1885. TYPE on undetermined genus of Myrtaceae from **Brazil**, Santa Catarina, São Francisco, September 1884, *Ule-41*.
- = *Uredo myrtacearum* Pazschke in Rabenhorst & Winter, Hedwigia 29: 159. 1890. TYPE on *Eugenia* sp. from **Brazil**, Santa Catarina, December 1883, *Ule-10*.
- = *Uredo eugeniaram* P. Hennings, Hedwigia 34: 337. 1895. TYPE on *Eugenia* sp. from **Brazil**, Santa Catarina, Blumenau, date not reported, *Moller-227*.
- = *Aecidium glaziovii* P. Hennings, Hedwigia 36: 216. 1897. TYPE on undetermined genus in Myrtaceae, **Brazil**, Rio de Janeiro, date not reported, *Glaziou-20621*. Placement in *Aecidium* is in error.
- = *Uredo pitanga* Spegazzini, Anal. Mus. Nac. Buenos Aires 6: 240. 1899. TYPE on *Stenocalyxis pitanga* Berg, **Uruguay**, December, 1881, *Arechavaleta s.n.*
- = *Uredo puttemansii* P. Hennings, Hedwigia 41: 106. 1902. TYPE on Myrtaceae, probably *Melaleuca quinquinervia* (Cav.) S. T. Blake ("*Melaleuca leucadendra*") sp. from **Brazil**, São Paulo, *Puttemans-197*. Host is not *Acacia*, Leguminosae, as originally reported (specimen seen in IBI, fide JFH. Nov 1984 and March 1994).
- = *Uredo goeldiana* P. Hennings, Hedwigia Beiblatt 42: (188). 1903. TYPE on *Eugenia* sp. from **Brazil**, Pará, Belém, 1883, *Goeldi s.n.*
- = *Uredo rochaei* Puttemans, Revista Polytechnica São Paulo, no. 11, p. 272. 1906. TYPE reported on *Myrciaria jaboticaba* (Velloso) Berg, now known as *Myrcia jaboticaba* Berg, from **Brazil**, São Paulo, São Paulo, date not reported, *A. Rocha s.n.*
- = *Uredo myrciae* Mayor. Mem. Soc. Neuchatel. Sci. Nat. 5: 590. 1913. TYPE on *Myrcia* cf. *acuminata* (Humboldt, Bonpland, & Kunth) DeCandolle from **Colombia**, Medellin, 14 Aug 1910, *Mayor-209*. 18: 153. 1916.



## On Myrtaceae:

- Abbevillea moschalanthe*, Rio de Janeiro (Rangel, 1916: 154; HNR320), see *Campomanesia moschalantha* (O. Berg) Kiaerski below.
- Callistemon speciosus* DeCandolle, Minas Gerais (Viégas, 1945: 42; IAC-4000).  
[*Campomanesia aurea* Berg, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 132), Santa Catarina (PUR-F17736). The rust was misidentified, it is *Phakopsora rossmaniae* Dianese et al.].
- Campomanesia moschalantha* (O. Berg) Kiaerski, Rio de Janeiro (Rangel, 1916: 154).
- Eucalyptus ? capitata*, Rio de Janeiro (IBI-4849).
- Eucalyptus citriodora* Hooker, Rio de Janeiro (IAC-4198), São Paulo (Joffily, 1944: 475; IBI-4617).
- Eucalyptus ? grandiflora*, Minas Gerais (IBI-13501).
- Eucalyptus ? phoetricha*, Minas Gerais (PUR-F19161).
- Eucalyptus* sp., Espírito Santo (IBI-2883), Pernambuco (IBI-4351).
- Eugenia brasiliensis* Lamarck, Rio de Janeiro (Rangel, 1918: 69).
- Eugenia ? cambucae*, São Paulo (IBI-12065).
- Eugenia grandis* Wight, São Paulo (Hennings, 1902: 106; Rangel, 1916: 154).
- Eugenia pungens* Berg, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 132; IBI-5003).
- Eugenia* sp., Minas Gerais (Dietel, 1897: 35; Rangel, 1916: 154; Thurston, 1940: 302), Paraná (Fontoura & Nowacki, 1967/70: 134), Rio de Janeiro (Dietel, 1899: 256; Sydows, 1907: 356; Jackson, 1931: 483), Santa Catarina (Hennings, 1895: 337, 1896: 23), São Paulo (IBI-2465).
- Eugenia uvalha* Berg, São Paulo (Viégas, 1945: 42; IAC-1376; IBI-4392).
- Marlierea edulis* Niedenzu, Minas Gerais (Thurston, 1940: 302), São Paulo (Rangel, 1916: 153; Viégas, 1945: 42; IAC-1446).
- Melaleuca leucodendron* Linnaeus, São Paulo (Puttemans, 1930: 314; IBI-774).
- Melaleuca* sp., São Paulo (IBI-13472).
- Myrcia jaboticaba* (Velloso) Berg, Paraná (Fontoura & Nowacki, 1967/70: 153), São Paulo (Puttemans, 1906: 272; Viégas, 1945: 42; IAC-122).
- Myrcia* sp., Minas Gerais (Thurston, 1940: 302), Pará (IBI-13251), São Paulo (Jackson, 1931: 483).
- Myrciaria cauliflora* (Martius) Berg (now known as *Myrcia jaboticaba* (Velloso) Berg), Minas Gerais (Thurston, 1940: 302; IBI-3650), São Paulo (IBI-6).
- Myrciaria plicata-costata* Berg, São Paulo (IBI-574).
- Myrtaceae* Genus undetermined, Goiás (PUR-F19207), Minas Gerais (Dietel, 1897: 35; Jackson, 1931: 483; Thurston, 1940: 302; IBI-13163), Pará (IBI-13264), Rio de Janeiro (Hennings, 1897: 216; Dietel, 1899: 256; Hennings, 1904: 79), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 132; Rick, 1907A: 29), Santa Catarina (PUR-F6631), São Paulo (Spegazzini, 1908: 8; Viégas, 1945: 42; IAC-3112).
- Phyllocalyx involucratus* (DeCandolle) Berg, Rio Grande do Sul (Lindquist, 1960: 101; 1963: 132).
- Pimenta dioica* Merrill, São Paulo (IBI-12271).
- Pseudomyrcianthes pyriforme* (Cambessedes) Kausel, Rio Grande do Sul (Lindquist & Costa Neto (1963: 132).
- Psidium guajava* Linnaeus, Espírito Santo (Viégas, 1945: 42; IBI-2845), Minas Gerais (Thurston, 1940: 302), Pará (Albuquerque, 1971: 148; IAN-286), Paraíba (IAC-2905), Paraná (Fontoura & Nowacki, 1967/70: 166; IBI-6092), Pernambuco (Pickel, 1936: 212), Rio de Janeiro (Jackson, 1931: 483; Viégas, 1945: 42; IBI-5846), Rio Grande do Sul (PUR-F19190), São Paulo (Sydows, 1907: 355; Viégas, 1945: 421 IAC-148).
- Psidium incanescens* Martius, São Paulo (IBI-892).
- Psidium* sp., Minas Gerais (Jackson, 1931: 483; Thurston, 1940: 302), Santa Catarina (Hennings, 1895: 337), São Paulo (Viégas, 1945: 43; IAC-1937).
- Syzygium jambos* (Linnaeus) Alston (*Eugenia jambosa* Linnaeus), Espírito Santo (PUR-F19163), Minas Gerais (Thurston, 1940: 302; IAC-469), Pará (Albuquerque, 1971: 148; IAN-588), Paraná (Joerstad, 1959: 80), Rio de Janeiro (Viégas, 1945: 42; IAC-7992), Rio Grande do

Sul (PUR-F6630), São Paulo (Hennings, 1902: 105; Sydows, 1907: 355; Viégas, 1945: 42; IAC-150).

*Puccinia psidii* is a native rust in the warmer regions of the Western Hemisphere. It has been reported from Argentina to Florida in the United States of America and on at least a dozen genera of Myrtaceae. *Puccinia psidii* causes a severe disease of guajava, *Psidium guajava*, infecting leaves, stems, and fruit. Infected fruit may become mummified when infections occur early. Other economically important fruits that are infected include jaboticaba, uvaia, pitanga, cerreja do Rio Grande, cambuca, and jambo. Introduced species of Myrtaceae have become infected with this rust, such as *Callistemon*, *Eucalyptus* and *Syzygium*. The rust is feared by commercial interests on other continents where *Eucalyptus* is very important in agroforestry and much effort is going into keeping the rust from spreading to these areas.

*Puccinia psidii* is probably autoecious but no spermogonia or aecia have been identified from field collections. Experimental inoculation studies (Figueiredo, et al., 1984) indicate that basidiospores may infect the host species on which teliospores are produced and the resulting infections produce no visible spermogonia but do produce aecia and aeciospores that are indistinguishable from uredinia and urediniospores. These experiments need to be repeated to confirm these results.

*Puccinia rompelii* P. Magnus *in* or *ex* Rick (Ann. Mycol.5: 29. 1907) was listed as a synonym in our first edition but Lindquist (1983) questioned the identity of the host as in the Myrtaceae. We exclude *P. rompelii* as a synonym because its teliospore walls are described as thicker than in *P. psidii* and its host is probably not in Myrtaceae.

The rust in collections on *Campomanesia aurea* Berg from Rio Grande do Sul (Lindquist & Costa Neto, 1963: 132), and Santa Catarina (PUR-F17736) were misidentified. The rust is *Phakopsora rossmaniae* Dianese et al.

The names listed below were placed as synonyms of *Puccinia psidii* by the Sydows, (1903), Jackson (1931), Lindquist (1982), and Farr (1973). A fragment of an isotype of *U. subneurophila* in PUR has a pencil sketch of a sorus and a group of this fungus' spores made by F. D. Kern, 6 March 1903. A note with the sketch by an unknown person, perhaps J. C. Arthur, states "not a rust". The sketch shows a suprastomatal, long-stalked synnema. This unusual kind of rust sorus characterizes a new species of an unnamed anamorph rust genus. The host is a member of the Apocynaceae. We have compared the rust and the host to other collections of this anamorph on Apocynaceae from São Paulo, Brazil and find that they are the same.

***Uredo subneurophila*** Spegazzini, Anal. Soc. Cient. Argentina 17: 123. 1883. TYPE on an unidentified genus of Apocynaceae, reported originally erroneously as "*Psidium* sp.," Myrtaceae, from **Paraguay** ("Fungi Guraran. pug. 1, number 144, collected by *Balansa-3800*, July 1883, Plantas du Paraguay")

≡ *Puccinia subneurophila* (Spegazzini) Spegazzini, Anal. Mus. Nac. Hist. Nat. Buenos Aires 31: 32. 1922.

When Spegazzini published *Puccinia subneurophila* (Spegazzini) Spegazzini, he thought he was establishing a name for the species of *Puccinia* that infects *Psidium guajava*. He believed that his name would have priority over *Puccinia psidii* published by Winter in 1884 because he was transferring *Uredo subneurophila* Spegazzini which was published in 1883 to *Puccinia*. But the Code does not allow an anamorph name to be transferred to a teleomorph genus. In addition, the host of the type of *Uredo subneurophila* is not *Psidium* nor is it in the Myrtaceae. It is in the Apocynaceae and the rust is not an anamorph of *Puccinia psidii*.

**Puccinia PSYCHOTRIAE** P. Hennings, Hedwigia 44: 57. 1905. TYPE on *Psychotria* sp., Rubiaceae, from **Brazil**, Amazonas: Rio Negro, Manaos, March 1901, *Ule-3152*. (?/?,**IIpe/III**).

*Puccinia psychotriae* has been reported only from the type.

Spermogonia and aecia unknown. Uredinia on adaxial side of leaves, scattered or cirinnate, on brownish or no spots; urediniospores 15-22 x 10-16 µm, ovoid to ellipsoid, wall sharply echinulate, colorless or pale brownish. Teliospores occasionally intermixed with urediniospores, 30-35 x 13-16 µm, oblong to clavate, rounded at apex, not or only slightly constricted at the septum, wall not or only slightly thickened at the apex, colorless to pale brownish; pedicel about 10 µm long, 3-4 µm wide, colorless (Hennings, 1905).

**Puccinia PTEROCAULI** P. Hennings, Hedwigia 35: 240. 1896. TYPE on *Pterocaulon spicatum* DeCandolle from **Brazil**, Santa Catarina: Blumenau, July 1888, *Ule-907*. (?/?,**IIpe/III**).

On Compositae:

*Pterocaulon alopecuroideum* (Swartz) DeCandolle, Minas Gerais (Thurston, 1940: 303).

*Pterocaulon pycnostachyum* (Lamarck) DeCandolle, Minas Gerais (Thurston, 1940: 303).

*Pterocaulon spicatum* DeCandolle. Santa Catarina (Hennings, 1896: 240).

*Pterocaulon virgatum* DeCandolle, Santa Catarina (Hennings, 1896: 240).

*Puccinia pterocauli* has been reported also from Argentina.

Spermogonia and aecia unknown. Uredinia scattered on both sides of leaves, 0.2-0.5 mm across, subepidermal in origin, erumpent, ruptured epidermis evident, powdery, cinnamon-brown; urediniospores 27-32 x 22-25 µm, ellipsoid, globose to subglobose; wall 2.5-3 µm thick, echinulate, pores 2, equatorial, covered by obvious cuticular caps. Telia on the abaxial side of leaves, like the uredinia but dark-brown, hidden in the host tomentum; teliospores 43-47 x 20-27 µm, ellipsoid to oblong clavate, rounded or subpapillate above, rounded below, constricted slightly at the septum; wall 2.5-3 µm thick at sides, 7-10 µm above, smooth, brown, germ pore apical in upper cell, at the septum in the lower cell; pedicel about 1.5 times as long as the spore, persistent, colorless (Lindquist, 1982).

*Puccinia pterocauli* is very similar to *P. biocellata*.

*Puccinia puiggarii* (Spegazzini) Sydow, see **DIORCHIDIUM PUIGGARI** Spegazzini.

? **Puccinia PULVERULENTA** Greville, Fl. Edinburg, p. 432. 1824. (**O/Icy, Ipe/III**).

= *Puccinia vagans* Arthur, Man. Rusts United States and Canada, p. 313. 1934. .

[see Arthur et al. (1920) and Arthur (1934) for many other synonyms and hosts]

On Onagraceae:

*Jussiaea anastomosans* DeCandolle [*Ludwigia anastomosans* (DeCandolle) H. Hara], Brazil (Silveira, 1951: 223), Espírito Santo (IBI-4659).

*Puccinia pulverulenta*, or one of its synonyms such as *P. epilobii-tetragoni* or *P. vagans*, has been reported to be widespread in the Northern Hemisphere and in the Southern Hemisphere from Australia, New Zealand, Bolivia, and Venezuela. At least 11 host genera in the Onagraceae have been reported, mostly *Epilobium*, *Gayophytum*, and *Oenothera* species. Arthur et al. (1920) and Arthur (1934) record many synonyms and hosts for *P. pulverulenta*. But they nor any other author list *Jussiaea* or *Ludwigia* as a host genus. The occurrence of *Puccinia pulverulenta* in Brazil needs to be confirmed.

**Puccinia PURPUREA** Cooke, Grevillea 5: 15. 1876. TYPE on *Sorghum vulgare* from **India**, date and collector not available. (**?/? ≠ Ipe/III**).

= *Puccinia penniseti* Barclay 1891, not Zimm.

= *Puccinia sanguinea* Dietel ex Atkinson, Bull. Cornell Univ. 3: 19. 1897.

= *Puccinia prunicolor* H. Sydow, P. Sydow & Butler, Ann. Mycol. 4: 435. 1906.

= *Puccinia sorghi-halapensis* Spegazzini, Anal. Mus. Nac. Buenos Aires 31: 386. 1922.

Anamorph

*Uredo sorghi* Passerini, Comm. Soc. Critt. Italy 2: 449. 1867.

= *Uredo sorghi* Fuckel, Bot. Zeit. 29: 27. 1871.

= *Uredo sorghi-halapensis* Patouillard, Bull. Soc. Myc. France 19: 253. 1903.

On Gramineae:

*Sorghum alnum* Parodi, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 116).

*Sorghum bicolor* (Linnaeus) Moench (= *Sorghum vulgare* Persoon), Minas Gerais (IBI-13518), Pernambuco (Pickel, 936: 209; IBI-15516), Rio de Janeiro (PUR-F5106), Rio Grande do Sul (IAN-717), São Paulo (Viégas, 1945: 43; IAC-6; IBI-17619), Sergipe (Viégas, 1945: 43; IAC-405).

*Sorghum halapense* Persoon, Minas Gerais (Thurston, 1940: 303; IBI-15192) Paraíba (Viégas, 1945: 43; IAC-2665), São Paulo (Viégas, 1945: 43; IAC-392; IBI-18778).

*Sorghum* sp., Paraíba (Viégas, 1945: 43; IAC-2667), Rio Acre (Sydow, 1916: 67), Rio Grande do Norte (Viégas, 1945: 43; IAC-3246), São Paulo (Viégas, 1945: 43; IAC-442; IBI-1556).

*Puccinia purpurea* is circumglobal in warmer regions where the hosts occur.

Spermogonia and aecia unknown. Sori mostly on the abaxial side of leaves, in purple spots.

Uredinia nearly chestnut-brown, powdery, with clavate or clavate-capitate, mostly curved, colorless or yellowish (or purple stained from the host) paraphyses, with the wall 4-7 µm apically becoming progressively paler below; urediniospores (26-)30-40 x 23-29(-32) µm, variable, ellipsoid, obovoid, or nearly globose, often

angular, wall 2  $\mu\text{m}$  thick, cinnamon or slightly darker, echinulate, pores 5-8, scattered or tending to be bizonate. Telia blackish brown, compact, pulvinate, exposed, teliospores (37-)40-50(-55)  $\times$  (22-)24-30(-33)  $\mu\text{m}$ , mostly ellipsoid, or oblong-ellipsoid, wall (2.5-)3-3.5  $\mu\text{m}$  thick at sides, 4-5(-7)  $\mu\text{m}$  apically, chestnut, smooth; pedicels to 95  $\mu\text{m}$  long, thick-walled and mostly not collapsing, colorless or yellow, persistent (Cummins, 1971).

Traits that help identify *Puccinia purpurea* include: uredinia and telia usually occur on purple leafspots, uredinia with strongly developed, peripheral, clavate-capitate paraphyses with walls 4-7  $\mu\text{m}$  thick apically becoming thinner below, and urediniospores with walls 2  $\mu\text{m}$  thick, cinnamon-brown, with 5-8 scattered germ pores or tending to be bizonate.

Although LeRoux and Dickson (Phytopathology 476: 101-107. 1957) published that they had demonstrated that *Oxalis corniculata* is a spermogonial and aecial host for this rust, they gave no description of the sori or spores and they reported no voucher specimens of their experimental work. Their results must be questioned. It is very likely that they mistakenly were using *Puccinia sorghi* on *Zea mays*, not *Puccinia purpurea* on *Sorghum* sp.

**Puccinia PUTA** H. S. Jackson & Holway, in Kern, Thurston & Whetzel, Mycologia 25: 477. 1933. (Nom. nov. for *Puccinia distinguenda* H. S. Jackson & Holway). (?!/?, IIcv/III).

$\equiv$  *Puccinia distinguenda* H. S. Jackson & Holway, Mycologia 23: 497. 1931. [as “*Puccinia distinguenda* (Sydow) Jackson & Holway”, basionym *Aecidium distenguindum* Sydow, Monog. Ured. 4: 131. 1923, but Jackson (1931) described teleomorph]. TYPE on *Ipomoea fistulosa* Martius, **Ecuador**: Guayaquil, 30 July 1920, *Holway-794*.. Not *Puccinia distinguenda* Sydow, 1908.

Anamorph

*Aecidium distinguendum* P. Sydow & H. Sydow, Monogr. Ured. 4: 131. 1923. TYPE on *Ipomoea* sp. from **Peru**: Tarapoto, *Ule-3244*.  
= *Puccinia agnesiae* H. Sydow, Ann. Mycol. 32: 288. 1934. TYPE on *Ipomoea crassicaulis* Robinson from **Brazil**: Bahia, Rio Salitre, 45 km wsw of Joazeiro, 15 Dec 1924, *Agnes Chase-7942*. Teleomorph not described.

On Convolvulaceae

*Ipomoea crassicaulis* Robinson, Bahia (H. Sydow, 1934: 288), Ceará (Almeida, 1985).

*Ipomoea* sp., Amazonas [P. Sydow & H. Sydow, 1923: 131. The Sydows (1923) reported two specimens of Ule as being from Brazil, without name of state or city. Labels of these two specimens state that Ule-2692 is from “Amazonas: Juruá Miry, Jun 1901” and Ule-2693 is from “Amazonas: Mai 1901” (Batista et al., 1966, identified this specimen as *Aecidium distinguendum*),].

*Puccinia puta* has been reported also from Peru, Ecuador, Colombia, Venezuela, and Mexico.

Spermogonia and aecia unknown. Uredinia, *Aecidium distinguendum*, mostly on abaxial side of leaves, solitary or in dense groups 1-4 mm across, cupulate, peridial cells 24-34  $\times$  15-18  $\mu\text{m}$ , wall uniformly 4-6  $\mu\text{m}$  thick, outer wall delicately striate, inner wall verrucose, urediniospores 24-30  $\times$  20-26  $\mu\text{m}$  (33-40  $\times$  24-33  $\mu\text{m}$  fide Hennen, type), catenulate, angular-globoid, wall 1.5-2  $\mu\text{m}$  thick at sides, apical walls up to 8  $\mu\text{m}$  or more thick, verrucose, warts 1(-1.4)  $\mu\text{m}$  apart. Teliospores 42-56  $\times$  28-32  $\mu\text{m}$  (56-61  $\times$  33-37, fide Hennen, type), ellipsoid or oblong, rounded above and below, or sometimes obtuse above, not constricted at septum, lateral wall 3.5-4  $\mu\text{m}$  [(2-)2.5-3.5(-4) fide Hennen, type] thick, apical wall 5-6  $\mu\text{m}$  and at angles formed by septum, dark chestnut- to blackish-brown, verrucose, warts (1.5-)2-2.5(-3)  $\mu\text{m}$  apart; pedicel once to twice length of spore, colorless or slightly tinted next to spore, 10-11  $\mu\text{m}$  thick at point of attachment, soon collapsing.

Two other species of rusts on *Ipomoea* from the Neotropics with uredinia in the genus *Aecidium* have apically thickened urediniospore walls: *Aecidium nocticolor* has been reported from Mexico on shrub or tree species of *Ipomoea*, and *Puccinia ibrae* on vining species of *Ipomoea* from Mexico and Honduras.

**Puccinia PUTTEMANSII** P. Hennings, Hedwigia 41: 105. 1902. TYPE on *Panicum* sp. from **Brazil**, São Paulo: “Mattos da Serra da Cantareira”, 28 April 1900, *Puttemans-140*. (?!/? $\neq$  IIpe/III).

On Gramineae:

*Panicum sciurotis* Trinius, [*Dicanthelium sciurotis* (Trinius) Davidse, fide Tropicos, 1992], Rio de Janeiro (Cummins, 1942; 693).

*Panicum rugulosum* Trinius sensu lato Doell (see below for synonyms), Minas Gerais (IBI-14580), Rio de Janeiro (IBI-12838), São Paulo (Viégas, 1945: 45; IAC-2518, IBI-12589). Reported as *Panicum millegrana* Poiré, Minas Gerais (Joerstad, 1959: 64), Rio de Janeiro (PUR-F9827), São Paulo (PUR-F4784).

*Panicum* sp., São Paulo (Hennings, 1902C: 105; *Puttemans-140*).

*Puccinia puttemansii* has been reported also from Trinidad.

Spermogonia and aecia unknown. Uredinia mainly on the abaxial side of leaves, cinnamon-brown; urediniospores (20-)22-24 x (17-)20-24  $\mu\text{m}$ , mostly broadly ellipsoid or obovoid, wall 1.5  $\mu\text{m}$  thick, golden or pale cinnamon-brown, echinulate, germ pores 4, rarely 3, equatorial. Telia mainly on abaxial side of leaves, exposed, blackish-brown, pulvinate; teliospores (27-)34-37 x (17-)20-24  $\mu\text{m}$ , mostly clavate or oblong-ellipsoid, wall 1.5  $\mu\text{m}$  thick at sides, 4-7  $\mu\text{m}$  apically, deep golden or clear chestnut-brown, smooth; pedicels to 30  $\mu\text{m}$  long, yellowish, thin-walled, mostly collapsing (Cummins, 1971).

*Panicum rugulosum*, in the broad sense, has been divided into at least seven varieties and includes *Panicum sellowii* Nees, and *Panicum millegrana* Poiré (Mo Bot. Gard., Tropicos database, May, 2004).

*Puccinia pygmaea* Dietel, see **Puccinia BRACHYPODII** Otth var. **POAE-NEMORALIS** (Otth) Cummins & H.C. Greene.

*Puccinia pygmaea* Eriksson var. *chisosana* Cummins, see **Puccinia BRACHYPODII-PHOENICOIDIS** Guyot & Malencon var. **CHISOSANA** Cummins & Greene.

**Puccinia RAUNKAERII** Ferdinansen & Winge, Bot. Tidskr. 29: 8. 1908. TYPE on *Rivina humilis* Linnaeus, Phytolaccaceae, from **The West Indies**, Saint Thomas, Lovenlund, ('10. 5. 06"), ?10 May 1906, *Raunkiaer s.n.* (a LECTOTYPE-needs to be selected from the three collections reported).

(0/Icv, IIpe/III).

= *Puccinia rivinae* Spegazzini, Anal. Mus. Nac. Buenos Aires 19: 304. 1909. TYPE on *Rivina laevis*, Phytolaccaceae, from **Argentina**, Corrientes: Bella Vista, Sept 1904, ? *Spegazzini s.n.* (LECTOTYPE).

Anamorph

*Aecidium rivinae* Berkeley & Curtis, Jour. Linn. Soc. 10: 358. 1869. TYPE on *Rivina octandra* (? *Rivina humilis*), Phytolaccaceae, from **Cuba**, May, ? collector.

= *Aecidium rivinae* Spegazzini, Anal. Mus. Nac. Buenos Aires 6: 232. 1899. TYPE on *Rivina laevis*, Phytolaccaceae, from **Argentina**, Tucumán, Jan 1895, *Spegazzini s.n.*

≡ *Endophyllum rivinae* Arthur, N. Am. Ured. 7: 126. 1907. TYPE on *Rivina octandra*, Phytolaccaceae, from **Cuba**, same as for *Aecidium rivinae*.

*Puccinia raunkaerii* has not yet been reported from Brazil but is to be expected because it has been reported on *Rivina humilis*, from nearby Argentina. It has also been reported from Colombia, The West Indies, and Texas in the United States of America.

Spermogonia and aecia on distorted shoots or witches' brooms, aecia cupulate, peridial cells rectangular, inner walls striate-verrucose, outer walls smooth, aeciospores 26-37 x 14-25  $\mu\text{m}$ , ellipsoid to obovoid, wall 1.5-2  $\mu\text{m}$  thick, cinnamon-brown, finely verrucose, with two equatorial germ pores; uredinia mostly on the adaxial side of leaves, cinnamon-brown, urediniospores 23-30 x 17-23  $\mu\text{m}$ , globoid to ellipsoid, wall 1.5-2  $\mu\text{m}$  thick, cinnamon-brown, sparsely and strongly echinulate, with two equatorial germ pores; telia mostly on the adaxial side of leaves, 0.2-1 mm across, chestnut-brown, pulverulent, numerous, gregarious in small groups, ruptured epidermis conspicuous, teliospores 29-43 x 21-26  $\mu\text{m}$ , ellipsoid to narrowly ellipsoid, rounded at both ends, slightly or not constricted at the septum, wall uniformly (1.5-)2(-2.5)  $\mu\text{m}$  thick, cinnamon-brown, with a thin outer layer, sparsely verrucose, pore of upper cell apical, pore of lower cell much depressed to near the pedicel, pedicel short, fragile, colorless (Lindquist, 1982).

**Puccinia RECONDITA** Roberge ex Desmazieres, Bull. Soc. Bot. France 4: 798. 1857. TYPE on *Secale* sp. from **France**, date not available, *Roberge-s.n.* (isotypes distributed in the exsiccati of Desmazieres' Plantes Cryptog. France No. 252). (0/Icv $\neq$  IIpe/III). See Cummins (1971) for extensive synonymy that includes 51 names.

= *Puccinia rubigo-vera* (DeCandolle) Winter (?or *Puccinia rubigo-vera* Winter), Rabh. Kryptog.

-Fl. Ed. 2. 1: 217. 1882.

= *Puccinia dispersa* Erikson & Hennings, Z. Pflanzenkr. 4:17: 1898.

Synnamorphs

*Uredo rubigo-vera* DeCandolle Fl. Fr. 5: 83. 1815.

*Aecidium clematidis* DeCandolle, *Aecidium* spp. anamorphs of *Puccinia recondita* hav not been reported from South America.

*Aecidium asperifolii* Persoon

On Gramineae:

*Avena* sp., São Paulo (Hennings, 1902D: 296).

*Briza calotheca* (Trinius) Hackel, São Paulo (IBI-1663).

*Briza subaristata* Lamarck, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 116).

*Bromus catharticus* Vahl, Rio Grande do Sul (Lindquist & Costa Neto, 1967: 58).

*Hordeum vulgare* Linnaeus, São Paulo (Spegazzini, 1908: 8; ?IBI-10509).

*Secale cereale* Linnaeus, Paraná (Fontoura & Nowacki, 1967/70: 171), Rio Grande do Sul, IAC-7500), São Paulo (Viégas, 1945: 45; IAC-229).

*Triticum aestivum* Linnaeus, Federal District (IBI-12507), Minas Gerais (Thurston, 1940: 304; Viégas, 1945: 46; IAC-4016), Paraná (Fontoura & Nowacki, 1977/70: 176; IBI-13463), Rio Grande do Sul (IAN-713, -725), São Paulo (Sydow, 1907: 355; Viégas, 1945: 46; IAC-222; IBI-12486).

*Triticum spelta* Linnaeus, Santa Catarina (Diete, 1899: 249).

*Triticum* sp., São Paulo (Hennings, 1902D: 296).

*Puccinia recondita* is a species complex, world wide in distribution, and has been reported on close to 40 genera of grasses. In older literature it was reported often as *Puccinia rubigo-vera*. Various degrees of host specialization occurs within the complex. Because of slight morphological differences, the name *Puccinia triticina* Erikson has been taken up for the rust on cultivated wheat by some recent authors.

Spermogonia and aecia (*Aecidium clematidis* DC.) occur on the Balsaminaceae, Boraginaceae Hydrophyllaceae, and Ranunculaceae; localized, cupulate, aeciospores (18-)21-26(-28) x 22(-24) x (14-)17-22(-24) µm, globoid or broadly ellipsoid, wall 1-2 µm thick, colorless, verrucose. Uredinia on both sides of leaves, mostly about cinnamon-brown; urediniospores (20-)24-32(-36) x (17-)20-25(-28) µm, mostly broadly ellipsoid or obovoid, wall 1-2 µm thick, yellowish brown to cinnamon-brown, echinulate, germ pores 6-10, scattered. Telia mostly on abaxial side but commonly on the adaxial side of leaves and the sheaths, covered by the epidermis, blackish-brown, brown paraphyses present, the sori usually loculate; teliospores variable in size and shape, (32-)40-60(-75) x (12-)15-22(-25) µm, mostly oblong-clavate, wall 1-1.5 µm thick at sides, 3-5(-7) µm apically, chestnut-brown, smooth; pedicels usually less than 20 µm long, brown or brownish (Cummins, 1971).

Spermogonia and aecia have not been reported in South America.

*Puccinia rhamni* (Persoon) Wettstein, see **Puccinia coronata** Corda.

*Puccinia rivinae* Spegazzini, see **Puccinia raunkaerii** Ferdinansen & Winge.

*Puccinia rochaei* Puttemans, see **Puccinia psidii** Winter.

*Puccinia rompelii* P. Magnus, see **Puccinia psidii** Winter.

*Puccinia rotundata* Dietel, see **Puccinia neorotundata** Cummins.

**Puccinia rouliniae** P. Hennings, Hedwigia 35: 238. 1896. TYPE on *Roulinia convolvulacea* Gr. from **Argentina**, Salta: "passaje del Rio Juramento" Feb 1873, *G. Hieronymus et Lorentz s.n. (-I, -/III)*.

= *Puccinia tassadiae* H. Sydow & P. Sydow, Ann. Mycol. 1: 328. 1903. TYPE on *Tassadia comosa* Fournier, Asclepiadaceae, from **Brazil**, state, place, and date of collection not reported, *Glaziou s.n.*

= *Puccinia aequatoriensis* H. Sydow & P. Sydow, Ann. Mycol. 1: 325. 1903. TYPE on

*Marsdenia* sp. from **Ecuador**, Palmira, place and date of collection not reported, A. Sodiro s.n.

= *Puccinia rouliniae* Spegazzini, Anal. Mus. Nac. Hist. Nat. Buenos Aires 31: 385. 1922. TYPE on *Roulinia fluminensis* from **Paraguay**, near Asuncion, Puerto Sajenia, July 1919, ? Spegazzini s.n.

On Asclepiadaceae:

*Calostigma multiflorum* Malme, Mato Grosso (Joerstad, 1956: 450).

*Metastelma odoratum* Decaisne, Paraná (Joerstad, 1956: 450).

*Nephradenia* sp. Mato Grosso do Sul (Joerstad, 1956: 450).

*Roulinia fluminensis* Decaisne, Rio Grande do Sul (Joerstad, 1956: 450).

*Tassadia comosa* Fournier, Brazil, state not reported (H. Sydow & P. Sydow, 1903: 328).

*Puccinia rouliniae* has been reported also from Argentina, Bolivia, Paraguay, Ecuador, and Cuba.

See *Puccinia araujae* Lèveillé for a comparison key of three closely related microcyclic species of *Puccinia* on Asclepiadaceae, subfamily Cynanchoideae.

Lindquist (1982) reported that *Puccinia balansae* Spegazzini (Anal. Soc. Cient. Argentina 16: 50. 1883. TYPE on *Araujia* sp. according to Arthur, but mistakenly reported originally as *Echites funiformis* Veloso, Apocynaceae, from **PARAGUAY**, Guarapi, 1880, *B. Balansa-2743*) is the same as *Puccinia roulineae*. If Lindquist is followed then the correct name is *Puccinia balansae* Spegazzini because it has priority.

*Puccinia rouliniae* Spegazzini, see **Puccinia ROULINIAE** P. Hennings.

*Puccinia rubigo-vera* (DeCandolle) Winter, see **Puccinia RECONDITA** Robergeex Desmazieres.

**Puccinia RUDERARIA** H. S. Jackson & Holway in Jackson, Mycologia 24: 153. 1932. TYPE on *Baccharis oxyodonta* DeCandolle from **Brazil**, Rio de Janeiro, 11 Nov 1921, *Holway-1291*. (0/Itr, IIpe/III).

On Compositae:

*Baccharis oxyodonta* DeCandolle, Minas Gerais (Jackson, 1932: 153; PUR-F8168, Thurston, 1940: 304), Rio De Janeiro (Jackson, 1932: 153).

*Baccharis* sp., Minas Gerais (PUR-F8174).

*Puccinia ruderaria* has been reported also from Bolivia.

Spermogonia and aecia too old for good description. Aeciospores 28-35 x 20-24  $\mu\text{m}$ , wall prominently tuberculate-rugose, colorless. Uredinia on both sides of leaves, 0.2-0.8 mm across, scattered on brownish leaf spots, tardily erumpent, ruptured epidermis conspicuous, powdery, yellowish; urediniospores (22-)26-30(-34) x 16-20(-22)  $\mu\text{m}$ , globoid to obovoid; wall 1.5-2.5  $\mu\text{m}$  thick, minutely echinulate, spines moderately spaced, colorless to pale golden-brown, pores obscure. Telia on abaxial side of leaves, 0.2-0.4  $\mu\text{m}$  across, scattered, tardily erumpent, ruptured epidermis conspicuous, compact, subpulvinate, pale chestnut-brown, becoming ashy-gray by germination; teliospores 42-60 x 20-26  $\mu\text{m}$ , ellipsoid to subclavate, rounded above, mostly narrowed below, not or slightly constricted at septum; wall 1-1.5  $\mu\text{m}$  thick at sides, broadly thickened above 6-9  $\mu\text{m}$ , smooth, golden- to pale chestnut-brown, mostly pale at apex; pedicel as long as or a little longer than the spore, colorless (Jackson, 1932; Lindquist, 1958).

These collections were at first referred to *P. evadens*. The teliospores are, however, much narrower. A few old aecia were found, too old for adequate description, which, however, served to make clear that the species was quite different from *P. evadens*. The aeciospores are 20-24 by 28-35  $\mu\text{m}$ , with colorless walls, prominently tuberculate-rugose.

The species is somewhat like *P. salebrata*. The aeciospores of that species are, however, much more coarsely tuberculate.

Fifteen species of *Puccinia* have been reported on *Baccharis* in Brazil. At least 53 species of *Puccinia* have been reported to parasitize species of *Baccharis* in the Americas (Lindquist, 1957). Thus, the New World genus *Baccharis*, which itself has about 380 known species, harbors more *Puccinia* species than any other host genus in the Americas.

*Puccinia ruelliae* Lagerheim, Tromso Mus. Aarsh. 17: 71. 1895.

Joerstad, (1956) reported this name as a species from Brazil, [on *Ruellia longifolia* (Pohl) Grisebach, Acanthaceae, from Rio de Janeiro, 29 Oct 1901, *P. Dusen*]. We believe this report is mistaken because Laundon (1963) states that *Puccinia ruelliae* Lagerheim is a synonym of *Puccinia ruelliae* H. Sydow & P. Sydow (1902), a species that has been reported only in Africa, Asia, and Australia. The identification of the specimen on which Joerstad's report was based needs to be confirmed.

*Puccinia rugosa* Spegazzini, see **PUCGINIA NEOROTUNDATA** Cummins.

**PUCGINIA SANGUINOLENTA** P. Hennings, Hedwigia 35: 228. 1896. TYPE on *Heteropteris* sp. (mistakenly reported originally as *Myrcia* sp. in the Myrtaceae, see below) from **Brazil**, São Paulo, São Paulo, Vila Mariana, May 1887, *Ule-675 (0/Ipe,IIpe/III)*.  
 = *Puccinia rubricans* Holway, J. Mycol. 10: 165. 1904. TYPE on *Banisteria portillana* (S. Watson) C. B. Robinson ex Small (reported originally as *Heteropteris portillana* S. Watson) from **Mexico**, Jalisco: Guadalajara, 28 Sept 19034, *Holway-5063*.  
 = *Prospodium pseudo-zonatum* A. P. Viégas, Bragantia 5: 13. 1945. TYPE on an unidentified genus of Malpighiaceae (mistakenly reported originally as an unidentified genus of Bignoniaceae), from **Brazil**, Minas Gerais: Belo Horizonte, Pampulha, 14 June 1941, A. P. Viégas, *M. Barreto-s.n.*

On Malpighiaceae:

*Heteropteris confertiflora* A. Jussieu (identification on packet is *Banisteria confertiflora* A. Jussieu), Minas Gerais (ex Kew).

*Banisteria* sp., São Paulo (Hennings, 1896: 228).

*Heteropteris* sp., Goiás (PUR-F6332).

**Undetermined**, Minas Gerais (Viégas, 1945).

*Puccinia sanguinolenta* has also been reported from Argentina, Venezuela and Mexico.

Spermogonia globoid, yellowish or whitish, crowded in circular groups 1-1.5 mm across, on abaxial side of leaves; aecia circinate in groups around the spermogonia on brilliant red spots, aecia and aeciospores like the uredinia and urediniospores. Uredinia 0.2-0.8 mm across, mostly scattered on brilliant reddish, indeterminant, broadly effused spots on the abaxial side of leaves, erumpent, ruptured epidermis noticeable, powdery, cinnamon-brown; without paraphyses, urediniospores 34-43 x 32-35 µm, mostly globoid to broadly ellipsoid, wall 4-7 µm thick, sometimes with a colorless outer layer 1 µm or less thick, sparsely and prominently echinulate, pores 4, equatorial, rather indistinct. Telia 0.3-0.8 mm across, scattered on the abaxial side of leaves, erumpent, ruptured epidermis noticeable, compact, blackish, teliospores 50-58 x 37-41 µm, broadly ellipsoid, rounded or obtuse above, rounded below, not constricted at the septum; wall 4-7 µm thick at sides, 8-10 µm at apex, chestnut-brown, paler above, closely reticulate-pitted, the pits 2-3 µm across, pedicel up to 70 µm long, yellowish brown next to the spore, colorless and roughened below, and slightly swollen at the base (Arthur, 1922).

Hennings (1896) published the the location as the state of Rio de Janeiro, but the label of the isotype in HG records the location of "E. Ule n. 675" as "São Paulo, Villa Mariana, Mai 87".

Holway (1905) first reported that *Puccinia rubricans* Holway is a synonym of *Puccinia sanguinolenta*. He also identified the host of the type of *P. sanguinolenta* as *Heteropteris* sp. based on comparison with the type of his *P. rubricans*, which he reported as *Heteropteris portillana* S Watson from Guadalajara, Mexico. Later *Heteropteris portillana* was transferred as *Banisteria portillana* (S. Watson) C. B. Robinson ex Small. The identification of the genus of the host of the type of *P. sanguinolenta* is not clear.

Viégas (1945) proposed *Prospodium pseudo-zonatum* because its host was missidentified as Bignoniaceae. He provided a good description and illustrations showing urediniospores with two opposite, equatorial pores with distinct cuticular caps.

See under *Puccinia banisteriae* for a key that aids in identification of species of *Puccinia* on Malpighiaceae.

**PUCGINIA SCHEDONNARDI** Kellerman & Swingle, J. Mycol. 4: 95. 1888. TYPE on *Schedonnardus paniculatus* (reported originally as *Schedonnardus texanus*) from **The United States of America**, Kansas: Manhattan, March 1888, *W. A. Kellerman & W. T. Swingle-1268. (0/Icv≠ Ipe/III)*.  
 = *Puccinia melicina* Arthur & Holway in Arthur, Pro. American Philos. Soc.64: 191. 1925.  
 TYPE on *Melica scabra* Kunth from **Bolivia**, La Paz, 12 May 1920, *Holway-598*.



Anamorph (0/I on Malvaceae)

***Aecidium hibisciatum*** Schweinitz [as "*Caecoma (Aecidium) hibisciatum*"], Trans. Am. Phil. Soc. II. 4: 293. 1832. Not reported from Brazil.

On Gramineae (II/III):

***Melica sarmentosa*** Nees, Paraná (Joerstad, 1959: 65), Rio Grande do Sul (Joerstad, 1959: 65).

*Puccinia schedonnardi* has been reported from North and South America and from the Philippines and Japan and as infecting six genera of grasses; *Lycurus*, *Melica*, *Muhlenbergia*, *Schedonnardus*, *Sporobolus*, and *Triplasis* (Cummins, 1971). Including anamorph names, Hennen and Cummins (1956) list 18 synonyms for *Puccinia schedonnardi*.

Spermogonia and aecia, *Aecidium hibisciatum* Schweinitz., occur on *Hibiscus* and other genera of Malvaceae, aeciospores (16-)20-24(-28) x (12-)(16-19(-23)  $\mu\text{m}$ , ellipsoid or globose, wall (0.5-)1-1.5(.2.5)  $\mu\text{m}$  thick, colorless, finely verrucose. Uredinia and telia on both sides of leaves, without paraphyses, urediniospores (18-)21-26(-30) x (15-)18-24(-28)  $\mu\text{m}$ , globose to obovoid, wall 1-2  $\mu\text{m}$  thick, pale cinnamon-brown, echinulate, pores 6-8, scattered; teliospores (24-)28-36(-45) x (16-)18-25(-29)  $\mu\text{m}$ , ellipsoid or oblong-ellipsoid, rarely diorchidoid, wall (1-)1.5-2(-3)  $\mu\text{m}$  thick laterally, 3-7(-10)  $\mu\text{m}$  apically, chestnut-brown, smooth; pedicels to 120  $\mu\text{m}$  long but usually less than 100  $\mu\text{m}$ , wall colorless, thick-walled but sometimes collapsing (Cummins, 1971).

Cummins (1971) reported that *Aecidium hibisciatum*, the aecial anamorph of *Puccinia schedonnardi*, may occur on at least seven genera of Malvaceae: *Abutilon*, *Callirhoe*, *Hibiscus*, *Malvastrum*, *Napaea*, *Sida*, and *Sidalcea*. This anamorph has been reported from Argentina (Lindquist, 1982) but not from Brazil. These malvaceous genera also are the main hosts for the microcyclic *Puccinia heterospora* which Arthur (1934) reported is correlated with *P. schedonnardi*. *Puccinia heterospora* is common in South and North America.

There are still reports that the spermogonial and aecial stages (*Aecidium hibisciatum*) of *Puccinia schedonnardi* infect cultivated cotton (*Gossypium* spp.), but Hennen and Cummins (1956) reported that that rust on cotton (*Aecidium gossypii*) is part of the life cycle of *Puccinia cacabata*, not *Puccinia schedonnardi*.

**PUCCINIA SCHILEANA** Spegazzini var. **PARTHENICOLA** (H. S. Jackson) Lindquist, J. C. 1982.

Royas de la Republica Argentina y Zonas Limitrofes. Secretaria de Agricultura y Ganaderia de la Nacion, Instituto Nacional de Tecnologia Agropecuaria (INTA). Buenos Aires, 574 pp. p. 452. (??,II/III).

≡ *Puccinia parthenicola* H. S. Jackson, Mycologia 24: 166. 1932. TYPE on *Parthenium hysterothorus* Linnaeus from **Bolivia**, Cochabamba, 29 Feb. 1920, *Holway-349*.

≡ *Puccinia abrupta* Dietel & Holway var. *parthenicola* (H. S. Jackson) Parmelee, Canad. J. Bot. 45: 2293. (1967) 1968.

Anamorph

***Uredo parthenii*** Spegazzini, Anal. Museu Nac. Buenos Aires 6: 239. TYPE on *Parthenium hysterothorus* from **Argentina**, from the provinces of Cordoba, Tucuman, and Salta, "summer 1887-97". A lectotype needs to be chosen from the specimens seen by Spegazzini.

On Compositae:

***Parthenium hysterothorus*** Linnaeus, Paraná (IBI-12973), São Paulo (IBI-12551).

*Puccinia schileana* var. *parthenicola* has been reported from Argentina to The United States of America on three or four species of *Parthenium*.

Uredinia scattered on leaves, orange-brown, powdery; urediniospores 21-30.5 x (17.5-)21-27  $\mu\text{m}$ , ellipsoid, obovoid, flattened to cuneate in side view; wall 1-1.7  $\mu\text{m}$  thick, very finely echinulate with an indistinct pattern, spines 0.7  $\mu\text{m}$  or less high, 2-3  $\mu\text{m}$  apart, yellow-brown, pores 2, subequatorial and usually 1 apical. Telia on stems and leaves; teliospores 30.5-40 x 27-33.5  $\mu\text{m}$ , broadly ellipsoid, not constricted at septum, wall 2.4-3.2  $\mu\text{m}$  thick at sides, 4.8-8  $\mu\text{m}$  at apex and paler, smooth, laminate, red-brown, pores apical and septal; pedicel to 160  $\mu\text{m}$  long, flexuous, persistent, colorless, often broken in mount (Parmelee, 1967). Lindquist (1982) included the following key to differentiate between three varieties of *Puccinia schileana*

**Key to help identify varieties of *Puccinia schileana* on *Verbesina* and *Vigiera*, Asteraceae**

*Puccinia schileana* var. *abrupta* has larger teliospores 27-51 x 21-38  $\mu\text{m}$ , and thicker teliospore wall than *Puccinia schileana* var. *schileana*.

1. Urediniospore pores 2, subequatorial

2. Teliospores 27-38 x 25-33  $\mu\text{m}$ , wall cork chestnut

*Puccinia schileana* var. *schiliana*

on *Verbesina*; Argentina

2. Teliospores 32-41 x 25-31  $\mu\text{m}$

*Puccinia schileana* var. *abrupta* (Dietel & Holway) Lindquist,  
on *Vigiera*; Bolivia, Peru, N. America

1. Urediniospore pores 3, 2 subequatorial and 1 apical *Puccinia schileana* var. *partheniicola*  
on *Parthenium*; S. America, N. America.

*Puccinia schnyderi* Spegazzini, see **Puccinia ARAUJAE** Lèveillé.

**Puccinia SCLERIAE** (Pazschke) Arthur, Mycologia 9: 75. 1917. (**0/Icv**  $\rightleftharpoons$  **IIpe/III**).

$\equiv$  *Rostrupia scleriae* Pazschke, Hedwigia 31: 96. 1892. TYPE on *Scleria* sp. from **Brazil**, Santa Catarina: Itajaí, Nov 1885, *Ule*-589.

$\equiv$  *Dicaeoma scleriae* (Pazschke) Arthur, N. Am Fl. 7: 349. 1920.

Anamorph

*Aecidium passifloricola* P. Hennings, Hedwigia 43: 168. 1904. TYPE on *Passiflora* sp. from **Peru**, Tarapoto, Nov 1902, *Ule*-3235.

On Passifloraceae (**0/Icv**) or **?(-Icv)**

*Passiflora edulis* Sims, Pará (Albuquerque, 1971: 148; IAN-500)

*Passiflora glandulosa* Cavanilles, Pará (IAN-560).

On Cyperaceae (**IIpe/III**):

*Scleria mitis* Berg, Minas Gerais (Viégas & Teixeira, 1945: 54; IAC-5051).

*Scleria panicoides* Kunth, São Paulo (IBI-1635).

*Scleria sylvestris* Poeppig & Kunth, Rio de Janeiro (Jackson, 1926: 144), São Paulo (Jackson, 1926: 144).

*Scleria* sp., Pará (IAN-860), Rio de Janeiro (Dietel, 1899: 249), Santa Catarina (Pazschke, 1892: 96).

*Puccinia scleriae* has been reported as widespread from scattered places in warmer regions of Africa, Asia, and the Americas. A report of *Puccinia scleriae* on *Rhynchospora* sp. (Silveira, 1951: 223) is based on a misidentification of the *Scleria* sp. host. The genus name *Rostrupia*, a synonym of *Puccinia*, was used in some older reports because the teliospores of *Puccinia scleriae* are frequently more than two-celled.

The connection of *Aecidium passifloricola* to *Puccinia scleriae* that was made by Thomas (1918) in Puerto Rico has never been confirmed by additional inoculation experiments.

*Puccinia scleriae* has urediniospores that are 19-27 x 13-19  $\mu\text{m}$ , ellipsoid or obovoid, walls evenly about 1  $\mu\text{m}$  thick, pale cinnamon-brown or colorless, moderately echinulate, pores 3-4, equatorial, indistinct; telia loculate enclosing the teliospores, teliospores 1-4 celled, often more than 2-celled.

*Puccinia scleriae* may occur on the same hosts as those of *Uromyces scleriae*. Urediniospores of *Uromyces scleriae* are 23-35 x 18-26  $\mu\text{m}$  with walls thickened at the apex and sparsely echinulate. The apically thickened walls of the urediniospores of *Uromyces scleriae* are especially important for identification.

**Puccinia SCUTIAE** Lindquist, Hickenia 1: 15. 1978. TYPE on *Scutia buxifolia* Reissek, Rhamnaceae, from **Brazil**, Rio Grande do Sul: Encruzilhada do Sul, Coxilha de Sul, 27 June 1975, *N. Martius* & *N. Camilia*-8328. (**?/?,?/III**).

*Puccinia scutiae* has been reported only from the type collection. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia, aecia, and uredinia unknown. Telia on adaxial side of leaves, dark brown. Teliospores 39-51 x 15-18  $\mu\text{m}$ , ellipsoid, rounded or somewhat narrowed above and below, not or only slightly constricted at the septum, wall 2-2.5  $\mu\text{m}$  thick laterally, 2.5-3  $\mu\text{m}$  at the apex, dark brown, smooth, pedicel colorless, a little longer than the spore, sori with many, intermixed, obovoid, one-celled teliospores (Lindquist, 1978).

*Puccinia sebastianiae* H. Sydow in Theissen, see **Puccinia PILOCARPI** Cooke.

**Puccinia SEMIINSCULPTA** Arthur, Bot. Gaz. (Crawfordsville) 40: 204. 1905. TYPE on *Vernonia*

*alamanii* DeCandolle from **Mexico**, Mexico: Amecameca 31 Oct 1899, *Holway-3754*.

(0/Ipe,IIpe/III).

On Compositae:

*Vernonia bardanoides* Lessing [= *Lessinganthus bardanoides* (Lessing) H. Robinson], São Paulo (Jackson, 1932: 118).

*Vernonia elegans* Gardner [= *Lessingianthus elegans* (Gardner) H. Robinson], Mato Grosso (Joerstad, 1956: 477).

*Vernonia obscura* Lessing [= *Lessinganthus obscurus* (Lessing) H. Robinson], São Paulo (Jackson, 1932: 118).

*Puccinia semiinsculpta* has been reported also in Mexico.

Spermogonia on adaxial leaf surface. Aecia on adaxial surface in slightly hypertrophied spots, pale yellowish brown; aeciospores pedicellate, (22-)24-30(-32) x (18-)21-24(-26)  $\mu\text{m}$ , broadly ellipsoid or obovoid, wall 1.5-2(-3)  $\mu\text{m}$  thick, pale golden to nearly colorless, uniformly echinulate, pores 2 or 3(4), equatorial. Uredinia on both sides of leaves, scattered, pale yellowish brown; urediniospores similar to the aeciospores. Telia mostly on adaxial surface, exposed, mostly not compact; spores of two types the germinating kind (38-)42-48 x (20-)22-30(-33)  $\mu\text{m}$  from narrowly to broadly obovoid, golden brown, the pore apical in each cell under an umbo, resting kind (40-)44-56 (-60) x (28-)30-40  $\mu\text{m}$  broadly ellipsoid, wall (3-)5-7(-8)  $\mu\text{m}$  at sides, 6-10(-11)  $\mu\text{m}$  over pores. dark chestnut brown or slightly paler over pores but not as a defined umbo, wall in both types from rugose with short anastomosing ridges to rugosely reticulate, pore of upper cell apical, of lower cell next to septum or midway to hilum, pedicels colorless, to 85  $\mu\text{m}$  long but usually shorter, rugose basally in intact pedicels (Cummins, 1978).

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but three from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

*Puccinia semota* H. S. Jackson & Holway, see **PUCINIA CNICI-OLERACEI** Persoon ex Desmazieres.

**PUCINIA SEORSA** H. S. Jackson & Holway in Jackson, *Mycologia* 24: 103. 1932. TYPE on *Piptocarpha axillaris* (Lessing) Baker from **Brazil**, São Paulo: Taipas, 6 Feb 1922, *Holway-1540*. (0/Icv,IIpe/III).

On Compositae:

*Piptocarpha axillaris* (Lessing) Baker, Minas Gerais (IBI 12803), Paraná (IBI 12883), São Paulo (Jackson, 1932: 103).

*Piptocarpha* sp., Federal District (IBI-12457), Minas Gerais (IBI-12803), Rio de Janeiro (Jackson, 1932: 103), São Paulo (Jackson, 1932: 1003).

*Puccinia seorsa* has been reported with certainty only from Brazil. Urban (1973) reported that the identification of a specimen recorded as *Puccinia seorsa* from Guatemala by Cummins (1978) is doubtful.

Spermogonia on adaxial side of leaves, in small groups. Aecia on abaxial side of leaves below the aecia; peridium short cylindrical, yellowish; aeciospores (28-)30-36(-41) x (24-)27-30(33)  $\mu\text{m}$ , broadly ellipsoid, globoid or sometimes lemon shape, wall 2-2.5(-3)  $\mu\text{m}$  thick, colorless or pale yellowish, finely verrucose with rod-like verucae, discrete or fusing in striae. Uredinia on abaxial side of leaves, chestnut-brown, paraphyses 12-18  $\mu\text{m}$  wide, peripheral, long, incurved, dorsally thick-walled, pale golden; urediniospores (28-)30-35(-38) x (26-)29-33(-34)  $\mu\text{m}$ , mostly globoid, wall 2-2.5(-3)  $\mu\text{m}$  thick, nearly chestnut-brown, echinulate, pores (3)4or 5(6), scattered or sometimes nearly equatorial, with slight or no caps. Telia on abaxial side of leaves, chestnut-brown, becoming grayish from germination, relatively compact, with paraphyses as in the uredinia, teliospores (50-)70-115(-122) x (17-)20-25(-31)  $\mu\text{m}$ , mostly fusiform cylindrical, wall 1  $\mu\text{m}$  thick at sides, 2-4  $\mu\text{m}$  thick at apex, pale chestnut-brown, or deep golden-brown, smooth, pore of upper cell apical of lower cell at septum, pedicels to 115  $\mu\text{m}$  long, colorless, thin-walled and collapsing.

*Puccinia serjaniae* Ellis & Everhart, see **PUCINIA ARECHAVALETAE** Spegazzini.

**PUCINIA SESSILIS** Schneider in Schroeter, *Abh. Schles. Nat. Abth.* 1869-1872: 19. 1870.

(?/?≠ IIpe/III).

On Gramineae:

***Vulpia bromoides*** (L.) Gray (reported as *Festuca bromoides* Linnaeus), Rio Grande do Sul (Lindquist & Costa Neto, 1967: 59).

Cummins (1971) reports *Puccinia sessilis* on species of *Festuca* and *Phalaris* from the temperate areas of the Northern Hemisphere but does not include this Brazilian record in his distribution. Additional collections are needed to confirm that this species occurs in Brazil. We have not included the teleomorph synonyms and anamorph names listed by Cummins (1971).

Spermogonia and aecia (*Aecidium majanthae* Schumacher) on Araceae, Iridaceae, Liliaceae, and Orchidaceae but unknown in South America; aeciospores (16-)18-25(-27) x 15-20(-22)  $\mu\text{m}$ , globose or more or less ellipsoid, wall 1(-1.5)  $\mu\text{m}$  thick, finely verrucose, colorless or yellowish. Uredinia on both sides of leaves, about cinnamon-brown; urediniospores (23-)27-32(-36) x (20-)22-26(-28)  $\mu\text{m}$ , broadly ellipsoid or obovoid, wall 1.5(-2)  $\mu\text{m}$  thick, golden or cinnamon-brown, echinulate, germ pores (4)5 or 6 scattered or tending to be equatorial (Japan), (5) 6 or 7(8) mostly 6, scattered (Europe), 7-9. mostly 8, tending to be bizonate (N. America). Telia on both sides of leaves, blackish, covered by the epidermis, not or weakly loculate with scant brown paraphyses; teliospores (34-)40-56(-60) x (15-)18-23(-26)  $\mu\text{m}$ , oblong or oblong-clavate, wall 1-1.5  $\mu\text{m}$  thick at sides, (2-5-)3-5(-6)  $\mu\text{m}$  apically, clear chestnut-brown, smooth; pedicels mostly less than 15  $\mu\text{m}$  long, brownish (Cummins, 1971).

*Puccinia setariae-viridis* Dietel, see **Puccinia LEVIS** (Saccardo & Bizzozero) Magnus var. **PANICI-SANGUINALIS** (Rangel) Ramachar & Cummins.

**Puccinia SHERARDIANA** Koernicke, Hedwigia 16: 19. 1877. TYPE on *Malva sherardiana* from Armenia, place, date, and collector not available. ( $\pm$  0/-,-/III).

On Malvaceae:

*Abutilon sylvaticum* Schumann, Brazil (Silveira, 1951: 223).

*Malva parviflora* Linnaeus, Brazil (Silveira, 1951: 223).

*Malvastrum coromandelianum* Garcke, Minas Gerais (Jackson, 1931: 480), Rio de Janeiro (PUR-F6503); São Paulo (Jackson, 1931: 480).

*Sida rhombifolia* Linnaeus, Brazil (Silveira, 1951: 223).

*Puccinia sherardiana* is widespread from Chile to Canada, and has been reported also from eastern Asia. In North America host genera include *Althea*, *Sidalcea*, and the most common, *Sphaeralcea*. Host identification of some of the Brazilian reports need to be confirmed.

Arthur (1934) reports that *Puccinia sherardiana* is a microcyclic correlated form of *Puccinia interveniens* Bethel, a macrocyclic, heteroecious species with uredinia and telia on the grass genera *Stipa* and *Nassella* and spermogonia and aecia on genera in the Malvaceae: *Callirhoe*, *Sidalcea*, and *Sphaeralcea*. *Puccinia interveniens* has been reported from Chile and Argentina, but not yet from Brazil.

Traits that help identify *Puccinia sherardiana* include telia that are closely grouped and dark brown, teliospores that are up to 75  $\mu\text{m}$  long with walls moderately thick 1.5-4  $\mu\text{m}$ .

*Puccinia sherardiana* is similar to several other microcyclic species of *Puccinia* on various genera of Malvaceae. See *Puccinia heterospora* for keys that may help identify microcyclic species of *Puccinia* on Malvaceae.

**Puccinia SIMASII** Rangel, Arch. Jard. Bot. 2: 69. 1918. TYPE reported on *Breweria burchelii* Choisy (the host is probably *Jacquemontia* sp.) from Brazil, Rio de Janeiro: "Icarahy" near Niteroi, date not recorded, *F. Simas s.n.* (?/?; IIpe/III).

On Convolvulaceae:

*Jacquemontia grandiflora* (reported as *Breweria burchelii* Choisy), Rio de Janeiro, (Isotype, PUR-F7117), São Paulo (IBI-17167, II,III).

The original type of *Puccinia simasii* could not be found in the herbarium at the National Botanical Garden in Rio de Janeiro. The species has been reported only from a very small leaf piece in a specimen in PUR that is probably an isotype, and our recent collection cited above.

*Puccinia smilacis* Schweinitz, Schr. Nat. Ges. Leipzig 1: 72: 1822. TYPE on *Smilax* sp. from The United States of America (0/I $\rightarrow$  IIpe/III).

Anamorph

*Uredo smilacis* Schweinitz, Schr. Nat. Ges. Leipzig 1: 70: 1822.

On Liliaceae:

*Smilax* sp., Santa Catarina (Pazschke, 1892: 96), São Paulo (Sydow, 1907: 355).

The reports of this rust from Brazil cited above are based on misidentifications of the rust. *Puccinia smilacis* is mainly from North America where it has been reported to produce spermogonia and aecia on *Apocynum* spp. in the Apocynaceae in The United States of America. It has also been reported from China.

*Puccinia solanicola* Mayor see **Puccinia claviformis** Lagerheim.

*Puccinia solanina* Spegazzini, see **Puccinia pampeana** Spegazzini.

**Puccinia solani-tristis** P. Hennings, Hedwigia 35: 236. 1896. TYPE on *Solanum triste* Jacquin from **Brazil**, Rio de Janeiro: Therezópolis, Serra do Mar, December 1886, Ule556. (-I-, -III).

On Solanaceae:

*Solanum citrifolium* Willdenow ex Roemer & Schultz, Minas Gerais (IBI-12758), Rio Grande do Sul (IBI-12198).

*Solanum didymum* Dunal, (Viégas, 1945: 47; IAC-2572).

*Solanum gemellum* Martius, Minas Gerais (Joerstad, 1959: 89).

*Solanum gracillimum* Sendtner, Minas Gerais (Joerstad, 1959-89).

*Solanum neves-armondii* Dusen, Rio de Janeiro (Jackson, 1932: 83; Joerstad, 1959: 89).

*Solanum rufescens* Sendtner, Rio de Janeiro (Jackson, 1932: 83).

*Solanum triste* Jacquin, Rio de Janeiro (Hennings, 1896: 236).

*Solanum* sp., Amapá (Hennen et al., 2001: 151; IBI-16037, IBI-16040), Minas Gerais (IBI-14577), Pará (IBI-16040), Rio de Janeiro (Jackson, 1932: 83), São Paulo (IBI-12555, IBI-14664 Sydow, 1907;354; Jackson, 1932: 83).

*Puccinia solani-tristis* has been reported also from Ecuador and Venezuela. *Puccinia solani-tristis* and *P. claviformis* are the two microcyclic species of *Puccinia* on *Solanum* spp. that have been reported from Brazil.

Kern (1933) published a key for the nine microcyclic species of *Puccinia* that are known on *Solanum* spp. from the Neotropics. These are known mostly from the western cordilleras. Some are difficult to separate by their morphology.. Kern (1933) uses the following traits for identifying *Puccinia solani-tristis*: Telia in groups, not distributed evenly over large areas, teliospores mostly two-celled, clavate to ellipsoid-clavate, more or less constricted at the septum, 23-35 µm long, wall 1-1.5 µm thick, not or only slightly thicker at the apex.

*Puccinia solmsii* P. Hennings, see **Puccinia congesta** Berkeley & Broome.

*Puccinia sordida* Dietel, see **Puccinia conyzae** P. Hennings.

**Puccinia sorghi** Schweinitz, Trans. Amer. Phil. Soc. II, 4: 295. 1832. TYPE, lectotype designated by Cummins (1971) on *Zea mays* from **The United States of America**, Pennsylvania: Bethlehem, date not available, Schweinitz s.n. (0Icv ≅ Ipe/III).

= *Puccinia maydis* Berenger, Atti Soc. Ital. 6: 475. 1845.

= *Puccinia zae* Berenger in Klotzsch, Herb. Viv. Suppl. No. 618. 1851.

Anamorph: Aecial anamorph on Oxalidaceae:

*Aecidium oxalidis* Thuemen, Flora 59: 425. 1876. This anamorph has not been reported from Brazil.

On Gramineae:

*Zea mays* Linnaeus (Gramineae), Espírito Santo (IBI-2828), Mato Grosso (IBI-12971), Minas Gerais (Thurston, 1940: 304; IBI-3619), Paraíba (Viégas, 1945: 48; IAC-3247), Paraná (Fontoura & Nowacki, 1967/70: 180; IAC-7975), Pernambuco (Pickel, 1936: 209; IBI-15519), Rio de Janeiro (IAC-4658), Rio Grande do Sul (Lindquist & Costa Neto, 1963:

116; HNR-157), Santa Catarina (Pazschke, 1892: 96; Hennings, 1896: 244), São Paulo (Hennings, 1902D: 296; Sydow, 1907: 355; Viégas, 1945: 48; IAC-124; IBI-13915).

*Puccinia sorghi* is widespread almost everywhere *Zea mays* is grown. *Puccinia sorghi* has been studied extensively by plant pathologists and mycologists. Spermogonia and aecia have not been reported from Brazil and are only rarely collected.

Spermogonia and aecia, *Aecidium oxalidis* Thuemen, occur on species of *Oxalis*; aeciospores 18-26 x 13-19 µm, mostly globoid or ellipsoid, wall 1-1.5 µm thick, pale yellowish, verrucose. Uredinia on both sides of leaves, cinnamon-brown; urediniospores (24-)26-31(-33) x 21-)24-28(-30) µm, mostly broadly ellipsoid or broadly obovoid, wall 1.5-2 µm thick, golden or cinnamon-brown, echinulate, germ pores 3 or 4 equatorial or approximately so. Telia on both sides of leaves, early exposed blackish brown, compact; teliospores (26-)30-42(-46) x (14-)18-23(-25) µm, oblong, ellipsoid or obovoid, wall (1-)1.5-2(-3) µm thick at sides (4-)5-7(9) µm apically, chestnut-brown or the longer narrower spores usually golden brown, smooth; pedicels mostly thin-walled and collapsing, pale yellowish to brownish, to 80 µm long (Cummins, 1971).

**Puccinia SPARGANIOIDES** Ellis & Bartholomew, *Erythea* 4: 2. 1896. TYPE on *Spartina pectinata* Link, originally reported mistakenly as *Carex sparganioides*, from **The United States of America**, Kansas: Rooks Co., 24 Aug 1895, *E. Bartholomew-s.n.* (**0/I** ~~II/III~~).

Synanamorphs

Aecial Anamorph (unknown in Brazil).

*Aecidium fraxini* Schweinitz, *Schr. Ges. Nat. Leipzig* 1:66. 1822. TYPE on *Fraxinus* sp., Oleaceae, from **The United States of America**, North Carolina: place and date ?, Schweinitz.

= *Caeoma fraxinatum* Link, in *Wild. Species Plantarum* 6 (2): 62. 1825. TYPE on *Fraxinus* sp. from **The United States of America**

Uredinial anamorph

*Uredo peridermiospora* Ellis & Tacy, *J. Mycology* 6: 77. 1890.

≡ *Puccinia peridermiospora* Arthur, *Science* II, 10: 565. 1909.

On Gramineae:

*Spartina alterniflora* Loisel (reported originally as *Spartina brasiliensis* Raddi), Bahia (Hennen & Cummins, 1956: 131).

*Puccinia sparganioides* is widespread east of the Rocky Mountains in North America. Only one specimen from Brazil has been reported.

Spermogonia and aecia, *Aecidium fraxini* Schweinitz, occur on species of *Forestiera* and *Fraxinus*; aeciospores 26-35 x 21-27 µm, globoid or ellipsoid, wall 2-3 µm thick g sides, 7-13 µm apically, finely verrucose, colorless. Uredinia mostly on abaxial side of leaves, yellow; urediniospores (27-)30-43(-47) x (16-)20-27(-30) µm, mostly ellipsoid or oblong, wall 1.5-3 µm thick laterally, 8-10 µm apically, colorless, echinulate, pores 4, equatorial, obscure. Telia mostly on abaxial surface, exposed, pulvinate, blackish; teliospores (37-)40-58(-64) x (14-)1723(-25) µm, ellipsoid or oblong-ellipsoid, wall 1.5 µm thick at sides, 5-7 µm apically, chestnut-brown, smooth; pedicels to 100 µm long, colorless or yellowish, rather thick-walled but usually partially collapsing (Cummins, 1971).

**Puccinia SPEGAZZINII** DeToni in Saccardo, *Syll. Fung.* 7: 704. 1888. Nom. nov. for *Puccinia australis* Spegazzini. (**-I,-/III**).

≡ *Puccinia australis* Spegazzini, *Anal. Soc. Cient. Argentina* 17: 7. 1880. TYPE on *Mikania cordifolia* from **Argentina**, Buenos Aires: Boca del Riachuelo, April 1880, *O. Schnyder*. Not *Puccinia australis* Koern, 1876.

= *Puccinia melothriae* Stevens, *Bot Gaz.* 43: 283. 1907. TYPE on *Mikania* sp. (mistakenly identified originally as *Melothria pendula* L., Cucurbitaceae) from **The United States of America**, North Carolina: West Raleigh, 15 Sept 1906, *F. L. Stevens & J. G. Hall*-471.

= *Puccinia dubia* Mayor, *Mem. Sox. Neuchatel. Sci. Nat.* 5: 482. 1913. TYPE on *Mikania* sp., mistakenly reported originally as unidentified "? Ampelidaceae" (Vitaceae), from **Colombia**, Antioquia: near Angelopolis, 2 Sept 1910, *Mayor*-315.

On Compositae:

*Mikania cordifolia* Willdenow, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 144).

*Mikania micrantha* Humboldt, Bonpland & Kunth, Pará (Albuquerque, 1971: 148; IAN-639).

*Mikania scandens* Willdenow, Rio de Janeiro (Puttemans-31), Santa Catarina (Hennings, 1896: 241).

*Mikania smilacina* DeCandolle, Federal District (IBI-15853).

*Mikania* sp., Amazonas (Hennings, 1904B: 158), Minas Gerais (IAC-5342; IBI-13175), Pará (IBI-16064), Paraná (IBI-12148), Rio de Janeiro (Dietel, 1899: 251; Jackson, 1932: 126), Rio Grande do Sul (IBI-12924), São Paulo (Hennings, 1902C: 105, 1902D: 296; Sydow, 1907: 354; Jackson, 1932: 126; Viégas, 1945: 49; IAC-2628; IBI-12557).

*Puccinia spegazzinii* is widespread from Argentina to the Southern United States of America on various species of *Mikania*.

Telia on the abaxial side of leaves, about 0.25 mm across, compact, tightly grouped and often confluent, pale cinnamon-brown, may become greyish-white from germination, erumpent, ruptured epidermis inconspicuous, teliospores (35-)38-60(-70) x (10-)14-18(-20)  $\mu\text{m}$ , cylindrical, narrowly ellipsoid or clavate, rounded above, narrowed below, not or slightly constricted at the septum, wall about 0.5-1  $\mu\text{m}$  thick at sides, 2.5-3.5(-4)  $\mu\text{m}$  thick above, smooth, pale yellowish, pore of each cell apical; pedicel as long as the spore or shorter, often somewhat expanded immediately below the spore, collapsing, colorless (Cummins, 1978).

See *Chrysocyclus mikaniae* for a key to help identify rusts on *Mikania* in the Neotropics.

*Puccinia spermacoces* Berkeley & Curtis, see **Puccinia lateritia** Berkeley & Curtis.

*Puccinia spermacoces* Schweinitz, see **Uromyces spermacoces** (Schweinitz) M. A. Curtis.

*Puccinia sphaeroidea* P. Hennings, see **Puccinia cynanchi** Berkeley & Curtis.

*Puccinia sphaerospora* H Sydow, P. Sydow & P. Hennings, see **Puccinia cynanchi** Berkeley & Curtis.

*Puccinia sphenospora* P. Sydow & H. Sydow, see **Sphenospora pallida** (Winter) Dietel.

**Puccinia spigeliae** H. Sydow & P. Sydow, Ann. Mycol. 14: 66. 1916. TYPE on *Spigelia* sp., Loganiaceae, from **Brazil**, Ceará: Serra de Baturité, Sept 1910, *Ule-3403*. (-/-, -/III).

*Puccinia spigeliae* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

**Puccinia spilanthis** Mayor, Mem. Soc. Neuchatel. Sci. Nat. 5: 531. 1913.

TYPE on *Spilanthes americana* (Mutis) Hieronymus from **Colombia**: Antioquia, 31 July 1910, *Mayor-248*. (-/-, -/III).

On Compositae

*Spilanthes ocyimifolia-radiifera* A. H. More, Rio de Janeiro (Jackson, 1932: 168).

*Spilanthes uliginosa* Swartz, Rio de Janeiro (Jackson, 1932: 168).

*Puccinia spilanthis* has been reported also from Peru, Ecuador, Colombia, and Venezuela.

Except for the numerous one-celled teliospores it could be placed in *Puccinia cnici-oleracei*.

Spermogonia, aecia, and uredinia not produced. Telia on roundish spots up to 5 mm in diameter on the abaxial side of leaves, sori mostly densely grouped, compact, and confluent, dark brown to blackish, Teliospores one- or two-celled, one-celled spores numerous, 21-35 x 11-16  $\mu\text{m}$ , ellipsoid to elongate, rounded, truncate or slightly conical above and narrowed at the base, wall ca 1.5  $\mu\text{m}$  thick at sides, 2-5  $\mu\text{m}$  thick above, smooth, yellow-brown above, smooth, pedicel up to 35  $\mu\text{m}$  long x 3-4  $\mu\text{m}$  wide, yellowish, persistent; two-celled spores similar but 30-42 x 11-16  $\mu\text{m}$ , oblong -ellipsoid to elongate -ellipsoid.

*Puccinia spilanthis* P. Hennings, see **Puccinia cnici-oleracei** Persoon ex Desmazieres.

*Puccinia stakmanii* Presley, see **Puccinia cacabata** Arthur & Holway.

**Puccinia straminea** Dietel, Hedwigia 38: 249. 1899. TYPE on *Sisyrinchium* sp. from **Brazil**, Rio de Janeiro: Serra dos Orgãos, 8 Oct 1896, *Ule-2458*. (?/?, IIpe/III).

On Iridaceae:

*Sisyrrinchium* sp., Rio de Janeiro (Dietel, 1899: 249; Jackson, 1926: 159).

*Puccinia straminea* has been reported only from Brazil but Jackson (1926) suggested that *Puccinia straminea* is the same as *Puccinia sisyrinchii* Montagne that has been reported from Argentina and Chile.

**Puccinia STRIIFORMIS** Westendorp, Bull. Roy. Acad. Belgium Cl. Sci. 21: 235. 1854.

LECTOTYPE on *Triticum aestivum* from **Belgium**: Courtray, date and collector not available, lectotype designated by Hyalander et al. (1953). (??≠ **IIpe/III**).

On Gramineae:

*Triticum* sp., Paraná (PUR-F19047).

*Puccinia striiformis* (stripe rust) is worldwide in distribution in cool climates where its hosts occur. Cummins (1971) records that grass species in nearly 50 genera may serve as hosts.

Spermatophytia and aecia unknown. Uredinia in chlorotic streaks and, although not always easy to find, paraphyses colorless, peripheral, urediniospore walls colorless, echinulate, germ pores (9-)10-14(-15) scattered, pores more easily seen if mounted in chloral hydrate solution. Telia long covered by epidermis, blackish with brown peripheral paraphyses or these forming locules (Cummins, 1971).

*Puccinia striiformis* has been reported in much of the older literature as *Puccinia glumarum* Erikson & Hennings. In some cooler Andean regions of South America *Puccinia striiformis* may be a limiting factor in the production of *Hordeum vulgare* (barley).

In addition to *Puccinia striiformis* (stripe rust), *P. graminis* and *P. recondita* are two other rust species that infect *Triticum* spp.

**Puccinia STYLOSANTHIS** Viégas Bol. Soc. Bras. Agron. (Rio de Janeiro) 8: 164. 1945.

(??, **IIpe/III**). Viégas published a description of telia in Portuguese, not Latin, and treated the name as a transfer of *Uredo stylosnathis* P. Hennings, thus the name applies to only an anamorph, not a teliomorph, and the species must be published as new in Latin with a new name.

Anamorph

*Uredo stylosanthis* P. Hennings, Hedwigia Beiblatt 38: (68). 1899. TYPE on *Stylosanthes viscosa* Swartz from **Brazil**, Santa Catarina: São Francisco, May 1884, *Ule*-38.

On Leguminosae:

*Stylosanthes guyanensis* (Aublet) Swartz, São Paulo (Viégas, 1948: 164; IAC-4827; IBI-15419A).

*Stylosanthes viscosa* Swartz, Santa Catarina (Hennings, 1899: (68).

*Stylosanthes* sp., Minas Gerais (IBI-15311).

*Puccinia stylosanthis*, which is probably closely related to *Puccinia arachidis* Spegazzini, has been reported also from South Africa as *Uredo stylosanthis* (Lenne', J.M., 1990). Lenne' and Sousa Cousta (1995) also reported records from Brazil.

*Puccinia subcollapsa* Ellis, see **Puccinia CYNANCHI** Berkeley & Curtis.

**Puccinia SUBCORONATA** P. Hennings, Hedwigia 34: 94. 1895. TYPE on *Cyperus* sp. from **Brazil**,

Goaís: Goaís, Feb 1893, *Ule*-1985. (??≠ **IIpe/III**).

= *Puccinia antioquiensis* Mayor, Mem. Soc. Neuchat. Sci. Nat. 5: 473. 1913. TYPE on *Cyperus difusus* Vahl from **Colombia** (a lectotype needs to be chosen from the two collections listed by Mayor, both of which are reported to have telia).

On Cyperaceae.

*Cyperus difusus* Vahl, Rio de Janeiro (Jackson, 1926: 141).

*Cyperus malaccensis* Lamarck, Brazil (Silveira, 1951: 223).

*Cyperus* sp., Goiás (Hennings, 1895A: 94).

*Puccinia subcoronata* has been reported also from Bolivia, Colombia, Venezuela, some Islands in the West Indies and Central America.

*Puccinia subdiorchidioides* P. Hennings, see **Puccinia ABNORMIS** P. Hennings.

*Puccinia subneurophila* Spegazzini, see discussion under **Puccinia PSIDII** Winter.



- Puccinia substriata** Ellis & Bartholomew, Erythea 5: 47. 1897. TYPE on *Paspalum setaceum* Michaux from **The United States of America**, Kansas: Rooks Co., 20 Aug 1896, *Bartholomew-12237*. (0/Icv $\neq$  IIpe/III). See below for notes on the varieties of *Puccinia substriata* designated by Ramachar and Cummins (1965)  
 = *Puccinia pilgeriana* P. Hennings, Bot. Jahrb. Syst. 40: 226. 1908. TYPE on *Paspalum* sp. from **Brazil**, Mato Grosso: Cuiaba, 1899, *Pilger*.  
 = *Puccinia penniseti* Zimmerman, Bericht über Land und Forstwirth. Deutsch Ostafrika. 1904. I. p.16, tab I, fig. 5. TYPE on *Pennisetum spicatum* Koern from **East Africa**, Amani  
 Synonyms are given only for those names that have been used in the Americas.

Synanamorphs:

On Solanaceae, Aecia

- Aecidium tubulosum* Patouillard & Gaillard, Bull. Soc. Myc. France 4: 97. 1888. TYPE on *Solanum* sp. from **Venezuela**, Rio Mapire, Upper Orinoco, April, 1887, *A. Gaillard*.  
 = *Aecidium uleanum* Pазschke, Hedwigia 31: 95. 1892. TYPE on *Solanum* sp. from **Brazil**, Santa Catarna: Tuberão, Oct 1890, *Ule-1027*.  
 = *Puccinia tubulosa* (Patouillard & Gaillard) Arthur, Amer. J. Bot. 5: 464. 1918. Telia not described.  
 = *Aecidium solaniphilum* Spegazzini, Revista Argentina Bot. 1: 101. 1925. TYPE on *Solanum sordidum* Sendtner from **Argentina**, Misiones: Bompland, Aug 1910, *Spegazzini s.n.*

On Gramineae, Uredinia:

- Uredo cubangoensis* Rangel, Arch. Mus. Nac. Rio de Janeiro 18: 160. 1916. TYPE on *Paspalum* ? *mandiocanum* Trinius from **Brazil**, Rio de Janeiro: Cubango near Niteroi, April 1914, *Rangel-1143*.  
 = *Puccinia paspalicola* (P. Hennings) Arthur, Manual Rusts U.S. & Canada. Purdue Res. Found. 438 p. (p. 127), 1934. Telia not described. See explanation below.

On Gramineae:

- Digitaria eriantha* Steud. (reported as *Digitaria decumbens* Stent), Rio Grande do Sul (PUR-F18071).  
*Paspalum corcovadense* Raddi, São Paulo (PUR-F4925).  
*Paspalum coryphaeum* Trinius, Brazil (Ramachar & Cummins, 1965: 25).  
*Paspalum humboltianum* Fluegge, São Paulo (PUR-F4839).  
*Paspalum malacophyllum* Trinius, São Paulo (Ramachar & Cummins, 1965: 25; IBI-1719).  
*Paspalum mandiocanum* Trinius, Minas Gerais (Thurston, 1940: 304), Rio de Janeiro (Rangel, 1916: 160; Ramachar & Cummins, 1965: 25; PUR-4903), São Paulo (IBI-1712).  
*Paspalum paniculatum* Linnaeus, Minas Gerais (Thurston, 1940: 304), Paraná (Joerstad, 1959: 66), São Paulo (Ramachar & Cummins, 1965: 25; IBI-1711).  
*Paspalum pilosum* Lamarck, São Paulo (PUR-F4857).  
*Paspalum plantigenum* Nees, São Paulo (IBI-1715).  
*Paspalum plicatulum* Michaux, Minas Gerais (Thurston, 1940: 304), Paraná (Joerstad, 1959: 66), São Paulo (IBI-1710).  
*Paspalum pruinosum* Trinius, São Paulo (IBI-1716).  
*Paspalum urvillei* Steudel, Rio Grande do Sul (PUR-F17720).  
*Paspalum usteri* Hackel, São Paulo (Ramachar & Cummins, 1965: 25).  
*Paspalum* sp., Brazil (Hennings, 1908: 226), Mato Grosso (PUR-F4870), São Paulo (IBI-1713).  
*Pennisetum glaucum* (Linnaeus) R. Brown (= *Pennisetum typhoides* (Burm.) Stapf & Hubb., (Charchar & Anjos, 2000).  
*Setaria geniculata* Beauvois, Minas Gerais (Thurston, 1940: 304).

On Solanaceae (0/I):

- Solanum aethiopicum* Linnaeus (reported originally as *Solanum gilo* Raddi), Federal District (Lima, M. L. P. et al., 2002: 106), Paraíba (Viégas, 1945: 77).  
*Solanum bonariense* Linnaeus (Solanaceae), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 116; IAN-711).

*Solanum melongena* Linnaeus, São Paulo (Figureido, M. B., et al., 1971: 173, IBI-10810, IAC-2491).

*Solanum paniculatum* Linnaeus, Pernambuco (IBI-4365), São Paulo (Hennings, 1902C: 106).

*Solanum sordidum* Sendt., (Viégas, 1945: 77).

*Solanum subscandens* Velloso, São Paulo (Jackson, 1932: 83).

*Solanum tequilense* A. Gray, (Viégas, 1945: 77).

*Solanum torvum* Swartz, São Paulo (Jackson, 1932: 83).

*Solanum variabile* Martius, São Paulo (Viégas, 1945: 77, IBI-167).

*Solanum* sp., Minas Gerais (Jackson, 1932: 83), Santa Catarina (Pazschke, 1892: 95; Hennings, 1896: 260, Sydow, H & P., 1907: 355) São Paulo (Jackson, 1932: 83).

*Puccinia substriata* is widespread in warm regions of the world as a species complex composed of at least five varieties that Ramachar and Cummins (1965) separated by minor morphological traits of telia and uredinia. They reported only variety *substriata* from Brazil. Charchar and Anjos (2000) reported a rust on the cultivated *Pennisetum glaucum* (*Pennisetum typhoideum*, pearl millet) from Brazil as *P. s. var. penicillariae*. But perhaps this rust is *P. s. var. indica*, the common variety on cultivated pearl millet in other parts of the world. Traits of telia are required to identify varieties as shown in a key below (Ramachar and Cummins, 1965).

Spermogonia and aecia (*Aecidium tubulosum* Patouillard & Gaillard on *Solanum* spp.) cupulate, aeciospores (23-)26-31(-37) x 18-23 µm or 21-28 µm, wall 1-1.5 µm thick, evenly verrucose, verrucae ca 1(-1.5) µm apart. Uredinia on both sides of leaves or mainly on abaxial side of leaves, cinnamon-brown; urediniospores 24-31(-37) x (20-)24-27(-31) µm, mostly broadly ellipsoid or obovoid, wall 1.5-2 µm thick, cinnamon-brown, echinulate, germ pores (3 or)4(or 5), equatorial. Telia mostly on abaxial side of leaves, early exposed (tardily exposed in *P. s. var. indica*), compact, dark brown; teliospores (29-)34-50 x 20-26(-29) µm, [or teliospores (41-)51-71 x (14-)17-20(-24) µm] mostly oblong-ellipsoid, or clavate, wall 1.2-2 µm thick at sides, 3-7 µm apically, clear chestnut-brown or golden, smooth; pedicels to 30 µm long, colorless or yellowish, thin-walled and mostly collapsing (Cummins, 1971).

The variability of this complex is “on the order of *P. recondita* and *P. graminis*”. Aecia, where known or hypothesized, are on species of *Solanum*, Solanaceae. This species complex has been recorded on at least six genera of grasses, all in the tribe Paniceae. *Puccinia substriata* var. *indica* is the best known population because it attacks the widely cultivated *Pennisetum glaucum* (= *Pennisetum typhoideum*), “pearl millet”, in many warm areas of the world. In some older literature the rust on pearl millet has been reported as *Puccinia penniseti* Zimmerman (Ber. Land-Forstw. Deutsch. Oest Afr. 2: 11.1904-1906, not Barclay, 1891) and *P. substriata* var. *penicillariae*.

Figureido et al. (1971) was first to report the *Aecidium tubulosum* state of *Puccinia substriata* (*Puccinia penniseti*) on *Solanum melongenum* in Brazil.

Viégas (1945: 77) was first to report the *Aecidium tubulosum* state of *Puccinia substriata* on *Solanum gilo* from Brazil, not Paz Lima et al., (2002: 106).

Ramachar & Cummins (1965) attribute the name *Puccinia paspalicola* (P. Hennings) Arthur to Arthur alone as “*Puccinia paspalicola* Arthur” but they nor Arthur made any specific reference to type material with telia.

Cummins (1971) reported that *Uredo paspalicola* P. Hennings belongs with *Phakopsora compressa* not with *Puccinia substriata* and that *Uredo stevensiana* Arthur (Mycologia 7: 326. 1915) on *Paspalum* spp. from Puerto Rico is a synonym of an anamorph of *Phakopsora compressa*, not *Puccinia substriata* as mistakenly reported by the Sydows (Monog. Ured. 4:607. 1924).

#### Key to help identify varieties of *Puccinia substriata*, Poaceae (after Ramachar and Cummins, 1965)

- |   |  |
|---|--|
| 1. Telia tardily exposed, teliospores mostly 43-60 x 19-24 µm                     | <i>Puccinia substriata</i> var. <i>indica</i> .        |
| 1. Telia early exposed  | 2  |
| 2. Urediniospore pores mostly slightly subequatorial                              | <i>Puccinia substriata</i> var. <i>substriata</i> .    |
| 2. Urediniospore pores mostly equatorial  | 3.   |
| 3. Urediniospore pores mostly 3, sometimes 4, teliospores mostly 38-50 x 23-28 µm | <i>Puccinia substriata</i> var. <i>imposita</i> .      |
| 3. Urediniospore pores mostly 4, sometimes 3 or 5                                 | 4.   |
| 4. Teliospores mostly 43-60 x 23-27 µm  | <i>Puccinia substriata</i> var. <i>penicillariae</i> . |
| 4. Teliospores mostly 30-43 x 18-23 µm  | <i>Puccinia substriata</i> var. <i>insolita</i> .      |

see images of I spores.

*Puccinia synedrellae* P. Hennings, see **Puccinia CNICI-OLERACEI** Persoon ex Desmazieres.

**Puccinia TAGETICOLA** Dietel & Holway in Holway, Bot. Gaz. (Crawfordsville) 24: 26. 1897.

TYPE on *Tagetes tenuifolia* Cav. (*Tagetes patula* Linnaeus) from **Mexico**, Jalisco: Guadalajara, 12 Oct 1896, Holway-s.n. (??, Ipe/III).

On Compositae:

*Tagetes* sp., Brazil, a collection not reported (Silveira, 1951: 223).

*Puccinia tagetica* has been reported also from Bolivia, Colombia, Venezuela, Central America, The West Indies, and Mexico on at least nine species of *Tagetes*, but its occurrence in Brazil requires confirmation.

Spermogonia and aecia unknown. Uredinia on both sides of leaves and on stems, 0.2-2.5 mm in diameter, powdery, light cinnamon-brown, ruptured epidermis conspicuous, urediniospores 23-30 x 18-21  $\mu$ m, broadly ellipsoid to globoid, somewhat flattened laterally, wall 1.5-2  $\mu$ m thick, moderately echinulate except around pores, yellow, orange-yellow to golden brown, germ pores 2, equatorial, usually obscure, covered by low, colorless cuticular caps. Telia on both sides of leaves 0.3-1 mm across, blister-like at first, surrounded by the ruptured epidermis, pulvinate, dark chocolate-brown to blackish, not internally compact but not powdery, teliospores 42-58(-62) x 27-39  $\mu$ m, broadly ellipsoid to slightly broadly obovoid, rounded above and below, slightly or not constricted at the septum, upper cell slightly larger than the lower, wall 4-6  $\mu$ m thick laterally, 7-10  $\mu$ m above, smooth, dark chestnut-brown, pore of upper cell apical, pore of lower cell at septum, both with large pale umbos, pedicel up to 90  $\mu$ m long, usually thick-walled next to the spore, not collapsing laterally (Cummins, 1978).

*Puccinia indecorata* from Bolivia is another rust reported on *Tagetes*: spermogonia and aecia unknown, uredinia an *Aecidium* sp., teliospores 40-65 x 20-24  $\mu$ m, ellipsoid, oblong to clavate, wall 1-1.5  $\mu$ m thick laterally, 5-9  $\mu$ m thick above, may germinate without dormancy.

**Puccinia TANACETI** DeCandolle var. **TANACETI**, Fl. France 2: 222. 1805. TYPE on

*Chrysanthemum vulgare* (Linnaeus) Bernh. from **Europe** (Nannfeldt et al., 1953). (??, Ipe/III).  
= *Puccinia chrysanthemi* Roze, Bull. Soc. Mycol. France 16: 92. 1900.

On Compositae:

*Chrysanthemum indicum* Linnaeus, Minas Gerais (IBI-15911), Rio de Janeiro (IAC-4674), São Paulo (Viégas, 1945: 19; IAC-3753, IBI-17597).

Cummins (1978) reported that *Puccinia tanacetii* var. *tanacetii* is the name of the well known brown leaf rust of cultivated chrysanthemum which is distributed world wide. In much of older literature this rust has been reported under the name *Puccinia chrysanthemi*.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, commonly in circles, cinnamon-brown, powdery; without paraphyses; urediniospores (25-)28-32(-35) x (20-)22-26(-28)  $\mu$ m, mostly broadly ellipsoid or obovoid; walls more or less evenly 1.5-2(-2.5)  $\mu$ m thick, echinulate except over the pores, germ pores usually 3, equatorial, each with a conspicuously smooth cap. Telia on abaxial side of leaves, exposed, commonly in circles, compact, blackish-brown; teliospores (36-)40-56(-60) x (19-)22-28(-30)  $\mu$ m, mostly ellipsoid; walls (1-)1.5-2(-2.5)  $\mu$ m thick at sides, (4-)6-8(-10)  $\mu$ m at apex, finely punctate-verrucose, verrucae spaced (0.5-)1-1.5(-2)  $\mu$ m, appearing striate at apex; germ pore at apex in upper cell, at septum in the lower cell, nearly uniformly clear chestnut-brown; pedicel to 10  $\mu$ m long, colorless (Cummins, 1978).

*Puccinia tanacetii* var. *dracunculina* differs from *P. tanacetii* var. *tanacetii* because the former has narrower urediniospores with thinner walls (Cummins, 1978).

Another rust, the microcyclic white rust of chrysanthemum, *Puccinia horiana*, has recently become of more importance on commercially grown chrysanthemums.

**Puccinia TANACETI** DeCandolle var. **DRACUNCULINA** (0/Ipe, Ipe/III).

= *Puccinia absinthii* DeCandolle, Flore Fr. 5: 56. 1815.

≡ *Puccinia dracunculina* Fahrenhorst, Ann. Mycol. 39: 181. 1941. TYPE on *Artemisia dracunculoides* Pursh from **The United States of America**, Colorado: Boulder, Bartholomew and Bethel s.n.

On Compositae

*Artemisia pontica* Linnaeus, São Paulo (Figueredo & Hennen, 1979: 427; IBI-13398).

Cummins (1978) reported that the rust that infects *Artemisia* spp. is *Puccinia tanacetii* var. *dracunculina*. Spermogonia and aecia have not been reported from Latin America. Figueredo and Hennen (1979) first recorded this rust in Brazil. The rust was found on the experimentally cultivated *Artemisia pontica* that was grown in Brazil and other countries for absinth production, a bitter liquid that is used as a flavoring for liquors, such as vermouth.

*Puccinia taraxici* Plowright, see **PUCGINIA HIERACEI** (Roehling) Martius.

*Puccinia tassadiae* H. Sydow & P. Sydow, see **PUCGINIA ROULINIAE** P. Hennings.

*Puccinia tecomae* Saccardo & P. Sydow, see **PROSPODIUM APPENDICULATUM**(Winter) Arthur.

*Puccinia tecomicola* Spegazzini, see **PROSPODIUM TECOMICOLA** (Spegazzini)H. S. Jackson & Holway.

*Puccinia tetranthi* H. Sydow, see **PUCGINIA CNICI-OLERACEI** Persoon ex Desmazieres.

**PUCGINIA THALIAE** Dietel, Hedwigia 38: 250. 1899. TYPE on *Thalia dealbata* Frasier (Marantaceae) from **Brazil**, Rio de Janeiro: Rio de Janeiro, March 1898, *Ule-1044*. (?/?,IIpe/III).  
= *Puccinia cannae* P. Hennings, Hedwigia 41: 105. 1902. TYPE on *Canna* sp. from **Brazil**, São Paulo: São Paulo, Horto Florestal, 23 April 1901, *Puttemans s. n.*

Anamorph

*Uredo cannae* Winter, Hedwigia 23: 172. 1884. TYPE on *Canna* sp. from **Brazil**, Santa Catarina: São Francisco, 23 April 1901, *Ule19*.  
≡ *Dicaeoma cannae* (Winter) Arthur, N. Amer. Fl. 7(5): 380. 1920.  
= *Uredo ischnosiphonis* P. Hennings, Hedwigia 43: 164. 1904. TYPE on *Ischnosiphon leucophaeus* Schumann (Marantaceae) from **Brazil**, Amazonas: Rio Juruá-Mirim, September 1901, *Ule-2695*.

On Cannaceae:

*Canna indica* Linnaeus, Amapá (Hennen et al., 2001:153; IBI-17089), Minas Gerais (Thurston, 1940: 297; Viégas, 194: 18; IAC-3986; IBI-15190), Pará (Albuquerque, 1971: 148; IAN-503), Paraíba (Viégas, 1945: 18; IAC-2909), Pernambuco (IBI-15585), Rio de Janeiro (IAC-4673), São Paulo (Viégas, 1945: 18; IAC-606; IBI-17712).

*Canna patens* +, São Paulo (*Puttemans-208*).

*Canna* sp., Bahia (IBI-13601), Minas Gerais (Thurston, 1940: 297), Pará (IBI-13635), Pernambuco (Pickel, 1936: 212; IBI-13052), Rio de Janeiro (Sydow, 1907: 355; Jackson, 1926: 161), São Paulo (Hennings, 1902C: 105; IBI-12315).

On Marantaceae

*Calathea* sp., Amapá (Hennen et al., 2001: 152), Pará (Sotã-et al.-S98-136).

*Ctenanthe* sp., São Paulo (IBI-12036).

*Ischnosiphon aruma* (Aublet) Koernicke, Pará (Albuquerque,1971: 149; IAN-649).

*Ischnosiphon leucophaeus* Koernicke, Amapá (Hennen et al., 2001: 153), Amazonas (Hennings, 1904: 164), Pará (Dietel, 1909: 264).

*Ischnosiphon simplex* Huber, Pará (IBI-13270).

*Ischnosiphon* sp., Pará (*Sotã* et al.-S97-385).

*Maranta arundinacea* Linnaeus, São Paulo (IBI-9861).

*Maranta* sp., Maranhão (IBI-15633), Paraíba (Viégas, 1945: 50; IAC-3248), Rio Grande Do Sul (Lindquist & Costa Neto, 1963: 120), São Paulo (IBI-18285).

*Thalia dealbata* Fraser, Rio de Janeiro (Dietel, 1899: 250).

*Marantaceae* gen.indeten., Mato Grosso do Sul (IBI-14371), São Paulo (IBI-12085A).

*Puccinia thaliae* is widespread in the Neotropics and subtropics where it is native on both Cannaceae and Marantaceae. It has also spread to other warm tropical regions of the world where the hosts are cultivated. This rust is best known on *Canna* spp. ("biri"), ornamental plants grown in parks and gardens in all of Brazil. It can be very destructive on leaves and eventually may kill the plants.

Spermogonia and aecia unknown. Uredinia 0.1-0.5 mm across, mostly on abaxial side of leaves, on small, inconspicuous, yellow to dark spots 1-2 mm across scattered or in irregular groups, subepidermal in origin, erumpent, powdery, bright yellowish when fresh; urediniospores 21-32 x 18-25 or 50-83-14-21  $\mu\text{m}$ , ovoid to pyriform, wall 1(-1.5, -2)  $\mu\text{m}$  thick, echinulate, colorless, pores obscure. Telia 0.2-0.5 mm across, scattered or sometimes around the uredinia, mostly on the abaxial side of leaves, long covered by the epidermis, blackish, loculate surrounded by blackish brown paraphyses, teliospores variable in different collections, 35-53 x 13-22, or 50-83 x 14-21  $\mu\text{m}$ , clavate to oblong, rounded, broadly rounded to pointed above, rounded or somewhat narrowed below, constricted or not at the septum, pedicel short, broken near the spore.

Because of the differences in the size of urediniospores in various collections, more than one taxon may be involved here.

*Puccinia tinctoria* Spegazzini, see **Puccinia eupatorii** Dietel.

*Puccinia trachytela* H. Sydow, see **Puccinia banisteriae** P. Hennings.

*Puccinia tuberculata* Spegazzini, see **Prospodium tuberculatum** (Spegazzini) Arthur.

*Puccinia tubulosa* Arthur, see **Puccinia substriata** Ellis & Bartholomew.

**Puccinia tuyutensis** Spegazzini, Anal. Soc. Cient. Argentina 12: 70. 1881. TYPE on *Cressa truxillensis* Humboldt, Bonpland & Kunth (reported as *Evolvulus falcatus* Grisebach by Spegazzini) from **Argentina**, Buenos Aires: Tuyú, Dec 1880, *Spegazzini s.n.* (**0/Icv,IIpe/III**).

≡ *Dicaeoma tuyutensis* (Spegazzini) Kuntze, Rev. Gen. Plt. 3: 468. 1898.

= *Puccinia cressae* Lagerheim [as "(DC.) Lagerheim"], Bol. Soc. Brot. 7: 131. 1889. TYPE on *Cressa villosa*. from **Portugal**, Villanova da Rainha, date of collection not determined, *Welwitsch s.n.*

≡ *Dicaeoma cressae* (Lagerheim) Kuntze, Rev. Gen. Plt. 3: 468. 1898.

= *Puccinia cretica* Holway, Erythea 5: 31. 1897. TYPE on *Cressa cretica* from **The United States of America**, California: San Pedro, date?, *McClatchie s.n.*

Synanamorphs

*Aecidium cressae* DeCandolle, Fl. franc. 6: 89. 1815. TYPE on *Cressa cretica* from **France**, Perauls, near Montpellier (fide Arthur, 1920).

= *Aecidium tuyutensis* Spegazzini, Anal. Soc. Cient. Argentina 12: 80. 1881. TYPE on *Cressa truxillensis* Humboldt, Bonpland & Kunth (identified originally as *Evolvulus falcatus*) from **Argentina**, Buenos Aires: Tuyú, Dec 1880, *Spegazzini s.n.*

*Uredo tuyutensis* Spegazzini, Anal. Soc. Cient. Argentina 12: 76. 1881. TYPE on *Cressa truxillensis* Humboldt, Bonpland & Kunth (identified originally as *Evolvulus falcatus*) from **Argentina**, Buenos Aires: Tuyú, Dec 1880, *Spegazzini s.n.*

On Convolvulaceae:

*Evolvulus falcatus* Grisebach, Brazil (Silveira, 1951: 223). This report requires confirmation.

*Puccinia tuyutensis* has been reported from Argentina to The United States of America, the Mediterranean region, and the Middle East (mostly as *P. cressae* Lagerheim).

Lindquist (1953, Bol. Soc. Argentina Bot. 5: 35-36) determined that *P. cressae* is a synonym of *P. tuyutensis*. Lindquist reported that spermogonial and aecial infections are systemic and induce swellings and malformations of infected areas.

**Puccinia uleana** P. Hennings, Hedwigia 34: 93. 1895. TYPE on *Calea* sp. (Compositae) from **Brazil**, Goiás: Sobradinho, Feb 1893, *Ule-2015. (?/?/?/III)*.

*Puccinia uleana* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

*Puccinia uliginosa* Spegazzini, see **Puccinia conspersa** Dietel.

**PUCCINIA URBANIANA** P. Hennings, Hedwigia 37: 278. 1898. TYPE on *Stachytarpheta jamaicensis* Vahl from **Jaimaca**, Port Antonio, date collected not available, *Hymphrey s.n. (-I-, -III or ?/?), IIIendo/IIIpuccinia*).

On Verbenaceae:

*Stachytarpheta (Valerianooides) cayenensis* Rich, Bahia (PUR-F7175).

*Puccinia urbaniana* has been reported also from Jamaica, Guyana, and Mexico. This record from Brazil requires confirmation.

Spermogonia, aecia, and uredinia unknown. Telia minute, confluent in compact groups on abaxial side of leaves, on rounded yellowish spots 5-10 mm in diameter, teliospores 30-45 x 13-22  $\mu\text{m}$ , oblong to oblong-clavate, rounded or rarely narrowed or truncate at the apex, slightly constricted at the septum, rounded or narrowed below, wall not or only slightly thicker above, pedicel up to 40  $\mu\text{m}$  long, thick, persistent, brownish (The Sydows, 1902).

Several collections of *Endophyllum stachytarphetae* also have telia of *Puccinia urbaniana*, indicating a life cycle plasticity similar to *Puccinia pampeana* and *Endophyllum pampeanum* (Buriticá & Hennen, 1980).

*Puccinia uruguayensis* Spegazzini see **PUCCINIA EUPATORII** Dietel.

**PUCCINIA USTERII** Dietel, Ann. Mycol. 5: 245. 1907. TYPE on Malpighiaceae genus undetermined, from **Brazil**, São Paulo, Villa Mariana, Nov 1905, *Usteri s.n. (?/?/?/III)*.

*Puccinia usterii* has been reported only from the type collection. New collections are needed to determine if this rust still occurs in Brazil.

See under *Puccinia banisteriae* for a key that aids in identification of species of *Puccinia* on Malpighiaceae.

*Puccinia vagans* Arthur, see **PUCCINIA PULVERULENTA** Greville.

**PUCCINIA VALENTULA** H. S. Jackson & Holway in Jackson, Mycologia 24: 105. 1932. TYPE on *Piptocarpha axillaris* (Lessing) Baker from **Brazil**, São Paulo: São Paulo, 6 Feb 1922, *Holway-1539. (?/lev?, IIpe/III)*.

On Compositae:

*Piptocarpha axillaria* (Lessing) Baker, Minas Gerais (IBI-13202), São Paulo (Jackson, 1932: 105; IBI-14086-149).

*Piptocarpha regnellii* (Schultz-Bipontius) Cabrera, Santa Catarina (IBI-12905).

*Piptocarpha* sp., Minas Gerais (PUR-F18932), Rio de Janeiro (PUR-F18930), São Paulo (IBI14264).

*Puccinia valentula* has been reported only from Brazil.

Spermogonia not reported. Aecia on adaxial side of leaves, aeciospores 30-39 x 26-28  $\mu\text{m}$ , irregularly broadly ellipsoid, wall (1-)2  $\mu\text{m}$  thick, hyaline, strongly verrucose but with a spot of coalesced verrucae that form irregular ridges. Uredinia on abaxial side of leaves, light chestnut-brown, powdery, paraphyses 90-160 x 12-22  $\mu\text{m}$ , long cylindrical, numerous, peripheral, wall more or less evenly ca 1  $\mu\text{m}$  thick, sometimes a little thicker at the apex to 3  $\mu\text{m}$ , pale golden-brown. Urediniospores 24-28  $\mu\text{m}$  in diameter, globoid, wall 2-3  $\mu\text{m}$  thick, a little thicker around pores, pale yellow-brown, minutely and moderately echinulate, spines 1.5-2.5(-3,5)  $\mu\text{m}$  apart, pores obscure (+/- 3-6, scattered). Telia like the uredinia but chestnut-brown, teliospores 32-39 x 26-34  $\mu\text{m}$ , broadly ellipsoid to subgloboid, not constricted at septum, wall 3.5  $\mu\text{m}$  thick at apex, 2-2.5  $\mu\text{m}$  at sides, 5-6  $\mu\text{m}$  at septum, minutely inconspicuously verrucose, may appear minutely punctate or sometimes smooth, chestnut-brown, pores evident, near apex in upper cell, basal in lower cell, pedicel short, hyaline.

? **PUCCINIA VALENTULA** var **thinner walled** III-form. var. nov. J. F. Hennen & M. B. Figueiredo.

*Puccinia valenzuelianae* Spegazzini, see **PUCCINIA CYNANCHI** Berkeley & Curtis.

*Puccinia vanillosmopsidis* H. S. Jackson & Holway, see **PUCCINIA VELATA** Dietel.

**Puccinia varia** Arthur, Amer. J. Bot. 5: 487. 1918. TYPE on an undetermined species of Acanthaceae from **Guatemala**, Panajachel, Solola, 30 Jan 1915, *Holway-160*. (??,II/III).

Anamorph

*Uredo varia* P. Dietel, Hedwigia 36: 35. 1897. TYPE on an undetermined species of Acanthaceae from **Brazil**, Rio de Janeiro: Rio de Janeiro, Corcovado, Dec 1891, *Ule-1817*.

On Acanthaceae:

**Genus undetermined**, Rio de Janeiro (Dietel, 1897: 35; Arthur, 1918: 487; PUR-F7521), São Paulo (*Puttemans-1730*). Not Rick, 1911: 177.

*Puccinia varia* has been reported also from Costa Rica and Guatemala.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, 0.3-0.8 mm diam, irregularly scattered or in more or less irregular concentric groups to 3 mm diam, cinnamon-brown; urediniospores 27-35 x 22-30 µm, obovoid, wall 1.5-2 µm thick, echinulate except around the pores, golden-yellow, pores 2, equatorial and opposite. Telia not seen, teliospores in uredinia 49-60 x 32-37 µm, cylindrical to ellipsoid, obtuse-rounded above and below, usually slightly constricted at septum, wall 4-6 µm thick at sides, 5-8 µm thick above, smooth, chestnut-brown, pedicel to 30 µm long, persistent, colorless, smooth (Laundon, (1963)

Arthur (1918) and Laundon (1963) reported that the host may be *Ruellia* sp. or *Jacobinia* sp. and that no more teliospores are present on the type. Another anamorph (synanamorph) may be *Aecidium venezuelanum*.

**Puccinia varioides** Joerstad, Ark. Bot. Series 2, 3: 445. 1956. TYPE on *Aphelandra* sp. from **Ecuador**, San Jorge, 1892, *Lagerheim-sn*. (??,IIpe/III).

Anamorph

*Uredo aphelandrae* H. S. Jackson & Holway in Jackson, Mycologia 24: 96. 1932. TYPE on *Aphelandra prismatica* Hieronymus from **Brazil**, São Paulo: Alto da Serra, 14 June 1922, *Holway-1970*.

On Acanthaceae:

*Aphelandra prismatica* Nees, São Paulo (Jackson, 1932: 96; Laundon, 1963: 71).

*Puccinia varioides* has been reported also from Ecuador.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, about 0.2-1 mm wide, tardily naked, ruptured epidermis evident, powdery, cinnamon-brown; urediniospores (30-)39-45(-50) x 23-29(-31) µm, obovoid to pyriform or clavate, wall 1-1.5 µm thick, echinulate except around pores, yellow-brown, pores 2, equatorial and opposite. Telia mostly on abaxial side of leaves, 0.5-1.5 mm diam, irregularly scattered, cinnamon-brown, ruptured epidermis noticeable; teliospores 46-65 x 20-30 µm, ellipsoid, cylindrical, clavate, somewhat rounded above, constricted at septum, somewhat narrowed below, wall 0.5-1.5 µm thick at sides, slightly thickened above 2-5 µm, smooth, colorless to pale yellowish, smooth, pore apical above, at septum in lower cell, pedicel to 55 µm long, 12 µm thick, colorless, deciduous.

**Puccinia velata** Dietel, Hedwigia 36: 31. 1897. (not Arthur, 1918). TYPE on *Vanillosmopsis* sp. (reported originally as on an unidentified genus of Compositae) from **Brazil**, Minas Gerais: Oro Preto, Feb 1892, *Ule-1863*. (??,?/III).

= *Puccinia vanillosmopsidis* H. S. Jackson & Holway in Jackson, Mycologia 24: 105. 1932.

TYPE on *Vanillosmopsis erythropappa* (DeCandolle) Schultz-Bipontius from **Brazil**, Rio de Janeiro: Tijuca, 23 Dec 1921, *Holway-1420*.

On Compositae:

*Vanillosmopsis erythropappa* (DeCandolle) Schultz-Bipontius, Rio de Janeiro (Jackson, 1932: 105).

*Vanillosmopsis* sp., Minas Gerais (Dietel, 1897: 31, IBI-12781).

*Puccinia velata* has been reported only from Brazil.

Spermogonia not seen, probably not formed. Aecia and uredinia not known. Telia hypophyllous, 0.2-0.4 mm in diam., without paraphyses, densely grouped, or scattered, chestnut-brown, pulverulent; teliospores 24-30 x 18-21 µm [new measurements, (27-)29-32 x 21-22(-24 µm)], broadly ellipsoid, rounded at both ends, slightly or not constricted at the septum, wall 2.5-3 µm thick [new measurements, lat wall 1.5-2 µm, api wall 2-3 µm], pale chestnut-brown, minutely verrucose, pore in upper cell apical, pore in lower cell next to the pedicel, pedicel mostly deciduous, hyaline, short (modified from Dietel, 1897).

We compared the host of isotypes of *Puccinia velata* in BPI and HBG with our collections of *Vanillosmopsis* and determined that it also is *Vanillosmopsis*. Apparently when Jackson and Holway named *Puccinia vanillosmopsidis* they did not compare their material with *Puccinia velata* Dietel because it had been reported on an unidentified Compositae and they did not know that it was a species of *Vanillosmopsis*.

**Puccinia veniabilis** H. S. Jackson & Holway in Jackson, Mycologia 24: 119. 1932. TYPE on *Vernonia* sp. from **Brazil**, Rio de Janeiro: Teresopolis, 4 Oct 1921, *Holway-1189*. (**0/Icv,IIpe/III**).

On Compositae:

*Vernonia diffusa* Lessing [= *Vernonanthura diffusa* (Lessing) H. Robinson], Santa Catarina (PUR-F17896), São Paulo (PUR-F7921, -F7922).

*Vernonia* sp., Minas Gerais (PUR-F18946), Rio de Janeiro (Jackson, 1932: 119), São Paulo (Jackson, 1932: 119; IBI-12078).

*Puccinia veniabilis* has been reported only from Brazil.

Spermogonia on adaxial side of leaves, in close groups, deep-seated, 100-135 x 75-90 µm, punctiform, ostiolar filaments short. Aecia on abaxial side of leaves, solitary and in groups opposite the spermogonia, in groups of 2 to 4, peridium cylindrical, white, membranous; peridial cells 45-60 x 20-30 µm, polyhedral, inner facing wall finely verrucose; aeciospores catenulate, 28-36 x 20-24 µm, ellipsoid, cell wall 1.5-2 µm thick, strongly verrucose-tuberculate and often striate, colorless or pale golden. Uredinia not seen. Urediniospores in telia 22-28 long. 22-28 µm, . globoid, wall 1.5-2.5 µm thick, strongly echinulate, pale cinnamon-brown, germ pores scattered randomly 3 and 4, obscure. Telia on abaxial side of leaves, widely scattered and densely grouped, 0.2-0.4 mm across, erumpent, pulvinate, chestnut-brown, becoming ashy-gray from germination, paraphyses peripheral, 60-100 µm. 12-15 µm, copius, incurved, 2-3 septate. cinnamon-brown. teliospores 17-24 x 60-100 µm, cylindrical, rounded and frequently pointed at apical end, rounded at pedicel, truncate at base, not or slightly constricted at septum, wall 1-1.5 µm thick at sides, thickened at apex, cinnamon-brown and pale chestnut brown, smooth; pedicel equal to spore or shorter, colorless (Jackson, 1932).

Traits that help to identify *Puccinia veniabilis* include: long narrow teliospores, greatly thickened at the apex, the thickening usually much stronger on one side of the germ pore, and the strongly developed, thick-walled, 1-2 septate paraphyses.

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but three from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

**Puccinia verbeniphila** Lindquist, Revista Fac. Agron. (La Plata) 44: 152. 1969. *Nom. nov.* for *Puccinia elongata* Spegazzini. (**?/? ,IIcv/III**).

≡ *Puccinia elongata* Spegazzini, Anal. Soc. Cient. Argentina 9: 188. 1880. Not *Puccinia elongata* Schroeter, 1879. TYPE on *Verbena littoralis* Humboldt, Bonpland & Kunth from **Argentina**, Buenos Aires: "Boca del Riachuela", February 1880, *C. Spegazzini-s.n.*

Anamorph

*Aecidium spgazzinianum* Saccardo & Trotter, Syll. Fung. 21: 775. 1912. *Nom. nov.* for *Aecidium verbenae* Spegazzini. This is the anamorph for uredinia and probably for aecia if they are discovered.

≡ *Aecidium verbenae* Spegazzini, Anal. Soc. Cient. Argentina 9: 174. 1880. TYPE on *Verbena littoralis* from **Argentina**, Rio de la Plata, ("spring") 1880, ? *Spegazzini-s.n.* Not *Aecidium verbenae* Roberge in Desmazieres, 1847.

= *Aecidium elongatum* Spegazzini, Revista Argentina Bot. 1: 95. 1925. *Nom. nov.* for *Aecidium verbenae* Spegazzini, not *Aecidium elongatum* Roberge in Desmazieres, 1847.

= *Aecidium verbenicola* Spegazzini, Anal. Mus. Nac. Buenos Aires 19 (ser. 3, v. 12): 323. 1909. TYPE on *Verbena tenerae* from **Argentina**: Buenos Aires: near Lazama, Nov 1904, *Spegazzini-s.n.* Not *Aecidium verbenicola* Ellis & Kellerman, 1884.

= *Aecidium verbeniphilum* Spegazzini, Revista Argentina Bot. 1: 102. 1925. *Nom. nov.* for *Aecidium verbenicola* Spegazzini.

On Verbenaceae:

*Verbena bonariensis* Linnaeus, Minas Gerais (Viégas, 1945: 24; IAC-234, -1970, -5540), São



Paulo (Viégas, 1945: 24; IAC-2482, 3049).

*Verbena litoralis* Humboldt, Bonpland & Kunth, (*V. brasiliensis* Vell.), Minas Gerais (Thurston, 1940: 298), Rio de Janeiro (Dietel, 1899: 258; Jackson, 1932: 62), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 134), São Paulo (IBI-4165).

*Verbena monteseensis* Sprengel, Paraná (PUR-F19384).

*Verbena* sp., Minas Gerais (Jackson, 1932: 62; *Puttemans-2708*), Rio de Janeiro (Hennings, 1902D: 296), Santa Catarina (as *Aecidium verbenae* Spegazzini: Pazschke, 1892: 95; Hennings, 1896: 257), São Paulo (Lindquist, 1947: 375).

Lindquist (1983) reported *Puccinia verbeniphila* also from Argentina.

Spermogonia and aecia unknown. Uredinia, *Aecidium spegazzinianum*, on the abaxial side of leaves and on stems, scattered in small groups of up to 6-10 sori, often closely grouped with telia, cupulate, yellowish; peridial cells polygonal, outer facing wall mostly smooth, inner facing wall verrucose to verrucose-striate; urediniospore catenulate, 14-22 x 14-8  $\mu\text{m}$  [19-26(-30) x 14-19(-21)  $\mu\text{m}$ , fide Hennen from *Puttemans-2708*, Brazil], globoid, wall 1-1.5(-2)  $\mu\text{m}$  thick, strongly verrucose and with numerous, regularly placed, refractive granules 3-3.5  $\mu\text{m}$  in diameter, colorless. Telia mostly on stems, subepidermal in origin, erumpent but some remain covered within the stem tissues, up to 2-3 mm in diameter, compact, dark chestnut-brown; teliospores 44-75 x 12-14(-18)  $\mu\text{m}$ , clavate-cylindrical, the upper cell usually shorter than the lower cell, obtuse above, narrowed below, little or not constricted at the septum, wall 1.5  $\mu\text{m}$  thick at sides, 7-10  $\mu\text{m}$  at apex, smooth, chestnut-brown; pedicel short, slightly pigmented. Often with one-celled teliospores 25-36 x 10-14  $\mu\text{m}$  (Lindquist, 1983).

In specimens from Brazil the urediniospores have numerous, very obvious refractive granules, a trait not reported by other authors. Previous authors have referred to the *Aecidium* sori as aecia but because spermogonia have not been reported and telia often occur within or along side of the *Aecidium* anamorph we believe that they are uredinia. When aecia are discovered, we expect they will resemble these uredinia.

*Puccinia verbesinae* Schweinitz, see **PUCINIA IRREGULARIS** Dietel.

*Puccinia verbesinae* Spegazzini, see **PUCINIA SPEGAZZINIANA** De Toni.

**PUCINIA VERBESINAE-DENTATAE** H. S. Jackson & Holway in Jackson, Mycologia 24: 170. 1932. Type on *Verbesina brachypoda* Blake from **Ecuador**, Cuenca, 12 Sept 1920, *Holway-983*. (??, IIpe/III).

Anamorph

*Uredo verbesinae-dentatae* Sydow, Oesterr. Bot. Zeitschrift 52: 185. 1902. TYPE on *Verbesina dentata* Humboldt, Bonpland & Kunth from **Ecuador**, place and date of collection not found, *Lehmann-s.n.*

On Compositae:

*Verbesina glabrata* Hooker & Arnott, Rio de Janeiro (Jackson, 1932: 170; PUR-F8321), São Paulo (Jackson, 1932: 170).

*Puccinia verbesinae-dentatae* has been reported only from Ecuador and Brazil.

Jackson (1932) treated *Puccinia verbesinae-dentatae* as a new combination based on *Uredo verbesinae-dentatae* P. Sydow & H. Sydow. But because Jackson (1932) described telia from the specimen *Holway-983*, it must be taken as the lectotype and the name ascribed to Jackson alone. Jackson (1932) reported that the specimens cited from Brazil do not have telia and are assigned to *Puccinia verbesinae-dentatae* tentatively.

Jackson and The Sydows (1924) reported traits that may help to identify *Puccinia verbesinae-dentatae* as: uredinia on the abaxial side of leaves, about 1 mm across, scattered singly or in groups, dark brown, powdery; urediniospores 22-31  $\mu\text{m}$  in diameter, globoid, subgloboid, or ovoid, wall 2.5-4.5  $\mu\text{m}$  thick, shortly echinulate, chestnut-brown, germ pores 2, subequatorial in the lower 1/3 of the spore, opposite; telia pulvinate, light chestnut-brown, germinating at once; teliospores 75-120 x 18-24  $\mu\text{m}$ , long cylindrical, usually tapering somewhat at each end, strongly constricted at the septum, the lower cell usually longer and narrower than the upper; wall 1-1.5  $\mu\text{m}$  thick, not thickened at the apex except very slightly so at the edge of the pore, golden-brown, smooth; pedicel equaling the length of the spore or shorter, colorless.

**PUCINIA VERNONIPHILA** Spegazzini, Anal. Mus. Nac. Buenos Aires 19 (ser. 3, v.12): 306. 1909.

TYPE on *Vernonia flexuosa* Sims [= *Chrysolaena flexuosa* (Sims) H. Robinson] from **Argentina**, Buenos Aires, Nov 1907, *Spegazzini-s.n.* (?/?, **Ipe/III**).

On Compositae:

*Vernonia glabrata* Lessing [= *Lessingianthus glabratus* (Lessing) H. Robinson], São Paulo (Jackson, 1932: 120).

*Vernonia squarrosa* (Lessing) Lessing [= *Lessingianthus plantaginoides* (Kuntze) H. Robinson], São Paulo (Jackson, 1932: 120).

*Vernonia* sp., São Paulo (Jackson, 1932: 120).

*Puccinia vernoniphila* has been reported as very common in Argentina and Uruguay (Lindquist & Rosengurtt, 1967). Although Jackson lists several collections under *Puccinia vernoniphila*, he reported that the exact status of this species is in doubt.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, round, ruptured epidermis evident, powdery, cinnamon-brown; urediniospores 23-29 x 22-25 µm, globose, wall 2.5-3 µm thick, echinulate, golden yellow, pores 4, 5 or 6, scattered. Telia on abaxial or both sides of leaves, pulvinate, compact, dark chocolate-brown; teliospores 48-57 x 25-29 µm, ellipsoid, rounded or pointed at upper end, narrowed to pedicel, not or only slightly constricted at septum, wall 3.5-4 µm thick on sides, 6-8 µm at apex, smooth to lightly verrucose, chestnut-brown, pedicel about 1.5 times longer than the spore, flexuous, colorless (Lindquist, 1982).

At least 45 species of *Puccinia* have been named on *Vernonia* spp., all but five from the Americas. Twenty of these are reported from Brazil. Descriptions and keys for these species are in Jackson (1918, 1932), and Urban (1973).

*Puccinia venustula* Arthur, see **Puccinia POSADENSIS** Saccardo & Trotter.

**Puccinia VERSICOLOR** Dietel & Holway in Holway, Bot. Gaz. (Crawfordsville) 24: 28. 1897.

TYPE on *Heteropogon melanocarpus* (Elliott) Benth from **Mexico**, Jalisco: Guadalajara, 12 Oct 1896, *Holway*. (**0/Icv** ≠ **Ipe/III**).

= *Puccinia trachypogonis* Spegazzini, Anal. Mus. Nac. Buenos Aires 19: 301. 1909. TYPE on *Trachypogon spicatus* (L. f.) Kuntze [reported as *Trachypogon montufarii* (Kunth) Nees] from **Argentina**, Catamarca: Jan 1903, *Spegazzini-s.n.*

= *Puccinia calchakina* Spegazzini, Rev. Argent. Bot. 1: 110. 1925. TYPE on *Heteropogon contortus* (Linnaeus) P. Beauvois ex Roemer & Schultz from **Argentina**, Salta, Dec 1896, *Spegazzini-s.n.*

= *Puccinia varispora* Arthur & Holway, in Arthur, Proc. Amer. Phil. Soc. 64: 86. 1925. TYPE on *Bothriochloa saccharoides* (Sw.) Rydberg from **Bolivia**, Nor Yungus: Hacienda Anacuri, June 1920, *Holway-709*.

= *Puccinia filipodia* Cummins, Ann. Mycol. 35: 98. 1937. TYPE on *Heteropogon contortus* (Linnaeus) P. Beauvois ex Roemer & Schultz from the **Philippine Islands**, Luzon: Hocus Sur Prov., Jan 1928, *Clemens-17757*.

Synanamorphs (as reported in The Old World).

*Uredo themedae* Dietel, uredinial anamorph.

*Aecidium plectronae* Cooke, aecial; anamorph.

On Gramineae:

*Heteropogon contortus* (Linnaeus) Beauvois ex Roemer & Schultz, Ceará (Cummins, 1953).

*Schizachyrium sanguineum* (Retz.) Alston [reported as *Andropogon hirtiflorus* (Nees) Kunth], Minas Gerais (Cummins, 1953).

*Puccinia versicolor* has been reported in the New World from Argentina to Mexico and Texas near Mexico, and from warmer regions in Africa and Asia. *Puccinia versicolor* also parasitizes species in at least eight other genera of grasses in the tribe Andropogoneae (Cummins, 1971).

Spermogonia and aecia reported as *Aecidium plectroniae* Cooke on species of *Canthium*, Rubiaceae, in India and Africa; and *Lantana*, Verbenaceae, in India; aeciospores 23-25 x 19-21 µm, wall 1.5-2 µm thick at sides, to 5 µm apically, verrucose. Uredinia mostly on abaxial side of leaves, yellow, without paraphyses; urediniospores (22-)25-33(-38) x (19-)21-28(-30) µm, mostly broadly ellipsoid, wall 3-6(-8) µm thick, the inner surface irregular and giving a stellate appearance to the lumen, colorless, moderately echinulate, germ pores 8-11, scattered, very obscure; occasional collections have cinnamon-brown spores with a uniformly

2-2.5  $\mu\text{m}$  thick wall. Telia mostly on abaxial side of leaves, to 4 mm long, early exposed, pulvinate, blackish brown; teliospores (33-)35-46(-50) x (22-)25-32(-35)  $\mu\text{m}$ , mostly broadly ellipsoid or oblong-ellipsoid, wall (2.5-)3-4(-5)  $\mu\text{m}$  thick at sides, 4-8(-12)  $\mu\text{m}$  apically, deep golden or clear chestnut-brown, smooth; pedicels to 130  $\mu\text{m}$  long, colorless, mostly thin-walled and collapsing at least in the lower part (Cummins, 1971).

Traits that help to identify *Puccinia versicolor* include: uredinia without paraphyses, urediniospores wall colorless or nearly so, echinulate, pores scattered, (Cummins' group VI), pores are usually obscure in urediniospores of *Puccinia versicolor* but they are assumed to be scattered and located in the thinner parts of the wall which is thickened in a stellate manner, teliospore pedicel mostly exceeding 100  $\mu\text{m}$  long.

**Puccinia VINCAE** Berkeley in Smith, Engl. Fl. V 2: 364. 1836. (0/Ipe,IIpe/III).

Anamorph

*Uredo vincae* DeCandolle, Fl. Fr. 6: 70. 1815.

On Apocynaceae:

*Vinca major* Linnaeus, São Paulo (Joerstad, 1959: 92).

*Puccinia vincae* has been reported from Latin America only by Joerstad as cited above. Joerstad (1959) reported spermogonia, aecia, and telia in the specimen which came from São Paulo in the year 1847 collected by J. F. Widgren. New collections are needed to determine if this rust still exists in Brazil.

Arthur (1934) reported that *Puccinia vincae* is adventive in the United States of America and Canada from Europe.

Spermogonia on the abaxial side of leaves, scattered among the aecia. Aecia on the abaxial side of leaves, systemic; aeciospores pedicellate, two sorts, early forms 38-40 x 22-24  $\mu\text{m}$ , ellipsoid, wall 4-4.5  $\mu\text{m}$  thick, colorless, echinulate, pores obscure, later forms 24-40 x 23-25  $\mu\text{m}$ , ellipsoid, wall 2-3  $\mu\text{m}$  thick, brown, echinulate, pores 3 or 4, equatorial. Uredinia on the abaxial side of leaves, scattered, often among the aecia, dark cinnamon-brown; urediniospores 27-35 x 19-24  $\mu\text{m}$ , ellipsoid or oblong; wall 2-2.5  $\mu\text{m}$  thick, echinulate, dark cinnamon-brown, pores 3-4, equatorial. Telia mostly on the abaxial side of leaves, chestnut-brown; often among the aecia or scattered separately, teliospores 31-40 x 19-26  $\mu\text{m}$ , ellipsoid or oblong, rounded at both ends, slightly or not constricted at the septum; wall uniformly 1.5-2.5  $\mu\text{m}$  thick, chestnut-brown, verrucose or verrucose-reticulate, the verrucae often in irregular longitudinal lines, pore of upper cell mostly apical, covered with a hyaline papilla, of the lower cell much depressed; pedicel to 10  $\mu\text{m}$  long, fragile, colorless (Arthur, 1934; Wilson & Henderson, 1966).

**Puccinia VINULLA** H. S. Jackson & Holway in Jackson, Mycologia 24: 100. 1932. TYPE on *Valeriana scandens* Loefling, Valerianaceae, from **Brazil**, São Paulo, Campos do Jordão, 21 April 1922, Holway-1746. (?/?,IIpe/III).

*Puccinia vinula* has been reported only from the type. Jackson (1932) reported that the nearly colorless, smooth walled teliospores is an important trait to help identify this species.

**Puccinia VIRGATA** Ellis & Everhart, Proc. Acad. Nat. Sci. Philadelphia 1893: 154.1893. TYPE on *Sorghastrum nutan* (Linnaeus) Nash s from **The United States of America**, Kansas: Rooks County, 23 Jan 1892, Bartholomew-s.n. (?/?≠ IIpe/III).

On Gramineae:

*Sorghastrum nutans* (Linnaeus) Nash, Rio de Janeiro (Arthur, 1925: 192); São Paulo (Arthur, 1925: 125; Cummins, 1953: 25; IBI-1720).

*Sorghastrum pellitum* (Hackel) Parodi, Rio Grande do Sul (Lindquist & Costa Neto, 1967: 59).

*Sorghastrum stipoides* (Kunth) Nash, Goiás (Cummins, 1953: 25. 1953).

*Puccinia virgata* has been reported also from Mexico and The United States of America and on *Erianthus* sp. .

Spermogonia and aecia unknown. Uredinia chestnut-brown, on both sides of leaves, paraphyses clavate or capitate, golden-brown, wall 1.5-3  $\mu\text{m}$  thick in stipe, 3-9  $\mu\text{m}$  apically; urediniospores 31-40(-43) x (16-)20-27(-30)  $\mu\text{m}$ , mostly obovoid, wall 2-3  $\mu\text{m}$  thick, often 3-6  $\mu\text{m}$  apically, chestnut-brown apically, usually paler below, echinulate, pores 4(5), equatorial. Telia blackish brown, compact, early exposed; teliospores (40-)45-60(-75) x 18-26  $\mu\text{m}$ , mostly clavate, wall 1.5-2  $\mu\text{m}$  thick at sides, 5-10(-12)  $\mu\text{m}$  apically, chestnut-brown; pedicels to 20  $\mu\text{m}$  long, thick-walled, not collapsing, brown (Cummins, 1971).

*Puccinia vonguntanii* Mayor, see **PROSPODIUM VONGUNTENII** (Mayor) Dietel.

*Puccinia wedeliae* Mayor, see **Puccinia CNICI-OLERACEI** Persoon ex Desmazieres.

**Puccinia WEDELIICOLA** H. S. Jackson & Holway in Jackson, *Mycologia* 24: 171. 1932. TYPE on *Wedelia trichostephia* DeCandolle, Compositae, from **Brazil**, Rio de Janeiro, Itatiaia, 7 May 1922, Holway-1822. **(0/Icv, IIpe/III)**.

*Puccinia wedeliicola* has been reported only from the type. Jackson reported that the aecia lack peridia. See *Puccinia obrepta* for a key to species of *Puccinia* on *Wedelia*.

Spermogonia on the adaxial side of leaves in groups of 4-8, punctiform, blackish, each with an obvious fascicle of periphyses, on discolored, somewhat hypertrophied leaf spots. Aecia on the adaxial side of leaves, in groups around the spermogonia, without peridia, tardily erumpent, ruptured epidermis evident, whitish, powdery, aeciospores 18-21 x 24-36  $\mu\text{m}$ , ellipsoid, often irregular, wall 2-3  $\mu\text{m}$  thick, verrucose-tuberculate crasse crebrique, colorless. Uredinia on the abaxial side of leaves, scattered, subepidermal in origin, early erumpent, surrounded by the ruptured epidermis, 0.3-0.5 mm. diam, powdery, cinnamon-brown; urediniospores 21-24 x 21-27  $\mu\text{m}$ , irregularly globoid to ovoid, wall 1.5-2  $\mu\text{m}$  thick, minutely and sparsely echinulate, chestnut-brown, pores 2, equatorial. Telia on the abaxial side of leaves, scattered, erumpent, ruptured epidermis not evident, compact, flattened to subpulvinate by coalescence, chestnut brown but soon turning grayish by germination; teliospores 16-24 x 42-54  $\mu\text{m}$ , ellipsoid, oblong to clavate, rounded above, rounded or narrowed below to the pedicel, slightly constricted at the septum, wall smooth, 1-1.5  $\mu\text{m}$  thick at sides, 6-9  $\mu\text{m}$  at the apex with a broad pale yellowish umbo; pedicel as long as or shorter than the spore, colorless (Jackson, 1932).

*Puccinia wedeliicola* is quite different from others on *Wedelia* having thickened apices to the teliospores; on account of the number of pores in the urediniospore wall, and the absence of a peridium in the aecia.

See *Puccinia obrepta* for a key to species of rusts on *Wedelia*.

*Puccinia winteri* Pazschke in Rabenhorst & Winter, see **DASYSPORA GREGARIA** (G. Kunze) P. Hennings.

*Puccinia zaeae* Berenger, see **Puccinia SORGHI** Schweinitz.

*Puccinia zinniae* P. Sydow & H. Sydow, see **Puccinia CNICI-OLERACEI** Persoon ex Desmazieres.

**Puccinia ZOYSIAE** Dietel, Bot. Jahrb. 32: 48. 1902. TYPE on *Zoysia japonica* Steudel from **Japan**, Komaba in Tokyo, Sept 1899, *Kusano-249*. [?on *Zoysia pungens* Willd. (= *Z. matrella*)].

**(0/Icv<sup>z</sup> IIpe/III)**.

= *Puccinia ischaemi* Dietel, Ann. Mycol. 15: 493. 1917. TYPE on

Anamorph on Rubiaceae: **0/Icv**

*Aecidium paederiae* Dietel, 1897, unknown in Brazil.

On Gramineae, **II/III**:

*Zoysia matrella* (Linnaeus) Merrell (reported originally as *Zoysia pungens* Willdenow), São Paulo (IBI-15485).

*Puccinia zoysiae* was only recently found in Brazil (1990) and not reported in our Index (Hennen et al., 1982). But it has been reported from China, Japan, and The United States of America. The spermogonial and aecial infections were reported on *Paederia chinensis*, Rubiaceae, in Asia.

Aecia (*Aecidium paederiae* Dietel) occur on species of *Paederia*, Rubiaceae, in Asia; peridia short; aeciospores 16-21 x 12-17  $\mu\text{m}$ , globoid or broadly obovoid, wall 1-1.5  $\mu\text{m}$  thick at sides, 3-8  $\mu\text{m}$  apically, hyaline, finely verrucose. Uredinia on adaxial side of leaves, bright yellow when fresh, nearly colorless when dry; urediniospores 17-22 x (14-)15-18  $\mu\text{m}$ , mostly obovoid or ellipsoid; wall uniformly 1.5-2.5  $\mu\text{m}$  thick or thickened apically to 8  $\mu\text{m}$ , the thick-walled spores common in some collections, rare in others, echinulate, yellowish or colorless, germ pores very obscure, probably about 6, scattered. Telia on both sides of leaves, early exposed, blackish brown; teliospores (28-)30-40(-42) x (15-)16-22(-24)  $\mu\text{m}$ , mostly ellipsoid, wall 1.5-2.5  $\mu\text{m}$  thick at sides, (3-)4-6(-7)  $\mu\text{m}$  apically, chestnut-brown except usually a pale differentiated area at the apex, smooth; pedicels to 100  $\mu\text{m}$  long, mostly thick-walled and not collapsing, yellowish (Cummins, 1971).

The presence and proportion of urediniospores with a thickened apical wall varies greatly. Short, colorless, thin-walled paraphyses occur in some collections but apparently not in all.

Asuyama (Ann. Phytopathol. Soc. Japan 5:23-29• 1935) proved the life cycle by inoculation of *Paederia chinensis* (Cummins, 1971).

*Puccinia zoysiae* may cause unsightly foliage damage to lawns composed of *Zoysia* grass.

*Puccinia zorniae* Dietel, see **Puccinia ARACHIDIS** Spegazzini var. **OFUSCATA** (Arthur) Cummins.

#### **Pucciniastrum** G. Otth,

Mitth. Nat. Ges. Bern 1861: 71. 1861. TYPE species *Pucciniastrum epilobii* Otth on *Epilobium* sp. Onagraceae, from Europe.

*Pucciniastrum* is a genus of forty or more heteroecious species, widespread in the Northern Hemisphere. Where known, spermogonia and aecia occur on species of the Gymnosperm genera: *Abies*, *Picea*, and *Tsuga*. These host genera do not occur naturally in the Southern Hemisphere. *Pucciniastrum agrimoniae* is a wide ranging species that survives in the uredinial phase. *Pucciniastrum epilobii* on species of Onagraceae that also survives in the uredinial phase has been reported from Argentina.

Telia may be difficult to detect because they are in short layers either within or immediately beneath epidermal cells. Teliospores are two to four celled by vertical septa. Uredinia barely protrude above the epidermis and are surrounded by a thin-walled, membranous peridium that opens by a pore. Peridial cells that surround the pore, "ostioler cells", are often enlarged and sometimes sculptured with warts or spines. These are useful for identifying some species.

**Pucciniastrum AGRIMONIAE** (Dietel) Tranzschel, Scripta Bot. Hort. Univ. Petropol. 4: 301.

1895. (?/?≠ **IIpe/III**).

≡ *Thekopsora agrimoniae* Dietel, Hedwigia 29: 153. 1890. TYPE on *Agrimonia pilosa*, from **Russia**, Siberia, Altai, date not reported by Dietel, *Martianoff* (Dietel reported, *l.c.*, that the specimen was distributed in the *esciccata* *Mycoth. univ. No. 2046*).

Anamorph

**Uredo agrimoniae** ("Caeoma (*Uredo*) *agrimoniae*") Schweinitz, Trans. Am. Phil. Soc. II. 4: 291. 1832.

TYPE on *Agrimonia parviflora* Solander, from **The United States of America**, North Carolina, Salem, date not reported by Schweinitz, *D. von Schweinitz*.

= *Coleosporium ochraceum* Bonorden, Beitr. z. Coniomyceten p.20: 1860. (only II).

= *Uredo agrimoniae-eupatoriae* Winter, in Rabenhorst, Krypt. Fl.9:252. 1881.

On Rosaceae (II,III):

***Agrimonia hirsuta*** Bongard, São Paulo (Jackson, 1931: 104).

***Agrimonia parviflora*** Alton, Santa Catarina (Dietel, 1897: 33).

*Pucciniastrum agrimoniae* is widely distributed in the Northern Hemisphere. In South America, it has been reported only from Brazil.

Spermogonia and aecia are unknown but Arthur (1934) predicted that when discovered they will be found on species of *Tsuga*, Pinaceae, in the Northern Hemisphere. The rust survives as urediniospores or as perennial uredinial mycelium in the roots of *Agrimonia* spp. (Ziller, 1974).

**Pucciniastrum AMERICANUM** (Farlow) Arthur, Bull. Torrey Bot. Club 47: 468. 1920.

(**0/Icv**≠ **II/III**).

≡ *Pucciniastrum arcticum* var. *americanum* Farlow, Rhodora 10: 16. 1908. TYPE on *Rubus* sp. from **The United States of America**, Massachusetts: near Cambridge, October 1875, *Farlow-s.n.*

On Rosaceae

***Rubus idaeus*** Linnaeus (includes *Rubus strigosus*), São Paulo (Figueiredo, M. B. et al., 2003; IBI-2002-12).

*Pucciniastrum americanum* is native to North America and perhaps northern Eurasia. It was introduced accidentally into Chile between 1975-1980 by importation of infected plants from North America. More recently, it was probably introduced similarly into Brazil. This rust species has also been intercepted by plant quarantine officers in the Miami, Florida on fruits of *Rubus idaeus* imported from Colombia.

A disease of *Rubus idaeus* ("framboesa, red raspberries"), caused by the rust fungus *Pucciniastrum americanum*, was found for the first time in Brazil on cultivated plants and fruits from near Ibiúma, S. P. in May 2002. *P. americanum* is a heteroecious, long cycle rust native to Canada, The United States of America, and perhaps northern Eurasia. In its native areas it produces spermogonia and aecia on the Gymnosperms, *Picea* spp. ("spruce"). But in much of its geographic range the fungus persists by uredinial infections. [Records in the Arthur Herbarium, Purdue University, West Lafayette, Indiana, U. S. A. show that] This rust was introduced from The United States of America into Chile between 1975-1980. [Records from The U. S. Department of Agriculture's National Fungus Collections show that] The rust has also been introduced into Colombia.

**Pucciniastrum goeppertianum** (Kuehn) Klebahn, Wirtsw. Rostp. p. 391. 1904. (0/Icv<sup>2</sup> - /III).

= *Calyptospora goeppertiana* Kuehn, Hedwigia 8: 81. 1869. TYPE on *Vaccinium vitis-idaea* Linnaeus from **Poland**, "montibus giganteis, loco Krummhübel", autumn, 1868, *J. Kühn*. This is the type species of the genus *Calyptospora* Kuehn.

Anamorph on Pinaceae (0/I, on *Abies* spp. in the Northern Hemisphere only):

*Peridermium ornamentale* Arthur, Bull. Torrey Bot. Club 28: 665. 1901. TYPE on *Abies lasiocarpa* Nuttall from **The United States of America**, Washington: Mount Pado, 4 Sept 1900, *W. N. Suksdorf s. n.* (see Hiratsuka, Y. et al., 1967, for discussion of this species). = *Peridermium holwayi* H. Sydow & P. Sydow, Ann. Mycol. 1: 19. 1903. TYPE on *Pseudotsuga douglasii* from **Canada**, British Columbia: Glacier, date not recorded, *Holway s. n.*

On Ericaceae (III):

*Gaylussacia brasiliensis* Meissner, Rio de Janeiro (Silveira, 1974: 121).

The record of *Pucciniastrum goeppertianum* in Brazil needs to be confirmed.

Ziller (1974) reported telia of this rust from the Northern Hemisphere on *Vaccinium* spp. and the spermogonial and aecial anamorphs on *Abies* spp. Uredinia are not produced. He reported that some observations indicate that at least some populations of the rust may be microcyclic and that basidiospores produced on *Vaccinium* may reinfect *Vaccinium*. The telial infections incite witches brooms with characteristic continuous, glossy, reddish brown sori that surround the infected stems.

**Pucciniola** Marchand,

Bijdr. Nat. Wet. 4: 47. 1829. See Laundon (1965A) for the complex details about the type species.

Arthur (1921) used the genus name *Pucciniola* (= *Uromycopsis*) for 25 species that were formerly placed in *Uromyces*. Arthur proposed that *Pucciniola* be based on a confusing mixture of variations in the morphological and ontogenic concepts of life cycles. In ontogenic terminology the species are long cycled and autoecous, both the uredinia and aecia when known, have the morphology of the anamorph genus *Aecidium*. In herbarium specimens aecia can be identified only if spermogonia are present. In morphologic terminology the species have no uredinia. Teliospores are one celled. Later, Arthur abandoned the use of *Puccinioloa* and it is not used any more. Most of the species are now placed in *Uromyces*. See also *Allodus* and *Uromycopsis*.

*Pucciniola cestri* (Montagne) Arthur, see *Aecidium cestri* Montagne (**UROMYCES CESTRI** Montagne).

*Pucciniola tweediana* (Spegazzini) Arthur, see **UROMYCES INDURATUS** H. Sydow, P. Sydow & Holway.

**Puccinosira** Lagerheim,

Ber. Deutsch. Bot. Ges. 9: 344. 1891. TYPE SPECIES *Puccinosira triumfettae* Lagerheim, a synonym of *Puccinosira pallidula* (Spegazzini) Lagerheim. Family Puccinosiriaceae.

There are about 17 species worldwide, seven of which are in the neotropics. Probably *Puccinosira* species are derived from species of *Puccinia* in which the life cycles are shortened. The telia have some traits of the telia and some traits of the aecia of the parental *Puccinia* species (Buriticá & Hennen, 1980).

Spermogonia subepidermal, globoid. Aecia and uredinia not produced. Telia short to long erumpent columns with a cylindrical peridium. Teliospores in vertical rows, ovoid or ellipsoid, 2-celled by a horizontal

septum, with intercalary cells between the spores, spores weakly to strongly adherent, usually easily dividing into two cells; wall colorless to lightly pigmented, smooth or verrucose, germ pore one or obscure.

#### Key to help identify species of *Puccinosira* in Neotropica

1. On Tiliaceae
  - A. Teliospores 20-28 x 10-18 µm, walls smooth, colorless, ca 1 µm thick
    1. *P. pallidula*. On *Heliocarpus*, *Triumfetta*, **South America, Central America, West Indies**
  - A. Teliospores 18-30 x 16-20 µm, walls finely verrucose, pigmented, more than 1 µm thick.
    2. *P. dorata*. On *Heliocarpus*, **Mexico**.
2. On Solanaceae.
  - A. Apical wall of lower cell of teliospores thickened all the way across.
    3. *P. solani*. On *Solanum*, **Ecuador**.
  - A. Apical wall of lower cell of teliospores not thickened or only partially so.
    4. *P. holwayi*. On *Solanum*, **Brazil**.
3. On Compositae (Eupatoriaceae) .
  - A. Peridial cells weakly developed, becoming widely separated in mature sori.
    5. *P. arthuri*. On *Eupatorium*, **Ecuador**.
  - A. Peridial cells well developed, remaining mostly intact in mature sori.
    - B. Teliospores of two sizes, 28-42 x 18-42 µm & 20-26 x 12-14 µm, walls granular-verrucose.
      6. *P. brickelliae*. On *Brickellia*, **Central America, Mexico**.
    - B. Teliospores mostly 26-40 x 18-28 µm, wall smooth or minutely verrucose.
      7. *P. cumminsiana*. On *Eupatorium*, **Central America, Mexico**.

*Puccinosira albida* Buriticá & Pardo-Cardona, see **Puccinosira pallidula** (Spegazzini) Lagerheim.

**Puccinosira holwayi** H. S. Jackson, Mycologia 26: 84. 1932. TYPE on *Solanum laxiflorum* Sendter from **Brazil**, Rio de Janeiro: Petropolis, 29 Dec 1921, *E. W. D. Holway-1434*. (0/-, -/III). = *Puccinosira hyphoperidiata* Viégas, Bragantia 5: 51. 1945. TYPE on *Solanum* sp. from **Brazil**, São Paulo: Ubatuba, Aguatuba, Alto da Serra, 23 Nov 1938, *Viégas-2772*.

On Solanaceae:

*Solanum laxiflorum* Sendter, Rio de Janeiro (Jackson, 1932: 84; Buriticá & Hennen, 1980: 31; PUR-8693).

*Solanum* sp., São Paulo (Buriticá & Hennen, 1980: 31; IAC-2772).

*Puccinosira holwayi* has been reported only from Brazil from the reports cited above. (Buriticá, & Hennen, 1980).

*Puccinosira hyphoperidiata* Viégas, see **Puccinosira holwayi** H. S. Jackson.

**Puccinosira pallidula** (Spegazzini) Lagerheim, Tromso Mus. Aarsh. 16: 122. 1894. (0/-, -/III). = *Coleosporium pallidulum* Spegazzini, Fungi Guaranitici, An. Soc. Cient. Argentina 17: 95. 1884. TYPE on *Triumfetta* sp., originally reported as "Malvaceae", from **Paraguay**: Guarapi, July 1883, *B. Balansa-s.n.*  
= *Puccinosira triumfettae* Lagerheim, Ber. Deutsch. Bot. Ges. 9: 344. 1891. TYPE (Lectotype) on *Triumfetta* sp. from **Ecuador**, Guyas: Playas, Dec 1890, *Lagerheim-s.n.* Two other collections were also reported by Lagerheim.  
= *Puccinosira pallidula* (Spegazzini) P. Hennings, Hedwigia 35: 247. 1895.  
= *Aecidium triumfettae* P. Hennings, Hedwigia 35: 259. 1896. TYPE on *Triumfetta* sp. from **Argentina**, Misiones: Loreto, 21 March 1884, *Niederlein-s.n.*  
= *Aecidiella triumfettae* Ellis & Kelsey, Bul. Torrey Bot. Club 245: 208. 1897. TYPE on *Triumfetta* sp. from **St. Croix Island, Dutch West Indies**, Jan-Feb 1896 (10 Feb 1896), *A. E. Ricksecker-23*.

On Tiliaceae:

*Triumfetta abutiloides* Saint-Hilaire, Santa Catarina (Pazschke, 1892: 96).

*Triumfetta astilboides*, Santa Catarina (Hennings, 1896: 247).

*Triumfetta rhomboidea* Jacquin, Rio Grande do Sul (PUR-F17802).

*Triumfetta semitriloba* L., Rio de Janeiro (Jackson, 1931: 477).

*Triumfetta* sp., Mato Grosso (IBI-16769), Minas Gerais (IBI-12754), Pará (Albuquerque, 1971: 149; Buriticá & Hennen, 1980: 30; IAN-691), Rio de Janeiro (Jackson, 1931: 477; IBI-12824), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 131), Santa Catarina (PUR-F8682), São Paulo (Viégas, 1945: 52; IAC-1366; IBI-12222).

*Puccinosira pallidula* is widespread from Argentina to Mexico on species of *Heliocarpus* and *Triumfetta* (Buriticá and Hennen, 1980).

Spermogonia on adaxial side of leaves; telia crowded in groups 1-2.5 mm across on small yellow-brown spots on abaxial side of leaves below the spermogonia, in short columns 0.1-0.15 mm across, pale yellow; peridium adherent to the teliospore column, peridial cells 16-24 x 10-16 µm, oblong, inner facing wall 2-3 µm thick, minutely verrucose, outer facing wall 5-8 µm thick, more or less smooth; teliospores 20-28 x 10-18 µm, ovoid, to oblong, rounded at both ends or one conical, slightly constricted at the septum, wall ca 1 µm thick, without intercalary cells in mature part of sorus. (Buriticá, & Hennen, 1980).

*Puccinosira albida* Buriticá & Pardo-Cardona (Rev. Acad. Colombia. Scienc. 22: xx. 1998) on *Triumfetta lapula* Linnaeus from Colombia was reported to be almost identical to *P. pallidula* except for its white telia and teliospores.

*Puccinosira pallidula* (Spegazzini) P. Hennings, see **PUCINIOSIRA PALLIDULA** (Spegazzini) Lagerheim.

*Puccinosira triumfettae* Lagerheim, see **PUCINIOSIRA PALLIDULA** (Spegazzini) Lagerheim.

#### **RAVENELIA** Berkeley,

Gard. Chron. 1853: 132. 1853. LECTOTYPE SPECIES *Ravenelia epiphylla* Schweinitz, originally reported as = *Ravenelia glandulosa* Berkeley & Curtis on *Tephrosia virginiana* (Linnaeus) Persoon from United States of America, South Carolina.

Spermogonia mostly subcuticular (Group VI, type 7), in a few species subepidermal (Group VI, type 5). Aecia subepidermal or sometimes subcuticular in origin, erumpent, mostly with pedicellate spores (*Uredo* form), or in a few species with catenulate spores (*Aecidium* or *Caeoma* form). Uredinia mostly subepidermal or sometimes subcuticular in origin, erumpent, powdery, the *Uredo* form often with well developed, peripheral paraphyses; urediniospores born singly on pedicels, mostly echinulate, a few with spiral sculpture patterns. Telia subepidermal or sometimes subcuticular in origin, dark brown to nearly black, teliospores complex, with up to four kinds of cells, forming discoid shaped teliospores, with few up to 80 or more probasidial cells in a spore, these mostly in one layer of strongly, laterally adherent probasidial cells, in a few species 2 layers in the center part of the spore due to transverse or oblique septa, distal surface of teliospores smooth or sculptured and with polygonal outlines of the probasidial cell walls, with obscure germ slits or rarely germ pores, 1 in each cell, probasidial cells often subtended by small, difficult to observe, sterile, intercalary cells, these subtended by few to many, colorless, hygroscopic cysts, these in one series, "uniseriate", or in more than one series, "multiseriate", teliospores pedicellate, pedicel composed of 2 to a few, coherent hyphal strands united in fascicles, metabasidia external.

Keys are presented below that may help to identify the species of *Ravenelia* in Brazil and the New World.

#### **Morphology of *Ravenelia***

The teliospores of *Ravenelia* are the most complex of all fungal spores and are the largest of all rust spores. In some species individual spores can be seen by the unaided eye or a 10X hand lens. They have four kinds of cells: 1. Usually eight or more (up to at least 80) probasidial cells united laterally into a discoid layer. In some species two layers of probasidial cells occur in the central part of the spore. In distal view the probasidial cells appear polygonal, resembling the surface of a soccer ball. In most species of *Ravenelia* the probasidial cells have germ slits located in the distal cell walls immediately adjacent to the angle of a corner of a lateral wall (Lopez-Franco & J. F. Hennen, 1989). Some species produce germ pores, also difficult to observe. These slits and pores are difficult to observe because of the pigmentation and the refraction



produced by the inner lateral walls. For most species neither germ slits nor pores have been demonstrated but it can be assumed that one or both occur. 2. The probasidial cells are often subtended by an inconspicuous layer of sterile intercalary cells. 3. Hygroscopic cysts subtend the sterile cells. In water the cysts expand, may burst, and release a gelatinous sticky substance. and 4. The complex spore is borne on a pedicel composed of two to several elongated, laterally united hyphal strands. Pedicels are attached either strongly or loosely at the base of the spore to either the cyst cells, or to intercalary cells, or directly to the probasidial cells. However, the precise internal structure and ontogeny of the teliospores is not well known.

Because of their complexity, *Ravenelia* teliospores have been referred to as teliospore "heads" or "compound teliospores". Some mycologists have assumed that *Ravenelia* teliospores are the result of an evolutionary union of several single teliospores. But how ever these spores have evolved, they function as one unit of dispersal, thus we refer to these multicellular, complex structures as teliospores.

The paraphyses found in uredinia of *Ravenelia* species are usually well differentiated and mostly peripheral. Some authors have reported intrasoral, long, narrow, usually thin-walled, hyaline, pedicel-like structures that arise sympodially from the urediniosporogenous cells as paraphyses. Each sporogenous cell produces pedicellate urediniospores that are deciduous, leaving a long, old pedicel still attached to the sporogenous cell. After a few spores have been produced, the sporogenous cell remains in the sorus with the old pedicels still attached. These may appear to be paraphyses. It is not clear if the sporogenous cells also produce structures similar to these old pedicels but without spores. If so these could be called paraphyses. However, because these pedicel-like structures occur with all pedicellate urediniospores of *Ravenelia*, we have not described them as paraphyses, but assume that they are old pedicels.

In nature many species of *Ravenelia* seem relatively benign on their hosts, but some species incite spectacular galls and witches' brooms. The galls of *R. edulis*, a species in India on *Acacia* sp., are said to be eaten when young and fresh.

#### **Host and geographic range of *Ravenelia* species**

Although *Ravenelia* species have been reported on Euphorbiaceae, Tiliaceae, and Zygophyllaceae, those rust species have been transferred to other genera or hosts were missidentified. *Ravenelia* species occur only on the Leguminosae. All three subfamilies of legumes have their own *Ravenelia* species. These various specificity relations between host and parasite is another important area for speculation about coevolution.

Although *Ravenelia* species are most numerous in tropical and subtropical arid regions where many Faboideae, Caesalpinneae and Mimoseae host species abound, very dry deserts and even rain forests also have species of *Ravenelia*. The Neotropics have the most species, followed by the tropics and subtropics of Africa and then Asia. Nearly 115 species of *Ravenelia* are known in the Western Hemisphere. About 40-45 of these are from Brazil occurring commonly on *Acacia*, *Calliandra*, *Cassia* (including *Senna* and *Chamaecrista*), *Lonchocarpus*. No species have been reported Europe, and until recently, Australia. Most species of *Ravenelia* are known only from their type specimen or only a few collections. At least one species, *R. opaca*, reported to be on *Gleditsia triacanthus* from southern Illinois in the United States of America, is probably extinct. The host is a very common weedy tree in the eastern half of the USA, but no reports exist for the occurrence of this species except for that of the type which was collected 13 Aug 1890. Several mycologists have made special efforts to search for this species without success. *Mimosa*.

#### **Taxa related to *Ravenelia***

*Kernkampella* is a rust genus that was formerly included in *Ravenelia* but all of its species parasitizes species in the Euphorbiaceae. Only one species, *K. appendiculata* on *Phyllanthus* spp., has been reported in the New World, from Bolivia to Mexico. The other species are from Asia, mostly from India. The separation of these two genera is problematical. Except for *Kernkampella*, no other rust genus has spores with multihyphal pedicels. Only the pedicels of teliospores of some species of *Tranzschelia*, which are laterally united only partway toward their base, approach this condition. A few species of *Ravenelia* may have a few of their teliospores with pedicels composed of only a single hyphal cell intermixed with teliospores with multihyphal pedicels. A closely related genus, *Spumula*, has complex teliospores similar to *Ravenelia* but its pedicels are always composed of a single hyphal strand.

Comparative morphology suggests combining *Cystomyces* (a genus with only one species, *C. costaricensis*, from Costa Rica) with *Ravenelia* or designating *Cystomyces* as a satellite genus directly related to *R. atrocrustacea*. A difference between these two taxa is that *R. atrocrustacea* has multihyphal pedicels in teliospores that have four or more probasidial cells. Spores with three cells have two cysts and unihyphal

pedicels just as in *Cystomyces*. Teliospore cells in both species have similar distal germ slits and both lack intercalary (patelliform layer) cells.

Savile (198?) speculated that because the teliospores of *Ravenelia* appear to mimic the compound pollen grains (polyads) of the Mimoseae subfamily of legumes, that they are gathered and disseminated by bees. Savile suggested coevolutionary phenomena, that he did not explain, to account for this. interaction between host, fungus, and insect. A more obvious adaptation from field observation suggested by Thirumalachar and Mundkur (1950) and others is that the hygroscopic cysts that subtend the multicellular spores swell and burst when wet and act as a glueing agent for the spores when they are dislodged from their sori, disseminated, and land in a new place some distance from the original sorus. Sori that are adaxial are often shaped like little “splash-cups” which may further aid dissemination by rain drops. The teliospores are too large for long distance dissemination by wind. Also the gelatinous material of the burst hygroscopic cysts probably absorbs and retains sufficient water to aid in germination of the probasidial cells. This germination process results in the formation of several metabasidia and basidiospores from the same multicelled teliospore.

The descriptions of species and some keys recorded here are mostly from an unpublished manuscript by Hennen and Cummins. Most of the World's species of *Ravenelia* are included in the United States Department of Agriculture, National Fungus Collection Web site.

1. See *Ravenelia bakeriana* for a key to help identify species of *Ravenelia* on *Lonchocarpus* and *Derris*.
2. See *Ravenelia cohniana* for a key to help identify species of *Ravenelia* on *Caesalpinia* and *Cenostigma* in the Neotropics.
3. See *Ravenelia comptula* for a key to help identify species of *Ravenelia* reported on *Calliandra*.
4. See *Ravenelia dentifera* for a key to help identify *Ravenelia* species on *Cassia sensu lato* in the Americas, genera:, *Cassia*, *Chamaecrista*, and *Senna*, in the Neotropics.

**1. Key to *Ravenelia* on Caesalpinioideae (Caesalpinaceae) in the Americas (host leaves mostly once pinnate).**

(21 rust species) Host genera: *Caesalpinia*, *Cassia*, *Cenostigma*, *Chamaecrista*, *Senna*. Br = reported from Brazil

1. Teliospore probasidial cells smooth.
  2. Paraphyses lacking.
    3. Urediniospore pores scattered **1. *R. cassiaecola* var. *berkeleyi*. (*Chamaecrista*).**
    3. Urediniospore pores equatorial **2. *R. microcystis*. (*Cassia*) Br.**
  2. Paraphyses present (3 leads for #4)
    4. Urediniospore pores scattered, spores echinulate.
      5. Central probasidial cells mostly 13-17  $\mu\text{m}$  across **3. *R. mesillana*. (*Senna*).**
      5. Central probasidial cells mostly 18-22  $\mu\text{m}$  across **4. *R. arthuri*. (*Senna*).**
    4. Urediniospore pores bizonate, spores echinulate **5. *R. macrocarpa*. (*Senna*) Br.**
    4. Urediniospore pores unizonate, spores striated.
      6. Urediniospore pores equatorial, 3-5 **6. *R. corbuloides*. (*Caesalpinia*).**
      6. Urediniospore pores basal, 2 **7. *R. spiralis*. (*Cenostigma*).**
1. Teliospores with some probasidial cells ornamented.
  7. Paraphyses lacking.
    8. Urediniospore pores scattered.
      9. Urediniospores mostly 20  $\mu\text{m}$  or longer.
        10. Probasidial cells each with 1 tubercle 4-8  $\mu\text{m}$  long **8. *R. bella*. (*Senna*).**
        10. Probasidial cells merely finely rugose **9. *R. uleana*. (*Chamaecrista*).**
      9. Urediniospores mostly less than 20  $\mu\text{m}$  long.
        11. Teliospore pedicel deciduous, spores with spines

10. **R. mirandensis**. (*Senna*).
11. Teliospore pedicel persistent, to 25  $\mu\text{m}$  wide, spores with few beads/warts or smooth  
**11. R. cassiaeicola var. cassiaeicola**  
(*Chamaecrista*)
8. Urediniospore pores equatorial.  
12. Probasidial cells each with 5-7 spines/cones  
**12. R. cohniana**. (?*Caesalpinia*,  
*etc.*) Br.
12. Probasidial cells unadorned except peripheral cells.  
13. Peripheral cells each with rounded tubercle to 7  $\mu\text{m}$  long;  
urediniospores 12-14  $\mu\text{m}$  long  
**13. R. microspora**. (*Senna*) Br.
13. Peripheral cells each with tooth or prong to 17  $\mu\text{m}$  long;  
urediniospores 18-20  $\mu\text{m}$  long  
**14. R. dentifera**. (*Senna*) Br.
7. Paraphyses present. (add *Ravenelia faceta*, *Spumula faceta*)  
14. Teliospores with sterile peripheral cells with outgrowths that branch finely and  
profusely apically, urediniospore walls with spiral, finely notched flanges  
**15. Ravenelia cenostigmatis**  
(*Cenostigma*) Br.
14. Teliospores without such peripheral outgrowths  
15. Urediniospore pores scattered, spores echinulate.  
16. Teliospores smooth except peripheral cells rarely with 1 papilla  
**3. R. mesillana**. (*Senna*).
16. Teliospores rarely smooth, ornamentation various.  
17. Probasidial cells each with 0-5 beads/warts  
**16. R. humphreyana**. (*Caesalpinia*).
17. Probasidial cells with other ornamentation.  
18. Probasidial cells each with 1 tubercle/cone  
**17. R. spinulosa**. (*Senna*).
18. Probasidial cells each with 3 or more tubercles.  
19. Paraphyses thick-walled; urediniospores  
14-17  $\mu\text{m}$  long  
**18. R. humphreyana** var.  
*inconspicua*. (*Caesalpinia*).
19. Paraphyses thin-walled; spores 21-25  
 $\mu\text{m}$  long .  
**19. R. indigoferae**  
(Papilionoideae) Br.
15. Urediniospore pores equatorial, spores striated spirally.  
20. Peripheral probasidial cells each with 1 prominent tubercle, inner  
spores warted **20. R. corbula**. (*Caesalpinia*).
20. All probasidial cells with similar tubercles/spines  
**21. R. pileolarioides**. (*Caesalpinia*)  
Br.

## 2. Key to Species of *Ravenelia* on Papilionoideae in the Americas (22 species)

(leaves once pinnate or trifoliolate)

*Andira*, *Brongniartia*, *Cratylia*, *Erythrina*, *Gleditsia*, *Indigofera*, *Lonchocarpus*, *Piscidium*, (*Senna*),  
*Tephrosia*

1. Teliospores with unadorned (smooth) surface  
2. Species with telia only (microcyclic)  
3. Telial cysts pendent with narrow base **1. R. opaca**. (*Gleditsia*) USA  
3. Telial cysts united from margin to pedicel  
4. Sori with paraphyses to 170  $\mu\text{m}$  long

2. **R. sydowiana.** (*Lonchocarpus*) **Br**
4. Sori lacking paraphyses
5. Teliospores mostly 3-5 cells wide
6. Spermogonia subepidermal
3. **R. atrocrustacea.** (*Lonchocarpus*) **Br**
6. Sori subcuticular
4. **R. lonchocarpicola.** (*Lonchocarpus*)
5. Teliospores mostly 6-9 cells wide
7. Central cells mostly 12-17  $\mu\text{m}$  across
5. **R. mera var mera.** (*Lonchocarpus*)
7. Central cells mostly 16-22  $\mu\text{m}$  across
6. **R. mera var. robusta** (*Lonchocarpus*)
2. Species with uredinia and telia
8. Uredinia with paraphyses; inner probasidial cells 2-layered
7. **R. laevis** (*Indigofera*)
8. Uredinia without paraphyses
9. Urediniospore pores scattered
10. Urediniospores mostly 19-23  $\mu\text{m}$  long; all probasidial cells 1-layered
8. **R. caulicola.** (*Tephrosia*)
10. Urediniospores mostly 23-27  $\mu\text{m}$  long; inner probasidial cells 2-layered
9. **R. similis.** (*Brongniartia*)
9. Urediniospore pores equatorial
11. Urediniospores mostly 27-33  $\mu\text{m}$  long; inner probasidial cells 2-layered
10. **R. epiphylla** (*Tephrosia*)
11. Urediniospores mostly 33-42  $\mu\text{m}$  long; all probasidial cells 1-layered
11. **R. platensis** (*Erythrina*) **Br**
1. Teliospores with at least some cells surface adorned
12. Species with telia only (microcyclic)
12. **R. goyazensis.** (?*Andira*) **Br**
12. Species with uredinia and telia
13. Peripheral probasidial cells each with a long projection
14. Inner probasidial cells unadorned (smooth)
13. **R. fimbriata.** (*Senna*) **Br**
14. Inner probasidial cells with warted surface
15. Paraphyses lacking
14. **R. brongniartiae.** (*Brongniartia*)
15. Paraphyses present, branched with Uromyces-like apex
15. **R. bakeriana.** (*Lonchocarpus*) **Br**
13. Peripheral probasidial cells with surface as the inner cells
16. Uredinia lacking paraphyses
17. Urediniospore pores scattered
16. **R. irregularis** (*Tephrosia*)
17. Urediniospore pores equatorial
18. Germ pores 3; all teliospore cells 1-layered
17. **R. pernigra.** (*Cratylia*) **Br**
18. Germ pores 3-5 (-6); inner teliospore cells 2-layered
19. Probasidial cells each with usually 6-9 tubercles
18. **R. rubra.** (*Tephrosia*)
19. Probasidial cells each with 3-15 bead-like warts
19. **R. talpa** (*Tephrosia*)
16. Uredinia with paraphyses
20. Urediniospore pores scattered
21. Inner probasidial cells 2-layered, each with tubercles
20. **R. indigoferae** (*Indigofera*) **Br**
21. All probasidial cells 1-layered, surface obscurely warted
21. **R. piscidiae.** (*Piscidium*)
20. Urediniospore pores zonate

22. Pores 2, basal, spores reniform

22. **R. lonchocarpi**. (*Lonchocarpus*) Br

22. Pores several, bizonate (also some scattered)

21. **R. piscidiae**. (*Piscidium*)

### Species of *Ravenelia* in Brazil

*Ravenelia acaciae-farnesiana* P. Hennings, see **RAVENELIA HIERONYMI** Spegazzini.

*Ravenelia affinis* P. Sydow & H. Sydow., see **RAVENELIA DIETELIANA** P. Hennings.

*Ravenelia amazonica* Sydow, see **UREDIO AMAZONICA** (H. Sydow) J.W. Baxter.

*Ravenelia antiguana* Cummins, see **RAVENELIA INDIGOFERAE** Tranzschel.

**RAVENELIA ARMATA** H. Sydow & P. Sydow, Ann. Mycol. 14: 68. 1916. TYPE on *Calliandra* sp., Leguminosae, from **Brazil**, Roraima: Dec 1909, *Ule- 3381* (B). (?/?,II/III).

*Ravenelia armata* has been reported only from the type.

Spermogonia and aecia unknown. Uredinia on both sides of leaves but mostly on the adaxial side of leaves, subepidermal in origin, becoming erumpent and surrounded by upturned epidermis, without paraphyses, cinnamon-brown, commonly circinate arranged, urediniospores (26-)29-35(-38) x 18-24(-25)  $\mu\text{m}$ , mostly obovoid, wall 1.5-2  $\mu\text{m}$  thick at sides, to 3  $\mu\text{m}$  at base and 3-4.5  $\mu\text{m}$  at apex, cinnamon-brown but at the apex the outer part paler brown., echinulate, pores 5-7, mostly 6, equatorial. Telia as the uredinia but blackish brown, teliospores (65-)75-80(-85)  $\mu\text{m}$  diam., chestnut-brown, mostly with 4 central and 6 peripheral probasidial cells, 3-4 cells across, cells in one layer, each with a small intercalary cell and germ slit, central cells 28-33  $\mu\text{m}$  across, each cell with several, 8-20 colorless papillae or rounded spines to 5  $\mu\text{m}$  long and 2-3  $\mu\text{m}$  wide at base, cysts uniseriate, of same number as peripheral cells, coherent, appressed or appressed pendent, pedicel colorless, of few (2 ?) hyphae, deciduous.

The species is similar to *Ravenelia echinata* Lagerheim & Dietel var. *ectypa* (Arthur & Holway) Cummins in typically having teliospore heads with 4 central and 6 peripheral cells but that fungus has scattered pores in the urediniospores.

**RAVENELIA ATROCRUSTACEA** P. Hennings, Hedwigia 43: 159. 1904. TYPE on *Lonchocarpus* sp. (reported originally as *Swartzia* sp.) from **Brazil**, Amazonas: Rio Juruá, "Juruá Miry", Aug 1901, *Ule 2930*. (0/-./III).

= *Ravenelia tauaensis* Viégas, Bragantia 5: 57. 1945. TYPE on *Lonchocarpus* sp. from **Brazil**, Paraíba: Taua, Alagoinha, 11 Dec 1938, *Deslandes-147*.

On Leguminosae:

**Lonchocarpus** sp., Amazonas (Hennings, 1904B: 159), Paraíba (Viégas, 1945: 57; IBI-3159).

*Ravenelia atrocrustacea* has been reported also from Peru.

Spermogonia on the adaxial side of leaves, subepidermal in origin, type 5. Aecia and uredinia not produced. Teila on the adaxial side of leaves, subepidermal in origin, erumpent, surrounding the spermogonia, mostly confluent, blackish, without paraphyses, teliospores (40-)50-90  $\mu\text{m}$  diam, dark chestnut-brown or often opaque, without a discrete, pale outer layer, smooth, 3-5 probasidial cells across, with germ slits, cells in one layer, central cells (18-)22-28  $\mu\text{m}$  across, intercalary cells not seen, cysts uniseriate of same number as or fewer than the peripheral cells, large, firmly united, adherent to spore, swelling together to about the same size as the spore, pedicel of one or a few hyphae, mostly persistent, to 180  $\mu\text{m}$  long.

Baxter (1969) first discovered that spermogonia of *R. atrocrustacea* were subepidermal in origin, a trait that separates it from other species of *Ravenelia* on *Lonchocarpus*. He also was first to determine that *R. tauaensis* Viégas is a synonym of *R. atrocrustacea*. Baxter (1969) also identified the anamorph spores that Viégas had erroneously determined as urediniospores of *R. tauaensis* as spores of another species, *Uredo irensis* Dale.

See notes with the description of the genus *Ravenelia* for speculation about the relation of *R. atrocrustacea* with the genus *Cystomyces*.

See *Ravenelia bakeriana* for a key to species of *Ravenelia* on *Lonchocarpus* and *Derris*

**RAVENELIA BAHIENSES** P. Hennings, Hedwigia 47: 267. 1908. TYPE on *Mimosa misera* Benth (Mimosa remansoana Harms), Leguminosae, from **Brazil**, Bahia: Remanso, Jan 1907, Ule 3321. (-/-, -/III).

*Ravenelia bahiense* has been reported only from the type.

Spermogonia, aecia and uredinia unknown, probably not produced. Telia on stems on somewhat deformed young branches, confluent over extended area, on the abaxial side of on leaflets but not common, black, without paraphyses, teliospores (40-)55-65(-67)  $\mu\text{m}$  diam, chestnut-brown, smooth, with a thin, pale outer wall layer, (3) 4 or 5 (6) probasidial cells across, cells in one layer, with intercalary cells and germ slits, central cells (18-)20-22(-23) x (15-)16-19  $\mu\text{m}$  in surface view, cysts uniseriate, of same number as peripheral cells, pendent, globose, pedicel colorless, of few hyphae, deciduous.

The specimen has the aspect of a part of a witches' broom but Hennings describes it as... "paulo deformantibus". The species undoubtedly is microcyclic.

**RAVENELIA BAKERIANA** Dietel, Ann. Mycol. 6: 97. 1908. TYPE on *Lonchocarpus* sp., from **Brazil**, Pará: hort. bot. Belém, 15 Apr 1908, Baker s.n. isotypes Sydow, *Fungi exotici exsiccati* No. 18. (0/Ipe, IIpe/III).

Anamorph

*Uredo margine-incrassata* P. Hennings, Hedwigia Beiblatt 41:(15). 1902. TYPE on *Lonchocarpus* sp. from **Brazil**, Pará: Belém, Apr 1900, Huber 27.

On Leguminosae:

*Derris glabrescens* (Benth) Macbride (*Lonchocarpus glabrescens* Benth), Pará (PUR-89529).

*Derris spruciana* (Benth) Ducke, Pará (IBI-13256).

*Lonchocarpus* sp., Minas Gerais (IBI-15334), Maranhão (IBI-17102).

*Ravenelia bakeriana* has been reported only from Brazil.

Spermogonia subcuticular (type 7), on both sides of leaves, in close groups up to 1 mm across, in brownish leaf spots. Aecia (*Uredo margine-incrassata*) on both sides of leaves, in a circle around the spermogonia, subepidermal in origin, erumpent, powdery, with abundant peripheral, 1- or 2- septate, often branched paraphyses which are united basally and with capitate, brown, apically thick-walled, *Uromyces*-like apices, aeciospores pedicellate, (28-)30-41(-43) x (24-)26-35  $\mu\text{m}$ , asymmetrical, more or less triangular with 3 conspicuous supraequatorial lobes with 1 pore each, the aspect of the spore differing with differing orientation, wall cinnamon-brown, uniformly echinulate. Uredinia on the abaxial side of leaves, scattered, paraphyses and spores similar to those of aecia or somewhat darker nearing chestnut-brown. Telia on the abaxial side of leaves, blackish brown, subepidermal in origin, erumpent, with encircling paraphyses as in uredinia, teliospores (44-)55-74(-85)  $\mu\text{m}$  wide, (2) 3-5 probasidial cells across, most commonly 4 probasidial cells across with 4 central and 8 peripheral, cells in one layer, central cells (18-)22-26(-28)  $\mu\text{m}$  across in surface view, dark chestnut-brown, densely verrucose or tuberculate with warts mostly 3-4  $\mu\text{m}$  high except some to 10  $\mu\text{m}$  near the cysts, cysts uniseriate of same number as peripheral cells, pendent, mostly free, sometimes with a few tubercles, pedicel multihyphal, deciduous.

Traits that help identify *Ravenelia bakeriana* are its unusual anamorph spores that are three lobed in the equatorial region with a germ pore in each lobe, and paraphyses 1- or 2- septate, often branched, united basally, and with capitate, brown, apically thick-walled, *Uromyces*-like apices. Cummins (1937) and Baxter (1968) reported that these anamorph spores and paraphyses are indistinguishable from those of *Dicheirinia guianensis* Cummins on *Lonchocarpus nicou* DeCandolle. ? See *Ravenelia lonchocarpi* for comparison of tuberculate teliospores in two Holway collections from São Paulo, Brazil identified as *R. lonchocarpi*.

### 3. Key to help identify Species of *Ravenelia* on *Lonchocarpus* and *Derris* spp.

Also see keys to help identify species of *Dicheirinia*

1. Teliospores with at least some cells with surface sculpture; pedicellate anamorph spores produced
  2. Peripheral probasidial cells with long projections, central probasidial cells closely, irregularly tuberculate, anamorph spores 3-lobed or quadrangular, paraphyses often mimic *Uromyces* or *Puccinia* teliospores

***Ravenelia bakeriana* (0/Ipe, IIpe/III)**  
(Brazil)

2. All probasidial cells with surface sculpture as columnar or conical projections, anamorph spores

asymmetrical, reniform in side view, obovoid to pyriform in face view, paraphyses incurved, dorsal wall thickened, apex sharp pointed

*Ravenelia lonchocarp* (0/Ipe,IIpe/III)  
(Brazil)

1. Teliospores with cells not sculptured, no pedicellate anamorph spores produced

3. Sori with paraphyses to 170 µm long. *Ravenelia sydowiana* (0/-,-/III)  
(Brazil, Argentina)

3. Sori lacking paraphyses

4. Teliospores mostly 3-5 cells across

5. Spermogonia subepidermal. *Ravenelia atrocrustaceae* (0/-,-/III)  
(Brazil, Peru)

5. Spermogonia subcuticular. *Ravenelia lonchocarpicola* (0/-,-/III).  
(Argentina)

4. Teliospores mostly 6-9 cells across.

6. Central teliospore cells mostly 12-17 µm diam.

*Ravenelia mera* var. *mera* (0-/-,-/III)  
(Mexico, Central America, Bolivia)

6. Central teliospore cells mostly 16-22 µm diam

*Ravenelia mera* var. *robusta* (0-/-,-/III)  
(Guatemala)

**RAVENELIA BEZERRAE** J. C. Dianese, Medeiros & Furlanetto in J. C. Dianese et al., Fitopatol. Bras.

18: 444. 1993. TYPE on *Enterolobium ellipticum* Benth from **Brazil**: Federal District: Papuda, 3 Apr 1993, J. C. Dianese s. n. (?/?,IIpe/III).

*Ravenelia bezzerae* has been reported only from the type.

Spermogonia and aecia, unknown. Uredinia on both sides of leaves, subepidermal in origin, erumpent, light brown, ? paraphyses hymenial, 24-35 x 2-3 µm, abundant, cylindrical, rounded at tip, grouped around each urediniospore. Urediniospores (24-) 25-26 x (15-)16-18 µm, wall 3-5 µm thick, germ pores 4, equatorial, sporogenous cells 20-25 x 4-6 µm. Telia mostly on the adaxial side of leaflets, subepidermal in origin, erumpent, brown to dark brown; teliospores (65-) 72-77(-80) µm diameter, 4-5 prosubdial cells across, each cell with 3-5 spines, mostly with 2-4 central spores and 6 peripheral cells, central cells 25-21 µm across, cysts 6, uniseriate, coherent, appressed to lower face of spore; pedicel unihyphal, thick, persistent (Dianese et al., 1993).

The hymenial paraphyses included above are probably old urediniospore pedicels. See notes under the description of the genus *Ravenelia*. The teliospore pedicels were reported as composed of a single hyphal strand. Unless multihyphal pedicels can be demonstrated, this rust may be a *Spumula*.

*Ravenelia capituliformis* P. Hennings, see **OLIVEA CAPITULIFORMIS** Arthur.

**RAVENELIA CEBIL** Spegazzini, Anal. Mus. Nac. Buenos Aires 19: 295. 1909. TYPE on

*Anadenanthera macrocarpa* (Benth) Bren. (originally reported as *Piptadenia macrocarpa* Benth) from **Argentina**, Tucumán: Parque Roca, 10 Apr 1906, Spegazzini s. n. (LPS 4950; unsatisfactory condition for study!). (0/Ipe,IIpe/III).

= *Ravenelia mineirosensis* Rezende & Dianese sp. nov., see discussion below.

Anamorph

*Uredo vilis* (H. Sydow & P. Sydow) J. W. Baxter, Mycologia 67: 437. 1975.

≡ *Ravenelia vilis* H. Sydow & P. Sydow, Ann. Mycol. 14: 68. 1916. TYPE on *Anadenanthera* sp. (reported originally as *Piptadenia* sp.) from **Brazil**, Ceará: Serra de Maranguape, Oct 1910, Ule-3408. Telia not described.

On Leguminosae

*Anadenanthera colubrina* (Vall.) Bren. var. *cebil* (Grisebach) V. Reis, from Argentina.

*Anadenanthera peregrina* (Linnaeus) Spegazzini var. *falcata* (Benth) V. Reis, São Paulo (IBI-16897).

*Anadenanthera peregrina* var. *peregrina*, Goiás (IBI-16662), Mato Grosso do Sul (IBI-14360), Minas Gerais (IBI-15342), São Paulo (IBI-15111).

*Anadenanthera* sp., Amapá (IBI-16617), Mato Grosso (IBI-16719), Ceará (IBI-17116).

*Ravenelia cebil* has been reported also from Argentina, Paraguay, Uruguay, and perhaps Puerto Rico.

Spermogonia few in a group, on both sides of leaves, sub-cuticular in origin. Aecia, aeciospores, and paraphyses as in uredinia but among and opposite spermogonia. Uredinia on both sides of leaves, subcuticular in origin, erumpent, paraphyses, peripheral, abundant, brown, capitate, apically thick-walled to 10 µm; urediniospores pedicellate, (18-)21-28(-33) x (10-)12-15(-16) µm, ellipsoid, elongately obovoid or oblong-ellipsoid, wall 1.5(-2) µm thick or slightly thicker at apex, about cinnamon-brown, inconspicuously echinulate, often appearing smooth apically, pores 4-6 equatorial. Telia on both sides of leaves in small groups, subcuticular in origin, erumpent, blackish brown, teliospores (50-)70-100(-100) µm diam, chestnut-brown with a pale, thin, outer layer, smooth or minutely verrucose, (5-)6-8(-9) probasidial cells across, inner cells 2-layered, central cells (14-)15-18(-19) µm across, cysts multi-seriate, pendent, pedicel colorless, multihyphal, deciduous.

Lindquist (Rev. Fac. Agron. 30: 122. 1954) cites LPS 4959 as the type for *Ravenelia cebil*, but the specimen labelled type received from Instituto Spegazzini bears LPS 4950. The packet has drawings by Spegazzini on the front. The type is not satisfactory for study but the identity of *R. cebil* is not in doubt.

The seeds of the hosts give a potent hallucinogenic snuff (Mabberley, D. J. 1987. The plant book, p. 27, Univ. Cambridge Press).

We believe that *Ravenelia emansensis* and *R. mineirosensis*, both reported on *Anadenanthera* and their description and notes copied from the original publication as shown below, are probably synonyms of *Ravenelia cebil*. But we have not yet been able to examine the type specimens.

**1. R. cebil, 2.R. mineirosensis, 3. R. emansensis**, (comparisons from literature)

II spores µm	wall	pores	sculpture
1. (18-)21-28(-33) x (10-)12-15(-16)	1.5(-2)	4-6 equa	echin, smooth apically
2. (17-)23(-28) x (14-)15(-18)	2(-3)	4-6 scat equat	strongly echin
3. (22-)27(-30) x (10-)13(-15)	(?)	2-3-4 equat	cylindrical echin

III spores

cells across	1 or 2 layers	wide µm	cysts	outer layer	sculpt
1. (5-)6-8(-9)	2-layer	(50-)70-90(100)	multiser	pale thin	smo/verr
2. 5-7	(?)	(85-)96(-110)	6-8	?	smo
3. 6-7	? 2-layer	(89-)96(-110)	uniser	?	smo

*RAVENELIA MINEIROSENSIS* Rezende & Dianese sp. nov.

Etymology: after Mineiros, a city of the State of Goiás close to the site where the type was collected.

Holotypus: in foliis vivis *Anadenantherae colubrinae* (Vell.) Brenan var. *colubrinae*; Brazil, Goiás, "Parque Nacional das Emas", in agro gramineo, Mineiros, , 13 April 1997, M. Sanchez 2657, UB Col. Micol. 14369.

Isotypus: in foliis vivis *Anadenantherae colubrinae* (Vell.) Brenan var. *colubrinae*; Parque Nacional das Emas, via flumen Jacuba, Mineiros, GO, 11 IV 1997, Pfenning 102, UB Col. Micol. 14258.

Spermogonia and aecia unknown. Uredinia (33-)55(-95) x (33-)38(-63) mm, hypophyllous, subepidermal, erumpent, cinnamon-brown (Figures 5A,B). Paraphyses 48-52 µm long x 4-6 mm wide, clavate with globose to obovoid tips (16-)18(-20) x (15-)16(-17) mm, mostly peripheral, golden-brown (Figures 5B,C). Urediniospores (17-)23(-28) x (14-)15(-18) mm, ellipsoid to obovoid, strongly echinulate; echinulations conical, 5-7 mm high, with a depressed halo around of the base (Figure 5D); wall 2 mm thick at the sides, 2-3 mm at the spore apex and 1,5-2 mm at the base; germ pores 4-6, scattered, mostly equatorial and subequatorial. Telia (50-)75(-100) x (33-)50(-70) mm, amphigenous, mostly hypophyllous, rusty-brown, paraphysate as uredinia; paraphyses mostly peripheral (Figures 6A,B). Teliospore heads (85-)96(-110) x (86-)91(-110) mm, smooth, 5-7 seven cells across; central cells 4, pentagonal, (17-)18(-20) x (15-)18(-20) mm, with prominent lines around each cell; marginal cells 6-8 rectangular, smooth, (17-)22(-25) mm.; walls 3-4 mm thick (Figures 6C,D). Cysts 6-8, mostly 8, globose, (18-)19(-20) x (17-)18(-20) mm, hygroscopic, pendent (Figure 6E). Pedicels multihyphal, 16 x 6 mm, not persistent.

Several leguminous species belonging in *Piptadenia* Benth. were recombined in *Anadenanthera* Speg. (Lewis, 1987). Thus the *Ravenelia* species previously reported on the *Piptadenia* species were compared with this new species here described because there is no record of a *Ravenelia* species infecting



*Anadenanthera*. According to Sydow & Sydow (1915) the *Ravenelia* spp. found on the *Piptadenia* species are: *R. henningsiana* Diet. on *Piptadenia* sp., *R. simplex* Diet. on *P. stipulacea* (Benth.) Ducke. (= *P. communis* Benth.), and *R. cebil* Speg. on *Anadenanthera colubrina* (Vell.) Brenan var. *cebil* (Gris.) Alts. (= *P. macrocarpa* Benth. var. *cebil* (Gris.) Chad. & Hass). Hennen et al. (1982) listed *R. henningsiana*, *R. simplex*, and *Uredo vilis* (Syd. & P. Syd.) Baxter (= *R. vilis* Syd. & P. Syd.) (Baxter, 1975; Sydow & Sydow, 1916) as the *Ravenelia* species occurring in Brazil.

The new *Ravenelia* species on *Anadenanthera* was compared with other smoothly-teliospored species found on this host genus and also with those four species parasitic on *Piptadenia* spp (*Ravenelia emaensis* sp. nov. on *Anadenanthera* sp.; *R. simplex* on *P. communis*; *R. henningsiana* on *Piptadenia* sp.; *R. cebil* on *P. macrocarpa* and *Uredo vilis* on *Piptadenia* sp.).

*Uredo vitis* with two germ pores [4 equatorial in original description] in its thin-walled urediniospores [1-1.5 to -2 µm at apex] is not the uredinial phase of *R. mineirosensis* sp. nov. which shows thick-walled [2 at sides, 2-3 at apex, 1.5-2 µm at base] spores with 4-6 germ pores. *Ravenelia simplex* clearly differs from *R. mineirosensis* sp. nov. based on size and shape of the teliospores. Neither *R. henningsiana* with epiphyllous paraphysate telia and uredinia, and tuberculate smaller teliospores, nor *R. sydowiana* with paraphysate telia can not be confused with the new species. *Ravenelia chacoensis* reported from Argentina (Lindquist, 1946) shows shorter paraphyses (30mm) and at least seven central cells in the teliospore head, a number much higher than four central cells found in *R. mineirosensis* which forms 52 mm long paraphyses. Finally, *R. cebil* described as another variety of *Anadenanthera colubrina* (= *Piptadenia macrocarpa*) showing 3-5 ovoid cysts and amphigenous uredia is also different from this new fungus which forms 6-8 globoid, cysts and shows only hypophyllous uredinia.

Thus, this discussion leads to the conclusion that the fungus here described belongs to a new species which is designated *R. mineirosensis* sp. nov.

#### 4 - *Ravenelia emaensis* Rezende & Dianese sp. nov. (Figures 7. A-E; 8. A-F)

Holotypus: in foliis vivis *Anadenantherae* sp., Parque Nacional das Emas, via flumen Jacuba, Mineiros, GO, L. Pfenning no. 102, 12 IV 1997, UB Col. Mycol. 14258.

Spermatogonia and aecia unknown. Uredinia (55-)58(-62) x (15-)19(-22) mm, hypophyllous, subepidermal, erumpent, cinnamon-brown, paraphysate; paraphyses orange-rusty, 40-50 mm long, with ovoid or globose tips, up to 7 mm diameter (Figures 7A,B). Urediniospores (22- 27(-30) x (10-)13(-15) mm, obovoid, clavate to piriform, pale brown, with cylindrical echinulations 4-5 mm long, 2-4 germ pores, often three; pores equatorial, unizonate (Figures 7C,D,E). Telia (14-)22(-24) x (12-)17(-24) mm, hypophyllous, sometimes also forming urediniospores, paraphysate (Figures 8A,B,C); paraphyses same as those of the uredinia. Teliospores compound, multicellular, (89-)96(-110) x (82-)88(-110) mm, with perimeter irregular or round, 6-7 cells across, smooth, orange-rusty; central cells 9-12, with hexagonal perimeter, (21-) 23 (-26) x (17-) 19 (-21) mm; marginal cells 18-24, wall 0.5-1,0 mm of thickness at sides and 5-6 mm at the spore top, (18-) 23 (-27) x (-10) 14 (-17) mm, (Figures 8D,E). Cysts 18-24 corresponding on number to the marginal cells, 18x16 mm diam., adherent, non hygrophyllous, hyaline. Pedicels compound, with 4-6 hyphal strings, 30x14 mm, deciduous (Figures 8E,F).

Other specimen examined: on living leaves of *Anadenanthera* sp., km 44 on the road to Mineiros from Parque Nacional das Emas, in the right lane near the sign indicating Emaus, Mineiros, Goiás, 12 IV 1997, Pfenning 122, UB Col. Mycol. 14330.

The *Ravenelia* species which showed a closer relationship with this new species were described in Sydow & Sydow (1915), Cummins (1978) and listed by Hennen et al. (1982). They show smooth teliospore heads or are either parasitic to *Piptadenia* or to the *Anadenanthera* species.

The new species can be easily separated from all related species (*Ravenelia simplex*; *R. henningsiana*; *R. cebil*; *R. sydowiana*; *R. spegazziniana*; *R. chacoensis*; *Uredo vilis* and *R. mineirosensis*) because of the extremely high number of adherent cysts present in its teliospore heads (18 to 24), and due to the formation of uniquely verrugose instead of echinulate urediniospores. The closest species is *R. sydowiana* with 6-19 pendant cysts which also has just 3-5 central cells found in heads (50-85 mm diam.) which, however, are much smaller than those of *R. emaensis* sp. nov. Dimensional and morphological differences also allow to segregate this new species from *R. mineirosensis* sp. nov. which shows only four central cells in the teliospore heads, a number much lower than the 9-12 cells found in *R. emaensis* sp. nov. For these reasons the specimen studied is considered a new *Ravenelia* species, namely *R. emaensis* sp. nov.

**RAVENELIA CENOSTIGMATIS** Berndt & F. Freire, Mycoscience 41: 227. 2000. TYPE on *Cenostigma gardnerianum* Tul., Leguminosae, from **Brazil**, Piauí: São Raimundo Nonato County, Luiziana Farm, 28 Aug 1999, F. Freire-sn. (?!?, **IIp str/III**).

*Ravenelia cenostigmatis* has been reported only from the type.

Spermogonia and aecia unknown. Uredinia not seen, urediniospores scattered in telia, 24-31 x 20-24  $\mu\text{m}$  (27 x 22.2  $\mu\text{m}$  on average), broadly ellipsoid, obovoid or subglobose, reddish brown to light brown; wall 2-2.5  $\mu\text{m}$  thick, apically thickened slightly or up to 5-7(-9)  $\mu\text{m}$ , two-layered, the outer very thin, nearly colorless, with spiral, delicate, very finely notched riges closely spaced ca 2  $\mu\text{m}$  apart; germ pores (2-)3(-4), in the proximal third of the spore. Telia densely scattered on the abaxial side of leaflets, 0.2-0.3 mm in diameter, blackish brown, basket-like, surrounded by a dense border of stout, subacute to obtuse, incurved paraphyses, ca 55-130 x 8-12  $\mu\text{m}$ , walls much thickened apically and dorsally, golden-yellow. Teliospores 60-100  $\mu\text{m}$  across, round to broadly ellipsoid; 3-6 probasidial cells across, one layered, central cells 18-27 x 15-20  $\mu\text{m}$  (Berndt & F. Freire, 2000).

See *Ravenelia cohniana* for a key to help identify species of *Ravenelia* on *Caesalpinia* and *Cenostigma* in the Neotropics.

**RAVENELIA CERRADENSIS** Rezende & Dianese sp. nov. Fitopatol. bras. 26: 628. 2001. Holotypus: in foliis vivis Chamaecristae clauseniorum var. cyclophyllae Irwing & Barneby (= Cassiae clauseniorum var. cyclophyllae); 4.1 km via Chapada dos Guimarães ad Morro São Gerônimo, Parque Nacional Chapada dos Guimarães, Chapada dos Guimarães, MT; M. Sanchez, no 2448; 20 V 1997; UB Col. Mycol. 13781.

Spermogonia and aecia not observed. Uredinia (0,2-)0,3(-0,4) x (0,1-)0,2(-0,3) mm, amphigenous, light brown, paraphysate. Paraphyses hymenial or peripheral, 50 mm long x 4 mm wide, cylindrical with globoid to ovoid tips (18-20 mm diam.) (Figure 1A,B); Urediniospores (20-)24(-29) mm long x (19-)23(-29) mm wide, echinulated, yellowish, with scattered 6-12 germ pores, thick walled; walls (0,8-)1,5(-2,0) mm thick (Figure 1B,C). Telia amphigenous, (0,20-)0,28(-0,38 x (0,13-)0,20(-0,32) mm, subepidermal, erumpent, dark brown, forming rows around small galls, covered by a thin membrane (Figure 2A,B), paraphysate. Paraphyses mostly hymenial similar to uredinial paraphyses (Figure 2D). Teliospores compound, light brown, forming teliospore heads, (60-)66 (80-)x (61-)68(-75) mm, smooth, tending to a subconical shape (Figure 2E); central cells 10, (52-)57(-72) x (45-)52(-70) mm, (Figures 2C,E), 8-10 rusty yellow; marginal cells (20-)31(-40) x (17-)21(-27) mm. Cysts 8-10, hyaline, uniseriate, hydrophylic, globoid to ovoid (15-)21(-25) x (15-)21(-27) mm, pendants. Pedicel persistent, compound, consisting of 4-6 hyphal strands (Figure 2F).

Several *Cassia* sensu lato (s.l.) species are presently accommodated in *Chamaecrista* Moench. and *Senna* Mill. (Lewis, 1987). Thus, when comparing *Ravenelia* species infecting *Chamaecrista* spp. all previous records of the fungus on *Cassia* and *Senna* have to be considered in the discussion.

Sydow & Sydow (1915) described 15 known *Ravenelia* species on *Cassia* s.l. Among them 10 species showed aparaphysate telia. Thus all five remaining paraphysate species [*R. mesillana* Ellis & Barth. (= *R. longiana* Syd. & P. Syd.), *R. spinulosa* Diet. & Holw. var. *papillifera* (Syd. & P. Syd.) Cumm. & J.W. Baxt. (= *R. papillifera* Syd. & P. Syd.), *R. spinulosa* Dietel & Holw., *R. macrocarpa* Syd., and *R. testui* Maubl.] will be discussed because some of the *Cassia* spp. reported as host could now belong in *Chamaecrista*. Among those five species only *R. macrocarpa* which has also been listed in Hennen et al. (1982) shows teliospores which are not superficially papillate or tuberculate as in this new species. However, *R. macrocarpa* shows subcuticular uredinia instead of subepidermal sori. It also shows teliospore heads with a more elliptical surface reaching a length of 140 mm while *R. cerradensis* sp. nov. shows heads which are more globoid (an average of 66 x 68 mm). *Ravenelia spinulosa* v. *papillifera* has papillate marginal cell, *R. mesillana* forms multiseriate cysts, and showed only paraphysate uredinia. Finally in *R. testui* all of the teliospores are unipapillate not smooth as in the new species. Thus, all five species are different from *R. cerradensis* sp. nov.

Furthermore, Hennen et al. (1982) mentioned *R. faceta* H.S. Jacks. & Holw. another species with paraphysate sori on *Cassia* in Brazil. However, this species differs from *R. cerradensis* due to smaller (45-60 mm) tuberculated teliospores.

More recently Hennen & Cummins (1990) described 15 *Ravenelia* species being ten from Brazil. Among those, two were found on *Senna* species (*R. densifera* Henn. & Cumm. and *R. eminens* Henn. & Cumm.) both with aparaphysate telia and producing highly tuberculate teliospores. The other species in Hennen & Cummins (1990) were found on hosts not related to *Cassia* s.l. all of them showing major differences from the new species and thus do not require a comparison with *R. cerradensis* sp. nov. This is

also the case of the following species collected in Brazil: *R. corbuloides* Henn. & Cumm., *R. geminipora* Henn. & Cumm., *R. lata* Henn. & Cumm., *R. pernigra* Henn. & Cumm., *R. septata* Henn. & Cumm., *R. spiralis* Henn. & Cumm., *R. tessellata* Henn. & Cumm., and *R. tortuosa* Henn. & Cumm.

Based on the discussion above it becomes clear that the specimen described belongs to a new *Ravenelia* species, now designated *R. cerradensis* sp. nov.

*Ravenelia chapadensis* Resende & Dianese, see **RAVENELIA ULEANA** Dietel.

- RAVENELIA COHNIANA** P. Hennings, *Hedwigia* 35: 246. 1896. TYPE on *Caesalpinia* sp. from **Brazil**, Rio de Janeiro: Rio de Janeiro, July 1887, *Ule* 703. (??,II/III).  
 = *Ravenelia distans* Arthur & Holway, in Arthur, *Amer. J. Bot.* 5: 424. 1918. TYPE on undetermined Mimosoideae (perhaps *Calliandra* sp.) from **Guatemala**. Retalhuleu, 26 Feb 1916, *Holway* 535.  
 = *Ravenelia concinna* H. Sydow, *Ann. Mycol.* 28: 46-47. 1930. TYPE on *Acacia* sp. (close to *A. polyphylla* DeCandolle, *A. riparis* Humboldt, Bonpland, & Kunth, and *A. glomerosa* Bentham), from **Venezuela**, Caguita, 29 Dec 1927, *H. Sydow* 135.  
 = *Ravenelia lindquistii* Hennen & Cummins, *Rept. Tottori Mycol. Inst.* 28: 7. TYPE on *Acacia praecox* Grisebach, from **Argentina**, Salta: Alemania, 12 Aug 1936, *Cabrera-3753*.

Anamorph

*Uredo imperspicua* Spegazzini *Rev. Arg. Bot.* 1 (2a-3a): 136. 1925. TYPE on *Acacia precox* Griseb. from **Argentina**, Salta: north of Orán, Rio Pescado, Feb 1905, *Spegazzini s.n.*

On Leguminosae:

*Caesalpinia pulcherrima* Swartz, Ceará (IBI-17126.).

*Caesalpinia* sp., Rio de Janeiro (Hennings, 1896: 246), São Paulo (IBI-16539).

*Ravenelia cohniana* has been reported also from Argentina (as *Ravenelia lindquistii* and *Uredo imperspicua*), Venezuela (as *Ravenelia concinna*), and Guatemala (as *Ravenelia distans*).

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves and caulicolous, subepidermal in origin, erumpent, cinnamon-brown, without paraphyses; urediniospores (17-)20-28(-32) x 13-17(-19) µm, variable in shape, mostly ellipsoid or ovoid, commonly pointed apically, wall 1.5-2 µm thick, often thicker in the acuminate apex, finely and rather sparsely echinulate, pale golden brown, pores (3) 4 (5) equatorial. Telia as the uredinia except blackish brown; teliospores (38-)45-70(-78) µm diam, clear chestnut brown with an outer colorless thin layer, (3-)4-5(-6) probasidial cells long, 3-4 cells wide, each cell bearing (2-)3-5(-8) sharp cones 3-5 µm long, 2-3 µm wide at base, central cells 15-20(-24) µm diam, cells in one layer; cysts uniseriate of same number as peripheral cells, globoid, coherent, appressed or semipendent; pedicel colorless, of 2 hyphae in larger spores but 1 in small spores (*vide* Dietel, 1906).

We propose *Ravenelia distans* Arthur & Holway, perhaps on *Calliandra* sp. from Guatemala, *Ravenelia lindquistii* Hennen & Cummins on *Acacia praecox* from Argentina, and *R. concinna* H. Sydow on *Acacia* sp. from Venezuela as synonyms because they have sori subepidermal in origin, urediniospores often with pointed or apiculate apices, (3-)4(-5) equatorial germ pores, and similar spiny teliospores. The sori in *R. concinna* are subepidermal in origin, not subcuticular as originally reported. The somewhat more pointed spines on the teliospores of *R. distans* are not significantly different from the more rounded ones in *R. concinna*. Although identification of the hosts requires confirmation, if host identifications of the collections and our proposed synonymy are correct, then *Ravenelia cohniana* is unusual because it infects hosts in two subfamilies of legumes, the Caesalpinioideae and the Mimosoideae.

#### 4. Key to help identify species of *Ravenelia* on *Caesalpinia* and *Cenostigma* based on teliospores in the Neotropics (add *R. cenostigmatis*; *Cenostigma*; Brazil)

The teliospore walls are smooth. *Ravenelia cenostigmatis* has very similar urediniospores but its teliospores are remarkably different.

In Mexico, *R. striatispora* Cummins & J. W. Baxter has similarly striate urediniospores but with interconnecting ridges and the sori lack paraphyses. It occurs on *Pithecellobium*. *R. corbula* J. W. Baxter on *Caesalpinia*, also in Mexico, has spirally verrucose anamorph spores and a basket-like sorus formed by the peripheral paraphyses but differs in having tuberculate teliospores and urediniospores with equatorial pores.

1. Teliospore probasidial cells smooth throughout

2. Central probasidial cells of teliospores 20-25(-27) µm across

1. *Ravenelia corbuloides*

- (*Caesalpinia*; Brazil).
2. Central probasidial cells (12-)14-17(-18)  $\mu\text{m}$  across
    3. Central probasidial cells (16-)18-22  $\mu\text{m}$  across, spores 80-100  $\mu\text{m}$  across, 5-6 cells across.
      2. *Ravenelia striatispora*  
(host reported as *Pithecellobium*)
    3. Central probasidial cells (12-)14-17(-18)  $\mu\text{m}$  across, spores 60-85  $\mu\text{m}$  across, (4-)5-6(-7) cells across.
      3. *Ravenelia spiralis*  
(*Cenostigma*; Brazil)
  1. Teliospore probasidial cells with at least some sculpture.
    4. Central probasidial cells +/- smooth, peripheral cells with 0-5 bead-like warts
      4. *Ravenelia humphreyana* var. *humphreyana* (*Caesalpinia*)
    4. Teliospores with all or nearly all probasidial cells sculptured
      5. Each peripheral probasidial cell with a mamiform protuberance, other cells inconspicuously warty, cysts multiseriate.
        5. *Ravenelia corbula*  
(*Caesalpinia*, Mexico)
      5. All cells more or less uniformly sculptured, cysts uniseriate.
        6. Each probasidial cell with (2-)4-7(-10) tubercles 4-7  $\mu\text{m}$  long,
          6. *Ravenelia humphreyana*  
var. *inconspicua* (*Caesalpinia*)
        6. Each probasidial cell with 3-8 cones 1-5  $\mu\text{m}$  long.
          7. Each probasidial cell with 5-7 cones 3-5  $\mu\text{m}$  high, 2-3  $\mu\text{m}$  wide at base.
            7. *Ravenelia cohniana*  
(*Caesalpinia*, *Acacia*; Brazil, Venezuela, Guatemala)
          7. Each probasidial cell with 4-8 cones 1-3  $\mu\text{m}$  high
            8. *Ravenelia pileolarioides*  
(*Caesalpinia*; Brazil)

**RAVENELIA COMPTULA** H. Sydow, Ann. Mycol. 37: 312: 1939. TYPE on unidentified Mimosoideae, either *Calliandra* or *Acacia*, from **Ecuador**, Prov. Guayas: Chagon, 31 August 1937, H. Sydow-4 (?/?,II/III).

On Leguminosae

*Acacia* sp. (or ? *Calliandra* sp.), Minas Gerais (IBI- ).

*Ravenelia comptula* has been reported only from the type from Ecuador and two collections from Brazil.

Spermogonia, aecia and uredinia unknown. Urediniospores in telia (19-)20-23(-25) x (9-)10-13(-14)  $\mu\text{m}$ , narrowly ellipsoid or oblong-ellipsoid, wall uniformly 1  $\mu\text{m}$  thick, pale golden, evenly finely echinulate, pores (2) 4 or 5 (6), equatorial. Telia on the abaxial side of leaves, subepidermal in origin, with numerous intermixed urediniospores but without paraphyses, blackish brown, teliospores (50-)55-66(-75)  $\mu\text{m}$  diam., chestnut-brown, overlaid with a thin pale layer, (3) 4-6 probasidial cells across, spores most commonly with 8 peripheral and 6 interior cells each cell bearing 3-8 spines to 8  $\mu\text{m}$  long, often slightly irregularly bent toward the apex, central cells variable 18-25 x (14-)16-19  $\mu\text{m}$ , cells 1-layered, cysts uniseriate of same number as peripheral cells, appressed, with spines as those of the spores, pedicel colorless of 2 or few hyphae, deciduous.

The host plant, a “. . . kraftigen, stark bestachelten Baum. . .”, has very small and numerous leaflets and is more likely to be *Acacia* than *Calliandra* but Sydow comments that the teliospores are reminiscent of the *Ravenelias* on *Calliandra*. He did not mention the spines on the cysts. The sori are subepidermal, not subcuticular as reported by Sydow.

One other specimen has been reported in addition to the type, presumably on a closely related spiny host that also has numerous small leaflets: BRASIL. Minas Gerais: near Monte Belo, 2 June 1988, *Hennen et al.* 88-149, II, III. (?and 90-116).

### 5. Key to help identify species of *Ravenelia* reported on *Calliandra*

1. Uredinia without paraphyses
  2. Urediniospores oblong-ovate, 35-60 x 15-24  $\mu\text{m}$ , wall thickened at apex, germ pores 4,

- equatorial *Ravenelia lagerheimiana* (Ecuador)  
 2. Urediniospores globoid to ellipsoid, 16-20 x 14-16 µm, germ pores 6-8, scattered  
*Ravenelia echinata* (Mexico to Bolivia)
1. Uredinia with paraphyses  
 3. teliospores with papillae  
 4. Each probasidial cell with 6-10 papillae to 3 µm long  
*Ravenelia paszchkeana* (Brazil)  
 4. Each probasidial cell with 2-4 papillae to 9 µm long  
*Ravenelia mexicana* (Mexico)
3. Teliospores smooth  
 5. Teliospores 35-46 µm in diam., with 6 peripheral probasidial cells  
*Ravenelia dieteliana* (Brazil)  
 5. Teliospores 46-58 µm in diam., with 8 marginal probasidial cells  
*Ravenelia affinis* (Brazil)
- To be added: *R. comptula*, *R. distans*, *R. linda*, *R. santos-costae*.

*Ravenelia concina* H. Sydow, see **RAVENELIA COHNIANA** P. Hennings.

**RAVENELIA CORBULOIDES** Hennen & Cummins, Rep. Tottori Mycol. Inst. (Japan)28: 2. 1990.

TYPE on *Caesalpinia bracteosa* Tulasne from **Brazil**, Bahia: hwy. 324, km. W of Feira de Santana, 29 June 1979, J. F. & M. M. Hennen 70-121. (**0/Ipe,IIpe/III**).

On Leguminosae:

*Caesalpinia bracteosa* Tulasne, Bahia (Hennen & Cummins, 1990: 2).

*Caesalpinia pyramidalis* Tulasne, Alagoas, Bahia (Hennen & Cummins, 1990: 2).

*Ravenelia corbuloides* has been reported only from Brazil.

Spermogonia mostly on the adaxial side of leaves, few in a group. Aecia on both sides of leaves, closely associated with spermogonia, subcuticular in origin, becoming erumpent, paraphyses blackish brown, paraphyses and aeciospores as those of uredinia, uredinia mostly on the abaxial side of leaves, subcuticular, in origin, erumpent, dark brown, with abundant, thick-walled pale yellowish, incurved, to 40 µm long, 7-9 µm wide paraphyses, urediniospores (23-)26-30(-36) x (14-)17-20(-22) µm, mostly ellipsoid, the apex rounded or cone-shape, wall 2-3 µm thick at sides, the apex to 7(-8) µm thick, usually with a pale cone-shaped or broadly apiculate cap, adorned with beaded ridges spaced 2-3(-3.5) µm and spirally arranged, pores 3-5, equatorial. Telia on the abaxial side of leaves, subcuticular in origin, erumpent, blackish, without paraphyses when formed *de novo*, teliospores 60-110 µm diam, chestnut-brown, overlaid by a pale, discrete layer, smooth, 4-6 probasidial cells across, cells in one layer, central cells 22-25(-27) µm, cysts uniseriate of same number as peripheral cells, appressed or semipendent, pedicel colorless, multihyphal, semipersistent.

*Ravenelia corbuloides* differs from *Ravenelia pileolarioides* H. Sydow & P. Sydow in having smooth teliospores. The host of *R. pileolarioides* was reported to be *Pithecellobium* sp. but almost certainly is a *Caesalpinia*.

See *Ravenelia cohniana* for a key to help identify species of *Ravenelia* on *Caesalpinia* and *Cenostigma* in the Neotropics.

**RAVENELIA DENTIFERA** Hennen & Cummins, Rept. Tottori Mycol. Inst. (Japan)28: 3. 1990. TYPE on *Senna silvestris* (Velloso) Irwin & Barneby (*Cassia silvestris* Velloso) from **Brazil**, São Paulo, Campinas, Instituto Agronomico 27 Aug 1976, Hennen & Figueiredo 76-316. (**??,IIpe/III**).

Anamorph

*Uredo cassiicola* P. Hennings, Hedwigia 34: 98. 1895. TYPE on *Senna* (*Cassia* sp. aff. *C. silvestris*) from **Brazil**, Minas Gerais, Uberaba, June 1892, *Ule-1903*.

On Leguminosae:

*Senna silvestris* (Velloso) Irwin & Barneby (*Cassia silvestris* Velloso), Goiás, Minas Gerais, São Paulo (Hennen & Cummins, 1990: 3).

*Ravenelia dentifera* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, especially obvious on adaxial side of leaflets, brownish yellow, subcuticular in origin, erumpent, often circinately arranged, without paraphyses, urediniospores (16-)18-20(-22) x (11-)13-15 µm, obovoid or broadly ellipsoid; wall (1.5-)2(-2.5) µm thick, pale yellowish brown, echinulate, pores 4, equatorial. Telia on the adaxial side of leaves,

teliospores (60-)65-95(-106)  $\mu\text{m}$  diam, chestnut brown, with a thin, pale, outer wall layer, peripheral cells and sometimes adjacent cells each with 1 tapered, colorless prong to 13  $\mu\text{m}$  long, other cells smooth, (4) 5-7 (8) probasidial cells across, central cells 16-19(-20) x (13-)15-17(-18)  $\mu\text{m}$ , diam, cells in one layer with intercalary cells and germ slits; cysts uniseriate of same number as peripheral cells, appressed, coherent, colorless, pedicel not seen.

The teliospores of *Ravenelia dentifera* are distinctive because of the prong-like teeth that project from the peripheral probasidial cells. In erumpent sori, a thin, collapsed, membranous peridium occurs closely appressed to the ruptured host cuticle.

**6. Key to help identify *Ravenelia* species on *Cassia sensu lato*, genera: *Cassia*, *Chamaecrista*, and *Senna*, in the Neotropics**

1. Teliospores smooth throughout.
    2. Paraphyses lacking,
      - Urediniospore pores equatorial ***R. microcystis* (*Cassia*) Brazil**
      - Urediniospores scattered ***R. cassiaecola* var. *berkeleyi* (*Cassia*) Mexico**
    2. Paraphyses present
      3. Urediniospore pores scattered or more or less bizonate in longer spores
        4. Central teliospore cells mostly 13-17  $\mu\text{m}$  across ***R. mesillana* (*Senna*) Mexico, sw U. S. A**
        4. Central teliospore cells mostly 18-22  $\mu\text{m}$  across ***R. arthuri* (*Senna*) West Indies, Venezuela**
      3. Urediniospore pores scattered or more or less bizonate, 6-8, wall echinulate but tending to be smooth on proximal 1/3 of spore ***R. macrocarpa* (*Senna*) Argentina, Brazil, Peru**
  1. Teliospores with some or all probasidial cells sculptured
    5. Paraphyses lacking
      6. Urediniospore pores scattered
        7. Urediniospores mostly 20  $\mu\text{m}$  or longer
          8. Central cells of teliospores smooth, outer cells each with 1 tubercle 4-8  $\mu\text{m}$  long ***R. bella* (*Senna*) Mexico**
          8. Teliospore cells merely finely rugose ***R. uleana* (*Chamaecrista*) Brazil**
        7. Urediniospores mostly less than 20  $\mu\text{m}$  long.
          9. Teliospore pedicel deciduous, cells with spines ***R. mirandensis* (*Senna*) Venezuela**
          9. Teliospore pedicel persistent, to 25  $\mu\text{m}$  wide, cells with few beads/warts or smooth ***R. cassiaecola* var. *cassiaecola* (*Chamaecrista*) West Indies, U.S.A.**
      6. Urediniospore pores equatorial, teliospores unadorned except peripheral cells
        10. Peripheral probasidial cells each with rounded tubercle to 7  $\mu\text{m}$  long; urediniospores 12-14  $\mu\text{m}$  long ***R. microspora* (*Senna*) Brazil**
        10. Peripheral probasidial cells each with tooth or prong to 17  $\mu\text{m}$  long; urediniospores 18-20  $\mu\text{m}$  long ***R. fimbriata* (*Senna*) Brazil**
        10. Peripheral probasidial cells and sometimes adjacent cells each with tooth or prong to 13  $\mu\text{m}$  long; urediniospores 18-20  $\mu\text{m}$  long ***R. dentifera* (*Senna*) Brazil**
    5. Paraphyses present, urediniospore pores scattered
      - 11.. Probasidial cells smooth except peripheral cells rarely with 1 papilla ***R. mesillana* (*Senna*) Mexico, SW U.S.A**
      11. Probasidial cells each with 1 tubercle/cone, rarely smooth ***R. spinulosa* (*Senna*) Guatemala, Mexico**
- Ravenelia faceta*, [perhaps on *Cassia excelsa* (Schrader) ?, = *Senna spectabilis*] teliospore pedicels unihyphal, to be transferred to ***Spumula faceta***.

**RAVENELIA DIETELIANA** P. Hennings, Hedwigia 34: 96. 1895. TYPE on *Calliandra macrocephala* Bentham from **Brazil**, Goiás: Formosa, , Sept 1892, *Ule-1935*. (?/?,II/III).  
 = *Ravenelia hassleri* Spegazzini, An. Mus. Buenos Aires 23: 21. 1912. TYPE on *Calliandra macrocephala* Bentham from **Paraguay**, locality and date not recorded, *Hassler s.n.*  
 = *Ravenelia affinis* P. Sydow & H. Sydow. , Monogr. Ured. 3: 256. 1914. TYPE on *Calliandra turbinata* Bentham from **Brazil**, . Mato Grosso: Santa Anna das Chapadas, *G. O. A. Malmé* s. n.

On Leguminosae:

*Calliandra dysantha* Bentham, Federal District (*Franco 29*, ex NY); Goiás (*Irwin et al. 14472*, ex NY), Minas Gerais (*Hatchback 27784*, ex NY).

*Calliandra macrocephala* Bentham (Federal District, *Hunt 5492*, ex NY), Mato Grosso do Sul, *Archer s. n.*), Minas Gerais, *Claussen 820* (?), ex NY).

*Calliandra parviflora* Bentham, Mato Grosso, *Hennen & Lopez-F. 88-595*).

*Calliandra* sp., Minas Gerais (*Emygdio et al. 3586*).

*Ravenelia dieteliana* has been reported also from Paraguay on *Calliandra macrocephala* (Spegazzini, 1912; Lindquist, 1945).

Spermogonia and aecia unknown. Uredinia on both sides of leaves, yellowish brown, subepidermal in origin, erumpent, with abundant clavate of capitate paraphyses, the head to 20 µm wide, nearly solid, golden-brown to chestnut-brown; urediniospores (18-)20-25(-28) x (14-)15-18(-19) µm, variable in shape, obovoid, broadly obovoid or oblong, wall 2 µm thick at sides, 2-3.5 µm at apex and base, pale golden brown apically to nearly colorless basally, echinulate, pores 4 or 5, equatorial. Telia as the uredinia but blackish brown, without paraphyses when developed *de novo*, teliospores (31-)35-48(-54) µm diam, chestnut-brown with a thin but discrete outer pale layer, smooth, typically with 6 peripheral and 2 or 3 inner probasidial cells (or 7-11 peripheral and 4(-5) inner cells in *R. affinis*), (2) 3 or 4 cells wide, central cells mostly 18-22 x 15-18 µm, intercalary cells well developed, cysts uniseriate of same number as peripheral cells, pendent, pedicel of few, perhaps 2 hyphae, deciduous.

Dietel described the teliospores "heads" as "apedicellatis". Spegazzini, using the name *R. hassleri*, described the pedicel as "hyalino, persistente, brevisculo, 30 x 8-10." The only pedicel seen in *R. affinis* apparently was bihyphal.

Lindquist (Bol. Soc. Argentina Bot. 1: 123-125. 1946) first determined that *R. hassleri* is a synonym. Compared to *R. dieteliana*, *R. affinis* has larger *teliospores* with a greater number of probasidial cells. This size difference is not significant for separating it as another species.

*Ravenelia distans* Arthur & Holway, see **RAVENELIA COHNIANA** P. Hennings.

*Ravenelia emaensis* Rezende & Dianese, see **RAVENELIA CEBIL** Spegazzini.

*Ravenelia eminens* Hennen & Cummins, see **RAVENELIA FIMBRIATA** Spegazzini.

**RAVENELIA FACETA** H. S. Jackson & Holway in Jackson, Mycologia 23: 341. 1931. TYPE on *Cassia* sp. [perhaps *Cassia excelsa* (Schrader) ?, = *Senna spectabilis*] from **Brazil**, Rio de Janeiro: Jacarépaguá, 4 Sept 1921. *E. W. D. & M. M. Holway-1091* (?/?,II/III).

*Ravenelia faceta* has been reported only from the type. Because the teliospores are unihyphal the species will be transferred to *Spumula*.

Spermogonia and aecia unknown. Uredinia not seen, urediniospores in the telia 26-29(-31) x 18-22 µm, mostly obovoid, wall near chestnut-brown, 1-1.5 µm thick laterally, the same or slightly thicker apically, rather closely echinulate with low cones, each surrounded at its base with a halo, pores 4, equatorial. Telia on the abaxial side of leaves, subepidermal in origin, erumpent, paraphyses mostly peripheral, numerous, about 6-10 µm wide and to 50 µm long, with 2 or 3 septa, cylindrical, straight or incurved, colorless; teliospores (45-)50-60(-65) µm diam, chestnut-brown, 3 or 4 probasidial cells across, each cell with 6-12, brownish, apically lobed or furcated, cylindrical tubercles to 6 µm long, cells in one layer, central cells (17-)20-24(-28) µm across, cysts pendent, globose, 3-5 but mostly 4, pedicel 10-12 µm wide, unihyphal, colorless.

The apically lobed or furcated appendages on the teliospores and the septate paraphyses help to identify *Ravenelia faceta*. With SEM the halos around the bases of the echinulae on the urediniospores have radiating buttresses.

**RAVENELIA FIMBRIATA** Spegazzini. Bol. Acad. Nac. Cienc. Cordoba 11: 480. 1889. TYPE on *Senna multijuga* (L. C. Richard) Irwin & Barneby (*Cassia multijuga* L. C. Richard), originally reported mistakenly as *Sesbania* sp. from **Brazil**, São Paulo: Apiahy, , "Aut.1888", *Puiggari-2765*. (?/?,II/III).

= *Ravenelia eminens* Hennen & Cummins. Rept. Tottori Mycol. Inst. (Japan) 28: 4. 1990. TYPE on *Senna multijuga* (L. C. Richard) Irwin & Barneby from **Brazil**, Minas Gerais: Sete Lagoas, EMBRAPA center for corn and sorghum research, 20 June, 1979, *J. F. & M. M. Hennen & A. Ferreira 79-79*.

Anamorph

*Uredo fimbriata* Spegazzini, Bol. Acad. Nac. Cienc. Cordoba 11: 481. 1889. TYPE same as for *Ravenelia fimbriata* Spegazzini.

On Leguminosae:

*Senna multijuga* (L. C. Richard) Irwin & Barneby, Federal District (*Irwin et al. 15863ex MICH*), Minas Gerais (IBI-13556); São Paulo (Spegazzini, 1889: 480, 481; IBI-18116).

*Ravenelia fimbriata* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, subcuticular in origin, erumpent; without paraphyses, urediniospores 13-16 x 10-13 µm, ellipsoid, ovoid or obovoid, wall 1.5 µm thick, often slightly thicker at apex and base, yellowish to pale brownish, finely echinulate, pores 4 or 5, equatorial, small, obscure. Telia on both sides of leaves, subcuticular in origin, erumpent, brownish black, without paraphyses; teliospores 65-100 µm diam, chestnut-brown, consisting of 30-60 or more probasidial cells, overlaid with a pale outer layer, (6)7-9 probasidial cells across, each peripheral cell with a brownish, cylindrical, smooth or minutely verrucose tubercle 7-12 or more µm long and 5-8 µm wide, central cells 10-14 µm across, smooth or with a few irregular ridges, cells in one layer; cysts multiseriate, pendent; pedicel multihyphal, colorless, deciduous.

Our recent collections of *Ravenelia fimbriata* in the vicinity of the type location, Apiaí, São Paulo, have made it possible to reidentify the host of the type specimen as indicated above and to determine that *Ravenelia eminens* is a synonym.

The cylindrical tubercles that usually occur only on each peripheral cell of the teliospores aid in identifying this species. A thin, multicellular, membranous peridium occurs on the inner side of the small pieces of host epidermis that surround the erumpent sori. *Ravenelia stuhlmanii* P. Hennings on *Cassia* spp. from Africa has similar but variable tubercles on each cell of the teliospores but otherwise is very similar.

See *Ravenelia dentifera* for a key to the species of *Ravenelia* on *Cassia*. *Chamaecrista*, and *Senna*.

**RAVENELIA GEMINIPORA** Hennen & Cummins, Rept. Tottori Mycol. Inst. (Japan) 28: 4. 1990.

TYPE on *Plathymenia reticulata* Benthham from **BRAZIL**, Minas Gerais: Sete Lagoas, 16 Mar 1984, *J. F. Hennen & M. M. Hennen-84-296*. (0/I,II/III).

On Leguminosae:

*Plathymenia reticulata* Benthham, Bahia, Goiás, Mato Grosso, Minas Gerais, São Paulo (Hennen & Cummins, 1990: 4).

*Ravenelia geminipora* has been reported only from Brazil and only on *Plathymenia* spp.

Spermogonia on the adaxial side of leaves in close groups. Aecia on both sides of leaves or mostly on the abaxial side of leaves, around and opposite the spermogonia, subepidermal in origin, erumpent, brown, with abundant, mostly peripheral apically dark golden or clear chestnut-brown, cylindrical or elongately spatulate paraphyses, the wall to 30 µm thick apically, thin and pale basally, aeciospores pedicellate (24-)28-33(-36) x (20-)22-25(-27) µm and mostly obovoid with pores face-view, much narrower and ellipsoid with pores lateral, wall (2-)3-4.5 thick at sides, 4-7 µm at apex, yellowish or golden brown, strongly echinulate except around pores, pores 4, equatorial, in pairs in the opposite, much flattened sides of the spores. Uredinia on the adaxial side of leaves, similar to aecia except scattered and not associated with spermogonia, urediniospores as the aeciospores. Telia mostly in loose epiphyllous groups, blackish brown, subepidermal in origin, erumpent, teliospores (55-)80-112(-120) µm diam, very dark brown and nearly opaque when mature but with a discrete, much paler, thin, outer wall layer, smooth, (5) 6 or 7 (8) probasidial cells across, central



cells (15-)16-20(-22)  $\mu\text{m}$  across, cells in one layer, cysts uniseriate of same number as peripheral cells, coherent and appressed to the spores, pedicel colorless to pale brownish, multihyphal, deciduous.

The two pairs of twin germ pores in the urediniospores, one pair on each side, are important identifying characteristics and the reason for the epithet for *Ravenelia geminipora*. In young, less pigmented teliospores the outer wall surface beneath the pale outer layer is sinuate striate, not smooth.

**RAVENELIA GOYAZENSIS** P. Hennings, Hedwigia 34: 96-97. 1895. TYPE on *Andira pisonis* Martius, from **Brazil**, Goiás: near Meiponte, Aug 1892, *Ule-2022 (?/?,?/III)*.

*Ravenelia goyazensis* has been reported only from the type. New collections are needed to confirm host identification and to determine if this rust still occurs in Brazil.

Spermogonia, aecia and uredinia unknown. Telia mostly on the abaxial side of leaves, subcuticular in origin, erumpent, blackish brown, without paraphyses, teliospores 70-86(-90)  $\mu\text{m}$  diam, chestnut-brown with a very thin, pale outer wall layer, (3)4 or 5 probasidial cells across, each cell bearing 1-4 cylindrical papillae 4-6  $\mu\text{m}$  long, central cells large, (20-)23-28(-33) x 22-25  $\mu\text{m}$ , cells in one layer cysts uniseriate, of same number as peripheral cells, apparently appressed and coherent, pedicel multihyphal, deciduous.

There is no subsequent record of this species which has teliospore heads with unusually large central cells. Although only telia are known it is improbable that the species is microcyclic. The identification of the host requires confirmation.

*Ravenelia hasseleri* Spegazzini, see **RAVENELIA DIETELIANA** P. Hennings.

**RAVENELIA HENNINGSIANA** Dietel, Beih. Bot. Centralbl. 20: 388. 1906. TYPE on *Piptadenia* sp. from **Brazil**, Rio de Janeiro: Tijuca, 26 May 1899, *Ule-s n. (?/?,II/III)*.

On Leguminosae:

*Piptadenia* sp. Rio de Janeiro (Dietel, 1906: 388; Jackson, 1931: 334).

Spermogonia and aecia unknown. Uredinia on the adaxial side of leaves, subepidermal in origin erumpent by a break in the elevated epidermis, brown, without paraphyses, urediniospores (22-)24-29(-33) x (14-)16-19(-20)  $\mu\text{m}$ , variable, oblong-ellipsoid, obovoid, or broadly ellipsoid, wall 1.5-2  $\mu\text{m}$  thick, or to 3  $\mu\text{m}$  at apex, echinulate, cinnamon-brown, pores 4, equatorial, obvious. Telia as the uredinia, but blackish brown, teliospores 63-100  $\mu\text{m}$  diam, 4-6 probasidial cells across, cells 1-layered, intercalary cells well developed, central cells variable but mostly 22-29(-31) x 15-20  $\mu\text{m}$ , chestnut-brown overlaid with a thin but discrete pale layer bearing warts about 3  $\mu\text{m}$  high and wide on the peripheral cells but the interior cells smooth, cysts pendent, free, more or less globoid, multiseriate, pedicel multihyphal, colorless, fragile and deciduous.

Other specimens examined: on *Piptadenia* sp. **BRAZIL**: Rio de Janeiro, 23 Aug, 11 Sept 1921, Holway-1066, -1101. The Holway collections agree in all respects with the holotype.

**RAVENELIA HIERONYMI** Spegazzini, Anal. Soc. Cient. Argentinensis 12: 67. 1881. TYPE on *Acacia caven* (Molina) Molina, from **Argentina**, Córdoba: Sierra Chica, San José, 11 Jan 1877, *Hierononymus s. n. (0/Icv,-/III)* or *?(0/Icv,IIcv/III)*.

≡ *Pleoravenelia hieronymi* (Spegazzini) Long, Bot. Gaz. (Crawfordsville) 37: 127. 1903.

≡ *Cystingophora hieronymii* (Spegazzini) Arthur, N. Amer. Flora 7: 131. 1907.

= *Ravenelia mimosae* P. Hennings, Hedwigia 34: 95. 1895. TYPE on *Mimosa* sp. from **Brazil**, Goiás, Paranahyba, July 1892, *E. Ule-1942*.

= *Ravenelia acaciae-farnesiana* P. Hennings, Hedwigia 34: 321. 1895. An unnecessary *nom. nov.* for *Ravenelia mimosae* P. Hennings.

= *Ravenelia deformans* (Maublanc) Dietel, Biehefte Botan. Centralblatt 20: 404. 1906.

[≡ *Pleoravenelia deformans* Maublanc, Bull. Soc. Mycol. France 22: 73. 1906. TYPE on *Acacia* sp. (? *A. arabica*), **Mozambique**, Mhalume, 11 Oct 1904, *LeTestu-7616*].

Anamorph

*Aecidium heironymi* Spegazzini, An. Soc. Cient. Argentinensis 12: 78. 1881. TYPE on *Acacia caven* (Molina) Molina from **Argentina**, Córdoba: Sierra Chica, near San José, Jan 1877, *Hierononymus s. n.*

? = *Uredo hieronymi* Spegazzini, Anal. mus. Nac. Buenos Aires 23: 30. 1912. TYPE on *Acacia caven* (Molina) Molina, Catamarca, **Argentina**, Nov 1909, LPS. [Not *Uredo hieronymi* Spegazzini, An. Soc. Cient. Argentinensis 12: 73. 1881. TYPE

on *Acacia caven* (Molina) Molina Uredinial stage of *Ravenelia australis* Dietel & Neger fide Lindquist, 1954].

On Leguminosae:

*Acacia caven* (Molina) Molina, Rio Grande do Sul, (Lindquist & Costa Neto, 1963: 125).

*Acacia farnesiana* Willdenow, Goiás (Hennings, 1895A: 95; 1895B: 321; PUR-F2077), Bahia (Hennings, 1908: 267), Paraíba (Viégas, 1945: 53; IAC-2664), São Paulo (IAC-8002).

*Ravenelia hieronymi* has been reported also from Argentina, Chile, and Uruguay. The reports of *Ravenelia hieronymi* from North American are probably all *Spumula heteromorpha* (Cummins, 1978). If our placement of *Ravenelia deformans* on *Acacia* from Mozambique as a synonym is correct, Southern Africa is added to the range of *R. hieronymi*.

Spermogonia, when present, aecia, and telia produced in great abundance from systemic infections in witches' brooms. Spermogonia subcuticular, irregularly hemisphaeroid or cushion-shaped, 30-40 x 70-130  $\mu\text{m}$ , cinnamon-brown at first, becoming dark in age, hymenium flat. Aecia with long cylindrical peridia, aeciospores catenulate, (18-)20-26(-28) x (13-)15-20  $\mu\text{m}$ , variable in size and shape, often angular, mostly broadly ellipsoid or oblong-ellipsoid, pale yellowish or pale golden in mass, wall 2-3  $\mu\text{m}$  thick, densely and finely verruculose, pores 7-10, scattered, relatively obscure. Uredinia, if produced, as the aecia. Telia scattered among the aecia, or uredinia, subepidermal in origin, erumpent, or following in the old aecia or uredinia, blackish brown, teliospores (65-)75-120(-140)  $\mu\text{m}$  diam, clear chestnut-brown or dark golden brown, smooth, with an outer, pale, discrete layer, variable in shape, flat or often folded so the under side is concave and the upper side is strongly convex thus appearing to be thick centrally, 5-9(-12) probasidial cells across but the number difficult to determine, especially in the "folded" teliospores, peripheral part of teliospores commonly 1-layered, inner part of spores 2-layered, central cells variable, (18-)21-25(-27) x (14-)16-22  $\mu\text{m}$ , germ slits one in each cell to one side in the distal cell wall, cysts apparently uniseriate, of same number as peripheral cells, appressed to underside of teliospore, coherent, but often swelling to appear pendent, pedicel multihyphal, colorless, usually deciduous.

The only sori known for *Ravenelia hieronymi* are those produced on the systemic infections in witches' brooms. Presumably all of these systemic infections are a result of infections produced by basidiospores. Teliospores were seen germinating and producing basidiospores in one Brazilian collection (Pitta-76-310). The germination of the *Aecidium* anamorph spores has not been observed and sori presumably derived from infections made by the *Aecidium* spores are unknown. Spermogonia have been seen only in the specimens listed above from Brazil. Thus, the role of the *Aecidium* spores in the life cycle is only speculative. Presumably they could be either aeciospores, urediniospores, or teliospores, or even a combination of these depending on environmental conditions.

Theoretical possibilities of the role of the *Aecidium* spores are as follows: 1. they could be aeciospores but non functional. 2. they could be aeciospores and produce systemic infections more or less identical to infections induced by basidiospores but without spermogonia. In this case the *Aecidium* spores from the latter infections would be urediniospores and could repeat the systemic sort of infections but without spermogonia. 3. they could be *Endophyllum* teliospores in which case the life cycle would have two kinds of telia, *Endophyllum* telia and *Ravenelia* telia, as occurs in *Puccinia pampeana*. In this case, the production of spermogonia would be variable. 4. they could be variable in the way they germinate depending, perhaps, on temperature or other environmental factors. Spore germination and inoculation experiments are required to resolve this problem.

Although *Ravenelia hieronymi* lacks pedicellate anamorph spores as occurs in *Ravenelia subtortuosae* reported from Texas (0/Icv, IIpe/III), and *R. australis* reported from Argentina, Chile, and Mexico (-/Icv, IIpe/III), these three species seem to be closely related as evidenced by their using species of *Acacia* as hosts, systemic spermogonial and *Aecidium* infections on witches' brooms, and the two cell layers in the teliospores. The peridium in the *Aecidium* sori of *Ravenelia australis* is often poorly developed. The oblique distal cell walls of the lower level probasidial cells raise one side of the cell almost to the distal surface of the spore. A germ slit occurs in this region next to a similar germ slit in an upper level cell. These paired germ slits can be seen when the top of the spore is viewed.

We place *R. deformans* (Maublanc) Dietel from South Africa as a synonym because it is morphologically identical. Thus, *R. hieronymi* is one of the few species of *Ravenelia* that occurs in both the Old and New World. A closely related long cycle species in South Africa is *R. macowaniana* Pazschke. It is a long cycle species that produces spermogonia and *Aecidium*-type aecia on witches' brooms and *Uredo*-type uredinia and telia on leaflets of *Acacia* sp.

**RAVENELIA IDONEA** H. S. Jackson & Holway in Jackson, Mycologia 23: 335. 1931. TYPE on *Acacia riparia* Bentham from **Brazil**, São Paulo: Santa Anna, 25 May 1922, *Holway-1879*. (??,II/III).

On Leguminosae:

*Acacia cavenia* Bertoloni, Mato Grosso (Joerstad, 1959: 74).

*Acacia riparia* Bentham or ?Humboldt, Bonpland & Kunth, Rio de Janeiro (Jackson, 1931: 335 *Holway 1112*, II.; São Paulo, Jackson, 1931: 335).

*Acacia* sp., Rio de Janeiro (Jackson, 1931: 335, *Holway 1055*; ii III, *Holway 1028*, II III, (*Reliq. Holw.* No. 268); Santa Catarina (IBI-12960).

*Mimosa seiparia* Bentham, Rio de Janeiro (Jackson, 1931: 335).

*Ravenelia idonea* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia mostly on the adaxial side of leaves, subcuticular in origin, erumpent, cinnamon-brown, paraphyses peripheral, colorless, mostly cylindrical, thin-walled or slightly apically thickened, urediniospores mostly broadly obovoid or broadly ellipsoid, sometimes obovate-sphaeroid, often flattened on the two sides with pores, wall uniformly 1.5  $\mu\text{m}$  thick, dark cinnamon- or nearly chestnut-brown, echinulate, but  $\pm$  smooth around the pores, pores 4, 2 on each flattened side, irregularly equatorial. Telia as the uredinia except blackish brown, teliospores (45-)55-75(-77)  $\mu\text{m}$  diam, chestnut-brown, smooth, 4-6 probasidial cells across, central cells (18-)19-22 x 16-18(-21)  $\mu\text{m}$ , cells in one layer, cysts uniseriate, of same number as peripheral cells, globose, pendent, pedicel colorless, multihyphal, deciduous.

The four equatorial germ pores of the urediniospores, two on one side and two on the other, each pair surrounded by a smooth area, are useful for identifying the species. The host originally identified as *Mimosa* appears more probably to be an *Acacia*.

**RAVENELIA INDIGOFERAE** Tranzschel in Dietel, Hedwigia 33: 369. 1894. TYPE on *Indigofera palmeri* Watson, from **Mexico**, Jalisco: Rocky hills near Guadalajara, *Pringle s. n.* (0/Ipe,IIpe/III).

$\equiv$  *Pleoravenelia indigoferae* (Tranzschel) Long, Bot. Gaz. (Crawfordsville) 35: 129. 1903.

= *Ravenelia schroeteriana* P. Hennings, Hedwigia 35: 245. 1896. Type on *Indigofera* sp. from **ARGENTINA**, Salta: between Salta and Campo Santo, April 1873, *Lorentz & Hieronymus s. n.*

= *Ravenelia antiguana* Cummins, Bull. Torrey Bot. Club 67: 608-609. 1940. TYPE on *Indigofera* sp., originally reported mistakenly as "*Cassia biflora* Linnaeus", from **GUATEMALA**. Dept. Sacatepeteguez: near Antigua, Nov 1938 - Feb 1939, *Standley-63356*.

Anamorph

*Uredo anilis* P. Hennings, Hedwigia Beiblatt 38: (68). 1899. Type on *Indigofera* sp. from **Brazil**, Santa Catarina: São Francisco, May 1884, *Ule-145*.

On Leguminosae:

*Indigofera suffruticosa* Miller (= *Indigofera anil* Linnaeus), Minas Gerais (Jackson, 1931: 350; Thurston, 1940: 304; IBI-13185), Rio de Janeiro (Jackson, 1931: 350), Santa Catarina (Hennings, 1899: 68), São Paulo (Viégas, 1945: 53, IAC-3181; IBI-12024).

*Ravenelia indigoferae* has been reported from Argentina northward to southern Arizona, The West Indies, Bermuda, and from Africa and Asia.

Spermogonia few in a group, on both sides of leaves, subcuticular, type 7. Aecia mostly on the abaxial side of leaves and on rachis, usually grouped in a circle around the spermogonia, otherwise as the uredinia. Uredinia on both sides of leaves or mostly on the abaxial side of leaves, subepidermal in origin, erumpent, yellowish brown, with numerous, mostly capitate paraphyses, 15-30  $\mu\text{m}$  diam apically, wall mostly 2-3  $\mu\text{m}$  thick, brown apically, colorless and thinner below; urediniospores (21-)23-25(-27) x (18-)20-22(-24)  $\mu\text{m}$ , mostly broadly ellipsoid, wall (1-)1.5(-2)  $\mu\text{m}$  thick, golden or pale cinnamon-brown, echinulate, pores 9-12, scattered. Telia mostly on the abaxial side of leaves, but may be on rachis and stem, subepidermal in origin, erumpent, blackish, teliospores (65-)85-120(-135)  $\mu\text{m}$  diam, chestnut-brown, without a thin paler outer layer, (3)4-7(8) probasidial cells across, each cell with (0)3-7(-10) cylindrical tubercles 3-7  $\mu\text{m}$  long, central cells (18-)20-27(-29; -32)  $\mu\text{m}$  across, central cells 2-layered; cysts uniseriate of same number as peripheral cells, appressed to teliospore, pedicel multihyphal, colorless, deciduous.

*Ravenelia ingae* (P. Hennings) Arthur see **YPSILOSPORA TUCMENSIS** J. Hernández & J. F. Hennen.

*Ravenelia irregularis* H. S. Jackson & Holway, see **RAVENELIA RIOENSIS** Hennen & Cummins.

*Ravenelia juruensis* H. Sydow & P. Sydow, see *Uredo juruensis* (H. Sydow & P. Sydow) J. W. Baxter.  
Not *Uredo juruensis* P. Hennings, 1904.

**RAVENELIA LATA** Hennen & Cummins, Rept. Tottori Mycol. Institute 28: 6. 1990. Holotype: on *Acacia glomerosa* Bentham?, from **Brazil**, Minas Gerais: Sete Lagoas, EMBRAPA center for corn and sorghum research, 20 June 1979, *J. F. & M. M. Hennen & Ferreira*, 79-79, II III (PUR, IBI-13557).

*Ravenelia lata* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on adaxial side of leaflets, subepidermal in origin, erumpent, brown, paraphyses peripheral, capitate, dark chestnut-brown, to 24 µm wide, wall in apex to 10 µm thick, thin and pale below; urediniospores (22-)25-32(-36) x (12-)14-17(-18) µm, mostly elongately obovoid, wall 1.5-2 µm thick at sides, 2.5-4 µm at apex, finely echinulate, golden-brown to cinnamon-brown, pores (4)5 or 6, equatorial. Telia as the uredinia but blackish brown, without paraphyses when formed de novo, teliospores 53-64 µm wide, dark chestnut-brown, covered by a thin but discrete, pale outer layer, mostly 4 probasidial cells across, typically with 4 central and 6 peripheral cells, each cell with 6-20 conical spines, central cells (18-)22-26 µm across, cells 1-layered, cysts uniseriate, of same number (6) as peripheral cells, pendent, globoid, pedicel usually persistent, of few coarse hyphae.

Other specimens. On *Acacia glomerosa* Bentham, BRAZIL. state of Bahia: 20 km. W of Victoria, 9 Mar 1984, *J. F. & M. M. Hennen* 84-229, II (IBI-15299); state of Minas Gerais: Corn and Sorghum Research Center, Sete Lagoas, 20 June 1979, *J. F. & M. M. Hennen & A. Ferreira* 79-80, III (ibi-13558); Itau de Minas, *J. F. & M. M. Hennen & Y. Ono* 88-224, II III (IBI-16333).

The conically spined teliospores of *R. lata*, usually composed of four inner and six outer probasidial cells with six uniseriate cysts, are almost identical in structure to those of *R. lagerheimiana* Dietel and *R. pазschkeana* Dietel, both of which reportedly infect *Calliandra* spp.

Although we describe the sori as subepidermal in origin, telial sori probably begin development intraepidermally (i.e. intracellular) on the inner surface of proximal epidermal cell walls. Abundant intracellular hyphae occur next to and close to the sori. Many of these hyphae have a characteristic form similar to, but much smaller than, those of *R. geminipora*.

The sori usually emerge through an opening made by a circular crack in the epidermis, which remains attached in one place as a hinge-like structure.

After the sori become erumpent, a thin membranous, cellular, peridium-like structure occurs closely adherent to the pieces of the ruptured host epidermis. This kind of structure occurs in nearly all species of *Ravenelia*, either adherent to the cuticle or epidermis.

*Ravenelia leucene-microphyllae* Dietel, see **RAVENELIA LYSILOMAE** Arthur.

*Ravenelia lindquistii* Hennen & Cummins, see **RAVENELIA COHNIANA** P. Hennings.

**RAVENELIA LONCHOCARPI** Lagerheim & Dietel in Dietel, Hedwigia 33: 67. 1894. TYPE on *Lonchocarpus campestris* Martius from **Brazil**, Minas Gerais: date and locality not given, *Regnell s. n.* (S). (**0/Ipe,IIpe/III**).

On Leguminosae:

*Derris floribunda* (Bentham) Ducke, Amapá (IBI-16591).

*Derris* sp., São Paulo (IBI-16655).

*Lonchocarpus campestris* Martius ex Bentham, Minas Gerais (Dietel: 1894A: 67); Maranhão, (Rezende et al. (200?).

*Lonchocarpus latifolius* Humboldt, Bonpland & Kunth, Brasil (Silveira, 1951: 34).

*Lonchocarpus nitidus* (Vogel) Bentham, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 125).

*Lonchocarpus* sp. São Paulo (Jackson, 1931: 150; these are Holway collections with tuberculate teliospores; IBI-12105).

*Ravenelia lonchocarpi* has been reported only from Brazil with certainty. There is one very doubtful report from Ecuador. Reports of *R. lonchocarpi* from Cuba, Santo Domingo, and Central America are based on misidentifications of *Sorataea nephroidea*.

Spermogonia on both sides of leaves, mostly on the adaxial side of leaves, subcuticular, type 7. Aecia on both sides of leaves, around the spermogonia, deep-seated below the palisade when on the adaxial side of leaves, strongly pustular, about cinnamon-brown, with abundant peripheral and innixed, yellowish paraphyses and brown pedicellate spores as in the uredinia. Uredinia on the abaxial side of leaves, cinnamon-brown, subepidermal in origin, erumpent, somewhat basket-like with abundant, pale brownish, falcate paraphyses with a thick dorsal and thin ventral wall, united basally and mostly 1-septate above, urediniospores radially asymmetrical, reniform in one view, obovoid when rolled 90°, (22-)24-28(-30) x 11-22 µm, 11-18 µm wide in the reniform aspect, dark-cinnamon brown, wall 1.5 µm thick, echinulate but smooth on the invaginated side around the pores, pores 2, subequatorial. Telia on the abaxial side of leaves, subepidermal in origin, erumpent, blackish-brown, usually with paraphyses as the uredinia, teliospores (35-)45-75(-88) µm wide, dark chestnut-brown, more or less opaque with no discrete outer wall layer, commonly 4 or 3-5(-6) probasidial cells across, each cell with (5-) 6-8(-10) columnar or conical projections 3-4(-5) µm long, (?or with numerous irregular tubercles, see below), cells in one layer, the central cells (14-)15-19 µm wide, intercalary cells not seen between the probasidial cells and the cysts, cysts uniseriate, of same number as peripheral cells, coherent, smooth (?or with irregular tubercles, see below), pedicel multihyphal, deciduous.

Rezende et al (2002) reported, among others, the following measurements which seem not to be significantly different from those above.

Uredinia-(98-)102(-108) x (69-)81(-98) µm; Peripheral paraphyses-(35-)80(-100) x (-5)7(-8) µm; Urediniospores-(24-)30(-32) x (-16)18(-20) µm, reniform, (-obovoid to piriform); Teliospores-(50-)75(-92) x (32-) x 60(-72) µm, 6 cells across, each cell with 6-10 columnar or conical projections 2-7 µm long.

Jackson (1931) reported two Holway collections from São Paulo identified as *R. lonchocarpi*. Their teliospores and teliospore cysts are conspicuously tuberculate. Other collections of *R. lonchocarpi* have teliospores with (5-) 6-8(-10) columnar or conical projections 3-4(-5,-7) µm long on each probasidial cells and smooth teliospore cysts. Costa Netos' collection from Rio Grande do Sul differs also in having more conspicuously erumpent sori with protective, longer paraphyses, 45-60 µm vs. 25-40 µm long.

*Sorataea nephroidea* (Sydow) Eboh & Cummins has almost identical reniform urediniospores. Paraphyses of *Sorataea nephroidea* are relatively thin-walled, rounded apically and usually septate, those of *Ravenelia lonchocarpi* are relatively thick-walled, pointed at the tip and less frequently septate. Because of this similarity, reports of *Ravenelia lonchocarpi* from Cuba, Santo Domingo, and Central America are based on misidentifications of *Sorataea nephroidea*. (Kern, 1928).

See *Ravenelia bakeriana* for a key to species of *Ravenelia* on *Lonchocarpus* and *Derris*.

**? RAVENELIA LYSILOMAE** Arthur var. **LYSILOMAE**, Bot. Gaz. (Crawfordsville) 39: 392. 1905.

TYPE on *Lysiloma tergemina* Benthham from **Mexico**, Guerrero: Igualla, 3 Nov 1903, *Holway* 5317. **(0/Ipe,IIpe/III)**.

= *Ravenelia leucaenae-microphyllae* Dietel, Bot. Centralbl. (Beih.) 20: 375. 1906. TYPE on ? *Acacia* sp. from **Mexico**, Guerrero: Igualla, 3 Nov. 1903, *Holway* 5314.

≡ *Dendroecia lysilomae* (Arthur) Arthur, Res. Sci. Congr. Bot. Vienne p. 340, 1906.

*Ravenelia lysilomae* var. *lysilomae* has been reported with certainty only on *Acacia* and *Lysiloma* from Guatemala and Mexico. The report by Jackson (1931: 337) from Brazil of *R. leucaenae-microphyllae*, which is a species from Mexico and a synonym of *R. lysilomiae*, needs to be confirmed. His report was based on a specimen collected by Holway on *Acacia* sp. from Gavea, Rio de Janeiro, Brazil, Sept. 8, 1921, *Holway-1100*.

Spermogonia in small groups on adaxial side of leaflets, subcuticular, type 7. Aecia similar to uredinia. Uredinia mostly on the abaxial side of leaves, subepidermal in origin, erumpent, brownish, paraphyses clavate or capitate, yellowish or golden, to about 15 µm diam apically, the apical wall 4-6 µm thick, urediniospores (24-)27-33(-37) x (11-)13-17(-19) µm, mostly elongately ellipsoid or oblong-ellipsoid, wall 1.5 µm thick at sides, 2-2.5 µm at apex, cinnamon-brown, usually paler below, finely and rather remotely echinulate, pores 4 or 5 (6) in an almost colorless equatorial band, large but difficult to count. Telia on both sides of leaves, often with thin-walled, saccate paraphyses, otherwise as the uredinia except blackish brown, teliospores (75-)88-110(-125) µm diam, smooth, chestnut-brown with a paler outer but scarcely discrete layer over the spore, (6) 7-9 probasidial cells across, cells in one in one layer, outer cells laterally compressed and

partly subtending spore, central cells (9-)12-19(-21)  $\mu\text{m}$  across, cysts uniseriate, of same number as peripheral cells, appressed to underside of spore, pedicel multihyphal, colorless, deciduous.

**RAVENELIA MACROCARPA** H. Sydow & P. Sydow, Ann. Mycol. 1: 329. 1903. Holotype: on *Cassia bicapsularis* Linnaeus, now probably *Senna pendula* (Willdenow) Irwin & Barneby, from **Brazil**. No locality or date given, collector Sello (**0/Ipe,IIpe/III**).  
 = *Haploravenelia macrocarpa* (H. Sydow & P. Sydow) H. Sydow, Ann. Mycol. 19: 165. 1921.

Anamorph

*Uredo cyclogena* Spegazzini, An. Soc. Cient. Argentina 9:172. 1880. TYPE on *Senna corymbosa* (Lamarck) Irwin & Barneby (*Cassia corymbosa* Lamarck) from **Argentina**, Buenos Aires: Boca del Riachuelo, Feb 1880, *Spegazzini-s.n.*.

On Leguminosae:

*Senna floribunda* Cavanilles, Santa Catarina (ex NY).

*Senna neglecta* (Vogel) Irwin & Barneby, Santa Catarina (ex NY)

*Senna pendula* (Willdenow) Irwin & Barneby (*Cassia bicapsularis* Linnaeus, *Cassia coluteoides* DeCandolle ex Colladon), Rio de Janeiro (Jackson, 1931: 343), São Paulo (*Holway 1875*).

*Senna* sp. (*Cassia laevigata* Willdenow), Rio de Janeiro (*Holway 14490*).

*Senna* sp. (*Cassia* sp.), São Paulo (IBI-14552, -18578); Brasil (Hennings, 1896: 252, as *Uredo cyclogena*).

*Ravenelia macrocarpa* has been reported also from Argentina, and Peru.

Spermogonia and aecia on *Ferreyra 7271* from Peru. Uredinia (*Uredo cyclogena* Spegazzini) on both sides of leaves, mostly on abaxial side, often in circles on pale chlorotic spots, subcuticular in origin, erumpent, pale cinnamon-brown, paraphyses 50-60  $\mu\text{m}$  long, 3.5-5  $\mu\text{m}$  wide stalk, 8-12  $\mu\text{m}$  wide head, few, clavate capitate, wall very thick in stipe, thinner in head, colorless; urediniospores (20-)22-28(-30) x (16-)18-20(-22)  $\mu\text{m}$ , mostly obovoid or broadly ellipsoid, wall 2.5-3(-3.5)  $\mu\text{m}$  thick, pale cinnamon-brown or golden-brown, echinulate but mostly less so to nearly smooth on proximal 1/3 of spore, spines (1-)1.5-2  $\mu\text{m}$  apart, pores 6-8(-9) mostly 8, scattered or tending to be bizonate in a wide equatorial area. Telia on both sides of leaves, subcuticular in origin, erumpent, blackish brown; teliospores (80-)93-120(-145)  $\mu\text{m}$  diam, dark chestnut-brown, smooth, with no discrete outer wall layer, (6)7-10(-11) probasidial cells across, central cells (13-)17-18(-20) x (12-)13-17  $\mu\text{m}$ , variable both in size and shape, cells in one layer; cysts multiseriate, numerous, globoid, pendent; pedicel multihyphal, fragile, deciduous (Hernández & Hennen, 2002: ).

For comparison, we include a description of *Ravenelia mesillana*, which occurs in Mexico and the SW United State of America, and is almost identical to *Ravenelia macrocarpa*.

***Ravenelia mesillana*** Ellis & Bartholomew in Ellis & Everhart, Bull. Torrey Bot. Club 25: 508. 1898.

Holotype: on *Senna bauhinioides* A. Gray (*Cassia bauhinioides* A. Gray), near Mesilla, **New Mexico**, Oct 1897, *Wootton s. n.* (NY: isotype PUR 6307). (**0/Ipe,IIpe/III**).

= *Ravenelia longiana* H. Sydow & P. Sydow, Hedwigia 40 (Beibl.): 128. 1901. Holotype on *Senna roemeriana* (Scheele) Irwin & Barneby (*Cassia roemeriana* Scheele), Austin, **Texas**, 24 Aug 1901, *W. H. Long Jr.* (isotypes, Sydow, *Uredineen 1736*).

= *Ravenelia cassiae-covesii* Long & Goodding in Long, Bot. Gaz. 72: 42. 1921. Holotype on *Senna covesii* (A. Gray) Irwin & Barneby (*Cassia covesii* A. Gray), Sabino canyon, (NY, isotype PUR). Catalina Mts., **Arizona**, 11 Mar 1920, *Gooding and Thurston 79*.

= *Haploravenelia mesillana* (Ellis & Bartholomew) H. Sydow, Ann. Mycol. 19: 165. 1921.

Spermogonia amphigenous especially along veins and on petioles and stems, subcuticular in origin, type 7. Aecia often extensively confluent around spermogonia, subcuticular in origin, brown, aeciospores and paraphyses as in uredinia. Uredinia amphigenous, subcuticular in origin, cinnamon-brown, paraphyses variable in number, cylindrical or capitate, the capitate ones with solid stipe and thin-walled head, the cylindrical ones usually uniformly thin-walled, urediniospores (19-)22-26(-29) x (15-)17-19(-21)  $\mu\text{m}$ , mostly broadly ellipsoid or oblong-ellipsoid, wall (2-)2.5-3  $\mu\text{m}$  thick, cinnamon-brown or dark golden brown, echinulate, pores (6) 7-10, irregularly bizonate or scattered. Telia as the uredinia except blackish brown, teliospores (60-)80-115(-150)  $\mu\text{m}$  diam, chestnut-brown, overlaid with a thin but discrete, nearly colorless layer, smooth or rarely a few peripheral cells with 1 papilla, (5) 6-9 (10) probasidial cells across, central cells (11-)13-17(-19)  $\mu\text{m}$  across, cells in one layer, cysts multiseriate, pendent, pedicel multihyphal, colorless, deciduous.

*Ravenelia mesillana* has been reported on *Cassia bauhinioides* Gray from U.S.A.: Texas; on *C. covesii* Gray from MEXICO, U.S.A.: Arizona; on *C. durangensis* Rose from U.S.A.: Texas; on *C. roemeriana* Scheele from U.S.A.: New Mexico. This species is common in southern Arizona and Texas; it also occurs southward to central Sonora but is not yet recorded in Neotropica.

See *Ravenelia dentifera* for a key to the species of *Ravenelia* on *Cassia*, *Chamaecrista*, and *Senna*.

**RAVENELIA MICROCYSTIS** Pазschke in Rabenhorst-Winter-Pазschke. *Fungi europaei* No. 3922, 1893, in Dietel, Hedwigia 33: 62. 1894. TYPE on *Cassia* sp. from **Brazil**, Santa Catarina: Blumenau, Dec 1886, *Ule s. n.* (**0/I,II/III**).  
= *Haploraavenelia microcystis* (Pазschke) H. Sydow, Ann. Mycol. 19: 165. 1921.

On Leguminosae:

*Cassia* sp., Rio de Janeiro (*Ule-1350*), Santa Catarina (Dietel, 1894A: 62, *Ule 10090*; Hennings, 1896: 246), Rio de Janeiro (*Ule s. n.*).

*Ravenelia microcystis* has been reported only from Brazil.

Spermogonia on the adaxial side of leaves in small groups. Aecia on the adaxial side of leaves, subcuticular in origin, without paraphyses, arranged concentrically around the spermogonia, yellowish brown, aeciospores pedicellate, (17-)18-22(-24) x (9-)10-12(-13)  $\mu\text{m}$ , ellipsoid or oblong-ellipsoid, wall 1.5  $\mu\text{m}$  thick at sides, 2-2.5(-3)  $\mu\text{m}$  at apex, yellowish to pale golden brown, echinulate, pores 4-6, equatorial. Uredinia on both sides of leaves, scattered, otherwise and urediniospores essentially as the aeciospores. Telia on the adaxial side of leaves subcuticular in origin, blackish, teliospores (58-)75-105(-120)  $\mu\text{m}$ , (7) 8 or 9 (10) probasidial cells across, chestnut-brown with a thin pale outer layer, smooth, cells in one layer, of rather uniform size (10-)11-15(-16)  $\mu\text{m}$  across, cysts multiseriate, globose, small, pendent, pedicel not seen (F. europ.: "Hyphae stipitales in stipit m compositum non conjunctae").

See *Ravenelia dentifera* for a key to the species of *Ravenelia* on *Cassia*, *Chamaecrista*, and *Senna*.

**RAVENELIA MICROSPORA** Dietel, Ann. Mycol. 6: 98. 1908. TYPE on *Senna* sp. (*Cassia* sp.), from **Brazil**, São Paulo: Nossa Senhora, Mar 1907, *Usteri s. n.* (**??,IIpe/III**).

On Leguminosae:

*Senna multijuga* (L. C. Rich.) Irwin & Barneby (*Cassia multijuga* L. C. Rich), Pará (IBI-13239).

*Senna sylvestris* var. *excelsa* (Schrader) Irwin & Barneby (*Cassia excelsa* Schrader), Federal District: (*Irwin et al. 18102*, ex NY); Goiás (*Macedo s.n.*, ex US); Minas Gerais (IBI-15357), Rio de Janeiro (Jackson, 1931: 343, *Holway et al. 1239*), São Paulo (Jackson, 1931: 343, *Holway et al. 1682 298*).

*Cassia* sp., São Paulo (Dietel, 1908: 98).

*Ravenelia microspora* has been reported also from Venezuela and is characterized especially by small urediniospores.

Spermogonia and aecia unknown. Uredinia mostly on the adaxial side of leaves, subcuticular in origin, erumpent, pale cinnamon-brown, the overarching cuticle conspicuous, without paraphyses, urediniospores (11-)12-14 x 9-10  $\mu\text{m}$ , obovoid or ellipsoid, wall 1  $\mu\text{m}$  thick pale yellowish, echinulate, pores 4 or 5, equatorial. Telia as such not seen, teliospores associated with the uredinia, chestnut-brown, (55-)66-100(-110)  $\mu\text{m}$  diam, 7-9 (10) probasidial cells across, without a discrete outer wall layer, cells in one layer, most of the peripheral cells each with 1 cylindrical or slightly capitate, brownish tubercle 4-5  $\mu\text{m}$  wide and to 7  $\mu\text{m}$  long, other cells smooth, central cells (10-)12-15(-17)  $\mu\text{m}$  across, cysts multiseriate, globose, pendent, pedicel multihyphal, colorless, deciduous.

See *Ravenelia dentifera* for a key to the species of *Ravenelia* on *Cassia*, *Chamaecrista*, and *Senna*.

*Ravenelia mimosae* P. Hennings, see **RAVENELIA HEIRONYMI** Spegazzini.

**RAVENELIA MIMOSAE-SENSITIVAE** P. Hennings, Hedwigia 35: 246. 1896. Holotype: on *Mimosa sensitiva* Linnaeus (or more probably *M. argentinensis* Burkhart), Tucumán, **Argentina**, Lorentz s. n. (B), n. v., isotype BPI. (**-I-,IIpe/III**).

= *Ravenelia mimosae-albidae* Dietel, Bot. Centralbl. (Beib.) 20: 378. 1906. Lectotype on *Mimosa albida* Humboldt & Bonpland, Cuernavaca, Morelos, **Mexico** 29 Sept 1898, *Holway 3125*, PUR 6283 (lectotype designated here).

= *Ravenelia mimosae-caeruleae* Dietel, Bot. Centralbl. (Beib.) 20: 378. 1906. Holotype on

*Mimosa caerulea* Rose, Cuautla, Morelos, **Mexico**, 20 Oct 1903, *Holway* (fide note by Arthur in PUR).

- = *Ravenelia mimosicola* Arthur, N. Amer. Flora 7: 137. 1907. Holotype on *Mimosa stipitata* Robinson, Iguala, Guerrero, **Mexico**, 4 Nov 1903, *Holway* 5326, PUR 6269.
- = *Ravenelia victotia-rossetii* Dianese, L., T. P. Santos, R. B. Medeiros & M. Sanchez in Dianese, J. C. et al., Fitopatol. bras. 18: 442. 1993. TYPE on *Mimosa radula* var. *imbricata* from **Brazil**, Federal District.: Biology Experiment Station of the University of Brasilia, 12 March 1993, *R. B. Madeiros & Hennen s.n.*

Anamorph:

- Uredo sensitiva* Spegazzini, An. Mus. Nac. Buenos Aires 6: 236-237. 1898. Holotype on *Mimosa sensitiva* Linnaeus, Valley of Rio Chico near Tucumán, **Argentina**, Jan 1895, collector presumably *Spegazzini*, LPS?.
- ≡ *Ravenelia sensitiva* (Spegazzini) Spegazzini, Rev. Argentina Bot. 1: 132. 1925. Basionym, *Uredo sensitiva* Spegazzini, telia not described, an anamorph.
- = *Uredo assumptionis* Spegazzini, An. Mus. Nac. Hist. Nat. Buenos Aires 31: 392. 1922. Holotype on *Mimosa balansae* Micheli, Asunción, **Paraguay**, July 1919.
- = *Ravenelia mimosae-pudicae* Kern, Thurston & Whetzel, Mycologia 25: 483. 1933. Holotype on *Mimosa pudica* Linnaeus, Itagui, **Colombia**, 17 Aug 1930, *Archer H-108*, PAC, telia not described, an anamorph.

On Leguminosae

*Mimosa radula* var. *imbricata* Benthams, Federal District, Goiás (Dianese et al., 1993).

*Mimosa* sp. Minas Gerais (*Hennen & Figueiredo-86-180*).

*Ravenelia mimosae-sensitivae* has been reported from Argentina to Mexico.

Spermogonia and aecia unknown. Uredinia amphigenous and on pods, subcuticular in origin, erumpent, yellowish brown, with abundant mostly spatulate or clavately capitate, golden brown paraphyses to 20 µm wide apically but usually only 8-12 µm wide, the wall to 8 µm thick apically, the stalk usually solid, urediniospores (17-)18-21(-25) x (13-)15-18(-20) µm, mostly broadly ellipsoid, wall 1.5-2.5 µm thick, golden or pale cinnamon-brown, closely verrucose-echinulate with hub and spoke pattern, pores 8-10, scattered. Telia as the uredinia except blackish brown and without paraphyses, teliospores (55-)69-90(-100) µm diam, (3) 4-6 (7) probasidial cells across, chestnut-brown with an outer, thin but discrete pale layer bearing more or less cylindrical tubercles 2.5-3 µm wide and (2-)3-7 µm long, with (3) 4-8(-10) on each cell, all cells in one layer with small intercalary cells, central cells (16-)19-25(-28) µm across, cysts uniseriate of same number as peripheral cells, pendent, pedicel multihyphal, colorless, deciduous.

Baxter (1965) determined that *R. mimosae-albidae*, and *R. mimosicola* were synonyms of *R. mimosae-sensitivae*. Earlier Lindquist (1954) suggested that *R. mimosae-caeruleae* was synonymous but did not make the formal transfer because he did not have type material for comparison. He also determined that *Uredo sensitivae* (*R. sensitivae*) is an anamorph of *R. mimosae-sensitivae*. Lindquist (1982) placed *U. assumptionis* and we place *U. mimosae-pudicae* as synanamorphs of *U. sensitivae*.

SEM photos reveal the reticulate pattern on the underside of the cuticle that is formed very early in development by the distal layer of a very young telial sorus. The cylindrical tubercles on the teliospores become almost full size while the spore is immature. The uniseriate cysts are pendent. SEM photos also reveal urediniospores, with hub and spoke sculpture pattern in which the spoke has two saturn-like rings, a smaller one above and a larger one below, are almost identical to those of *R. fragrans* Long on *Mimosa* spp. from Mexico and the southwestern United States of America.

*Ravenelia mineirosensis* Rezende & Dianese see **RAVENELIA CEBIL** Spegazzini.

**RAVENELIA [Spumula] MINUTA** H. Sydow & P. Sydow. Ann. Mycol. 14: 69. 1916. TYPE on *?Pithecellobium* sp., Leguminosae, from **Peru**, Rio Acre: Seringal Auristella, June 1911, *Ule-3492*. (-I-, IIpe/III).

*Ravenelia minuta*, which has been reported only from the type collection from nearby Peru, should be transferred to *Spumula* because the teliospores are unihyphal. The moniliform paraphyses were not mentioned by the Sydows and are easily overlooked or might be mistaken for spores of an anamorph.

Spermogonia. and aecia unknown. Uredinia on the adaxial side of leaves, subcuticular in origin, paraphyses not seen, urediniospores 18-23 x (10-)11-12 µm, elongately obovoid, wall finely echinulate, pores 4, equatorial. Telia on the adaxial side of leaves, small with pore-like opening, subcuticular in origin,



paraphyses cylindrical. moniliform. 4-5 celled, pale golden, united below, the free part about 70 x 8 µm, apex rounded, the whole adherent to the upturned cuticle, teliospores 33-45 µm diam, but irregular in outline, 3-5 probasidial cells wide, with no outer discrete layer, typically comprised of 1-4 central cells and 6 peripheral cells, in 1 layer, all cells with 1-5 conical spines about 3 µm high and 3 µm wide at base, central cells 17-20 x 15-18 µm, wall clear golden brown, cysts 3, globose, pendent, pedicel deciduous, unicellular judging by remnants attached to a few spores.

? **RAVENELIA PAPILLOSA** Spegazzini, An. Mus. Nac. Buenos Aires 6: 229. 1899. TYPE on *Acacia visco* Lorentz ex Grisebach. (*A. platensis*), originally mistakenly determined as *Albizzia julibrissin*, from **Argentina**, Buenos Aires: horto botanico, La Plata, 8 June 1847, *Spegazzini s. n.* (LPS 4956). (?/?,II/III).

Anamorph

**Uredo leguminicola** Spegazzini, An. Mus. Nac. Buenos Aires 19: 317-318. 1909. TYPE on *Acacia visco* Lorentz ex Griseb from **Argentina**, Buenos Aires: Botanical Garden of Buenos Aires, March 1906, *E. Aufran s.n.* The host was originally identified mistakenly as *Acacia lophanta* Willdenow and reidentified by Spegazzini as *Acacia platensis* Manganaro fide Lindquist (1954). *Acacia platensis* is a synonym of *Acacia visco*

*Ravenelia papillosa* has been reported with certainty only from Argentina. Grillo (1936: 42) recorded *Ravenelia papillosa* for Brazil but the report is probably mistaken.

Spermogonia and aecia unknown. Uredinia and telia developed on conspicuous witches' brooms. Uredinia on both sides of leaves and on rachises and branches, subepidermal in origin, erumpent, brown; paraphyses intermixed, numerous, clavate or clavate-capitate, 40-50 µm long, about 14-16 µm wide in head, wall yellowish to brown, stalk ca 5 µm across, thick-walled; urediniospores (18-)20-24 x (12-)14-19 µm, broadly ellipsoid or broadly obovoid, wall 2.5-3 µm thick, pale brownish or golden, echinulate, pores difficult to count in the holotype, about 10-12, scattered. Telia following in uredinia, or formed *de novo* without paraphyses, blackish, teliospores 88-120(-130) µm diam, dark chestnut-brown 7-10 probasidial cells across, each cell with 5-10 cones or conical papillae 2-3 µm high, especially obvious peripherally, cells 1-layered; cysts uniseriate of same number as peripheral cells(?), coherent; pedicel multihyphal, deciduous (Hernández and Hennen, 2003).

Lindquist (1982) reported this species only from around La Plata, Argentina, and that the numerous witches' brooms of this species do much damage to the hosts. Hernández and Hennen (2003) reported *Ravenelia papillosa* also from Tucumán and Catamarca province on *Parapiptadenia excelsa* (Grisebach) Lillo. .

*Ravenelia parahybana* Viégas, see **RAVENELIA PILEOLARIOIDES** H. & P.Sydow.

**RAVENELIA PAZSCHKEANA** Dietel, Hedwigia 38: 253. 1899. TYPE on undetermined Mimosaceae (considered probably to be *Calliandra* sp. by Sydow) from **Brazil**, Rio de Janeiro: Rio de Janeiro, Tijuca, Sept 1897, *Ule 2437*. Not otherwise known (?/?,II/III).

On Leguminosae (the records below are all based on the type collection, and probably on *Calliandra* sp.

*Calliandra* sp., Brazil state not recorded (Silveira, 1951: 34.)

*Leucaena* sp. Rio de Janeiro (PUR-F2058).

**Mimosoideae, genus undetermined**, Rio de Janeiro (Dietel, 1899: 253; Hennings, 1904A: 79).

*Ravenelia pazschkeana* has been reported only from the type collection.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, subepidermal in origin, erumpent, yellowish, paraphyses cylindrical, clavate or capitate, wall uniform or apically thickened in cylindrical ones or to 3-6 µm thick apically in capitate ones, colorless to pale brownish; urediniospores (22-)25-35(-39) x 12-16(-19) µm, variable, ovoid, oblong-ellipsoid, obovoid, or elongately obovoid, wall 1-1.5 µm thick at sides, (2-)4-5(-7) µm at apex, cinnamon-brown or golden brown, evenly echinulate, pores 4 or 5 (6), equatorial. Telia as the uredinia but blackish brown, without paraphyses when formed *de novo*, teliospores (45-)55-77(-80) µm diam, 4 or 5 probasidial cells across, cells 1-layered, typically with 6 peripheral and 4 inner cells, dark chestnut-brown with a very thin, pale outer layer, each cell with 4-10 conical spines 2-3 µm long, central cells 20-25 x 17-23 µm, cysts uniseriate of same number as peripheral cells, pendent or semipendent (sometimes with short papillae or tubercles, fide J. W. Baxter), pedicel of 2 (or few) hyphae, colorless, deciduous.

**RAVENELIA PERNIGRA** Hennen & Cummins, Rept. Tottori Mycol Inst. (Japan) 28: 8. 1990. TYPE on *Cratylia* sp. (?*C. argentea*) from **Brazil**, Mato Grosso do Sul: 5 km. NE of Coxim on Rio Taquari, 18 Apr 1983, *J. F. Hennen, M. M. Hennen & R. Antunes* 83-220 (IBI-14372). (?/?,Ipe/III).

On Leguminosae

*Cratylia argentea* (Desv.) O. Kuntze (includes *C. floribunda* Benth), Ceará, Paraná (*Hatschbach s. n., Hatschbach* 19788).

*Cratylia hypargyrea* Martius ex Benth, Espirito Santo (*R. P. Belém-1578*).

*Cratylia mollis* Martius ex Benth, Bahia (*L. M. C. Gonzalves-130, A. Fernandes et al.* 14076), Pernambuco (*J. M. Santos s. n.*).

*Cratylia* sp., Ceará (IBI-17120), Mato Grosso (IBI-16731).

*Ravenelia pernigra* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, subepidermal in origin, scattered, without paraphyses, dark brown, urediniospores (16-)18-22(-24) x (13-)15-18 µm, globoid or broadly obovoid, wall 1.5 µm thick, dark cinnamon brown, echinulate with prominent spines spaced (2-)2.5-4 µm, pores 3, equatorial. Telia as the uredinia except blackish, teliospores mostly 60-75(-80) µm diam, 4 (5) probasidial cells across, comprised typically of 3 or 4 central cells and 6 or 8 peripheral cells, central cells 23-27(-29) x (19-)20-22(-24) µm, cells 1-layered, wall dark chestnut-brown, rather opaque, with a scarcely discrete, paler, thin, outer layer bearing (3-)5-8 pale yellowish, slightly tapered, papillae (3-)4-7 µm long, 3-3.5 µm wide on each cell, cysts uniseriate, of same number as peripheral spores, appressed, pedicel of few coarse hyphae, deciduous.

The first three records listed above are from vascular plant herbarium specimens.

The specimen from Pernambuco state listed above has similar teliospores but urediniospores are larger, darker brown, and with thicker walls.

*Cratylia* species, the hosts of *Ravenelia pernigra*, are used as animal forage in some parts of Brazil.

**RAVENELIA PILEOLARIOIDES** H. Sydow & P. Sydow, Ann. Mycol. 14: 68-69. 1916. TYPE on *Caesalpinia* sp. (originally determined mistakenly as *Pithecellobium* sp.) from **Brazil**, Ceará: Serra de Maranguape, Oct 1910, *Ule-3407*. (?/?,Ipe/III).

= *Ravenelia parahybana* Viégas, *Bragantia* 5: 54. 1945. TYPE on *Caesalpinia* sp. from

**BRAZIL**, Paraíba: Flores, Município. de Alagoa Grande, Aug 1938, *Deslandes s. n.*

On Leguminosae:

*Caesalpinia pyramidales* Tulasne, Ceará (Sydow, 1916: 68; *R. T. de Almeida-355*).

*Caesalpinia* sp., Ceará (IBI-17132), Paraíba (Viégas, 1945: 54; IAC-2698).

*Ravenelia pileolarioides* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, subepidermal in origin, erumpent, dark brown, paraphyses peripheral to 100 µm long, 8-10 µm wide, incurved, very thick-walled dorsally and apically, golden to brown; urediniospores (24-)28-33(-36) x (14-)17-20(-23) µm, broadly ellipsoid or obovoid, wall 1.5-2.5 µm at sides, dark cinnamon- to chestnut-brown, 4 µm thick at apex by a nearly colorless, broadly cone-shaped cap, with spiral beaded ridges, 0.5 µm wide spaced (2-)2.5 (-3.5) µm, usually 8-10 showing in a surface focal plane, pores 3 (4), equatorial, obvious. Telia similar to uredinia, teliospores (50-)58-80(-100) µm diam, (3)4 or 5 probasidial cells across, central cells 20-24(-26) x 17-22 µm, cells in one layer, wall dark chestnut-brown, overlaid with a discrete, pale brownish layer, each cell bearing 4 to 8 broadly rounded cones or tubercles 1-3 µm long and wide, cysts uniseriate, same number as peripheral cells, colorless, coherent, more or less globoid, each with a few tubercles, pedicel of few hyphae, colorless, deciduous.

In our collection of *Ravenelia pileolarioides* from the type region (*Hennen & Almeida 90-90*) some teliospores are smooth or almost so, indicating a close relationship to *R. corbuloides*.

See *Ravenelia cohniana* for a key to help identify species of *Ravenelia* on *Caesalpinia* and *Cenostigma* in the Neotropics.

**RAVENELIA PITHECOLOBII** Arthur, Bot. Gaz. (Crawfordsville) 39: 394. 1905. TYPE on *Pithecellobium dulce* (Roxbury) Benth from **Mexico**, Jalisco: Guadalajara, 27 Sept 1903, *Holway* 505. (0/Ipe,IIpe/III).

On Leguminosae:

*Pithecellobium* sp., Ceará (Viégas, 1945: 55; IAC-3811, Almeida, 1985).

*Ravenelia pithecolobii* is known also from Colombia, Venezuela, and Mexico. We have not seen the collections of *Ravenelia pithecolobii* from Sobral and Forteleza, Ceará, Brazil reported by Viégas (1945) and Almeida (1985).

Spermogonia on both sides of leaves, subcuticular, type 7, numerous in close groups on small, distorted, light brown leaf spots 0.5-1.5 mm across. Aecia surrounding the groups of spermogonia, subepidermal in origin, erumpent, or distorted, light brown leaf spots 3-5(-8) mm across; aeciospores (24-)27-33(-38) x (15-)16-20(-22)  $\mu\text{m}$ , pedicellate, ellipsoid or elongately obovoid; wall 2  $\mu\text{m}$  thick laterally, 4-6  $\mu\text{m}$  thick apically, uniformly echinulate; pores 4-6 equatorial, without caps. Uredinia on both sides of leaves, often in circles, subepidermal in origin, about cinnamon-brown, without paraphyses, urediniospores (24-)27-33(-40) x (15-)16-20(-22)  $\mu\text{m}$ , mostly ellipsoid or elongately obovoid, wall (1.5-)2(-2.5)  $\mu\text{m}$  thick at sides (3-)4-6(-7)  $\mu\text{m}$  at apex, cinnamon-brown, echinulate, pores 4-6, commonly 5, equatorial. Telia as the uredinia but blackish brown, teliospores (60-)70-85(-100)  $\mu\text{m}$  diam, (4) 5-8 probasidial across, cells in one layer, chestnut-brown with a thin but discrete, pale outer layer which bears (1) 2 or 3 (4) aculeae 5-7  $\mu\text{m}$  long, 2-3  $\mu\text{m}$  wide at base on each cell, central cells 12-16(-18)  $\mu\text{m}$  across, cysts uniseriate, appressed to spore, of same number as peripheral cells, pedicel of few coarse hyphae or, in small spores of only 1 or 2 hyphal strands, colorless, semipersistent.

**RAVENELIA PLATENSIS** Spegazzini, An. Mus. Nac. Buenos Aires 6: 228. 1899. TYPE on *Erythrina crista-galli* Linnaeus from **Argentina**, Buenos Aires: Santa Catalina, "Verano" 1890, *Spegazzini s. n.* (0/Ipe,IIpe/III).

On Leguminosae:

*Erythrina crista-galli* Linnaeus, Rio de Janeiro (Jackson, 1931: 345; *Holway 1288*).

*Erythrina verna* Velloso (reported as *E. mulungu* Martius), Alagôas (Viégas, 1945: 55, IAAC-3817).

*Erythrina* sp., Rio de Janeiro (Jackson, 1931: 345, *Holway 1157*).

*Ravenelia platensis* has been reported also from Argentina, and Uruguay. Spegazzini (1899) listed localities as "...prope La Plata, in Santa Catalina, In Isla de Martín García et in Chaco, per ann: 1883-98." Lindquist (Rev. Fac. Agron. 30: 323. 1954) cited the type as above where we consider it to be lectotype. Lindquist (1954) reported this rust as wide-spread and recognizable from a distance because of the large galls on the branches. Lindquist and Rosengurt (1967) reported it from Montevideo, Uruguay and as widespread in the La Plata River area.

In the Holway specimens listed above, the teliospores are variable and mostly with few probasidial cells, some even uni-celled, some bi-celled as *Dicheirinia*, or often tri-celled. The cysts also vary and may be absent in spores with only one probasidial cell, or like the intercalary cells of *Dicheirinia* teliospores, thus non-hygroscopic.

The host species is the "national flower" of Argentina (Cabrera, 1967), widespread in southern Brazil, Paraguay, and northeastern Argentina, and a widely cultivated ornamental that has various other folk uses.

Spermogonia subcuticular, on both sides of leaves when on leaves, also on stem and petiole galls. Aecia on both sides of leaves and associated, often circinately, with the spermogonia, subepidermal becoming erumpent and often confluent, without paraphyses, aeciospores pedicellate, (28-)33-42(-46) x (22-)24-30(-35)  $\mu\text{m}$ , flattened obovoid or in occasional orientation reniform, wall (3-)4-5  $\mu\text{m}$  thick, pale golden, strongly and rather sparsely echinulate, the spines 2-3  $\mu\text{m}$  long, with smooth areas around pores on the two flattened sides, pores 3-4, equatorial, usually large and obvious. Uredinia and urediniospores similar to aecia and aeciospores spores. Telia also on both sides of leaves or caulicolous, blackish brown, teliospores (75-)85-100(120)  $\mu\text{m}$  diam, dark mahogany, smooth, (1-, 2-, several-), 5 or 6 probasidial cells across, cells in one layer, cysts (0-, 2-, several-)15-20, adherent, circling the pedicel as a collar, not different in water, pedicel composed of various hyphae, colorless but often pigmented next to the spore, persistent.

Our observations of infections of this species in a city park in La Plata, Argentina on 1 Oct 1997 revealed numerous dead galls up to 15 x 8 cm. from the last season. The galls seemed to be annual, dying after one season. New infections were abundant on young stems, petioles and leaflets producing large hypertrophied areas with numerous spermogonia that were oozing honey-dew and with a detectable odor. No other new sori had developed on this date. Old detached teliospores were found stuck by the gelatinized

cysts to dead branchlets. The galls were much deteriorated and no spores were found on them. The galls are initiated probably only by infections from basidiospores.

**RAVENELIA [Spumula]RATA** H. S. Jackson & Holway in Jackson, Mycologia 23: 337. 1931. TYPE on *Acacia pedicellata* Benthams, Leguminosae, from **Brazil**, Rio de Janeiro: Rio de Janeiro, 13 Aug 1921, *Holway-1032*. (0/-/III).

*Ravenelia rata* has been reported only from the type collection. The teliospores of this species are unihyphal and the species will be transferred to *Spumula*.

Spermogonia on both sides of leaves in small groups, subcuticular. Aecia and uredinia not produced. Telia on both sides of leaves with the spermogonia, subepidermal in origin becoming erumpent, pale brown, teliospore when seen from the top or bottom (30-)33-40(-44)  $\mu\text{m}$  diam, golden brown, 7-9-celled, most commonly comprised of 6 peripheral and 3 internal cells, central cells variable, 14-20 x 12-17  $\mu\text{m}$ , wall uniformly 1.5  $\mu\text{m}$  thick, ornamented with variable tubercles, varying from columnar to apically bifurcate or knobbed, 2-3  $\mu\text{m}$  high, colorless, cysts small, globoid, discrete, most often 3 with 1 to each peripheral cell, pedicel monohyphal, colorless, semipersistent to deciduous.

**RAVENELIA RIOENSIS** Hennen & Cummins, Rept. Tottori Mycol. Inst. 28: 9. 1990. *nom. nov.* for *R. irregularis*. (?/?,II/III).

$\equiv$  *Ravenelia irregularis* H. S. Jackson & Holway in Jackson, Mycologia 23: 336. 1931. TYPE on *Acacia* sp. from **Brazil**, Rio de Janeiro: Rio de Janeiro, 20 Dec 1921, *Holway-1416*. Not Arthur 1907 for a rust on *Tephrosia* sp.

On Leguminosae:

*Acacia* sp., Rio de Janeiro (Jackson, 1931: 336).

In addition to the type *Ravenelia rioensis* has been reported from two other collections, *Holway 1065, 1109*, from the same area and on apparently the same small leaflet *Acacia*.

Spermogonia and aecia unknown. Uredinia on the adaxial side of leaves, subepidermal in origin becoming erumpent, brown, without paraphyses, urediniospores (17-)19-24(-27) x (10-)12-14(-15)  $\mu\text{m}$ , obovoid or broadly ellipsoid, wall 1.5  $\mu\text{m}$  thick or thickened at apex to 2.5  $\mu\text{m}$ , cinnamon-brown, finely and sparsely echinulate, pore 4-6, equatorial. Telia as the uredinia but dark chestnut-brown, teliospores (35-)70-90(-99)  $\mu\text{m}$  diam, 4-6 probasidial cells across, chestnut-brown, inner cells 2-layered with smaller basal intercalary cells, each cell with 4-8 tubercles or rounded cones 2-3  $\mu\text{m}$  high, discrete outer layer lacking, central cells 17-23(-26) x 12-15  $\mu\text{m}$  surface view, cysts globoid, small, biseriate, pendent, pedicel colorless, multihyphal, deciduous.

**RAVENELIA SANTOS-COSTAE** J. C. Dianese, Medeiros, Santos & A. C. Dianese in J. C. Dianese et al., Fitopatol. Bras. 18: 443. 1993. TYPE on *Calliandra dysantha* Benthams from **Brazil**, Federal District: Brasilia, 7 Sept 1992, *Dianese s.n.* (?/?,IIpe/III).

*Ravenelia santos-costae* was reported from one other collection from the Federal District, Brasilia.

Spermogonia and aecia unknown. Uredinia 20-85  $\mu\text{m}$  (!) diam, mostly on the abaxial side of leaflets, subepidermal in origin, light brown, paraphyses numerous, (70-)80-96 x 4-6  $\mu\text{m}$ , cylindrical with globoid to ovoid tips, 14-24  $\mu\text{m}$  diam., urediniospores (25-)26-31(-32) x (16-)17-20(-22)  $\mu\text{m}$ , elongate, obovoid, to elliptical, base truncate, wall 2-3  $\mu\text{m}$  thick at base, 1.5-2  $\mu\text{m}$  at sides and apex, echinulate, yellowish, pores 2-4, equatorial, sporogenous cells 25-38 x 4-6  $\mu\text{m}$ , urediniospores and paraphyses formed blastically by sympodial proliferations from the sporogenous cells. Telia on adaxial side of leaflets, subepidermal in origin, erumpent, brown to dark brown, paraphyses hymenial, 35-42 x 4-6  $\mu\text{m}$ , cylindrical to clavate, teliospores 51-64  $\mu\text{m}$  across, mostly 4 probasidial cells across, usually 2-4 central cells surrounded by 6 peripheral cells, central cells 18-20 x 20-22  $\mu\text{m}$ , each cell with 10-16 echinulations, echinulae 4-7 x 2.5-3  $\mu\text{m}$ , cells 1-layered, cysts 6, uniseriate globoid, each with a short stalk, pedicel composed of 2 hyphal strands, persistent (Dianese et al., 1993)

An illustration (Fig. 7e) in the original publication of *Ravenelia santos-costae* indicates (perhaps) that the walls of the heads of the capitate paraphyses are sculptured, either verrucose or echinulate. Cysts also appear to be sculptured (Fig. 7b). These traits, which may be useful to help identify the species, were not included in the original description and need to be confirmed.

*Ravenelia schroeteriana* P. Hennings, see **RAVENELIA INDIGOFERAE** Tranzschel.

**RAVENELIA SEPTATA** Hennen & Cummins, Rept. Tottori Mycol. Inst. (Japan) 28: 9. 1990. Type on *Mimosa* sp. from **Brazil**, Minas Gerais: 15 km NW of São Gotardo, 4 April, 1986, *Hennen & Panchoni-86-75. (?/?IIpe/III).*

*Ravenelia septata* has been reported only from the type locality on the type host. The species is the only *Ravenelia* on *Mimosa* that has two layers of inner probasidial cells in the teliospores.

Spermogonia and aecia unknown. Uredinia mainly hypophyllous, subepidermal in origin becoming erumpent, yellowish, with inconspicuous, peripheral, slightly incurved, cylindrical, from uniformly thin-walled to dorsally thick-walled paraphyses, urediniospores (19-) 20-24 x (13-) 15-19  $\mu\text{m}$ , broadly ellipsoid, less often obovoid; wall 1.5-2  $\mu\text{m}$  thick, essentially colorless, echinulate, pores 7 or 8, scattered, obscure. Telia mostly epiphyllous, blackish brown, teliospores (65-) 75-100 (-120)  $\mu\text{m}$  diam, (4) 5 or 6 (7) probasidial cells across, chestnut-brown, an outer, thin, pale wall layer conspicuous, the peripheral cells each with 2-5 cones 3-5  $\mu\text{m}$  long, 2.5-3  $\mu\text{m}$  wide at base, 1-layered, the inner cells with fewer or no cones, 2-layered, central cells 20-24 (-25) x (17-) 18-21 (-23)  $\mu\text{m}$ , cysts colorless, globoid, multiseriate, separate, pedicel colorless, multihyphal.

*Ravenelia septata* is the only *Ravenelia* on *Mimosa* in which the inner probasidial cells of the teliospores are in two layers.

**RAVENELIA SIMPLEX** Dietel, Hedwigia 38: 252. 1899. TYPE on *Piptadenia* sp. from **Brazil**, Rio de Janeiro: Mauá, Aug 1897, *Ule 1080. (?/?II/III).*

On Leguminosae:

*Piptadenia communis* Benth, Minas Gerais (IBI-13512), Rio de Janeiro (Dietel, 1899: 252).

? **Leguminosae undetn.**, Pernambuco, Paraíba (Viégas, 1945: 56).

*Ravenelia simplex* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, brownish, subepidermal in origin becoming erumpent, with cylindrical, yellowish, septate, dorsally thick-walled, peripheral paraphyses, urediniospores 23-29 x 15-18  $\mu\text{m}$ , obovoid, pale brown, verrucose, pores 6, equatorial (not seen; from Dietel, 1899). Telia on both sides of leaves but mostly on the abaxial side of leaves, subepidermal in origin becoming erumpent, chestnut-brown, paraphysate, teliospores varying from 1-celled (uncommon) to 2-celled and typically diceirinioid (common) to 12-celled and typically ravenelioid, thus 1 to 2 to 3, to 4, to 5 probasidial cells across and from 15-60  $\mu\text{m}$  diam, near chestnut-brown, probasidial cells in one layer, each with 6-12 narrowly rounded cones or papillae 2-3.5  $\mu\text{m}$  long, without a discrete outer wall layer, cysts stalked, pendent, ovoid to globoid, hygroscopic and colorless present on multiple-celled (ravenelioid) spores, fewer than the cells, pedicel mostly few to often 2-hyphoid, or cysts small, non-hygroscopic and appearing as intercalary cells at the distal end of the pedicel (like *Dicheirinia*) on few, especially 2- and 3-celled spores, pedicel unihyphal.

The teliospores of *Ravenelia simplex* are unusually variable. Some are typical *Ravenelia*-like and some are typical *Dicheirinia*-like, with various intermediates, all occurring in a single sorus. *Dicheirinia spinulosa* (J. W. Baxter) Hennen & Cummins, a Mexican species, has similarly variable teliospores but unlike *Ravenelia* the multicelled spores lack hygroscopic cysts and have unihyphal pedicels.

**RAVENELIA SPIRALIS** Hennen & Cummins, Rept. Tottori Mycol. Inst (Japan). 28: 11. 1990. .TYPE on *Cenostigma* sp. from **Brazil**, Goiás: hwy. 153, 33 km. S of Araguaina, 3 Dec 1977, *J. F. & M. M. Hennen 77-307. (0/Ipstr,IIpstr/III).*

On Leguminosae:

*Cenostigma macrophylla* Tulasne, Bahia, Goiás, Maranhão, Mato Grosso, Mato Grosso do Sul, Minas Gerais (Hennen & Cummins, 1990: 11-12).

*Ravenelia spiralis* has been reported only from Brazil.

Spermogonia on the adaxial side of leaves in close or loose groups, type 7, conspicuous. Aecia subepidermal in origin, on the abaxial side of leaves opposite the spermogonia, cinnamon-brown, with abundant, incurved, peripheral paraphyses as in the uredinia but golden to deep golden-brown, aeciospores pedicellate and as the urediniospore. Uredinia on the abaxial side of leaves, scattered, dark chocolate-brown, subepidermal in origin, conspicuously erumpent and basket-like because of the abundant, incurved, basally united paraphyses, 50-100 x 8-9  $\mu\text{m}$ , the wall thin at base but thick above, especially apically and dorsally, golden to chestnut-brown, urediniospores (18-)20-26(-28) x (15-)17-20  $\mu\text{m}$ , broadly ellipsoid ovoid, or

obovoid, wall 0.5-2.5  $\mu\text{m}$  at sides, 2-8  $\mu\text{m}$  at apex, cinnamon-brown to light chestnut-brown, spirally striate with ridges 0.5  $\mu\text{m}$  wide and spaced 2-3  $\mu\text{m}$ , pores 2 near the hilum. Telia not seen, teliospores in uredinia 60-85  $\mu\text{m}$  wide, chestnut-brown, smooth, (4)5-6(7) probasidial cells across, the pigmented wall overlaid by a thin but discrete, nearly colorless layer, cells in one layer, central cells (12-)14-17(-18)  $\mu\text{m}$  across, cysts uniseriate of same number as peripheral cells, appressed, pedicel of few hyphae, deciduous.

*Ravenelia spiralis* is identified most easily by its uredinia which under low magnification appear as superficial, minute, dark brown rings or balls because of the numerous peripheral slightly incurved, brown paraphyses, and urediniospores whose walls have spirally striate, thin ridges about 0.5  $\mu\text{m}$  wide, spaced 2-3  $\mu\text{m}$  apart, and two germ pores near the hilum. The teliospore walls are smooth. *Ravenelia cenostigmatis* has very similar urediniospores but its teliospores are remarkably different.

In Mexico, *R. striatispora* Cummins & J. W. Baxter has similarly striate urediniospores but with interconnecting ridges and the sori lack paraphyses. It occurs on *Pithecellobium*. *R. corbula* J. W. Baxter on *Caesalpinia*, also in Mexico, has spirally verrucose anamorph spores and a basket-like sorus formed by the peripheral paraphyses but differs in having tuberculate teliospores and urediniospores with equatorial pores.

See *Ravenelia cohniana* for a key to help identify species of *Ravenelia* on *Caesalpinia* and *Cenostigma* in the Neotropics.

**RAVENELIA SYDOWIANA** Rick, Ann. Mycol. 5: 337. 1907. TYPE on *Lonchocarpus* sp. (reported originally as "Leguminosae indet.") from **Brazil**, Rio Grande do Sul: Nova Petropolis, 1907, Rick No. 151 *Fungi austro-americi*. (0/III).

On Leguminosae:

*Lonchocarpus leucanthus*, Rio Grande do Sul (*G. Malme*).

*Lonchocarpus* sp., Rio Grande do Sul (Rick, 1907B: 337, ex Theissen, *Decades fungorum brasiliensium*; Lindquist & Costa Neto, 1963: 126). Rio de Janeiro (PUR-F17345), São Paulo (IBI-13783).

*Ravenelia sydowiana* has been reported also from Argentina.

Spermogonia mostly on the adaxial side of leaves, subcuticular, type 7. Aecia and uredinia not produced. Telia mostly on the abaxial side of leaves, at times caulicolous, closely associated with the spermogonia, subepidermal in origin, erumpent, blackish, paraphyses commonest peripherally but also inmixed, numerous, cylindrical, straight, curved or flexuous, wall thick, colorless or pale yellowish; teliospores (40-)52-82(-88)  $\mu\text{m}$  diam, dark chestnut-brown, more or less opaque, without a thin, pale outer layer, 4-6 probasidial cells across, central cells (16-)18-22(-24)  $\mu\text{m}$  diam, peripheral cells commonly twice as many as central cells, 5 central and 10 peripheral is common, probasidial cells in one layer; cysts uniseriate, same number as peripheral cells, coherent and appressed to base of spore from margin to pedicel, pedicel multihyphal, to 170  $\mu\text{m}$  long, semipersistent.

Both Lindquist & Costa Neto (1963) and Baxter (1968) concluded that the host plant of the type of *Ravenelia sydowiana* is a species of *Lonchocarpus* because the fungus is similar to several other rusts on *Lonchocarpus* differing mainly by the paraphyses. Later collections of this rust from several phanerogamic specimens, identified positively as *Lonchocarpus* spp. and our own field collections from Brazil, leaves no doubt that the host of the holotype is *Lonchocarpus*. The paraphyses, first reported by Baxter (1968), give the impression of a Hyphomycete but in section it is obvious that they are part of the rust sorus. As is true for several other species of *Ravenelia* and the closely related *Cystomyces costaricensis* on *Lonchocarpus*, germ slits can be discerned in the mature probasidial cells even though they are nearly opaque.

See *Ravenelia bakeriana* for a key to species of *Ravenelia* on *Lonchocarpus* and *Derris*.

*Ravenelia tauensis* Viégas, see **RAVENELIA ATROCRUSTACEA** P. Hennings.

**RAVENELIA TESSELLATA** Hennen & Cummins, Rept. Tottori Mycol. Inst. (Japan) 28: 12. 1990.

TYPE on ? *Parkia* sp. from **Brazil**, Pará: 15 mi. E of Belém on Pirelli rubber plantation, 11 July 1979, J. F. & M. M. Hennen 79-161. (?.?, Ipe/III).

*Ravenelia tessalata* has been reported only from the type collection.

Spermogonia and aecia unknown. Uredinia in groups on the abaxial side of leaves, subepidermal in origin, erumpent, brown; paraphyses 35-55 x 6-9  $\mu\text{m}$ , abundant, incurved, golden, dorsally thick-walled, basally united; urediniospores (20-)24-27(-30) x (13-)16-20(-22)  $\mu\text{m}$ , very variable in shape but mostly obovoid, wall 2-2.5  $\mu\text{m}$  thick at sides golden to cinnamon-brown, usually with an apical, colorless crest or

umbo 2-7  $\mu\text{m}$  thick, finely, often obscurely echinulate, especially basally, pores 2-3, typically equatorial but variable in placement in the odd-shaped spores. Telia as the uredinia, blackish brown, teliospores (40-)55-80(-86)  $\mu\text{m}$  diam, (3)4 or 5 probasidial cells across, cells in one layer, central cells 23-25 x (18-)20-22  $\mu\text{m}$ , wall chestnut-brown, closely irregularly tessellate, warts low, mostly 2-4.5  $\mu\text{m}$  across of various shapes, cysts uniseriate, of same number as peripheral cells, pendent, globoid, pedicel of few colorless hyphae, deciduous.

*Ravenelia tessalata* is most easily identified by its teliospore wall sculptured that is irregularly chequered with angular, low warts mostly 2-4.5  $\mu\text{m}$  across of various shapes (tessellate) and urediniospores with irregular distal, colorless crests or umbos 2-7  $\mu\text{m}$  thick.

**RAVENELIA [Spumula]THEISSENIANA** H. Sydow & P. Sydow, Ann. Mycol. 14: 258. 1916. TYPE on undetermined Leguminosae, probably *Piptadenia* sp., from **Brazil**, Rio Grande do Sul: São Leopoldo, July 1914, *J. Rick*, com. F. Theissen. (?!**Ipe/III**).

On Leguminosae:

? *Piptadenia* sp., Santa Catarina (Sydow & Sydow, 1916: 258), São Paulo (IBI-17875).

*Ravenelia [Spumula] theisseniana* has been reported only from Brazil.

The hosts probably belong to the Mimosoideae, *Piptadenia* sp. The teliospore pedicels are unihyphal, not bihyphal as reported originally by the Sydows (1916). This trait suggests that the species should be placed in the genus *Spumula*. The grappling hook-like processes on the teliospores are similar to those of *Ravenelia stevensii* from Mexico and Puerto Rico.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, subepidermal, becoming semi-erumpent, yellowish, with abundant, cylindrical, incurved, basally 1-septate, subcolorless or yellowish, to 75  $\mu\text{m}$  long paraphyses, the wall varying 3-5  $\mu\text{m}$  thick except almost solid at apex, urediniospores 20-28 x 15-22  $\mu\text{m}$ , ovoid or pyriform, wall 1.5  $\mu\text{m}$  thick, yellowish brown, echinulate, pores 4, equatorial, rather obscure. Telia as the uredinia except blackish, teliospores 55-65  $\mu\text{m}$  diam, chestnut-brown, usually with 5 central and 10 peripheral probasidial cells, cells in one layer, central cells 11-15  $\mu\text{m}$  across, peripheral cells with 1-3 yellowish or yellowish brown processes 8-12  $\mu\text{m}$  long and capitately 3  $\mu\text{m}$  thick and often recurved or furcate at apex, cysts uniseriate of same number as marginal cells, pendent, globoid, pedicel subpersistent, colorless, unihyphal.

**RAVENELIA TORTUOSA** Hennen & Cummins, Rept. Tottori Mycol. Inst. (Japan) 28: 13. 1990. TYPE on unidentified spineless Leguminosae-Mimosoideae, **BRAZIL**, Bahia: 55 km. N of Vitoria da Conquista, hwy. 116, 10 Mar 1984, *J. F. & M. M. Hennen 84-234*. (**0/Ipe,IIpe/III**).

*Ravenelia tortuosa* has been reported only from the type.

Spermogonia on the abaxial side of leaves, 30-40 x 70-80  $\mu\text{m}$ , intraepidermal, aecia associated with spermogonia, on the abaxial side of leaves, intraepidermal, surrounded by elongate, few-septate, peridium-like paraphyses, 40-50 x 2-3  $\mu\text{m}$ , aeciospores borne catenulately but do not remain in chains, 22-28(-34) x (14-)20-22  $\mu\text{m}$ , irregularly narrowly to broadly ellipsoid, often truncate or obliquely truncate below, broadly rounded above, pores 4-6,  $\pm$  equatorial or scattered around the lateral walls; wall 1-1.5  $\mu\text{m}$  thick, up to 2-2.5  $\mu\text{m}$  at apex, echinulate. Uredinia on both sides of leaves intraepidermal, causing a palisade-like hypertrophy of the lower epidermis, brown, erumpent, without paraphyses, urediniospores variable in size and shape, (18-)22-30(-35) x (13-)15-18(-20)  $\mu\text{m}$ , ellipsoid or obovoid, sometimes ovoid with a broadly rounded base, wall 1.5-2  $\mu\text{m}$  at sides, about cinnamon-brown 2.5-3.5(-4)  $\mu\text{m}$  at apex and usually near chestnut-brown, pores (4)5 or 6, equatorial. Teliospores in uredinia 60-88  $\mu\text{m}$  diam, 3-5 probasidial cells across, central cells 28-33 x (18-)19-24(-26)  $\mu\text{m}$ , cells in one layer, chestnut-brown with a very thin, pale outer layer, each cell bearing 5-10 apically rounded cones or tubercles about 3  $\mu\text{m}$  long, cysts pendent, uni- or biseriate, pedicel colorless, multihyphal, semipersistent.

The host of *Ravenelia tortuosa* is without spines, has bipinnate leaves with numerous small leaflets and two pronounced flattened glands, one petiolar about midway between the base of the petiole and the first pair of pinnae, and another on the distal part of the rachis. These characters suggest the *Albizia* group or perhaps *Leucaena* of the Mimosoideae.

No other Neotropical species of *Ravenelia* have intraepidermal sori. The urediniospores are probably produced by percurrent proliferation, the sporogenous cells producing each new spore through the pedicel of the previous spore. The aecia, which are produced on witches' brooms, have rudimentary peridia and catenulately produced spores. Only eight of the 113 Neotropical species of *Ravenelia* are known to have anamorph sori with catenulately produced spores.

**RAVENELIA ULEANA** P. Hennings, Hedwigia 34: 96. 1895. TYPE on *Chamaecrista claussenii* (Benth.) Irwin & Barneby (first identified as *Cassia* sp.), from **Brazil**, Goiás: “Maranhãogebiet”, Sept 1892, *Ule-1914*. (?!?,II/III).

= *Ravenelia urbaniana* P. Hennings, Hedwigia 36: 215. 1897. TYPE on *Chamaecrista claussenii* (Benth.) Irwin & Barneby (first identified as *Cassia* sp.) from **Brazil**, Goiás: *Glaziou-22750*.

= *Ravenelia chapadensis* Resende & Dianese, Fitopatol. bras. 26: 629. 2001. TYPE on *Chamaecrista decumbentes* (Benth.) H. S. Irwin & Barneby from **Brazil**, Goiás: near Chapada dos Veadeiros National Park, 17 Oct 1994, *Sanchez-259*.

On Leguminosae:

*Chamaecrista claussenii* (Benth.) Irwin & Barneby, Goiás (*Anderson 936030*).

*Chamaecrista conferta* (Benth.) Irwin & Barneby var. *virgata* Irwin & Barneby, Federal District, Goiás (Resende & Dianese, 2001).

*Chamaecrista decumbentes* (Benth.) Irwin & Barneby, Goiás (Resende & Dianese, 2001).

*Chamaecrista orbiculata* (Benth.) Irwin & Barneby, Federal District (IBI-12441, IBI-12462).

*Chamaecrista venatoria* (Irwin & Barneby) Irwin & Barneby, Goiás: (Irwin et al.).

*Chamaecrista* sp., Fed. Dist. (*Heringer-1822*).

*Ravenelia uleana* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, subepidermal in origin, erumpent, often in circinate groups, the ruptured epidermis conspicuous, without paraphyses, urediniospores (18-)21-24(-28) x (17-)18-22  $\mu\text{m}$ , mostly broadly ellipsoid, wall 2.5-3  $\mu\text{m}$  thick, yellowish or golden brown, evenly echinulate, pores numerous, 15-20, scattered, usually obvious. Telia more or less as the uredinia but blackish brown, teliospores (55-)72-95(-106)  $\mu\text{m}$  diam, 4 to 7 probasidial cells across, cells in one layer, chestnut-brown, the pigmented. distal wall inconspicuously verrucose or rugose, overlaid with a nearly colorless, smooth, very thin but discrete outer wall, central cells irregular in size and shape, (19-)22-29(-30)  $\mu\text{m}$  across, probasidial cells with a narrow layer of proximal intercalary cells, cysts biseriata, free, oval, pendent, often with a short stalk, pedicel multihyphal, mostly wide, long and persistent.

The pendent biseriata cysts of *Ravenelia uleana* teliospores are reminiscent of those of *R. cassiaecola*.

We determined that the type of *Ravenelia uleana* (*Ule-1914*) in the Berlin herbarium is *Chamaecrista* sp. as reported above. Resende and Dianese (2001) did not report that they compared their material to *R. uleana*, probably because its host was reported originally as *Cassia* sp. and they did not know that it was a *Chamaecrista*. The conclusion that their rust was a new species was based on comparisons with other rust species on *Chamaecrista* and *Cassia*, but not *R. uleana*. There are some measurement differences between the published description of *Ravenelia chapadensis* and *R. uleana* but they are overlapping with our measurements (Resende and Dianese, 2001). We do not believe they are sufficient to propose the new species and we consider *R. chapadensis* a taxonomic synonym of *R. uleana*.

Important observation reported by Resende and Dianese (2001), that we did not include in our description, were the presence of intercalary cells in the teliospores and supposed paraphyses in the uredinia. We have observed intercalary cells in at least sixteen species of *Ravenelia*. They probably occur in many more but were not easily observed. Intercalary cells probably do indicate a close relationship with *Kernkampella* in which the teliospores have a well developed "patella layer" composed of intercalary cells.

Resende and Dianese (2001) reported long, usually hyaline, thin-walled, pedicel-like structures in the uredinia as paraphyses. We have observed that they arise sympodially from the urediniosporogenous cells. Each sporogenous cell produces pedicellate spores that are deciduous, leaving an old, long pedicel still attached to the sporogenous cell. After a number of spores have been produced, the sporogenous cell remains in the sorus with the old pedicels still attached. These may appear to be paraphyses. It is not clear if the sporogenous cells also produce structures similar to these old pedicels but without spores. If so, these could be called pediceloid paraphyses. We have chosen not to record these in our descriptions as paraphyses because they seem to be present in all anamorph sori that produce pedicellate spores.

See *Ravenelia dentifera* for a key to the species of *Ravenelia* on *Cassia*, *Chamaecrista*, and *Senna*.

*Ravenelia urbaniana* P. Hennings, see **RAVENELIA ULEANA** P. Hennings.



*Ravenelia vilis* H. Sydow & P. Sydow, see **UREDOPHORA VILIS** (H. Sydow & P. Sydow) J. W. Baxter (**RAVENELIA CEBIL** Spegazzini).

*Ravenelia victoria-rossetii* Dianese, Santos, Medeiros & Sanchez, see **RAVENELIA MIMOSAESENSITIVAE** P. Hennings.

*Ravenelia whetzeli* Arthur, see **CHACONIA INGAE** (H. Sydow) Cummins.

#### ***Rostrupia***

*Rostrupia praelonga* Spegazzini, see **CATENULOPSORA PRAELONGA** (Spegazzini) Buriticá.

*Rostrupia scleriae* Pazschke, see **PUCCINIA SCLERIAE** (Pazschke) Arthur.

#### **SCHROETERIASTER**

*Schroeteriaster argentinensis* H. Sydow & P. Sydow, see **PHAKOPSORA ARGENTINENSIS** (Spegazzini) Arthur.

*Schroeteriaster fenestrala* Arthur, see **PHAKOPSORA FENESTRALA** Arthur.

*Schroeteriaster ulei* H. Sydow & P. Sydow, see **PHAKOPSORA ULEII** (H. Sydow & P. Sydow) Buriticá & Hennen.

#### **SCOPELLA** Mains,

Ann. Mycol. 37: 58. 1939. Ono (1984) placed all species of *Scopella* in *Maravalia*.

*Scopella amazonensis* Albuquerque, see **MARAVALIA AMAZONENSIS** (Albuquerque) Ono.

*Scopella bauhiniicola* Cummins, see **MARAVALIA BAUHINIICOLA** (Cummins) Y. Ono.

*Scopella confluens* (P. Hennings) Cummins, see **UREDOPHORA CONFLUENS** P. Hennings.

*Scopella jarini* Albuquerque, see **MARAVALIA SWARTZIAE** Ono.

*Scopella lucumae* (Dietel) Cummins, see **MARAVALIA LUCUMAE** (Dietel) Y. Ono.

*Scopella palaquii* Cummins, see **MARAVALIA PALAQUII** (Cummins) Y. Ono.

#### **SKIERKA** Raciborski,

Paras. Algen Pilze Javas. 2: 30. 1900. TYPE SPECIES *Skierka canarii* Raciborski on *Canarium commune* Linnaeus (Burseraceae) from Java.

*Skierka* is characterized by its unique anamorph spores whose walls have a longitudinal, circumpolar, thin wing-like extension whose margin is irregularly echinulate or crenulate. The teliospores are also easy to recognize because they are one-celled, often with a narrow apical horn-like or spear-like extension, and are produced in irregular succession, strongly adherent, and extruded from the sorus in long whitish, hair-like columns.

About a fifteen species have been reported circumglobally in tropical areas. The only monographic treatment of the genus is that of Mains (1939b) who included ten species. Family, uncertain (Cummins & Hiratsuka, 1983).

**SKIERKA CRISTATA** Mains [as "(Speg.) Mains *comb. nov.*"]. Mycologia 31: 182. 1939. TYPE, a lectotype needs to be chosen from the two specimens with telia listed by Mains: *Johnston-779* on *Cupania macrophylla* A. Rich. from **Cuba**: San Antonio de las Baños, 11 June 1916; or *C. F. Baker-88*, on *Cupania* sp. from **Cuba**, Santiago de las Vega, 6 June 1905. (0/I,II/III).

= *Cionothrix cupaniae* Arthur, Mem. Torrey Bot. Club 17: 115. 1918. TYPE on *Cupania glabra* Swartz from **Cuba**: Oriente: Paso Estancia, 3 May 1916, *Johnston-694*.

Anamorph

*Uredo cristata* Spegazzini, Anal. Soc. Ci. Argentina 17: 119. 1884. TYPE on undetermined Sapindaceae, probably *Cupania* sp. from **Paraguay**, Villa Rica, Jan 1882, *Balansa-3474*. This anamorph name applies to both aecia and uredinia.

≡ *Uromyces cupaniae* Arthur & Johnston, nom. nov., Mem. Torrey Bot. Club 17: 134. 1918. Not *Uromyces cristatus* Schroeter & Niessl, 1877, on Caryophyllaceae.  
 ≡ *Ctenoderma cristatum* (Spegazzini) H. Sydow & P. Sydow, Ann. Mycol. 17: 103. 1920.

On Sapindaceae.

*Cupania* sp., São Paulo (76-706).

This is the first record of this species from Brazil.

**SKIERKA DIVINOPOLENSIS** J. C. Dianese, Medeiros & Santos in J. C. Dianese et al., Fitopatol. Bras. 18: 446. 1993. TYPE on *Mataybae guianensis* from **Brazil**, Minas Gerais: Município Araguaí, 25 Feb 1993, *M. Sanchez s.n.*

On Sapindaceae

*Cupania rugossa* Radk., Minas Gerais (J. C. Dianese, 1993: 449).

*Mataybae guianensis* Minas Gerais (J. C. Dianese, 1993: 449).

#### **SPHAEROPHRAGMIUM** Magnus,

Ber. Deutsch. Bot. Ges. 9: 121. 1891. TYPE SPECIES: *Sphaerophragmium acaciae* (Cooke) Magnus. *Sphaerophragmium* is a genus of sixteen species, 13 on Leguminosae and three on Annonaceae, all native of Asia and Africa, except the questionable *S. silveirae* listed below. Family Sphaerophragmiaceae. See the monograph by Lohsomboon et al. (1994).

The genus is characterized by multicellular teliospores that are pedicellate and both vertically and horizontally septate (muriform). The teliospore walls are sculptured with simple or often furcate spines or projections.

**SPHAEROPHRAGMIUM ACACIAE** (Cooke) Magnus, Ber. Deutsch. Bot. Ges. 9: 121. 1891.

(?/?/IIpe/III).

≡ *Triphragmium acaciae* Cooke, Grevillea 8: 94. 1880. TYPE on *Albizia lebbek* (Linnaeus) Benth from India, Bombay: Belgaum, 1879, *Hobson-K17*.

= *Sphaerophragmium luzonicum* Yates, Philippine J. Sci. Bot. 13: 374. 1918. TYPE on *Albizia procera* (Roxb.) Benth from The Philippines, Luzon: Rizal, date not reported, *Yates s.n.*

On Leguminosae.

*Albizzia lebbeck* Benth, Rio de Janeiro (Silveira, 1974: 119), Minas Gerais (IBI-14122, -15657).

This is an introduced rust species that has become widespread on its introduced host that is used in reforestation and as an ornamental.

*Sphaerophragmium debile* P. Sydow & H. Sydow, see **SPUMULA DEBILE** (P. Sydow & H. Sydow) Lohsomboon et. al.

*Sphaerophragmium luzonicum* Yates, see **SPHAEROPHRAGMIUM ACACIAE** (Cooke) Magnus.

**SPHAEROPHRAGMIUM SILVEIRAE** Spegazzini, Anal. Soc. Cient. Argentina 93: 111. 1922. TYPE on *Acacia pedicellata* Benth, Leguminosae, from **Brazil**, Rio de Janeiro, Sept 1921, *F. Silveira-s.n.* (?/?/?/III).

*Sphaerophragmium silveirae* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

*Sphaerophragmium sorghi* Batista & Bezerra, Nova Hedw. 2: 347. 1960. Not a rust.

### SPHENOSPORA Dietel,

Ber. Dtsch. Bot. Ges. 10: 63. 1892. TYPE SPECIES *Sphenospora pallida* (Winter) Dietel, see below.  
Family Raveneliaceae.

*Sphenospora* is characterized by telia that are waxy-oily cushions when moist, hard when dry, teliospores are pedicellate with two probasidial cells separated by a vertical septum. The probasidial cells are thin-walled, without sculpturing, colorless or very pale, and germinate without dormancy to produce well differentiated metabasidia. The metabasidia are straight, not curved as most other metabasidia. Several teliospores arise from a well differentiated teliosporogenous cell. Free hand sections or mounts of teliospores have abundant oily droplets. Uredinia are pulverulent and yellowish to brownish, often cinnamon-brown. Spermogonia and aecia are unknown for the genus.

About ten species are known, most of them in the tropics of the Americas.

The basic structure of the teliospores of *Sphenospora* is the same as that of *Diorchidium* but up to now only two-celled teliospores are known. *Sphenospora* differs from *Diorchidium* because its telia contain a gelatinous-oily matrix that upon drying is hard or leathery. Hennen et al. (1998) discuss the relation of *Sphenospora* to *Diorchidium*..

A comparison of the urediniospores of three species *Sphenospora* on Orchidaceae:

1. Urediniospores a little smaller: (20-)22-26(-29) x (17-)19-22(-23)  $\mu\text{m}$ , pores 3(-4), equatorial  
*Sphenospora mera*.
2. Urediniospores a little larger: (22-)24-33 x 18-26  $\mu\text{m}$ , pores 1, 2, or 4, equatorial *Sphenospora kevorkianii*.
3. Urediniospores larger: (26-)30-40(-45) x (18-)20-23(-25)  $\mu\text{m}$ , pores 3, equatorial, obscure.  
*Sphenospora saphena*.

*Sphenospora copaiferae* P. Sydow & H. Sydow, see **DIORCHIDIUM COPAIFERAE** (P. Sydow & H. Sydow.) Cummins & Y. Hiratsuka.

**SPHENOSPORA KEVORKIANII** Linder, Mycologia 36: 464. 1944. TYPE on *Epidendrum difforme* Jacquin from **Nicaragua**, Capo: Bilwas Karma, 6 Apr 1943, *Kevorkian s.n.* (??,IIpe/III).

Anamorph

- Uredo nigropunctata* P. Hennings, Hedwigia 35: 254. 1896. TYPE on *Cyrtopodium* sp. (published as "*Stanhopea* sp.") from **Brazil**, Rio de Janeiro, July (?Aug) 1887, *Ule-652*. (This name has priority because it was published just above *Uredo epidendri* on the same page).
- = *Uredo epidendri* P. Hennings, Hedwigia 35: 254. 1896. TYPE on *Epidendrum* sp. from **Brazil**, Santa Catarina: Tubarão, Feb 1889, *Ule-1267*.
- = *Uredo cyrtopodii* H. Sydow & P. Sydow, Bull. Herb. Boiss. II, 1: 77. 1901. TYPE on *Cyrtopodium* sp. from **Brazil**, Rio de Janeiro: Maua, 18 Aug 1896, *Ule-(?2447) or -2457*.
- = *Uredo wittmackiana* P. Hennings & Klitzing in P. Hennings, Gartenflora 53: 397. 1904. TYPE from **Mexico**, other data not available.
- = *Uredo guacae* Mayor, Mem. Soc. neuchâteloise Sci. nat. 5: 583. 1913. TYPE on *Epidendrum* sp. from **Colombia**, Antioquia: near Guaca 12 Sept 1910, *Mayor-108*.

See also *Uredo carnosae* Spegazzini which probably belongs here.

On Orchidaceae.

*Catasetum* sp., São Paulo (IBI-16795).

*Cyrtopodium punctatum* (Linnaeus) Lindley, Mauá (Sydow, 1924: 503).

*Cyrtopodium* sp., (published as *Stanhopea* sp.), Rio de Janeiro (Hennings, 1896: 254).

*Epidendrum* sp., Santa Catarina (Hennings, 1896: 254).

*Natylia lyrata*, Brasil (PUR-F16894).

*Prescottia sclerophylla*, Rio de Janeiro (PUR-F19210), São Paulo (IBI-12052).

*Sauroglossum nitidum* (Velloso) Schlechter, São Paulo (IBI-17379).

*Spiranthes* sp., São Paulo (IBI-13881).

*Stanhopea graveolens* Lindley, São Paulo (PUR-F52698).

*Stenorrhynchus* sp., Serra dos Orgãos (Dietel, 1899: 256).

*Zygostates lunata* Lindley, Brasil (PUR-F16442).

*Sphenospora kevorkiani*, or as one of its anamorph synonyms, a native rust widespread in the tropics of the Americas, has been reported to infected at least twelve genera of Orchidaceae including *Bletia* and *Oncidium*, not listed above. But the identifications of the hosts in most cases require confirmation. Most of the specimens in PUR and IBI have come from plant quarantine interceptions or submitted by orchid growers for identification.

Infections by *Sphenospora kevorkianii* on different host genera result in different symptoms. Infected leaves have powdery, yellow rust sori that are associate with small reddish or blackish discolored leafspots. This latter trait was the source of the epithet for the anamorph name *Uredo nigropunctata*. Variability in symptoms may have influenced the naming of the different synonyms listed above.. Telial sori have a waxy, yellow-brown to blackish appearance. Management includes the removal and destruction of the infected leaves.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, subepidermal in origin, blister-like at first, erumpent, yellowish brown; urediniospores (22-)24-33 x 18-26  $\mu\text{m}$ , broadly ellipsoid or obovoid, wall 1.5-3  $\mu\text{m}$  thick, yellowish, echinulate, pores 1, 2 or 4, equatorial. Telia on the abaxial side of leaves, erumpent, scattered or often circinately arranged, pulvinate, blackish- brown or black, waxy, hard when dry, teliospores 23-28 x 13-16  $\mu\text{m}$ , ellipsoid or oval, wall uniformly 1  $\mu\text{m}$  thick, colorless, smooth, germ pore 1 in each cell, apical, if differentiated, pedicel colorless, 40-65  $\mu\text{m}$  long 6-8  $\mu\text{m}$  wide, persistent.

**SPHENOSPORA MERA** Cummins, Bull. Torrey Bot. Club 72: 214. 1945. TYPE on *Cynoches chlorochilum* Rolfe, from **Venezuela**, unknown locality, intercepted in Plant Quarantine at San Juan, Puerto Rico, 16 Nov 1943 by L. J. Mc Connell 8719, PUR (isotypes PAC, US). (??, **Ipe/III**).

On Orchidaceae

*Eulophidium maculatum* (Lindley) Pfitzer; Brazil, (BPI US 042051).

*Sphenospora mera* has been reported also on seven other genera of Orchidaceae and from Peru, Central America, Mexico, and The West Indies, all intercepted in Plant Quarantine. Host identification requires confirmation.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, scattered, subepidermal becoming erumpent, pale cinnamon-brown, urediniospores (20-)22-26(-29) x (17-)19-22(-23)  $\mu\text{m}$  obovoid or broadly ellipsoid, wall 2-2.5  $\mu\text{m}$  thick, yellowish to nearly cinnamon-brown, echinulate, pores 3(4), equatorial, with slight cuticular caps. Telia on the abaxial side of leaves, pulvinate, scattered or circinately disposed, dark brown, waxy when fresh, hard when dry, paraphyses or some kind of sterile elements present, cylindrical, colorless, teliospores (20-)23-28(-30) x 11-14(-15)  $\mu\text{m}$ , more or less oblong-ellipsoid, wall uniformly 0.5  $\mu\text{m}$  thick, colorless, smooth, pedicel 30-45  $\mu\text{m}$  long, nearly as wide as the spore at the hilum, persistent.

**SPHENOSPORA PALLIDA** (Winter) Dietel in Engler & Prantl, Nat. Pfl. 1(1): 70. 1897. (??, **Ipe/III**).

≡ *Diorchidium pallidum* Winter, Grevillea 15: 86. 1887. TYPE on *Dioscorea* sp., originally reported as an unidentified vine, from **Brazil**, Santa Catarina: São Francisco, August 1884, Ule-143.

≡ *Puccinia sphenospora* P. Sydow & H. Sydow, Mon. Ured. 1: 838. 1907. *Nom. nov.* for *Diorchidium pallidum* Winter, not *Puccinia pallida* Tracy.

Anamorph

*Uredo dioscoreae* P. Hennings, Hedwigia 35: 255. 1896. TYPE on *Dioscorea grandiflora* from **Brazil**, Rio de Janeiro: Rio de Janeiro, August 1887, Ule-1342. [not *Uredo dioscoreae* (Berkeley & Broome) Petch, 1912, on *Dioscorea* sp. from Sri Lanka, an anamorph of *Goplana dioscoreae* Cummins].

= *Uromyces taubertii* P. Hennings, Bot. Jahrb. Syst. 15: 14. 1892. TYPE on *Dioscorea piperifolia* Willdenow from **Brazil**, Rio de Janeiro: Rio de Janeiro, date not reported, Glaziou-4266. Only urediniospores.

= ?*Uredo aristolochiae* Albuquerque, Pesq. Agropec. Bras. Ser. Agron. 6: 147.

1971 (Not *U. aristolochiae* DeCandolle from Europe).?may be OK as sp. nov.

On Dioscoreaceae. (Some hosts from São Paulo collections are *Cissampelos* in Menispermaceae).

*Dioscorea grandiflora* Martius, Rio de Janeiro (Jackson, 1926: 157; IBI-1725).

*Dioscorea lagoa-santa* Uline, São Paulo (Joerstad, 1956: 485).

*Dioscorea monadelpha* (Kunth) Pax, Paraná (Joerstad, 1956: 485).

*Dioscorea piperifolia* Humboldt & Bonpland & Kunth, Mato Grosso (Joerstad, 1956: 485).

*Dioscorea trifida* L., Rio Acre (Sydow, 1916: 67).

*Dioscorea* sp., Amapá (IBI-16008), Bahia (IBI-13580), Minas Gerais (IBI-15893), Pará, (PUR-F18962), Paraná (Joerstad, 1956: 485), Rio de Janeiro (Jackson, 1926: 157), Santa Catarina (Sydow, Mon. Ured. 1: 1907), São Paulo (IBI-12080).

*Sphenospora pallida* has been reported also from Peru, Ecuador, Venezuela, and Belize. Reports have been often only as the anamorph, *Uredo dioscoreae*.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, scattered, subepidermal in origin becoming erumpent, dull yellow when dry, probably bright yellow when fresh, urediniospores (20-)22-26(-29) x 19-22 µm, broadly obovoid, broadly ellipsoid, or globoid, wall (1.5-)2-2.5(-3) µm thick, pale yellowish or almost colorless, echinulate, pores equatorial, 3(-4?), obscure. Telia much as the uredinia except compact and waxy, teliospores (24-)25-29 x 12-14(-16) µm, mostly narrowly ovoid with septum parallel to the optical axis, wall uniformly 1-1.5 µm thick, colorless, smooth, pedicel broad at apex, narrowing below, thin-walled, colorless, collapsing.

**SPHENOSPORA SAPHENA** Cummins, Bull. Torrey Bot. Club 87: 40. 1960. TYPE on *Oncidium tetrapetalum* (Jacquin) Willdenow from **The United States of America, Florida**: Pass-A-Grille, June 1959, *J. H. Bollick* Accession No. 0-6628, State Plant Board of Florida, infected plants were supposedly imported from Jamaica in January or February, 1959. (??,IIpe/III).

On Orchidaceae

*Notylia lyrata* S. Moore, Brazil (BPI-US 042200-0 1).

*Oncidium* sp., Brazil (BPI-US 042122).

The Brazilian records were specimens intercepted by the US plant quarantine service from specimens sent to the United States of America from Brazil.

Spermogonia and aecia unknown. Uredinia on the abaxial side of leaves, subepidermal in origin becoming pustulate, brownish, in dense groups, urediniospores (26-)30-40(-45) x (18-)20-23(-25) µm, broadly ellipsoid or mostly ellipsoid, wall 2-3(-3.5) µm thick, yellowish or golden brown, echinulate, pores 3 or 4, equatorial, obscure. Telia on the abaxial side of leaves, subepidermal becoming erumpent, pulvinate, without paraphyses, brown, waxy when moist, hard when dry, teliospores 25-45 x 10-14 µm, mostly oblong-ellipsoid, wall 0.5 µm thick, colorless, pedicel 25-45 µm long, colorless.

**SPHENOSPORA SMILACINA** H. Sydow, Ann. Mycol. 23: 318. 1925. TYPE on *Smilax* sp. from **Guatemala**, San Felipe, 14 Jan 1917, *Holway-718*. (??,IIpe/III).

Anamorph

*Uredo yurimaguasensis* P. Hennings, Hedwigia 43: 164. 1904. TYPE on *Smilax* sp. from **Peru**, Yurimaguas, August 1902, *Ule-3251*.

≡ *Sphenospora yurimaguasensis* (P. Hennings) H. S. Jackson & Holway in Jackson, Mycologia 18: 153. 1926. Teleomorph not described.

On Smilacaceae (Liliaceae in first edition).

*Smilax domingensis* Willdenow, Rio de Janeiro (Jackson, 1926: 153; PUR-F2202).

*Smilax japecanga* Grisebach, Pará (IAN-694).

*Smilax papyracea* Poir, Minas Gerais (Thurston, 1940: 304).

*Smilax santarenensis*, Amapá (Sotão-910216).

*Smilaxsiphilitica*, Pará (Sotão-920218).

*Smilax* sp., Pará (*Sotão et al.*-S95-344), Paraíba (Viégas, 1945: 91; IAC-3849; Rio de Janeiro (Jackson, 1926: 153), São Paulo (Jackson, 1926: 153, IBI-12166).

*Sphenospora smilacina* has been reported also from Venezuela, Colombia, Ecuador, Peru, Mexico, Central America, and the West Indies.

Spermogonia and aecia unknown. Uredinia mostly hypophynous, subepidermal in origin, erumpent, pulverulent, near cinnamon-brown, often arranged in circles, urediniospores 25-30(-33) x (19-)21-24(-26) µm, broadly ellipsoid or obovoid, wall (1.5-)2-2.5(-3) µm thick, cinnamon-brown or yellowish brown, echinulate, pores 2, equatorial. Telia on the abaxial side of leaves, early erumpent, scattered or grouped, often

circinately, pulvinate, honey color or reddish, waxy, teliospores (22-)24-30 x (11-)12-15 µm, oblong-fusiform or oblong-ellipsoid, wall uniformly 1 µm thick, colorless, smooth, germ pore, if differentiated one, apical in each cell, pedicel colorless, usually collapsing laterally, 30-50 µm long, persistent.

*Sphenospora yurimaguasensis* H. S. Jackson & Holway, see *Uredo yurimaguasensis* P. Hennings (SPHENOSPORA SMILACINA H. Sydow).

#### *Spirochina*

*Spirochina loeseneriana* Arthur, see **KUEHNEOLA LOESENERIANA** (Arthur) H. S. Jackson & Holway.

#### **SPUMULA** Mains,

Mycologia 27: 638. 1935. TYPE SPECIES *Spumula quadrifida* Mains on *Calliandra bijuga* Rose, Leguminosae, from **Mexico**, Jalisco: trail from San Sebastian to Real Alto, *Ynes Mexia-1638*.

*Spumula* is characterized by teliospores with three to several, laterally united, smooth or sculptured probasidial cells, subtended by colorless more or less hygroscopic cysts, each probasidial cell has one germ pore and germinates with a well differentiated metabasidium, each spore is borne on a unihyphal pedicel. Family Raveneliaceae.

*Spumula* differs from *Ravenelia* mainly by having teliospore pedicels composed of only one hyphal strand instead of two or several. It, like *Ravenelia*, occurs only on Leguminosae.

**SPUMULA DEBILE** (P. Sydow & H. Sydow) Lohsomboon et al. Mycol. Res. 98: 918. 1994. (?/?,II/III).

≡ *Sphaerophragmium debile* P. Sydow & H. Sydow, Mon. Ured. 3: 186. 1914. TYPE on *Calliandra tweediei* Bentham, Leguminosae, from **Brazil**, Rio Grande do Sul: Porto Alegre, 19 Sept 1892, *Lindman*.

*Spumula debile* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

**Spumula (RAVENELIA) RATA** H. S. Jackson & Holway in Jackson, Mycologia 23: 337. 1931. TYPE on *Acacia pedicellata* Bentham, Leguminosae, from **Brazil**, Rio de Janeiro: Rio de Janeiro, 13 Aug 1921, *Holway-1032*. (0/-/III).

**Spumula (RAVENELIA) THEISSENIANA** H. Sydow & P. Sydow, Ann. Mycol. 14: 258. 1916. TYPE on undetermined Leguminosae, probably *Piptadenia* sp., from **Brazil**, Rio Grande do Sul: São Leopoldo, July 1914, *J. Rick*, com. F. Theissen. (?/?,IIpe/III).

#### *Teleutospora* Arthur & Bisby in Arthur,

Bull. Torrey Bot. Club 48: 38. 1921. See Laundon (1965A) for the designation of the type species.

Arthur (1922) proposed that *Teleutospora* should be used for microcyclic species of *Uromyces*. In ontogenic terminology the species are short cycled, i. e. only telia are produced, spermogonia may or may not be produced. Teliospores are one-celled and pedicellate. Later, Arthur abandoned the use of *Teleutospora* and it is not used any more. Most of the species are now placed in *Uromyces*.

#### *Thirumalachariella*

*Thirumalachariella holwayi* (H. S. Jackson) Kamat & Sathe, see **PHRAGMIDIELLA HOLWAYI** (H. S. Jackson) Buriticá.

#### *Trachyspora*

*Trachyspora vestita* (Dietel) Lindquist, Bol. Soc. Argentina Bot. 7: 18. 1957.

≡ *Uromyces vestitus* Dietel, Annal. Mycol. 6: 94. 1908. Not a rust.

Lindquist (1958) reported that *Trachyspora vestita* is *Chlamydomyces palmarum* (Cooke) Mason (Moniliales).

**TRANZSCHELIA** Arthur,

Rés. Sci. Congr. Bot. Vienne p. 340. 1906. TYPE SPECIES *Puccinia cohaesa* Long [= *Tranzschelia cohaesa* (Long) Arthur on *Anemone* sp., Ranunculaceae, from The United States of America, Texas].

Lopez-Franco and Hennen (1990) characterized *Tranzschelia* as having conical, subcuticular spermogonia with periphyses, receptive hyphae, and a flat hymenium, aecia when produced belong to the anamorph genus *Aecidium*, uredinia have oblong to capitate paraphyses, urediniospores are borne singly on pedicels, easily deciduous, with echinulate walls that are smooth at the apex, and germ pores around the equatorial region or slightly sub- or supra-equatorial, teliospores usually two-celled by a horizontal septum, borne singly on pedicels which in several species tend to adhere to others for more than 2/3 their length, then tending to be in fascicles, or in other species teliospores remain independent, wall pigmented, echinulate or verrucose, one germ pore in each cell in various positions depending on the species.

About 15 species are known world wide, all occur only in the Northern Hemisphere except for two species on cultivated species of *Prunus*. About eight species occur in North America, only the two on cultivated *Prunus* are in South America. Heteroecious species produce spermogonia and aecia on Ranunculaceae, uredinia and telia on *Prunus* spp. in the Rosaceae. All autoecious species parasitize genera in the Ranunculaceae. A few of these are microcyclic. Family Uropyxidaceae.

**TRANZSCHELIA DISCOLOR** (Fuckel) Tranzschel & Litvinov, Bot. Zh. SSSR 24: 248. 1939.

(0/ I≠ II/III).

≡ *Puccinia discolor* Fuckel, Fungi Rheneni 2121, 1867. TYPE on *Prunus insititia* from Europe.

≡ *Tranzschelia punctata* Arthur, Res. Sci. Congr. Vienne, p. 350. 1906.

≡ *Tranzschelia pruni-spinosae* (Persoon) Dietel f. *discolor* (Fuckel) Fischer, Beitr. Kryptogamenfl. Schweiz 2: 157-159. 1904.

≡ *Tranzschelia pruni-spinosae* (Persoon) Dietel var. *discolor* (Fuckel) Dunegan, Phytopathology 28: 424. 1938.

Anamorph

*Uredo persicae* Spegazzini, Revista Mus. La Plata 15: 9. 1908. TYPE on *Prunus persicae*, from **Brazil**, São Paulo: "autum around São Paulo", *A. Usteri* s.n. (We have not determined all of the older anamorph names available in European literature that may have priority as the correct names for the uredinial and aecial anamorphs).

On Rosaceae.

*Prunus americana* L., Rio Grande do Sul (Lindquist & Costa Neto, 1963: 124.).

*Prunus cerasus* L., São Paulo (Viégas, 1945: 57; IAC-171).

*Prunus domestica* L., Minas Gerais (Thurston, 1940: 304; Viégas, 1945: 57; IAC-3952), Paraná (Fontoura & Nowacki, 1967/70: 163), Santa Catarina (IBI-5419), São Paulo (Viégas, 1945: 57; IAC-164).

*Prunus persica* L., Minas Gerais (Thurston, 1940: 304; Viégas, 1945: 57; IAC-3961.), Paraná (Fontoura & Nowacki, 1967/70: 164), São Paulo (Viégas, 1945: 57; IAC-47).

*Tranzschelia discolor*, the rust of peaches, plums, apricots and cherries (*Prunus* spp.), is native to southwest Eurasia and has spread throughout the world where *Prunus* spp. are cultivated. It has been reported often in older literature as *Tranzschelia pruni-spinosae* or *Tranzschelia punctata*.

Spermogonia and aecia not reported for South America. Uredinia on abaxial side of leaves, numerous, scattered, small, powdery, dark brown; often on the adaxial side of leaves above the sori, appear angular, yellow leaf spots, these may become necrotic; sori with numerous, often capitate paraphyses, urediniospore walls thickened apically. Teliospores not common in Brazil. The upper cells of the teliospores are coarsely verrucose, the verrucae of the lower cells tend to be elongate to striate, the germ pore in both cells tend to be at the septum (Lopez-Franco and Hennen, 1990).

To prevent very early infections plant pathologists recommend pruning of older branches and application of fungicides during the dormant period of the fruit trees.

In the Mediterranean region and other areas of Eurasia spermogonia and aecia occur on *Anemone* spp., Ranunculaceae. Spermogonia and aecia have been reported only rarely in North America. In most parts of the world the rust survives by its urediniospores, and at times by overseasoning uredinial infections in young stems. As is common in rusts that attack many widely spread cultivated plants, physiologic specialization has been reported for *Tranzschelia discolor*. See Lopez-Franco and Hennen (1990) for more information about species of *Tranzschelia* in the Americas.

*Triactella* H. S. Jackson

*Triactella holwayi* H. S. Jackson, see **ESALQUE HOLWAYI** (H. S. Jackson) Hennen et al.

*Trichobasis* Lèveillé,

in Orbigny, Dict. Nat. Hist. 12: 785. 1848. A TYPE or LECTOTYPE SPECIES has never been chosen. The name is not in use. It is considered as a synonym of the morphological anamorph genus *Uredo*.

*Trichobasis crotonis* Cooke, see **PHAKOPSORA CROTONIS** (Burrill) Arthur.

*Trichobasis howei* Peck, see *Uredo asclepiadis* Schweinitz (**UROMYCES ASCLEPIADIS** Cooke).

*Trichobasis hyperici* W. Gerard, see *Uredo hyperici* Sprengle (**UROMYCES TRIQUETRUS** Cooke).

*Trichobasis lynchii* Berkeley, see **UREDOLYNCHII** (Berkeley) Plowright.

*Triphragmium*

*Triphragmium acaciae* Cooke, see **SPHAEROPHRAGMIUM ACACIAE** (Cooke) Magnus.

*Triphragmium binatum* Berkeley & Curtis, see **DICHEIRINIA BINATA** (Berkeley & Curtis) Arthur.

*Tunicopsora bagchii* Singh & Pandey, see **KWEILINGIA**.

*Uleiella* Schroeter,

Hedwigia Beiblatt 33: (65). 1894. TYPE SPECIES: *Uleiella paradoxa* Schroeter, see below.

Although two species of *Uleiella* have been named, we consider *Uleiella chilensis* from Chile as a synonym of *Uleiella paradoxa* from Brazil. See the note below about this species.

*Uleiella paradoxa* Schroeter, Hedwigia Beiblatt 33: (65). 1894. TYPE on *Araucaria imbricata* from **Brazil**, Santa Catarina: Serra Geral, May 1891, *E. Ule-1057*.

On Pinaceae.

*Araucaria brasiliensis angustifolia* Kuntze, Santa Catarina [Schroeter, 1894: (65)].

*Uleiella paradoxa* infects cones of *Araucaria* and produces large, black, ovoid, ellipsoid, or globoid, non-prdicellate, multicellular phragmospores. Because the unusual morphology of the spores and they have never been reported to germinate some authors state that this fungus is probably not a rust.

Oehrens (1963) reported *Uleiella chilensis* Dietel & Neger from Chile which we consider as a synonym of *Uleiella paradoxa*. See Barth (1964), and Thirumalachar (1949).

**UNCOL** Buriticá & P. A. Rodriguez,

Rev. Acad. Colombia Cienc. 24: 112. 2000. Type species *Uncol diazii* Buriticá & P. A. Rodriguez on unidentified Cyatheaceae from Colombia..

*Uncol* is characterized by its suprastomatal telial sori that are morphologically similar to those of *Calidion*, except teliospores are catenulate, and develop as sessile, blastic single cells. Buriticá & P. A. Rodriguez emphasize that other genera of rusts in which the telial sori are suprastomatal have pedicellate teliospores.

**UNCOL DIAZII** Buriticá & P. A. Rodriguez, Rev. Acad. Colombia Cienc. 24: 112. 2000. TYPE on unidentified Cyatheaceae from **Colombia**, Caquetá: 19 km from Florencia on the way to Altamera, 16 Jan 1976, K. P. Dumont, P. Buriticá et al.-76-171 (?/?,II?/III).

Anamorph

*Calidion dumontiae* Buriticá,

or *Calidion lindsaeae* (P. Hennings) H. Sydow & P. Sydow, Ann. Mycol. 16: 243. 1918. TYPE



same as for *Uredo lindsaeae* P. Hennings.

≡ *Uredo lindsaeae* P. Hennings, Hedwigia 43: 165. 1904. TYPE on *Lindsaea ulei* Hieronymus (Pteridophyta) from **Brazil**, Amazonas: Rio Juruá, Juruá-Mirim, Aug 1901, *Ule*-2998.

On Pteridophyta

*Lindsaea lancea* (Linnaeus) Bedd., Mato Grosso (PUR-F18273).

*Lindsaea ulei* Hieronymus, Amazonas (Hennings, 1904: 165; Sydow, 1918: 243).

*Polypodium brasiliensis* Poirlet, Rio de Janeiro (Silveira, 1974: 119).

The anamorph genus *Calidion* was established for a rust species that produces sori with well developed peripheral paraphyses and has been reported from a few collections on ferns in Amazonia. It is characterized by its sori that have three well defined zones, two within a substomatal chamber and one suprastomatal zone. Within the substomatal chamber there is a basal pseudoparenchymatous layer about ten cells deep and a middle layer of a palisade of irregularly cylindrical sporogenous cells. Suprastomatically there is an upper zone composed of a circle of numerous, dorsally thick-walled, peripheral paraphyses that enclose the maturing spores that have emerged from the sporogenous cell layer. The sori appear to be on the leaf surface but they are not truly suprastomatal because the epidermis is partially broken around the sori. Superficially the sori of *Calidion* resemble sori of *Desmella*, but the sori of *Desmella* are truly suprastomatal and they do not have paraphyses.

Two species have been published, *C. lindsaeae* and *C. dumontiae*. Buriticá and Rodriguez (2000) published a connection between *Calidion dumontiae* Buriticá from Colombia and a new teleomorph genus, *Uncol* Buriticá & P. A. Rodriguez.

*Uncol diazii* has been reported from Colombia and from Brazil from the above records. The anamorph genus *Calidion*, with only *C. lindsaeae* and the Colombian species *C. dumontiae* Buriticá, is characterized by sori that have strongly laterally thickened, almost colorless, incurved peripheral paraphyses. Buriticá and Rodriguez (2000) published a connection between *C. dumontiae* and *Uncol* Buriticá & P. A. Rodriguez.

*Uraecium* Arthur,

Bull. Torrey Bot. Club 60: 476. 1933. TYPE SPECIES *Uraecium holwayi* (Arthur) Arthur (≡ *Uredo holwayi* Arthur).

Arthur established *Uraecium* to include sori that had traits of *Uredo* (without a clear definition of *Uredo*, apparently the only morphological trait necessary being pedicellate spores) and the sori had to be intimately associated with spermogonia. Therefore, these sori probably function as aecia. Arthur coined the name at a time when he tried to use the life cycle stage as the primary characteristic for separating anamorph ("form") genera. The name combines the two words uredo and aecium. The type species, *Uredo holwayi* Arthur, parasitizes leaves (needles) of the Gymnosperm genus *Tsuga* in North America. It is characterized by having pedicellate spores and the sorus is surrounded by paraphyses that overlap in such a way as to form a covering around the sorus simulating a peridium.

Ainsworth and Bisby (1950) and Thirumalachar and Narasimhan (1951) considered *Uraecium* as a synonym of *Uredo*. We propose that *Uraecium* should be abandoned and that the name is a *nomen confusum* in terms of the ICBN.

*Uraecium lucumae* (Arthur & Johnston) Arthur, see *Uredo lucumae* Arthur & Johnston, **CHROTELIUM LUCUMAE** Cummins.

**UREDINOPSIS** Magnus,

Atti Congr. internat. Bot. Genova 1892. p. 167. 1893. TYPE SPECIES, *Uredinopsis filicina* Magnus on *Phegopteris vulgaris* from Europe.

*Uredinopsis* is a heteroecious genus of about ten species in the Northern Hemisphere; spermogonia and aecia are mostly on the gymnosperm genus *Abies*; uredinia and telia are on ferns. One species occurs in Brazil, *U. pteridis* Dietel & Holway on the fern genus *Pteridium*. This rust, although with a heteroecious life cycle, probably persists in Brazil by means of repeated infections by urediniospores because its spermogonial and aecial hosts do not occur in Brazil. The urediniospores are often extruded from the sori on the abaxial side of fern leaves as minute white thread-like tendrils visible to the unaided eye. In water these spores separate readily.

*Uredinopsis macrosperma* Magnus, see **UREDINOPSIS PTERIDIS** Dietel & Holway.

**UREDINOPSIS PTERIDIS** Dietel & Holway in Dietel, Ber. Deutsch. Bot. Ges. 13: 331. 1895. TYPE on *Pteridium* sp. from The United States of America, California, place or date not reported, *Blasdale s.n.* (**0/I** ~~§~~ **II/III**).

Anamorph

*Uredo macrospermum* Cooke, Grevillea 8: 71. 1879.

= *Uredinopsis microsperma* Magnus, Hedwigia 43: 122. 1904.

On Pteridophyta (?Polypodiaceae).

*Pteridium* sp., Rio de Janeiro (Jackson, 1926: 140),. Santa Catarina (Ule-1197b, Blumenau, Oct 1888, HBG), São Paulo (IBI-12492).

*Uredinopsis pteridis* has been reported in scattered places worldwide on *Pteridium* spp.

The urediniospores of *Uredinopsis pteridis* are narrowly ellipsoid, with colorless walls, and with a line of cog-like warts in a lengthwise spiral around the spore.

#### **UREDO** Persoon: Persoon, **anamorph**

Syn. Meth. Fung. p. 214, 1801. LECTOTYPE *Uredo betae* Persoon on *Beta vulgaris* Linnaeus (Chenopodiaceae) from Europe (chosen by Laundon, 1965 A).

The anamorph genus *Uredo* has been used extensively in the past as a kind of “waste basket” for almost any kind of sori thought to function as uredinia. Unfortunately, this has resulted in a great mixture of combinations of morphological traits to be placed in this genus. Therefore, when we find a species of *Uredo* named in the literature, we know little about its morphology based on its name. For modern usage this genus must be restricted to those anamorphs that have only the basic morphological traits of its lectotype species, *Uredo betae* Persoon. As a rust anamorph name based on morphology alone, it cannot be restricted to uredinia.

A more complete classification of rust anamorphs is needed based on morphology alone. This would give a clearer picture of the great morphological diversity of the anamorphs of rust fungi.

Arthur (1924) reported that *Uredo* is a "form genus" that he defined as "Species whose life-cycle is not known, or is not readily assumed from related forms...These genera do not represent the whole cycle of development, and are not based upon type species" Later, he abandoned this usage presumably in favor of using *Uredo* as a anamorph genus.

*Uredo achyroclines* P. Hennings, see **PUCCINIA ACHYROCLINES** H. S. Jackson & Holway.

*Uredo adenocalymmatitis* P. Hennings, see **PHRAGMIDIELLA PAULISTA** Buriticá & Hennen.

*Uredo aeschenomenis* Arthur, see *Malupa vignae* (Bresadola) Ono, Buriticá & Hennen [**PHAKOPSORA MEIBOMIAE** (Arthur) Arthur].

*Uredo affinis* Spegazzini, see **PUCCINIA IRREGULARIS** Dietel.

**UREDO AGNOSTOICA** Spegazzini, Revista Mus. La Plata 15: 8. 1908. TYPE on undetermined ? Sapotaceae from Brazil, São Paulo: Ipiranga, date not reported, *A. Uster-s.n.*

On Sapotaceae..

**Undetermined species.**, São Paulo (Spegazzini, 1908: 8).

*Uredo agnostica* has been reported only from the type.

Sori on abaxial side of leaves, scattered, deeply immersed in the parenchyma, blister-like, opening by a pore; paraphyses peripheral and within the sori, walls thick, colorless; urediniospore 34-41 x 24-31 µm, ovoid or polyhedral, pointed apically, flattened at the base, wall 3-3.5 µm thick at sides, 7-10 µm thick above, golden yellow, echinulate, spines often most pronounced apically (Lindquist, 1982).

Lindquist (1982) was not sure that the spores were urediniospores nor that the host belonged to the Sapotaceae.

**UREDO ALAGOINHENSIS** Urban, Acta Univ. Caroline Biológica (Praha) 1971 (1973): 79. (*Nom. nov.*

for *Uredo centratheri* Viégas). (?!?,II?).

≡ *Uredo centratheri* Viégas, Bragantia 5: 81. 1945. TYPE on *Centratherum violaceum* (Schrank) Gleason from **Brazil**, Paraíba: Alagoinha, Oct 1939, *Deslamdes-251*. Not *Uredo centratheri* H. Sydow in Sydow & Petrak, Ann. Mycol. 26: 428. 1928, from The Philippines.

On Compositae.

*Centratherum violaceum* (Schrank) Gleason, Bahia (IBI-13611), Paraíba (Viégas, 1945: 81).

*Uredo alagoinhensis* has been reported only from Brazil.

Sori mostly on the abaxial side of leaves, scattered, tardely dehiscent, then pulverulent; paraphyses 35-45 x 8-12 µm, numerous, peripheral, incurved, capitate, wall smooth; spores 16-18 x 12-16 µm, ovoid-globose, wall 3 µm thick, densely echinulate, dark yellow, pores indistinct (Viégas, 1945).

**UREDO ALCHORNEAE** P. Hennings, Hedwigia 35: 252. 1896. TYPE on *Alchornea iricurana*

Casaretto [*Alchornea glandulosa* Poeppig sub species *iricurana* (Cassarato) Secco], Euphorbiaceae, from **Brazil**, Santa Catarina: near Tubarão, July 1889, *Ule-1498, -1618*. One of these *Ule* specimens needs to be chosen as the lectotype.

*Uredo alchorneae* has been reported from Brazil only from the two *Ule* specimens and from Venezuela.

Sori on fruits or pedicels slightly deforming the host, 0.5-0.75 mm diameter, scattered or more or less grouped and confluent, soon erumpent, powdery, cinnamon-brown; spores 16-22 x 15-19 µm, subglobose, ovoid, or ellipsoid, often slightly angular, wall 1-1.5 µm thick, yellowish-brown, echinulate or echinulate-verrucose, germ pores 2, equatorial (P. Sydow & H. Sydow, 1924).

Paraphyses have not been reported for *Uredo alchorneae*. The relation to *Olivea capituliformis*, if any, requires clarification.

**UREDO ALEMQUERENSIS** Spegazzini, Anal. Soc. Cient. Argentina 93: 112. 1922. TYPE on *Acacia*

*alemquerensis* Huber, Leguminosae, from **Brazil**, Pará: dry forest by Rio Pará, July 1919, ? collector.

*Uredo alemquerensis* has been reported only from Brazil.

Spermogonia, aecia, and telia unknown. Uredinia scattered on abaxial leaf surface, minute, more or less 0.1 mm across, erumpent, pale cinnamon; spores 14-16 µm in diameter, globose or polygonal from mutual pressure within the sorus; wall 2-2.5 µm thick, reddish-yellow (ochraceous), "smooth"; pores 2 - 3, equatorial. (Spegazzini, 1922).

The spore walls are probably not "smooth" as the original descriptions state.

*Uredo alibertiae* P. Hennings, see *Malupa notata* (Arthur) Buriticá [**CROSSOPSORA BYRSONIMATIS** (P. Hennings) R.S. Peterson].

*Uredo alstroemeriae* Dietl, see **UROMYCES ALSTROEMERIAE** P. Hennings.

**UREDO AMAZONENSIS** P. Hennings, Hedwigia 44: 58. 1905. TYPE on *Bauhinia* sp. (Leguminosae) from **Brazil**, Amazonas: Rio Juruá, Juruá-Miry, July 1901, *Ule-2913*.

*Uredo amazonensis* has been reported only from the type. New collections are needed to determine a teleomorph and if this rust still occurs in Brazil.

Spermogonia, aecia, and telia unknown. Uredinia on pale effused spots on abaxial side of leaves, sori 0.2-0.25mm across, rounded, yellow-brown, scattered or in loose groups, urediniospores 22-35 x 18-23 µm, ovoid to ellipsoid, wall 1.5-2 µm thick, echinulate with long aculeae, yellow-brown, germ pores 3-4 (Sydow, P. & H. Sydow, 1924: 471).

See *Uromyces anthemophilus* for notes on rusts on *Bauhinia*.

**UREDO AMAZONICA** (H. Sydow) J. W. Baxter, Mycologia 67: 473. 1975.

≡ *Ravenelia amazonica* H. Sydow, Ann. Mycol. 14: 69. 1916. TYPE on Telia not described.

On Leguminosae.

*Pithecellobium glomeratus* Bentham, San Marcos, Rio Branco (Sydow, 1916: 69).

Spermogonia, aecia, and telia unknown. Uredinia epiphyllous, subepidermal in origin, erumpent, on small yellowish spots, in close groups up to 1 cm long, round to elliptic, 0.3-0.4 mm diameter; without

paraphyses. Urediniospores 27-40 × 18-24 µm, ellipsoid to oblong, cell wall 1.5-2 µm thick, up to 2.5-5 at the apex, scarcely echinulate, yellowish brown to rusty-brown, , germ pores 4-6, equatorial.

Host and distribution:

On *Feuilleea divaricata* (= *Zygia divaricata*, = *Pithecellobium divaricatum*, = *Zygia cataractae*), Paraguay.

On *Pithecellobium glomeratum* (= *Inga glomerata*, = *Zygia glomerata*, = *Zygia cataractae*), Brazil.

*Uredo amphiospora* H. S. Jackson & Holway, see **Puccinia hyptidis-mutabilis** Mayor.

*Uredo andropogonicola* Spegazzini, see **Puccinia posadensis** Saccardo & Trotter.

*Uredo aneimiae* P. Hennings, see **Desmella anemiae** H. Sydow & P. Sydow.

*Uredo anilis* P. Hennings, see **Ravenelia indigoferae** Tranzschel.

**UREDO ANTHURII** (Hariot) Saccardo, Syll. Fung. 11:229. 1895.

≡ *Caeoma anthurii* Hariot, Jour. Bot. (France) 6: 458. 1892.

= *Uredo anthurii* Hariot, Les Encyclop. Scient. P. 308. 1908.

On Araceae.

*Anthurium andreanum* Linden, São Paulo (IBI-12845; Cardoso & Hennen, Fitopatologia Brasileira 3: 111. 1978; IBI-11323).

*Anthurium* sp., Amapá (IBI-17087), Pará (IBI-13268), Minas Gerais (*Ule-1895*, HBG).

*Uredo anthurii* has been reported also from Colombia, The Dominican Republic, and Puerto Rico. The type specimen of *Caeoma anthurii*, the basionym of *Uredo anthurii*, came from an infected plant in the greenhouse at the Paris, France Botanical Garden, which, no doubt, had been brought in from the Neotropics.

Uredinia on both sides of leaves, 0.2-0.5 mm across, scattered or in groups, subepidermal in origin, blister-like at first, erumpent, epidermis remaining overarching the sorus with a pore like opening, tan, rarely with a few incurved peripheral paraphyses; urediniospores (30-)35-47(-52) × (28-)30-37 µm, borne without obvious pedicels, broadly ellipsoid to obovoid, wall 1-2 µm thick, strongly and evenly echinulate, colorless to pale golden, pores obscure or 4, more or less equatorial.

*Uredo anthurii* may cause unsightly spots on species of *Anthurium* that are cultivated as ornamentals.

*Uredo anthyllidis* Greville ex Berkeley, see **Uromyces anthyllidis** Schroeter.

*Uredo aperta* Winter, see **Puccinia porophylli** P. Hennings.

*Uredo aphelandrae* H. S. Jackson & Holway, see **Puccinia varioides** Joerstad.

*Uredo apocynaceae* P. Hennings, see **Crossopora asclepiadaceae** Buriticá & Hennen.

*Uredo appendiculata* Persoon, see **Uromyces appendiculatus** (Persoon) Unger.

*Uredo arachidis* Lagerheim, see **Puccinia arachidis** Spegazzini.

*Uredo arenariicola* P. Hennings, see **Puccinia modica** Holway.

*Uredo cabreriana* Kern & Kellerman, see **Dicheirinia binata** (Berkeley & Curtis) Arthur.

*Uredo aristolochiae* Albuquerque, see **Sphenospora pallida** (Winter) Dietel.

*Uredo arrabidaeae* P. Hennings, see **Phragmidella holwayi** (H. S. Jackson) Buriticá.

*Uredo asclepiadina* Spegazzini, see **Uromyces asclepiadis** Cooke.

*Uredo asclepiadis* Schweinitz, see **UROMYCES ASCLEPIADIS** Cooke.

**UREDO BACCHARIDICOLA** Spegazzini, Rev. de Bot. 1(2a-3a): 133. 1925. TYPE on *Baccharis serrulata* DC. from **Brazil**, Guarapí, Oct 1881, *Balansa-3447*.

≡ *Uredo baccharidis* Spegazzini, Anal. Soc. Cient. Argentina 16: 120. 1883. TYPE on *Baccharis* sp. from **Brazil**, Guarapi and Pirayú, Oct 1881, *Balansa-3434* & *32447*. Not *Uredo baccharidis* Leveille, 1816.

On Compositae

*Baccharis serrulata* DC., Pirayú (Lindquist, 1958, *Balansa--3434*), São Paulo (Lindquist, 1958).

*Baccharis oxydonta* DC., São Paulo (Lindquist, 1958).

*Uredo baccharidicola* has been reported only from Brazil.

Sori on the adaxial side of leaves, scattered singly or in circular groups, long covered by the epidermis, erumpent; spores 25-32 x 20-25 µm, globoid, ellipsoid or obovoid; wall 1.5-2 µm thick, echinulate with large, well spaced spines, colorless, pores obscure, probably 2, equatorial (Lindquist, 1958).

Jackson (1932) placed *Uredo baccharidicola* as an anamorph of *Puccinia praedicta*, but Lindquist (1958) reported that it should not be included in that species, but kept as an unconnected anamorph.

*Uredo bambusarum* P. Hennings, see **PUCGINIA OBLIQUO-SEPTATA** Viennot-Bourgin.

**UREDO BANISTERIICOLA** P. Hennings, Hedwigia 43: 80. 1904.

On Malpighiaceae.

*Banisteria* sp., Rio de Janeiro (Hennings, 1904A: 80).

*Uredo batistae* Lindquist, see **PHAKOPSORA CHAVESII** Dianese et al.

*Uredo bauhinae* P. Hennings, see **UREDO ULEI** P. Hennings.

*Uredo bauhiniicola* P. Hennings, see **MARAVALIA BAUHINIICOLA** (P. Hennings) Y. OnoCummins.

*Uredo behnickiana* P. Hennings, see **CLADOMA BEHNICKIANA** (P. Hennings) J. F. Hennen.

*Uredo bete* var *convolvuli* Persoon, see **PUCGINIA CONVOLVULI** Castagne.

*Uredo bidenticola* P. Hennings, see **UROMYCES BIDENTICOLA** Arthur.

*Uredo bidentida* Spegazzini, see **UROMYCES BIDENTICOLA** Arthur.

*Uredo bidentis* P. Hennings, see **UROMYCES BIDENTICOLA** Arthur.

*Uredo bignoniacearum* Spegazzini, see **PROSPODIUM BIGNONIACEARUM** (Spegazzini) Cummins.

*Uredo biocellata* Arthur, see **PUCGINIA OCELLIFERA** Cummins.

*Uredo bixae* Arthur, see **CROSSOPSORA BIXAE** Buriticá.

*Uredo blechnicola* P. Hennings, see **DESMELLA ANEMIAE** H. Sydow & P. Sydow.

*Uredo bomariae* Lagerheim, see **PUCGINIA BOMARIAE** P. Hennings.

**UREDO BOMFIMENSIS** P. Hennings, Hedwigia 43: 162. 1904. TYPE on *Pithecellobium* sp.,

Leguminosae, from **Brazil**, Amazonas: Rio Juruá, Bomfim, Oct 1900, Lectotype *Ule-2984*, chosen by Sydow (Monogr. Ured. 4:483. 1924).

*Uredo bomfinensis* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia, aecia, and telia unknown. Sori 0.1-0.2 mm diameter, round, yellow-brown, on indeterminate, indistinct, yellowish spots on abaxial side of leaves, widely scattered to mostly loosely grouped, erumpent, surrounded by the ruptured epidermis, urediniospores 15-21 x 12-16 µm, subglobose, ovoid to ellipsoid; wall 1.5 µm thick, yellow-brown, thinly echinulate; germ pores 4, equatorial (P. & H. Sydow, Monogr. Ured. 4: 483. 1924).

*Uredo bonariensis* Spegazzini, see **Puccinia hydrocotyles** (Montero) Cooke.

*Uredo bonplandii* Spegazzini, see **Diorchidium australis** (Spegazzini) Lindquist.

**UREDO BORRERIAE** (P. Hennings) Kern & Whetzel, Mycologia 18: 42. ; 1926. (??,Иpe/?).

≡ *Uromyces borreriae* P. Hennings, Hedwigia 35: 227. 1896. TYPE on *Spermococe verticillata* Linnaeus (= *Borreria verticillata* (Linnaeus) Meyer), from **Brazil**, Rio de Janeiro: Rio de Janeiro, July 1889 (the year 1887 is recorded on the label of the type specimen in HBG), *Ule-688*. See below.

On Rubiaceae.

*Spermacoces* sp. (recorded originally as *Borreria* sp.), Amapá (IBI-17067), Minas Gerais (Thurston, 1940: 305), Paraíba (IAC-2902), Rio de Janeiro (Dietel, 1899: 249). São Paulo (IBI-16994).

*Spermacoces verticillata* Linnaeus [≡ *Borreria verticillata* (Linnaeus) Meyer], Paraíba (Viégas, 1945: 80; IAC-2663), Rio de Janeiro (Hennings, 1896: 22; Jackson, 1932: 100; IAC-4663), São Paulo, (Viégas, 1945: 80; IAC-4052).

*Uredo borreriae* has been reported also from Venezuela and Puerto Rico.

Spermogonia, aecia, and telia unknown. Uredinia 0.25-0.75(-1) mm across, on both sides of leaves, sometimes on brownish spots, mostly abaxial, scattered, blister-like at first, erumpent, powdery, ruptured epidermis evident, yellowish-brown; urediniospores 21-31 x 16-24 µm, globose, subglobose or ovoid, wall ca 1-1.5(-2) µm thick, pale brown, finely echinulate, spines (2-)2.5(-3) µm apart, germ pores 2 or 3, equatorial.

Hennings (1896: 227) was confused about this rust because the type collection had two different rust species on it. The *Uromyces* teliospores that he described are one-celled teliospores of the microcyclic species *Puccinia lateritia* and the urediniospores are those of *Uredo borreriae* (Kern & Whetzel, 1926).

*Uredo byrsonimatis* P. Hennings, see **Phakopsora chavesii** Dianese et al.

*Uredo cabreriana* Kern & Kellerman, see **Dicheirinia binata** (Berkeley & Curtis) Arthur.

*Uredo cammeliae* Mayor, see **Phakopsora cammeliae** Buriticá & Hennen.

**UREDO CAJANI** H. Sydow & P. Sydow in H. Sydow & P. Sydow & Butler, Ann. Mycol. 4: 442. 1906.

Type on *Cajanus indicus* from **India**, Pusa, 20 Feb 1905, *E.J. Butler-600*. (??,И/?).

On Leguminosae.

*Cajanus cajan* (Linnaeus) Millspaugh, São Paulo (IBI-12005).

*Uredo cajani* is widespread in tropical regions where it is cultivated. The original home of the host and rust is probably India. We believe the rust species was introduced into the New World probably from Africa or Asia.

Spermogonia, aecia and telia unknown. Uredinia mostly on abaxial side of leaves, scattered, cinnamon-brown or darker; urediniospores (19-)21-26(-28) x (17-)18-22(-24) µm, broadly ellipsoid or obovoid; wall (1.5-)2(-2.5) µm thick, about cinnamon-brown, finely and uniformly echinulate, pores (2)3(4), equatorial, or slightly above, with obvious caps (Cummins, 1978).

Viennot-Bourgin (1953) identified a rust with uredinia and telia on *Cajanus cajan* (pigeon pea) from the Ivory Coast as *Uromyces dolichi* Cooke and discussed the problems of determining the correct holomorph names for rusts on *Cajanus*. Teliospores of *Uromyces dolichi* are reticulate. Up to now, all collections of

rusts on *Cajanus cajan* from the New World that might be anamorphs of a *Uromyces* consist only of uredinia. Cummins (1978) identified these collections from North America consisting of only uredinia as *Uromyces dolicholi* Arthur. Teliospores of *U. dolicholi* are smooth, and its type is on *Rhynchosia senna* Gillies ex Hooker var. *texana* (Torrey & Grey) M. C. Johnston [identified originally as *Dolicholus texensis* (Torrey & Grey) Vail] from Texas. But no inoculation experiments have been done that demonstrate that the rust on *Rhynchosia* would infect *Cajanus cajan*. Because telia of a *Uromyces* have not been found on *Cajanus* in the New World, we believe it best to identify the populations on *Cajanus* in the New World as the anamorph taxon *Uredo cajani* as did Hennen and McCain (1993).

See *Uromyces dolicholi* in this catalogue for its possible occurrence in Brazil and more on nomenclature of these rusts.

When abundant *Uredo cajani* causes defoliation and reduces yield of *Cajanus cajan* ("feijão guando", "pigeon pea"), a leguminous shrub that produces pods with edible seed rich in proteins, and grown in Brazil most often in home gardens.

*Uredo caleae* Mayor, see **PUCCINIA CALEAE** Arthur.

*Uredo cameliae* Mayor, see **PHYSOPELLA CAMELIAE** (Mayor) Cummins & Ramachar.

*Uredo cannae* Winter, see **PUCCINIA THALIAE** Dietel.

*Uredo capituliformis* P. Hennings, see **OLIVEA CAPITULIFORMIS** Arthur.

**UREDO CARNOSA** Spegazzini. Revista Argentina Hist. Nat. 1: 176. 1891. TYPE on unidentified species of Orchidaceae from **Paraguay**: Caa-guazu, 10 Apr 1876, ? *Balansa s.n.*  
On Orchidaceae.

*Catasetum fimbriatum* (E. Morren) Lindley & Paxton, São Paulo (Viégas, 1945: 80; IAC-454). Viégas (1945: 81) reported that Caa-guazu is in **Brazil**. Lindquist (1983: 525) reported this anamorph probably belongs to *Sphenospora* but there is not enough of the original specimen to make a definite judgement. Probably the rust is an anamorph of *Sphenospora kevorkianii*.

**UREDO CASSIAE-RUGOSAE** Thurston, Mycologia 32: 305. 1940. TYPE on *Cassia rugosa* Don from **Brazil**, Minas Gerais: Uberlandia, 19 May 1936, *Muller-1083*.  
On Leguminosae.

*Cassia rugosa* Don., Minas Gerais (Thurston, 1940: 305).

*Uredo cassiae-rugosae* has been reported only from the type.

Thurston (1940) reports traits as sori without paraphyses, spores 26-35 x 19-23 µm, ellipsoid to obovoid, wall 1-1.5 µm thick, densely echinulate, golden- to pale cinnamon-brown, pores 3-4 equatorial.

*Uredo cassiicola* P. Hennings, see **RAVENELIA DENTIFERA** Hennen & Cummins.

*Uredo cenchrophila* Spegazzini, see **PUCCINIA CENCHRI** Dietel & Holway.

*Uredo centratheri* Viégas, see **UREDO ALAGOINHENSIS** Urban.

**UREDO CENTROSEMAE** Viégas, Bragantia 5: 81. 1945.  
On Leguminosae.

*Centrosema* sp., São Paulo (Viégas, 1945: 81; IAC-2634).

*Uredo cerotelioides* H. S. Jackson & Holway, see **PHAKOPSORA ARRABIDAEAE** Buriticá & Hennen.

*Uredo cestri* Bertero, see *Aecidium cestri* Montagne (**UROMYCES CESTRI** Montagne).

*Uredo chaetochloae* Arthur, see **PUCCINIA CHAETECHLOAE** Arthur.

*Uredo chardoni* Kern, see **Puccinia Boutelouae** (Jennings) Holway.

*Uredo cherimoliae* Lagerheim, see **Phakopsora Neochermoliae** Buriticá & Hennen.

*Uredo chilensis* Dietel & Neger, see **Uromyces Lathyrinus** Spegazzini.

*Uredo chloridis-polydactylidis* Viégas, see **Puccinia Cacabata** Arthur & Holway.

**UREDO CHRYSOPHYLLI** Sydow, Hedwigia 49: 78. 1910. TYPE on *Chrysophyllum* sp., Sapotaceae, from **Brazil**, Pará, 12 May 1908, *C. F. Baker-350*. (?!?,?Ipe!).

*Uredo chrysophylli* has been reported only from the type.

Sori on the abaxial side of leaves, 0.1 mm wide, yellow-brown to brown, in irregular or circular groups on round, whitish spots 1-3 mm wide, surrounded by the ruptured epidermis; spores 22-32 x 18-25 µm, mostly ovoid or pyriform tending to reniform, wall 1.5-2 µm thick, echinulate, germ pores 2, equatorial, yellow-brown (P. Sydow & H. Sydow, 1924).

**UREDO CHRYSOPHYLLICOLA** P. Hennings, Hedwigia 41: 106. 1902. TYPE on *Chrysophyllum* sp. Sapotaceae from **Brazil**, São Paulo: São Paulo Botanical Garden, *Puttemans-163*. (?!?,Ipe!).

*Uredo chrysophyllicola* has been reported only from the type.

Sori 0.3-0.75 mm across, pale yellow, surrounded by ruptured epidermis, pulverulent, mostly on the abaxial or on both sides of leaves, scattered or in small groups, on roundish, reddish-yellow spots 1-2 mm across, or some infections locally systemic; spores 16-24 x 15-20 µm, globoid, subgloboid, ovoid or ellipsoid, wall 2-2.5 µm thick, colorless to pale yellow, loosely echinulate, pores obscure (P. Sydow & H. Sydow, 1924).

Our measurements from an isotype were spores 28-31 x 24-31 µm; wall 3.5-5 µm, spines (2.5-)3-3.5(-5) µm and (2-)2.5-3(3.5) µm apart.

*Uredo cisneroana* Spegazzini, see **Uromyces Cisneroanus** Spegazzini.

*Uredo coccolobae* P. Hennings, see **Physopella coccolobae** (Hennings) Buriticá & Hennen [CEROTELIUM COCCOLOBAE Buriticá & Hennen].

*Uredo colubrinae* Cummins, see **Phakopsora Colubrinae** Viégas.

*Uredo commelinae* Spegazzini, see **Uromyces Commelinae** Cooke.

*Uredo commelyneae* Kalchbrenner, see **Phakopsora Tecta** H. S. Jackson & Holway.

*Uredo concors* Arthur, see **Malupa vignae** (Bresadola) Ono, Buriticá & Hennen [PHAKOPSORA MEIBOMIAE (Arthur) Arthur]

*Uredo condylocarpi* H. S. Jackson & Holway, see **Malupa Condylocarpi** (H. S. Jackson & Holway) Buriticá & Hennen.

**UREDO CONFLUENS** P. Hennings, Hedwigia Beiblatt 38: (69). 1899. TYPE on *Manilkara subsericia* (Martius) Dubard (fide Pennington, Fl. Neotropica), reported as *Mimusops subsericea* Martius, Sapotaceae, from **Brazil**, Rio de Janeiro: restinga, Lagas de Freytas, Oct 1895, *Ule-2154*. Known only from the type collection. (0/Ipe,?!?).

≡ *Uredo sapotacearum* P. Hennings, Hedwigia 38: 256. 1899. TYPE on *Manilkara subsericia* (Martius) Dubard (≡ *Mimusops subsericia* Martius), from **Brazil**, Rio de Janeiro: Copacabana, Dec 1896, *Ule-2154*.

≡ "*Uredo* (= *Scopella*) *confluens* (P. Hennings) Cummins", Bull. Torrey Bot. Club 77: 208. 1950. Telia not described.

On Sapotaceae



***Manilkara subsericia*** (Martius) Dubard (*Mimusops subsericia* Martius), Rio de Janeiro (Hennings, 1899: (69).

*Uredo confluens* has been reported only from Brazil.

Spermogonia subcuticular, on both sides of leaves, 55-65  $\mu\text{m}$  high, 120-165  $\mu\text{m}$  wide, lenticular or hemispherical, reddish-brown; aecia on both sides of leaves on somewhat hypertrophied areas up to 2 cm in length along the midrib or lateral veins, (or cauliculous according to the Sydows, Monogr. Ured. 4: 437. 1924), densely grouped, becoming confluent around the spermogonia, 0.5-1 mm wide, chestnut-brown, pulverulent; aeciospores (20-)23-38 x (22) 27-33(-35)  $\mu\text{m}$ , pedicellate, broadly ellipsoid or obovoid, wall 1.5-3  $\mu\text{m}$  thick, often indistinctly bilaminate, cinnamon-brown, strongly echinulate, especially apically, with sharp spines up to 3  $\mu\text{m}$  long, germ pores 2, adjacent to the hilum. Cummins (1950: 208)

Cummins (1950: 208) reported spermogonia in Ule's type specimen and spores that had the morphology of those often associated with *Scopella*, so he assumed that the rust would be a *Scopella* even though he found no teliospores. But Ono (1984) did not include it in his paper in which he transferred *Scopella* to *Maravalia*.

**UREDO CONSANGUINEA** Sydow, Oesterr. bot. Zeitschr. 52: 184. 1902. TYPE on *Dorstenia multiformis* Miquel from Brazil, Rio de Janeiro: place, date, and collector?  
On Moraceae.

***Dorstenia multiformis*** Miquel, Rio de Janeiro (Sydow, 1902: 184; IBI-1728; Jackson, 1927: 52), São Paulo (IBI-14169).

The traits of the three species of *Uredo* reported on *Dorstenia* from the Neotropics are given below. No teleomorphs are known for these.

*Uredo consanguinea*:

Sori small, 0.1-0.2 mm across, reddish; irregularly scattered on yellowish spots on abaxial sides of leaves, paraphyses 30-45 x 10-12  $\mu\text{m}$ , peripheral, cylindrical, with one or two septa, walls 1-1.5  $\mu\text{m}$  thick, yellowish or light brown. Spores 20-28 x 16-23  $\mu\text{m}$ , globose, subglobose to broadly ellipsoid, walls evenly ca. 2  $\mu\text{m}$  thick, loosely echinulate, pale yellowish to pale brownish, germ pores obscure.

*Uredo rubescens* Arthur on *Dorstenia contrajerva* Linnaeus from Puerto Rico:

Sori irregularly grouped on indefinite pale spots on abaxial side leaves, 0.2-0.4 mm across, reddish, subepidermal in origin, erumpent by a small central pore, paraphyses 40-60 x 7-9  $\mu\text{m}$ , peripheral, incurved, without septa, colorless, walls ca. 1  $\mu\text{m}$  thick; spores 18-19 x 25-28  $\mu\text{m}$ , ellipsoid, walls evenly 1.5  $\mu\text{m}$  thick, strongly and closely echinulate, pale cinnamon-brown, pores obscure.

*Uredo uncinata* Kern, Cifferi & Thurston on *Dorstenia* sp from Santo Domingo:

Spores are easily identified by their long, appendage-like spines which are bent or even hooked.

*Aecidium bertonii* Spegazzini on *Dorstenia braziliensis* from Paraguay is probably the same species as *Uredo uncinata* but was placed in the wrong genus by Spegazzini.

*Uredo copaiferae* P. Hennings, see **SPHENOSPORA COPAIFERAE** Sydow.

*Uredo cordiae* P. Hennings, see **PUCCINIA CORDIAE** Arthur.

*Uredo cristata* Spegazzini, see **SKIERKA CRISTATA** Mains.

*Uredo crotalariae* Dietel, see **MILEZIA CROTALARIAE** (Dietel) Ono et al.

**UREDO CROTALARIAE-VITELLINAE** Rangel, Arch. Mus. Nac. Rio de Janeiro 18: 161. 1916.

LECTOTYPE on *Crotalaria vitellina* Kern from Brazil, Rio de Janeiro, Botanical Garden, April 1914, Rangel-1181. (?!?, Ipe/?).

On Leguminosae.

***Crotalaria vitellina*** Kern, Rio de Janeiro (Rangel, 1916A: 161).

***Crotalaria incanna***, Rio de Janeiro (Rangel, 1916: 161).

*Uredo crotalariae-vitellinae* has been reported only from Brazil.

Perhaps *Uredo crotalariae-vitellinae* is an anamorph of **UROMYCES CROTALARIAE** (Arthur) Baxter.

*Uredo crotonicola* P. Hennings, see **PHAKOPSORA ARGENTINENSIS** (Spegazzini) Arthur.

*Uredo crotonis* P. Hennings, see *Aeciure crotonis* (P. Hennings) Buriticá & Hennen  
(**ARTHURIA CATENULATA** H. S. Jackson & Holway).

*Uredo cubangoensis* Rangel, see **PUCCINIA SUBSTRIATA** Ellis & Bartholomew.

*Uredo cumula* Arthur, see **PUCCINIA BUCHNERAE** Cummins.

*Uredo cupheae* P. Hennings, see **PHAKOPSORA CUPHEAE** Buriticá.

*Uredo cuticulosa* Ellis & Everhart, see **PROSPODIUM APPENDICULATUM** (Winter) Arthur.

*Uredo cyclogena* Spegazzini, see **RAVENELIA MACROCARPA** H. Sydow & P. Sydow.

? **UREDIO CYPERICOLA** P. Hennings, in A. Engler, 1895. Die Pflanzenwelt Ost-Afrika und der  
Nachbargebiete, Teil C, p. 52. TYPE on *Cyperus* sp. from Kilimandscharo, East Africa, location and  
date of collection not found.

On Cyperaceae.

*Cyperus* sp., Pará (Hennings, 1908: 101).

The report of *Uredo cypericola* by Hennings listed here requires confirmation. The Sydows (1924)  
did not include Brazil as a locatin for this rust.

**UREDIO CYRTANTHERAE** H. S. Jackson & Holway in Jackson, Mycologia 24: 96. 1932. TYPE on  
*Jacobinia selloviana* Hieronymus, Aanthaceae (reported originally as *Cyrtanthera selloviana* Nees)  
from **Brazil**, São Paulo: Cantareira, 30 May 1922, *Holway-1917*. (?/?,II/?).

*Uredo cyrtantherae* has been reported only from the type.

Spermogonia, aecia and telia unknown. Uredinia on both sides of leaves, 0.2-1.0 mm diam, buff,  
scattered irregularly or mostly in concentric groups to 2 mm across; urediniospores 26-31 x 22-25 µm,  
spheroid, ellipsoid to obovoid; wall 2-3 µm thick, strongly echinulate except around the pores, straw color,  
pores difficult to see, probably 2 more or less equatorial and opposite.

*Uredo cyperi-tagetiformis* P. Hennings, see **PUCCINIA CYPERI-TAGETIFORMIS** Kern.

*Uredo cyrtopodii* Sydow, see **SPHENOSPORA KEVORKIANII** Linder.

*Uredo dactylocteniicola* Spegazzini, see **UROMYCES DACTYLOCTENII** Wakefield & Hansford.

**UREDIO DALBERGIAE** P. Hennings, Hedwigia 34: 98. 1895. TYPE on *Dalbergia* sp. from **Brazil**,  
Goiás: Goiás, Feb 1893, *Ule-1995*. (**ANpe**).

= *Uredo mararyensis* P. Hennings, Hedwigia 43: 162. 1904. TYPE on *Dalbergia* sp.,

Leguminosae, from **Brazil**, Amazonas: Rio Juruá, Marary, September 1900, *Ule-2916*.

= *Uredo nidulans* H. Sydow & P. Sydow, Ann. Mycol. 1: 332. 1903. TYPE on *Dalbergia*  
*foliosa* from **Bolivia**, Guani-Tipuani, date not reported, *M. Bang s.n.*

On Leguminosae.

*Dalbergia variabilis* Vogel, Santa Catarina, (Hennings, 1896: 251), Brasil (Joerstad, 1959: 75).

*Dalbergia* sp., Goiás (Hennings, 1895: 98), Mato Grosso (Joerstad, 1959: 75).

*Uredo dalbergiae* has also been reported from Bolivia as shown above.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves, on yellowish leaf spots,  
scattered or in loose or dense groups to 4 mm across, cinnamon-brown, erumpent, pulverulent; paraphyses 40-  
80 x 5-8 µm, numerous, peripheral, incurved, apically sharp-pointed, wall colorless to subcolorless, outer  
lateral wall 2.5-5 µm thick, inner lateral wall 1-2 µm thick; urediniospores 17-24 x 14-18 µm, subglobose,

ovoid, to piriform, often slightly reniform, wall 1-1.5  $\mu\text{m}$  thick, pale brown, echinulate, germ pores probably several, obscure (P. & H. Sydow, 1924).

Telia like the uredinia but spores elongate-needle-like, up to 9 septate, pointed on both ends, wall uniformly about 1  $\mu\text{m}$ , colorless to pale yellow.

Telia found on isotype specimen of *Uredo mararyensis* in PUR-F8906. *Uredo dalbergiae* is probably an anamorph of *Mimema* sp. or *Sorataea* sp.

The Sydows (1924) determined that *Uredo mararyensis*, which has been reported only from the type, is a synonym of *Uredo dalbergiae*.

*Uredo desmium* (Berkeley & Broom) Peth, see **PHAKOPSORA GOSSYPII** (Lagerheim) Hiratsuka.

*Uredo desmodii-leiocarpi* P. Hennings, see **UROMYCES HEDYSARI-PANICULATI** (Schweinitz) Farlow.

*Uredo dentata* Mains, see **PUCCINIA OBLIQUO-SEPTATA** Viennot-Bourgin.

*Uredo dianthi* Persoon, see **UROMYCES DIANTHI** (Persoon) Niessl.

*Uredo dieteliana* Saccardo & Sydow, see **UROMYCES BRASILIENSIS** Trotter.

*Uredo digitariae-ciliaris* Mayor, see **PUCCINIA OAHUENSIS** Ellils & Everhart.

*Uredo digitariaecola* Thueman, see **PUCCINIA OAHUENSIS** Ellis & Everhart.

*Uredo dioscoreae* P. Hennings, see **SPHENOSPORA PALLIDA** (Winter) Dietel.

**UREDO DIOSCOREICOLA** Kern, Cifferi & Thurston, Ann. Mycol. 31: 24. 1933. . TYPE on *Dioscorea altissima* Lamarck from **Dominican Republic**, LaVega: Cordillera Central, Bonao at Rio Maimon, 17 Dec 1930, Cifferi & Ekman-3936. (Not *Uredo dioscoreicola* Sawada, 1943, from Taiwan).

On Dioscoreaceae.

*Dioscorea* sp., Pará (Albuquerque, 1971: 149, identification needs confirmation).

Kern et al. (1933) treated *Uredo dioscoreicola* as a new name, “nom. nov.”, for “*Uredo dioscoreae* Arthur” (1924) but Arthur never propose such a name. Curiously Kern et al.(1933) also designated a “type” specimen that Arthur had not seen. In the publication that Kern et al. referred to as the place of publication, Arthur (1924) used the name *Uredo dioscoreae* P. Hennings which is an anamorph of *Sphenospora pallida* (Winter) Dietel. Kern states that the description given by Arthur is not that of *Uredo dioscoreae* P. Hennings but of another rust that Kern et al.(1933) reported from The Dominican Republic and which Arthur (1924) reported from Cuba and Puerto Rico. Because Kern et al. (1933) published some diagnostic traits for this rust, we believe that the name should be attributed to Kern et al as a new species and not as a new name.

**Uredo dombeyae** Lindquist, Hickenia 1: 155. 1978. (not *Uredo dombyae* Doidge, 1948) TYPE on “*Dombeya walichii* B. & H. (f.) (Bignoniaceae)”, from **Brazil**, São Paulo: Piracicaba, 5 Sept 1967, Allison & J. P. da Costa Neto-6407.

*Uredo dombeyae* Lindquist, requires a new name, and has been reported only from the type.

We question the identity of the host of this rust. The ornamental, *D. walichii* Bentham & Hooker is listed as in the Sterculiaceae, not Bignoniaceae, and native of the Mascarenes and Madagascar (Mabberley, 1997). If the host is in the Bignoniaceae, then the genus for *Dombeya* is *Tourretia*.

*Uredo duplicata* Rangel, see **PUCCINIA OAHUENSIS** Ellis & Everhart.

*Uredo eichorniae* Fragoso & Cifferi, see **UROMYCES PONTEDERIAE** Gerard.

*Uredo elephantopidis* P. Hennings, see **COLEOSPORIUM VERNONIAE** Berkeley & Cooke.

*Uredo epidendri*, see **SPHENOSPORA KEVORKIANII** Linder.

*Uredo eriochloe* Spegazzini, see **UROMYCES SETARIAE-ITALICAE** Yoshino.

*Uredo eriochloana* Saccardo & Trotter, see **UROMYCES SETARIAE-ITALICAE** Yoshino.

**UREDIO ERIOSEMAE** H. S. Jackson & Holway in Jackson, *Mycologia* 4: 351. 1931. TYPE on *Eriosema crinitum* (Kunth) G. Don (Leguminosae) from **Brazil**, São Paulo: Santana, 28 May 1922, Holway-1902. PUR-F8915 (?/?,II/?).

*Uredo eriosemae* has been reported only from the type.

Spermogonia, aecia, and telia unknown. Uredinia on both sides of leaves, mostly on the adaxial side, 0.2-0.3 mm across, minute, chestnut-brown, soon naked, pulverulent, ruptured epidermis conspicuous; paraphyses none; urediniospores 18-22 x 17-20  $\mu\text{m}$ , globoid or broadly ellipsoid, wall 2-2.5  $\mu\text{m}$  thick, brown, finely and moderately echinulate, pores 3 or 4, about equatorial (Jackson, 1931).

Perhaps *Uredo eriosemae* is the uredinial stage of *Uromyces dolicholii* Arthur which has been reported from southern Africa. New collections are required to confirm this.

*Uredo erythroxylois* Graziani, see **PHAKOPSORA COCA** Buriticá & Hennen

*Uredo eugeniarum* P. Hennings, see **PUCCINIA PSIDII** Winter.

**UREDIO EUPATORIICOLA** P. Hennings, *Hedwigia* 34: 337. 1895. TYPE on *Eupatorium* sp. from **Brazil**, Santa Catarina: Blumenau, date not recorded, *Moeller* 821. (?/?,II/?).

On Compositae.

*Eupatorium* sp., Santa Catarina (Hennings, 1895C: 337).

*Uredo eupatoriicola* has been reported also from Paraguay and Nicaragua.

*Uredo evolvuli* Spegazzini, see **PUCCINIA LITHOSPERMI** Ellis & Everhart.

*Uredo excipulata* H. Sydow & P. Sydow, see **CHACONIA INGAE** (H. Sydow) Cummins.

*Uredo fallaciosa* Arthur, see **PUCCINIA FALLAX** Arthur.

*Uredo farinosa* P. Hennings, *Hedwigia* 36: 216. 1897. This fungus is *Climoconidium farinosum* (P. Hennings) Patouillard, not a rust.

*Uredo fenestrala* Arthur, see **PHAKOPSORA FENESTRALA** Arthur.

*Uredo fici* Castagne, see **PHAKOPSORA NISHIDANA** Ito.

*Uredo fici* var. *guarapaensis* Spegazzini, see *Physopella ficicola* (Spegazzini) Buriticá & Hennen [**CEROTELIUM FICICOLA** Buriticá & Hennen].

*Uredo ficina* Juel, see *Physopella ficicola* (Spegazzini) Buriticá & Hennen (**CEROTELIUM FICICOLA** Buriticá & Hennen).

*Uredo ficicola* Spegazzini, see *Physopella ficicola* (Spegazzini) Buriticá & Hennen (**CEROTELIUM FICICOLA** Buriticá & Hennen).

*Uredo fimbriata* Spegazzini, see **RAVENELIA FIMBRIATA** Spegazzini.

*Uredo flavidula* Spegazzini, see **PUCCINIA PSIDII** Winter.

*Uredo floscopae* P. Hennings, see **UROMYCES FLOSCOPAE** H. Sydow & P. Sydow.

*Uredo fructicola* P. Hennings, Hedwigia Beiblatt 38: (129). 1899. The fungus is *Climoconidium farinosum* (P. Hennings) Patouillard, not a rust.

*Uredo fuirenae* P. Hennings, see **Puccinia fuirenicola** Arthur ex Kern.

*Uredo gaudichaudii* H. Sydow & P. Sydow, see **Uromyces blainvilleae** Berkeley.

**UREDIO GAYANAE** Lindquist, Revista Fac. Agron. La Plata 39: 118. 1963. TYPE on *Chloris gayana* Kunth, Gramineae, from **Brazil**, Rio Grande do Sul: Porto Alegre, Escola de Agron. e Veter., 22 July 1958, *Costa Neto-986*.

*Uredo gayanae* has been reported only from the type.

Uredinia on both sides of leaves, elliptic, 0.2-0.3mm across, erumpent, surrounded by the ruptured epidermis, urediniospores 34-42 x 24-31  $\mu$ m, globoid or obovoid, wall 1.5-2  $\mu$ m, pale cinnamon-brown, echinulate, pores 4-5, equatorial (Lindquist, 1982).

*Uredo geophilae* P. Hennings, see **Diorchidium amapaensis** Hennen & Sotão.

*Uredo gibertii* Spegazzini, see **Puccinia gibertii** Lindquist.

**UREDIO GLECHONIS** P. Hennings, Hedwigia Beiblatt 38: (69). 1899. TYPE on *Glechon* sp., Labiatae, from **Brazil**, Rio de Janeiro, 1 Jan 1896, *Ule-2135*.

*Uredo glechonis* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

*Uredo globulosa* Arthur, see **Uredo hyoxidis** (Bressadola) P. Hennings.

*Uredo gnaphalii* Spegazzini, see **Puccinia gnaphaliicola** P. Hennings.

**UREDIO GOELDII** R. T. Almeida, ). see **Uromyces ipatingae** Ferreira & Y. Hiratsuka. Fitopat. Bras. 1: 219. 1976. On Leguminosae.

*Clitoria fairchildiana* Howard (= *Clitoria racemosa* Bentham), Pará (Almeida, 1976: 219, IAN-884)

*Uredo goeldiana* P. Hennings, see **Puccinia psidii** Winter.

*Uredo gossypii* Lagerheim, see **Phakopsora gossypii** (Lagerheim) Hiratsuka.

*Uredo gouaniae* Ellis & Kelsey, see **Puccinia invaginata** Arthur & J. R. Johnston.

*Uredo guacae* Mayor, see **Sphenospora kevorkianii** Linder.

*Uredo gymnogrammes* P. Hennings, see **Desmella anemiae** H. Sydow & P. Sydow.

**UREDIO GYNANDREARUM** Corda, Icon. Fung.. 3: 3. 1839. TYPE on unidentified Orchidaceae from South America collected by Fieber. (??,II?).

On Orchidaceae.

**Species undetermined**, São Paulo (Maire, 1908: 152).

*Uredo gynandrearum* has been reported also questionably from Paraguay, and The West Indies. The application of the name *Uredo gynandrearum* is obscure and its occurrence in Brazil needs to be confirmed. Previous descriptions of sori and spores are inconsistent.

The Sydows ((1924) reported that probably the only specimen that could be identified as this species confidently was the type. Sori blister-like, scattered on leaves with or without pale yellowish spots, spores 16-22 µm in diameter, ovoid, wall finely echinulate, colorless.

**UREDO HAMMARI** P. Hennings, Hedwigia 41: 107. 1902. TYPE on *Hyptis* sp., Labiatae, from **Brazil**, São Paulo: São Paulo, "Horto Botanico de S. Paulo", now Horto Florestal, 1 Nov 1901, A. Hammer (Puttemans-179). (?/?,IIcv/?).

*Uredo hammari* has been reported only from the type.

The Sydows (1924) reported that *Uredo hammari* is an "Aecidiumform" but lacks a peridium. Thus, the correct anamorph genus is *Caecoma*, not *Uredo*. They did not make a transfer. Jackson (1932) believes that this anamorph probably belongs to *Puccinia cavatica*.

*Uredo harmsiana* P. Hennings, see **UROMYCES CROTALARIAE** (Arthur) J. W. Baxter.

*Uredo helianthi* Schweinitz, Trans. Am. Phil. Soc. II. 4: 291. Hennings' (1896: 247) report of this rust name on *Verbesina* sp., Compositae. from, Rio de Janeiro is an error. The rust was reidentified later by Ule as *Uromyces blainvilleae* Berkeley on *Blainvillea rhomboidea* Cass. from a specimen in HBG.

*Uredo heliconiae* Dietel, see **PUCCINIA HELICONIAE** Arthur.

*Uredo henningsii* Saccardo & D. Saccardo, see **UROMYCES SETARIAE-ITALICAE** Yoshina.

*Uredo heterantherae* P. Hennings, see **UROMYCES HETERANTHERAE** P. Sydow & H. Sydow. .

*Uredo hibisci* Sydow, see **KATENULOPSORA PRAELONGA** (Spegazzini) Buriticá.

*Uredo hieronymi* Spegazzini, An. Soc. Cient. Argentinensis 12: 73. 1881. TYPE on *Acacia caven* (Molina) Molina Uredinal stage of *Ravenelia australis* Dietel & Neger fide Lindquist, 1954].

*Uredo hieronymi* Spegazzini, Anal. mus. Nac. Buenos Aires 23: 30. 1912. TYPE on *Acacia caven* (Molina) Molina, Catamarca, **Argentina**, Nov 1909, LPS, see **RAVENELIA HIERONYMI** Spegazzini.

*Uredo holmbergii* Spegazzini, see **UROMYCES HOLMBERGII** Spegazzini.

*Uredo hoveniae* Lindquist & Costa Neto, see **PHAKOPSORA COLUBRINAE** Viégas.

*Uredo hydrocotyles* Bertero ex Montagne, see **PUCCINIA HYDROCOTYLES**.

*Uredo hymenaeae* Mayor, see **CROSSOPSORA HYMENEAE** Dianese, Buriticá & Hennen.

*Uredo hyperici* Sprengel, see **UROMYCES TRIQUETRUS** Cooke.

**UREDO HYPOXIDIS** (Bresadola) P. Hennings, Hedwigia Beiblatt 40: (173). 1901. (?/?,II/?).

≡ *Doassansia hypoxidis* Bresadola in Rabenhorst (Pazschke), Fung. Europ. 4201. 1901. TYPE on *Hypoxis decumbens* from **Brazil**, Santa Catarina: Tuberão, Oct 1890, Ule-1033.

= *Uredo globulosa* Arthur, Mycologia 8:22. 1916. TYPE on *Hypoxis decumbens* Linnaeus from **Puerto Rico**, Las Marias, 10 July 1915, F. L. Stevens-8127.

On Liliaceae (Amaryllidaceae, Hypoxidaceae)

*Hypoxis decumbens* L., Paraná (Joerstad, 1956: 448), Rio de Janeiro (Jackson 1926: 157; Viégas, 1945: 84; IAC-3001; Joerstad, 1956: 448), Santa Catarina (PUR-F2674), São Paulo (Hennings, 1901: 73; Jackson, 1926: 157).

*Hypoxis* sp., Santa Catarina (Hennings, 1896: 227), São Paulo (PUR-F2679), Brasil (Hennings, 1901: 173).

*Uredo hypoxidis* has been reported also from Argentina to the Southeastern United States of America, and also on *Curculigo* sp. from Trinidad and Sierra Leone.

Uredinia mostly on the abaxial side of leaves on purplish-black spots 0.5-1 mm across, sori 60-80  $\mu\text{m}$  high x 150-325  $\mu\text{m}$  across, peridium thin, delicate, sac-like, sometimes difficult to demonstrate, usually deeply discolored sharply delimiting the sorus, opening by a central orifice, the cells polygonal with walls about 2  $\mu\text{m}$  thick, urediniospores pedicellate, (18-)20-26(-28) x (13-)15-19(-20)  $\mu\text{m}$  broadly obovoid, wall ca 1.5  $\mu\text{m}$  thick, closely echinulate, colorless, pores obscure (Arthur, 1916; P. Sydow & H. Sydow, 1923; Laundon, 1965).

*Uredo hypoxidis* has been mistakenly reported as *Uromyces affinis* Winter (Hedwigia 24: 259. 1885). All rusts reported to be *Uromyces affinis* from Brazil are *Uredo hypoxydis*.

The type of *Uromyces affinis* Winter is on *Nothoscordum* sp., not *Hypoxis erecta* Linnaeus as originally reported, and the rust is *Uromyces primaverilis*. The collection is from The United States of America, Missouri: Perryville, C. H. Demetrio s. n. Thus, *Uromyces affinis* is a synonym of *Uromyces primaverilis*. The description and records listed by Arthur (N. Am. Flora 7: 755. 1926) are a mixture. Those from New York and Connecticut are *Uromyces necopinus*, others from Florida, Mississippi, Mexico, Puerto Rico, and South America are *Uredo hypoidis*.

*Uredo hyptidis* Curtis, see **Puccinia neohyptidis** Laundon.

**UREDIO HYPTIDIS** P. Hennings, Hedwigia 34: 100. 1895. (Not Curtis, 1848). On Labiatae.

*Hyptis scabra* Benth., Minas Gerais (Hennings, 1895: 100).

*Hyptis* sp., Rio de Janeiro (IAC-4661).

*Uredo ignava* Arthur, see **Kweilingia divina** (H. Sydow) Buriticá & Hennen.

*Uredo ignota* Spegazzini, Anal. Soc. Cient. Argentina 26: 14. 1888. An illegitimate name. Host undetermined. Brasil (Sydow, 1924: 554).

**UREDIO ILLAUDANDA** H. S. Jackson & Holway in Jackson, Mycologia 24: 105. 1932. TYPE on *Vanillosmopsis erythropappa* (DeCandole) Schultz-Bipontius from **Brazil**, Rio de Janeiro: Teresopolis, 4 Oct 1921, *Holway-1192*. (??,II?).

On Compositae.

*Vanillosmopsis erythropappa* (DeCandole) Schultz-Bip., Rio de Janeiro (Jackson, 1932: 105).

*Uredo imperspicua* Spegazzini, see **Ravenelia cohniana** P. Hennings.

*Uredo ingae* P. Hennings, see **Ypsilospora tucumanensis** Hernández & Hennen.

*Uredo ipomoeae* Schweinitz, see **Coleosporium ipomoeae** Burrill.

*Uredo ipomoeae-pentaphyllae* P. Hennings, see **Coleosporium ipomoeae** Burrill.

*Uredo ischnosyphonis* P. Hennings, see **Puccinia thaliae** Dietel.

*Uredo janiphae* Winter, see **Uromyces jatrophae** Arthur.

*Uredo jaranae* Albuquerque, see *Physopella jaranae* (Albuquerque) Buriticá & Hennen [**Cerotelium nuxiae** Buriticá & Hennen].

*Uredo jatrophiicola* Arthur, see **Phakopsora arthuriana** Buriticá & Hennen.

*Uredo juelii* J. Walker, see [*Physopella jueli* P. Sydow & H. Sydow) Buriticá & Hennen (**Phakopsora rossmaniae** Dianese et al.)

*Uredo juruensis* (H. Sydow & P. Sydow) J. W. Baxter Mycologia 67: 437. 1975. A later homonym, not

Hennings, 1904, a new name is necessary.

≡ *Ravenelia juruensis* H. Sydow & P. Sydow, Ann. Mycol. 14: 256. 1916. TYPE on *Pithecellobium glomeratum* Bentham, Leguminosae, from **Brazil**, Amazonas: Rio Juruá, Bom Fim, November 1900, *Ule-2926*. Telia not described.

*Uredo juruensis* (H. Sydow & P. Sydow) J. W. Baxter has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia, aecia, and telia unknown. Uredinia on distinctive orbicular spots to 1cm across on the abaxial side of leaves, cinnamon-brown, densely grouped in the center of the spot, subepidermal becoming erumpent, small, round, surrounded by the torn epidermis, yellowish; without paraphyses; urediniospores 16-21 × 14-17 μm, globoid, sub-globoid to ovoid; wall 1.5 μm thick at sides, 2 μm at the apex, finely echinulate especially at the apex, less towards the bottom, yellowish-brown, germ pores obscure.

[*Zygia glomerata* (= *Pithecellobium glomeratum*, = *Inga glomerata*, = *Zygia cataractae*), Brazil].

**UREDO KYLLINGIAE** P. Hennings, Hedwigia 35: 256. 1896. TYPE on *Kyllinga caespitosa* Nees (*Kyllinga pumila* Michaux) from **Brazil**, Santa Catarina: Itajaí, Nov 1885, *Ule-1421*. (?!?, IIpe/?) ? = *Uredo kyllingiae-brevifoliae* Dietel, Bot. Jahrb. 34: 591. 1905. TYPE on *Kyllinga brevifolia* Rottboell from **Japan**, Tosa: Kochi, June 1903, *T. Yoshinaga s.n.*

On Cyperaceae:

*Kyllinga brevifolia* Rottboell, São Paulo (Jackson, 1926: 144).

*Kyllinga pumila* Michaux, Minas Gerais (Joerstad, 1956: 481; as *Puccinia cyperi*), Santa Catarina (Hennings, 1896: 256).

*Uredo kyllingiae* has been reported also from Ecuador, Colombia, Venezuela, Trinidad, and Africa and Asia.

*Uredo kyllingiae-brevifoliae* Dietel (Bot. Jahrb. 34: 591. 1905) was regarded as a synonym of *Uredo kyllingiae* P. Hennings by Hiratsuka et al. (1992), and was connected to the teleomorph *Puccinia kyllingiae-brevifoliae* Miura. As such, it was reported from Asia. But this connection has not been determined reliably for the Americas where telial collections have not been reported. Arthur (1924) reported *Uredo kyllingiae* as an anamorph of *Puccinia cyperi*. Some authors unite *Puccinia kyllingiae-brevifoliae* with *Puccinia cyperi*. Sometimes *Kyllinga* is spelled as *Kyllingia*.

Uredinia scattered or a few aggregated into groups, mostly on the abaxial side of leaves or on both sides or on stems, on minute brown spots, the leaves sometimes completely brownish, sori 0.25-1 mm long, elliptical to oblong, brownish to pale brownish, long covered by the epidermis; urediniospores 20-28 × 15-19 μm, subglobose or often ovoid or ellipsoid, wall 1.5-2 μm thick, for a long time colorless, then yellowish or yellowish-brown, germ pores mainly 2, rarely 3-4, equatorial. (The Sydows, 1924).

*Uredo kyllingiae-brevifoliae* Dietel, see **UREDO KYLLINGIAE** P. Hennings.

**UREDO LAETICOLOR** Arthur, Bull. Torrey Bot. Club 47: 473. 1920. A new name for *Uredo operculinae* Arthur. (?!?, II/?).

≡ *Uredo operculinae* Arthur, Mycologia 9: 95. 1917. (Not Sydow, 1913, a rust also on *Operculina* sp. from the Philippines). TYPE on *Operculina dissecta* (Jacquin) House from Puerto Rico, Yauco, March 31, 1916, *H. H. Whetzel & Olive-310*.

On Convolvulaceae.

*Operculina convolvulus* Manso, São Paulo (Viégas, 1945: 86; IAC-1852).

**UREDO LAFOENSEAE** H. S. Jackson & Holway in Jackson, Mycologia 23: 483. 1931. TYPE on *Lafoensia pacari* Saint-Hilaire from **Brazil**, São Paulo: Campos do Jordão, 26 April 1922, *Holway-1774*. (?!?, II/?).

On Lythraceae.

*Lafoensia pacari* Saint-Hilaire, Federal District (IBI-15574), Minas Gerais (IBI-15907), São Paulo (Jackson, 1931: 483; IBI-14559).

*Uredo lafoenseae* has been reported only from Brazil.

Uredinia on abaxial side of leaves, subepidermal in origin, scattered or in groups, cinnamon-brown, 0.2-0.4 mm across, tardily erumpent, somewhat bullate, becoming pulverulent, ruptured epidermis conspicuous; urediniospores 22-31 × 16-19 μm, somewhat irregularly ellipsoid or obovoid; wall 1 μm or less



thick, moderately and finely echinulate, cinnamon-brown, pores 3, approximately equatorial (Jackson, 1931: 483.).

*Uredo leonotidicola* P. Hennings, see **Puccinia leonotidicola** P. Hennings.

*Uredo leonotidis* P. Hennings, see **Puccinia leonotidicola** P. Hennings.

**UREDO LICANIAE** P. Hennings, Hedwigia 34: 99. 1895. TYPE on *Licania* sp., Chrysobalanaceae, from **Brazil**, Goiás: Meiponte, Aug 1892, *Ule-1901*. (??,II?).

*Uredo licaniae* has been reported only from the type. See *Intrapes paliformis*, which this species may prove to be.

*Uredo lilloi* Spegazzini, see **PROSPIDIUM APPENDICULATUM** (Winter) Arthur.

*Uredo lindsaeae* P. Hennings, see **CALIDION LINDSAEAE** (P. Hennings) H. Sydow.

*Uredo loeseneriana* P. Hennings, see **KUEHNEOLA LOESENERIANA** (P. Hennings) H. S. Jackson & Holway.

*Uredo longiaculeata* P. Hennings, see **PROSPIDIUM TECOMICOLA** (Spegazzini) H. S. Jackson & Holway.

**UREDO LONGIPEDIS** P. Hennings, Hedwigia 34: 97. 1895. TYPE on *Calliandra longipedis*, Leguminosae, from **Brazil**, Goiás, Goiás, Dec 1892, *Ule-1893*.

*Uredo longipes* has been reported only from the type.

Sori on both sides of leaves, in groups on spots 2-5 mm in diameter, sori minute, yellow-brown to brownish, surrounded by ruptured epidermis; paraphyses numerous, 40-50  $\mu\text{m}$  long, clavate to capitate, 12-18  $\mu\text{m}$  wide at top, wall 4-12  $\mu\text{m}$  thick at top, dark yellow-brown at apex, pale below and subcolorless at base; spores 18-28 x 14-18  $\mu\text{m}$ , subglobose, ovoid, to pyriform, wall 1.5-2  $\mu\text{m}$  thick at sides and yellowish, 2-3.5  $\mu\text{m}$  at apex and dark yellow-brown, echinulate, germ pores 4, equatorial (H. & P. Sydow, 1924).

*Uredo lucumae* Arthur & Johnston, see **ACHROTELIUM LUCUMAE** Cummins.

**UREDO LUEHEAE** Spegazzini, Anal. Mus. Nac. Hist. Nat. Buenos Aires 23: 31. 1912. TYPE on *Lueheae divaricata* Martius from **Argentina**, Jujuy: Yuto, Nov 1911, *Spegazzini-s.n.*

On Tiliaceae.

*Luehea* sp., Minas Gerais (IBI-16258), Rio de Janeiro (IBI-12829), São Paulo (Jackson, 1931: 477; IBI-12829).

*Uredo luehae* has been reported also only from Argentina.

Sori on adaxial side of leaves, scattered or in loose groups, 0.1-0.2 mm across, pulvinate, erumpent, tan.; paraphyses about 30 x 12  $\mu\text{m}$ , numerous, forming a basket like structure, straight or incurved, the apex more or less thickened or subcapitate, wall 0.5  $\mu\text{m}$  thick on sides, 2-4  $\mu\text{m}$  thick in curved, apex capitate; spores 18-20  $\mu\text{m}$  in diameter, (24-26 x 17-19  $\mu\text{m}$ , fide Lindquist, 1982), subglobose, broadly ellipsoid, or obovoid; wall 1.5-2  $\mu\text{m}$  thick, evenly echinulate, pores obscure (The Sydows, 1924).

*Uredo lygodii* Hariot, see **Puccinia lygodii** Arthur.

**UREDO LYNCHII** (Berkeley) Plowright, Monog. Brit. Ured. p. 259. 1889.

≡ *Trichobasis lynchii* Berkeley, Gard. Chron. 8: 242. 1877. TYPE on *Spiranthes* sp. from Kew Botanical Gardens, England, originally from **Trinidad**, place and date not available, *Lynch-s.n.*

On Orchidaceae.

*Spiranthes nitida* Cogn., Rio de Janeiro (Jackson, 1926: 162).

Jackson (1926) was unsure of the identification of this specimen as *Uredo lynchii*. He reported the spores as 26-28 x 18-22  $\mu\text{m}$ , wall 2.5-3.5  $\mu\text{m}$  thick, and sparsely and prominently echinulate.

**UREDIO MACEIENSIS** P. Hennings, Hedwigia 43: 163. 1904. TYPE on leaves and twigs of ?  
*Johannesia(sic) princeps* Velloso, Euphorbiaceae, from **Brazil**, Alagoas: Maceio, July 1900, *Ule-2663*.

*Uredo maceiensis* has been reported only from the type. The host genus was misspelled in the original publication. It should be *Joannesia*, but the host of the type specimen in HBG is probably not *Joannesia princeps* Velloso. Perhaps the genus is *Maprounea* sp. also Euphorbiaceae.

Sori 1-2 mm in diameter or elongate, confluent and up to 4 mm long on petioles, irregularly distributed on both sides of the leaves, on petioles, (and on stems, Hennings, 1904), in groups on circular, yellowish, or brownish spots 3-5 mm. in diameter, solitary or finally confluent, erumpent, powdery, dark cinnamon brown; paraphyses numerous, peripheral, 30-50 x 15-16  $\mu\text{m}$ , clavate, yellowish above, colorless below, wall very thick above, lumen none or almost lacking; spores 24-34 x 18-25  $\mu\text{m}$ , mostly ovoid, wall 2.5-4  $\mu\text{m}$  laterally, up to 4-6  $\mu\text{m}$  at apex, germ pores 3, equatorial (H. & P. Sydow, 1924).

*Uredo macella* H. S. Jackson & Holway, see **UROMYCES OCCULTUS** Lindquist.

**UREDIO MACHAERII** Dietel, Hedwigia 36: 36. 1897. TYPE on *Machaerium* sp., Leguminosae, from **Brazil**, Rio de Janeiro: Niteroi, Sept 1892, *Ule-2048*.

*Uredo machaerii* has been reported only from the type.

Sori very closely scattered and often confluent almost covering the deformed branches of witches' brooms, cinnamon-brown, pulverulent; spores 11-16 x 10-14  $\mu\text{m}$ , globose, subglobose, to ovoid, wall ca 2  $\mu\text{m}$  thick, echinulate, yellowish to pale brown, germ pores 8-10, scattered (Dietel, 1897; P. & H. Sydow, 1924).

*Uredo macluriae* Spegazzini, see *Physopella macluriae* (Spegazzini) Arthur. (**CHACONIA APICRASSA** Hennen et al. sp. nov. ined).

*Uredo macrospermum* Cooke, see **UREDINOPSIS PTERIDIS** Dietel.

*Uredo maculans* Patouillard & Gaillard, see **PUCINIA MOGIPHANIS** Arthur.

*Uredo malvicola* Spegazzini, see **CATENULOPSORA PRAELONGA** (Spegazzini) Buriticá & Hennen.

*Uredo maprouniae* P. Hennings, see **CHACONIA MAPROUNIAE** Ono & Hennen.

*Uredo mararyensis* P. Hennings, see **UREDIO DALBERGIAE** Hennings.

*Uredo margine-incrassata* P. Hennings, see **RAVENELIA BAKERIANA** Dietel.

*Uredo mauriae* H. Sydow, see **KIMUROMYCES CERRADENSIS** Dianese et al.

*Uredo melinidis* Kern, see **UROMYCES SETATIAE-ITALICAE** Yoshino.

**UREDIO MICROTHELES** Spegazzini, Bol. Acad. Nac. Cien. Cordoba 11: 482. 1889 TYPE on *Desmodium* sp., Leguminosae, from **Brazil**, São Paulo: Apiaty, "spring" 1888, *Puiggari-2720*.

*Uredo microthelis* has been reported only from the type.

Sori mostly on abaxial side of leaflets, rarely on adaxial side, 0.15-0.25 mm diam, erumpent, subpulverulent, rust-brown; spores 17-18  $\mu\text{m}$  diam., globose, wall thickened (crassiusculo), yellowish, minutely densely echinulate (Spegazzini, 1889).

**UREDIO MIMOSAE-INVISAE** Viégas, Bragantia 5: 85. 1945. TYPE on *Mimosa invisae* Martius, Leguminosae, from **Brazil**, Paraíba: Alagoinha Experiment Station at Alagoinha, Jan 1940, *J. Deslandes-s.n.*

*Uredo mimosa-invisae* has been reported only from the type.

Sori numerous on both sides of leaflets, scattered, 0.33-0.25 mm across, at first covered by the epidermis, then erumpent, pulverulent; spores 18-28 x 18-20  $\mu\text{m}$ , globose-piriform, wall 3-3.5  $\mu\text{m}$  thick, minutely echinulate, yellowish, with 6-8 scattered germ pores (Viégas, 1945).

*Uredo mogiphanis*. Juel, see **Puccinia mogiphanis** Arthur.

*Uredo mogi-mirim* Viégas, see **Chaconia ingae** (H. Sydow) Cummins.

**Uredo monsterae** Sydow, from Caxiuanã, *Sotao 97-381, Sotao97-618*.

*Uredo myrciae* Mayor, see **Puccinia psidii** Winter.

**UREDO MYRSINES** Dietel, Hedwigia 38: 256. 1899. TYPE on *Cybianthus* sp., Myrsinaceae (reported originally as undetermined genus of Myrsinaceae) from **Brazil**, Rio de Janeiro, May 1896, *Ule-2363*. (**ANpe**).

*Uredo myrsines* has been reported only from the type. The host genus was determined by J. Pipoly, Dec. 1999 at BRIT from photo of type from HBG.

Sori on the abaxial side of leaves, on small yellowish spots 1-2 mm across, sori ca 0.1-0.2 mm across, single or many aggregated together and sometimes confluent, long covered by the brown epidermis; spores 18-24 x 16-19 µm variable in shape, mostly subglobose, ellipsoid or ovate, wall ca 1.5-2 µm thick, yellowish, short echinulate, germ pores 6-8 scattered (Dietel, 1899).

*Uredo myrtacearum* Pазschke, in Rabenhorst & Winter, see **Puccinia psidii** Winter.

*Uredo nectandrae* Viégas, *Bragantia* 5: 86. 1945. Not rust. This fungus is *Drepanoconis larvaeformis*. See *O Biológico* 12: 55. 1946.

**UREDO NEOPUSTULATA** Cummins, *Mycologia* 48: 608. 1956.

≡ *Uredo pustulata* P. Hennings, *Hedwigia Beiblatt* 35: (129). 1899. Not Persoon, 1801. TYPE on *Stenorrhynchus* sp. from Brazil, Rio de Janeiro: Serra dos Orgãos, 23 Dec 1896, *Ule-2455*.

On Orchidaceae.

*Stenorrhynchus* sp., Rio de Janeiro (Hennings, 1899: (129); Cummins, 1956: 608).

*Uredo neopustulata* has been reported also from Puerto Rico.

Sori scattered and deeply immersed in infections covering all of the leaf, or few in scattered groups, 0.5-1 mm in diameter, opening by a central pore, spores 19-26 x 16-20 µm, subglobose, ovoid, to ellipsoid, wall 1.5-2 µm thick, loosely echinulate, yellowish, germ pores obscure (The Sydows, 1924).

*Uredo nephrolepidis* Dietel, see **Desmella anemiae** H. Sydow & P. Sydow.

*Uredo neurophila* Spegazzini, see **Puccinia psidii** Winter.

**UREDO NICOTIANAE** Anasatasia, Saccardo & Splendore in Saccardo, *Syll. Fung.* 17: 440. 1905.

TYPE (lectotype needs to be chosen) on *Nicotiana quadrivalvis* and *N. sylvestris* from **Italy**, Neapolin: Scafati tobacco experimental station, date of collection and collector not available.

= *Uredo nicotianae* Arthur in Blasdale, *Univ. California Publ., Bot.* 7: 141. 1919. Type on *Nicotiana biglowii* Watson from **The United States of America**, California: Rionido, date of collection and collector not available.

On Solanaceae.

*Nicotiana tabacum* L., Brasil (Averna-Sacca, 1922: 205).

The Sydows (1924) saw no specimen of *Uredo nicotianae* but they reported that his anamorph probably belongs to a *Coleosporium*. The report of this rust from Brazil requires confirmation before it can be accepted.

*Uredo nidulans* H. Sydow & P. Sydow, see **Uredo dalbergiae** P. Hennings.

**UREDO NIDULARII** P. Hennings, *Hedwigia Beiblatt* 37: (206). 1898. TYPE on *Nidularium longiflorum* Ule from **Brazil**, Rio de Janeiro: Serra dos Orgãos, 21 December 1896, *Ule-2446*. (**??,II,?**).

On Bromeliaceae.

*Nidularium longiflorum* Ule, Rio de Janeiro (Hennings, 1898: 206; Dietel, 1899: 256).

*Nidularium organense* Ule, Rio de Janeiro (Dietel, 1899: 256).

report *Uredo nidularii* also on *Tillandsia* spp. and from Jamaica, Central America, and Mexico.

Sori in elliptical groups to 1 cm long or often seriatly arranged in groups to at least 2 cm long, subepidermal in origin but not deep seated, yellowish to about cinnamon-brown; spores (22-)25-31(-35) x (18-)22-25(-28)  $\mu\text{m}$ , mostly obovoid or ellipsoid, wall 1.5-2(-2.5)  $\mu\text{m}$  thick, echinulate with echinulae spaced (2-)2.5-3.5(-4)  $\mu\text{m}$ , echinulae absent or with few and shorter around each pore, golden-brown to cinnamon-brown when mature, pores 2, equatorial in slightly flattened sides, with inconspicuous or no colorless caps (Cummins and Pollack, 1974).

*Uredo nigropunctata* P. Hennings, see **SPHENOSPORA KEVORKIANII** Linder.

**UREDNO NOCIVIOLA** H. S. Jackson & Holway in Jackson, Mycologia 18: 144. 1926. TYPE on *Cyperus distans* Linnaeus f. from **Brazil**, São Paulo: São Paulo, 24 May 1922, *Holway-1877*. (**ANpe**).

On Cyperaceae.

*Cyperus distans* Linnaeus f., São Paulo (Jackson, 1926: 144).

*Cyperus cayennensis* (Lamarck) Britton, São Paulo (Jackson, 1926: 144).

*Uredo nociviola* has been reported also from Colombia and the West Indies.

Spermogonia, aecia, and telia unknown. Sori on the abaxial side of leaves, scattered, 1-3 mm long, oblong or linear, long covered by the epidermis which usually opens by one longitudinal fissure, spore mass cinnamon-brown, spores small (18-22 x 15-16  $\mu\text{m}$ ), walls 1.5-2  $\mu\text{m}$  thick, very finely verrucose, more strongly in the distal part of the spore, pores 2, supraequatorial (Jackson, 1926).

*Uredo notata* Arthur, see **CROSSOPSORA NOTATAE** (Arthur & J. R. Johnston) Arthur.

*Uredo novissimus* Spegazzini, see **UROMYCES NOVISSIMUS** Spegazzini.

*Uredo ochracea* Dietel, see **UROMYCES COMMELINAE** Cooke.

**UREDNO ONCIDII** P. Hennings, Hedwigia Beiblatt 41: (15). 1902. TYPE on *Oncidium lanceanum* from **Brazil**, Pará, 1899, *Huber-26*.

= *Uredo aurantiaca* Montmartini, Atti Ist. Bot. Pavia, N. Ser. 8: 101. plate 4. 1902.

On Orchidaceae.

*Oncidium lanceanum*, Pará (Hennings 1902: (15)).

*Oncidium lietzei* Regel, Minas Gerais (Viégas & Teixeira, 1945: 50; IAC-5041).

*Oncidium varicosum*, São Paulo (PUR-F8846).

*Oncidium* sp., Brasil (PUR-F88445, -F9788).

The United States Department of Agriculture's National Fungus Collection data base records about 100 specimens under the name *Uredo oncidii*, almost entirely from interceptions made by plant quarantine inspectors. Specimens have originated from Mexico, Central America, Islands in the Caribbean, and South America. Usually only the country name is recorded, not a specific location within a country.

Cummins (1960) did not discuss *Uredo oncidii* when he described *Puccinia oncidii* on *Oncidium* sp. which also came from a customs intercept from Mexico. The two are probably not related.

The Sydows (1924) reported *Uredo oncidii* as having sori on both sides of leaves on blackish brown spots, the sori 0.5-1 mm wide, of variable size, irregular and confluent, more or less numerous, covered by the pale epidermis, then opening by a minute central pore, orange, spores 22-30 x 15-22  $\mu\text{m}$ , ovoid to ellipsoid, loosely echinulate, more so at the apex, wall 1.5-2.5  $\mu\text{m}$  thick, yellow or yellowish brown, pores obscure.

*Uredo operculinae* Arthur, see **UREDNO LAETICOLOR** Arthur.

*Uredo oxalidis* L veill , see **PUCCINIA OXALIDIS** Dietel & Ellis.

*Uredo pachystegia* Dietel, see **UROMYCES DOLICHOSPORUS** Dietel & Holway.

*Uredo palaquii* P. Hennings, see **MARAVALIA PALAQUII** (Cummins) Y. Ono .

*Uredo palicureae* P. Hennings, see **UROMYCES PSCHOTRIAE** P. Hennings.

**UREDOPALLIDUSCULA** Spegazzini, Revista Mus. La Plata 15 (ser. 2, v. 2): 9. 1908. TYPE on ?  
*Coleus* sp., Labiatae, from **Brazil**, São Paulo: São Paulo,

*Uredopalliduscula* has been reported only from the type. The identification of the host and rust needs to be confirmed. *Coleus* is a paleotropical genus but some species are widely cultivated as ornamental foliage plants.

*Uredo panamensis* Arthur, see **PUCGINIA MOGIPHANIS** Arthur.

*Uredo panici* P. Hennings, see **UROMYCES SETARIAE-ITALICAE** Yoshino.

*Uredo panici-maximi* Rangel, see **UROMYCES SETARIAE-ITALICAE** Yoshino.

*Uredo paraguayensis* Spegazzini, see **PROSPODIUM PARAGUAYENSIS** Spegazzini.

*Uredo paranensis* Pennington, Anal. Soc. Cient. Argentina 53: 269. 1902. Reported on *Mogiphanes glauca*, Amaranthaceae, Argentina, Island in Rio Paraná (Pennington, 1902: 269). Lindquist (1983) reported that *Uredo paranensis* is probably an anamorph of *Uromyces platensis* Spegazzini and the host is probably *Pfaffia* sp. *Uredo paranensis* was reported mistakenly as from Brazil in the original Index. .

*Uredo parthenii* Spegazzini, see **PUCGINIA PARTHENII** Arthur.

*Uredo paspalicola* P. Hennings, see **PHAKOPSORA COMPRESSA** (Mains) Buriticá & Hennen.

*Uredo paspali-perrottetii* P. Hennings, see **PUCGINIA LEVIS** (Saccardo & Bizzozero) Magnus var. **PANICI-SANGUINALIS** (Rangel) Ramachar & Cummins.

*Uredo paulensis* P. Hennings, see **PUCGINIA BRACHYPODII** Oth.

**UREDOPAULISTANA** Spegazzini, Revista Mus. La Plata 15: 10. 1908. TYPE on *Acalypha* sp., Euphorbiaceae, from **Brazil**, São Paulo: São Paulo, date not reported, *Uster s.n.*

*Uredopaulistana* has been reported only from the type and the original description by Spegazzini. The identification of this rust and host needs to be confirmed.

*Uredo pavidia* H. S. Jackson & Holway, see **PHAKOPSORA PAVIDA** Buriticá & Hennen.

*Uredo peckoltiae* H. Sydow & P. Sydow, see **CROSSOPSORA ASCLEPIDIACEAE** Buriticá & Hennen

*Uredo peperomiae* P. Hennings, see **PUCGINIA PEPEROMIAE** Lindquist.

**UREDOPERIBEBUYENSIS** Spegazzini, Anal. Soc. Cient. Argentina 17: 123. 1884. TYPE on *Monnina* sp., Polygalaceae, from **Paraguay**, Cordillera de Peribebuy, 2 April 1883, *Balansa-3772*. On Polygalaceae.

*Polygala* sp., Minas Gerais (PUR-F8944).

*Uredo persicae* Spegazzini, see **TRANZSCHELIA DISCOLOR** Transzchel & Litvinow.

*Uredo pezizaeformis* De-Toni in Saccardo, see **DICHEIRINIA BINATA** (Berkeley & Curtis) Arthur.

*Uredo phyllanthi* P. Hennings, see *Milesia phyllanthi* (Hennings) Buriticá & Hennen [**PHAKOPSORA ULEI** (H. Sydow & P. Sydow) Buriticá & Hennen].

*Uredo piperinum* (Sydow) Berndt et al., see *Malupa piperinum* (Sydow) P Buriticá Hennen (**CROSSOPSORA PIPERIS** Berndt et al.).

*Uredo piperis* P. Hennings, see **PUCCINIA PEPEROMIAE** Lindquist.

*Uredo pitanga* Spegazzini, see **PUCCINIA PSIDII** Winter.

**UREDO PITHECOLOBII** P. Hennings (sic), Hedwigia 34: 98. 1895. TYPE on *Pithecellobium* sp.,

Leguminosae, from **Brazil**, Goiás: "ditiione fluv. Corumba", Oct 1892, *Ule-1954*.

*Uredo pithecollobii* has been reported only from the type.

Sori on deformed stems, powdery; spores 18-25 x 12-18  $\mu\text{m}$ , variable in shape, subglobose, ovoid, ellipsoid, piriform, to oblong; wall 1-1.5  $\mu\text{m}$  thick, densely minutely echinulate-verrucose, pale yellow brown, germ pores 4, distinct, equatorial (P. & H. Sydow, 1924).

*Uredo pluchiae* Sydow, see **PUCCINIA OCELLIFERA** Cummins.

*Uredo polymniae* P. Hennings, see **UROMYCES POLYMNIAE** Dietel & Holway.

*Uredo polyogonis* Spegazzini, see **PUCCINIA POLYPOGONIS** Spegazzini.

*Uredo pontederiae* Spegazzini, see **UROMYCES PONTEDERIAE** Gerard.

*Uredo proeminens* DeCandolle, *Uromyces proeminens* (DC.) Lèveillé., *Uromyces proeminens* (DC.) Passerini., see **UROMYCES EUPHORBIAE** Cooke & Peck.

**UREDO PSYCHOTRIICOLA** P. Hennings, Hedwigia 34: 321. 1895. TYPE on *Psychotria* sp. from **Brazil**, Goiás: place not reported, Feb 1893, *Ule-s.n.* (??,IIpe/?).

On Rubiaceae

? *Ixora* sp., Rio de Janeiro (PUR-F15205).

*Palecourea* sp., Minas Gerais (Thurston, 1940:305).

*Psychotria* sp., Goiás (Hennings, 1895B: 321); Rio de Janeiro (Dietel, 1899: 256; Jackson, 1832: 100), São Paulo (Hennings, 1908B: 2; Jackson, 1932: 100).

*Uredo psychotriicola* has been reported also from Peru. A specimen reported under this name from The Phillipines requires confirmation. See *Puccinia palicoureae* which is probably the teleomorph.

Spermogonia, aecia, and telia unknown. Sori 0.15-0.35 mm across, scattered or grouped on indeterminate yellowish or brownish spots on the adaxial side of leaves, urediniospores 24-30 x 18-25  $\mu\text{m}$ , subglobose, ellipsoid to ovoid, the wall about 2  $\mu\text{m}$  thick, echinulate, colorless to pale yellowish, germ pores obscure (H. & P. Sydow, 1924).

A specimen of *Puttemans-1264* from São Paulo, Serra da Cantareira, 30 April (or ?May) 1905 had sori abaxial, long surrounded by the ruptured epidermis, golden brown, spores 30-33(-39) x 23-28  $\mu\text{m}$ , wall (1.5)2-2.5  $\mu\text{m}$ , and spines (2.5-)3-4(-5)  $\mu\text{m}$  apart, and prominent.

*Uredo puttemansii* P. Hennings, see **PUCCINIA PSIDII** Winter. Host is not Leguminosae as first reported.

*Uredo rectangulata* F.G. Albuquerque, as "*retangulata*", see **CEROTELIUM RECTANGULATA** Buriticá & Hennen.

**UREDO REISSEKIAE** H. Sydow & P. Sydow, Ann. Mycol. 5: 356. 1907. TYPE on *Reissekia smilacina*

Endlicher (reported originally as *Reissekia cordifolia*, Rhamnaceae, from Brazil, Rio de Janeiro: "Venda das Pedras", 7 Jan 1897, *F. Noack-510*).

*Uredo reissekiae* has been reported only from the type. New collections are required to verify the nature of this rust.

Sori on minute spots 1-3 mm in diameter on the abaxial side of leaves, spores 16-25 x 12-18  $\mu\text{m}$ , subglobose to ellipsoid, wall ca 1.5  $\mu\text{m}$  thick, finely echinulate, yellowish-colorless, germ pores obscure. (P. & H. Sydow, 1924).

*Uredo rhombica* Spegazzini see **KIMUROMYCES CERRADENSIS** Dianese et al.

*Uredo rochaei* Puttemans, see **PUCINIA PSIDII** Winter.

*Uredo rollinaiae* Dale, specimens from Amapá ? and MG.?

*Uredo roupalae* Cummins, see **KIMUROMYCES CERRADENSIS** Dianese et al.

*Uredo rubida* Arthur & Holway, see **PUCINIA ERIANTHICOLA** Cummins.

**UREDO SALVIAE** Dietel, *Hedwigia* 36: 36. 1897. TYPE on *Salvia* sp. from **Brazil**, Santa Catarina: Serra Geral, April 1891, *Ule-1720*.

On Labiatae

*Salvia* sp., Santa Catarina (Dietel, 1897: 36).

*Salvia paranensis* Dusen, Paraná (Joerstad, 1959: 72).

*Uredo salviae* has been reported only from the two collection cited above.

Sori scattered on adaxial side of leaves, sometimes in circular groups, 0.5 -1 mm in diameter, cinnamon-brown; spores 20-25 x 18-22  $\mu\text{m}$ , globose, ovoid, to broadly ellipsoid; walls 2-3  $\mu\text{m}$  thick, evenly echinulate, chestnut-brown, germ pores 2-3 (P. & H. Sydow, 1924). Joerstad (1959) reports somewhat different traits in his material: spores 20-24 x 18-19  $\mu\text{m}$ , obovoid or ellipsoid, wall about 1.5  $\mu\text{m}$  thick, light brown, sparsely but strongly echinulate, spines 3-4  $\mu\text{m}$  apart, about 2  $\mu\text{m}$  long and conical, with 2 equatorial or subequatorial pores.

*Uredo sapotacearum* P. Hennings, see **UREDO CONFLUENS** P. Hennings.

*Uredo scopigena* P. Hennings, see **UROMYCES MEGALOSPERMUS** Spegazzini.

*Uredo sebastianae* Winter, see **MARAVALLIA SEBASTIANAE** Lindquist.

**UREDO SECLUSA** H. S. Jackson & Holway in Jackson, *Mycologia* 23: 484. 1931. TYPE on Myrtaceae, species undetermined, **Brazil**, São Paulo: Villa Prudente, 31 May 1922, *Holway-1925*. (?/?,II/?).

*Uredo seclusa* has been reported only from the type and Horto Florestal at Mogi-Mirim, São Paulo.

Uredinia hypophyllous, scattered, or more commonly gregarious on small purplish spots, small, irregularly circular in outline, cinnamon brown, tardily naked, pulverulent, ruptured epidermis conspicuous; urediniospores 24-32 x 15-20  $\mu\text{m}$ , somewhat irregularly ellipsoid or obovoid; wall 1  $\mu\text{m}$  or less thin, cinnamon-brown, moderately and finely echinulate, the pores two or three, super-equatorial.

This *Uredo* is very distinct from the uredinia stage of *Puccinia psidii* Wint. and appears to differ from any previously described (Jackson, 1931).

*Uredo solenioides* P. Hennings, see *Dicheirinia solenioides* Cummins (**DICHEIRINIA ULEANAE** Hennen & Cummins).

*Uredo smilacis* Schweinitz, see **PUCINIA SMILACIS** Schweinitz.

**UREDO SP.** on *Dipteryx* sp., Leguminosae, from Mogi-Mirim has not been named. Dianese has it in her

thesis.

**UREDOP. SP.** on *Platymiscium floribundum* Vogel, Leguminosae, from Serra da Cantareira, N of City of Sao Paulo, 82-168, IBI-14099,

Sori mostly scattered on small pale brown spots on abaxial side of leaflets, sometimes circular, ruptured epidermis obvious around slowly erumpent sori; paraphyses numerous, peripheral, short; wall greatly thickened, knob-like, and slightly incurved at apex, colorless; spores very small, 8-9(-9.5) x 6.5-7.5 µm, broadly ellipsoid, wall ca 0.5 µm thick, pale tan, echinulate, spines short, ca 0.5-1 µm apart

**UREDOP. SPARGANOPHORI** P. Hennings, Hedwigia 43: 160. 1904. TYPE on *Sparganophorus vaillantii* Gaertner (*Struchium*), Compositae, from **Brazil**, Amazonas: Rio Juruá, Santa Clara, Oct 1900, Ule-2945. (?!?,II/?).

*Uredo sparganophori* has been reported from Brazil only from the type collection. Urban (1973) reported this species also from The West Indies.

Spermatogonia, aecia, and telia unknown. Uredinia irregularly scattered or grouped on both leaf surfaces, without noticeable leaf spots, long-covered by the epidermis (*diutius tectis*), 0.25-0.50 mm diam., round, dark yellow; urediniospores 24-34 x 18-25 µm, variable in shape, mostly ellipsoid, ovoid, to pyriform, rarely subglobose; wall 1.5-2 µm thick, loosely echinulate, light yellow-brown; pores obscure. (the Sydows, Monogr. Ured. 4: 398. 1924).

*Uredo spegazzini* De Toni, see **UROMYCES COMMELINAE** Cooke.

*Uredo spinulosa* Dietel, see **UROMYCES BRASILIENSIS** Trotter.

*Uredo stevensiana* Arthur, see **PHAKOPSORA COMPRESSA** (Mains) Buriticá & Hennen.

*Uredo striolata* Spegazzini, see **PUCGINIA MACROPODA** Spegazzini.

*Uredo stylosanthi* P. Hennings, see **PUCGINIA STYLOSANTHIS** Viégas.

*Uredo subhyalina* Spegazzini, Bol. Acad. Nac. Cienc. Cordoba 11: 483. 1889. On *Desmodium* sp., Leguminosae, from São Paulo (Spegazzini, 1889: 483). **Not a rust** but *Synchytrium* sp., a fungus often confused for a rust because of the superficially similar sori and yellow spores.

*Uredo subneurophila* Spegazzini, Anal. Soc. Cient. Argentina 17: 123. 1884. This is **PELASTOMA SYNEMATIS** Hennen & Figueiredo, ined., on **Apocynaceae**.

*Uredo syntherisme* Spegazzini, see **PUCGINIA OAHUENSIS** Ellis & Everhard.

*Uredo tacita* Arthur, see **UROMYCES PEGLERIAE** Pole-Evans.

*Uredo telantherae* Viégas, see **PUCGINIA MOGIPHANIS** Arthur.

**UREDOP. TENEBROSA** H. S. Jackson in Jackson, Mycologia 18: 160. 1926. TYPE on Iridaceae, species undetermined, from **Brazil**, Paraná: Curitiba, 20 June 1922, *Holway-1976*. (?!?,II/?).

*Uredo tenebrosa* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Sori on both sides of leaves, scattered or occasionally confluent lengthwise, intercostal, on purplish spots, elliptic or linear, 0.5-1.5 mm long, tardely naked, chestnut-brown, pulverulent, long covered by the epidermis which ruptures along one side; spores 24-30 x 20-24 µm, obovoid, wall 2.5-3.5 µm thick, cinnamon- to chestnut-brown, finely and rather sparingly echinulate, pores 3-4, equatorial (Jackson, 1926).



**UREDO TEPHROSIICOLA** P. Hennings, Hedwigia 43: 163. 1904. TYPE on *Tephrosia* sp. from **Peru**, "Pompas bei Tarapoto", January 1902, *Ule-3226*.  
On Leguminosae.

*Tephrosia toxicaria* Persoon, Serra do Mel, Rio Branco (Sydow, 1916: 72).

*Uredo tephrosiicola* has been reported only from the two reports listed above, one from Peru and one from Brazil. At least seven species of *Ravenelia* parasitize *Tephrosia* spp. and probably *Uredo tephrosiicola* is an anamorph of a *Ravenelia* sp.

Sori on both sides of leaves, in groups or scattered, minute, 0.25 mm in diameter, yellow-brown to pale brown, covered by the epidermis at first, finally rupturing and remaining around the sori, spores 20-28 x 15-24  $\mu\text{m}$ , subglobose, ovoid, ellipsoid to oblong, wall about 2  $\mu\text{m}$  thick, echinulate, yellow to pale yellow brown, with 4 equatorial germ pores (P. & H. Sydow, 1924).

*Uredo teramni* Mayor, see *Malupa vignae* (Bresadola) Ono, Buriticá & Hennen (**PHAKOPSORA MEIBOMIAE** (Arthur) Arthur).

*Uredo terminaliae* P. Hennings, see **UREDO BYRSONIMATIS** P. Hennings.

*Uredo tessariae* Spegazzini, see **UROMYCES MEGALOSPERMUS** Spegazzini.

*Uredo tijucae* H. S. Jackson & Holway, see *Milesia tijucae* (H. S. Jackson & Holway) Buriticá & Hennen (**PHAKOPSORA TIJUCAE** Buriticá & Hennen).

**UREDO TORULINI** P. Hennings, Hedwigia 44: 57. 1905. TYPE on *Cyperus ferax* L.C. Richard (*Torulium confertum* Desv.), Cyperaceae, from **Brazil**, Amazonas: Rio Juruá, Bom Fim, Nov 1900, *Ule-3078*.

*Uredo torulini* has been reported also from Colombia.

Sori on both sides of leaves but mainly on the abaxial side of leaves, 0.5-1(-2) mm long, scattered, in groups, or seriate, often confluent, surrounded by or partially concealed from view by the ruptured epidermis, powdery, reddish-brown; urediniospores 16-22 x 13-18  $\mu\text{m}$ , subglobose, ovoid, or ellipsoid, wall 2  $\mu\text{m}$  thick, loosely and minutely verrucose-echinulate, brown, pores 2, equatorial (H. & P. Sydow, 1924).

**UREDO TRICHILIAE** Arthur, Mycologia 9: 90. 1917. TYPE on *Trichillia pallida* Swartz from **Puerto Rico**, Maricao along Rio Grande, 24 March 1916, *Whetzel and Olive-63. (?/?,II/?)*.

On Meliaceae.

*Trichillia pallida* Swartz (= *Trichilia weddellii* C. DeCandolle), Minas Gerais (Thurston, 1940: 306).

*Uredo trichiliae* has also been reported from Trinidad. Specimens in BPI identified as *Uredo trichiliae* are also from Venezuela and Costa Rica.

Spermogonia, aecia and telia unknown. Uredinia subepidermal in origin, soon naked, pulverulent, ruptured epidermis evident, bright yellow, numerous, caulicolous, on etiolated shoots, on the midrib and veins, 0.5-3.5 mm long, oblong or linear, peridium and paraphyses none, urediniospores 16-23 x 13-15  $\mu\text{m}$ , borne singly on pedicels, obovoid or ellipsoid, wall 1-1.5  $\mu\text{m}$ , closely and finely echinulate, colorless or nearly so, the pores obscure (Arthur, 1917).

From Brazil, *Uredo trichiliae* has been reported only from the one collection by Thurston.

*Uredo tuberculata* Spegazzini, see **PROSPIDIUM TUBERCULATUM** (Spegazzini) Arthur.

*Uredo uleana* Dietel, see **PUCCINIA HETEROPTERIDIS** Thuemen.

**UREDO ULEI** P. Hennings, Hedwigia 44: 58. 1905. Nom. nov. for *Uredo bauhiniae* P. Hennings.

≡ *Uredo bauhiniae* P. Hennings, Hedwigia 43: 162. 1904. LECTOTYPE on *Bauhinia* sp.

(Leguminosae) from **Brazil**, Amazonas: Rio Juruá, Juruá-Miry, August 1901, *E. Ule-2685*.

Not *Uredo bauhiniae* Berkeley & Curtis, 1858.

*Uredo ulei* has been reported only from the lectotype listed above.

Spermogonia, aecia, and telia unknown. Uredinia on pale yellowish to pale brownish spots 2-4 mm across on both sides of leaves, mostly on abaxial side, sori 0.3-0.5 mm across, pale yellowish, usually confluent in groups, spores 16-23 x 14-19  $\mu\text{m}$ , ovoid to ellipsoid, wall 1.5-2  $\mu\text{m}$  thick, echinulae short, germ pores obscure (Sydow, P. & H. Sydow, 1924: 471).

Probably the paraphyses reported by Hennings (1904) were an error.

The pale yellow sori and spores of *Uredo ulei* indicate that it is probably an anamorph of a *Maravalia* species. The Sydows (1924) reported that the host of the lectotype is *Bauhinia splendidis* and that the second specimen listed by Hennings (1905) as *Uredo bauhiniae* (from **Peru**, Yurimaguas, August 1902, *E. Ule*-3225) does not belong to *Uredo ulei*.

See *Uromyces anthemophilus* for notes on rusts on *Bauhinia*.

*Uredo uviferae* Sydow, see *Malupa uvifera* (Sydow) Buriticá & Hennen on *Coccoloba* sp, Polygonaceae, under **CEROTELIUM COCCOLOBAE**.

**UREDIO VALENTULA** H. S. Jackson & Holway in Jackson, Mycologia 23: 469. 1931. TYPE on *Croton* sp., Euphorbiaceae, from **Brazil**, Rio de Janeiro, Teresopolis, 15 Oct 1921, *Holway-1221*. (**0/Ipe, Ipe/?**).

*Uredo valentula* has been reported only from the type.

The name, *Uredo valentula*, applies to both aecia ("primary uredinia") and uredinia ("secondary uredinia").

Spermogonia on both sides of leaves, in small compact groups 0.3-0.8 mm across, subcuticular in origin, flattened, 88-115 x 38-64  $\mu\text{m}$ ; aecia on both sides of leaves, more commonly on the abaxial side of leaves, in more or less circular groups 0.5-1.5 mm wide surrounding the spermogonia, or more elongate to 5 mm or more if along vein, cinnamon-brown, early erumpent, ruptured epidermis noticeable, powdery, uredinia mainly on the adaxial side of leaves, 0.2-0.5 mm across, otherwise like the aecia; aecio- and urediniospores 25-31 x 15-18  $\mu\text{m}$ , obovate, broadly ellipsoid, or occasionally pyriform, wall 1.5-2.5  $\mu\text{m}$  thick, apical wall 3-5.5  $\mu\text{m}$ , colorless or slightly tinted, sparsely and rather strongly echinulate, pores 3, slightly supra-equatorial. Telia unknown. (Jackson, 1931).

A teleomorph connection, when discovered, will probably be *Phakopsora*.

*Uredo varia* Dietel, see **PUCCINIA VARIA** Arthur.

*Uredo venustula* Arthur, see **PUCCINIA POSADENSIS** Saccardo & Trotter.

*Uredo vernoniae* Mayor, see *Uredo pachystegiae* Dietel (**UROMYCES DOLICHOSPORUS** Dietel & Holway).

*Uredo viciae-fabae* Persoon, see **UROMYCES VICIAE-FABAE** Schroeter.

*Uredo vicosiana* Thurston, see **COLEOSPORIUM IPOMOEAE** Burrill.

**UREDIO VIÉGASII** Joerstad, Arkiv für Botanik ser. 2, 4: 83. 1959. TYPE on *Adiantum subcordatum* Swartz from **Brazil**, state?: Serra Grande, date?, *Pohl-s.n.*  
On Polypodiaceae.

*Adiantum subcordatum* Swartz, São Paulo (Viégas, 1945: 89; Joerstad, 1959: 82; IBI-13859).

*Uredo viégasii* has been reported only from Brazil.

Uredinia on abaxial side of leaves, subepidermal in origin, tardily erumpent, 0.3-1 x 0.2-0.4 mm, without a peridium, yellowish- or cinnamon-brown; urediniospores 32-38 x 31-34  $\mu\text{m}$ , broadly obovoid to subglobose, wall 2.5-4.5(?-8)  $\mu\text{m}$  thick, densely echinulate, yellowish, pores 8-10, scattered (Viégas, 1945; Joerstad, 1959).

Faull (1947) reported this species as the teleomorph genus *Hyalopsora* sp from Brazil on the same host, but without reporting teliospores or specimen data (Joerstad, 1959).

*Uredo vignae* Bresadola, see *Malupa vignae* (Bresadola) Ono, Buriticá & Hennen (**PHAKOPSORA**

**MEIBOMIAE** Arthur).

*Uredo vilis* (H. Sydow & P. Sydow) J. W. Baxter, see **RAVENELIA CEBIL** Spegazzini.

*Uredo viticis* Juel, see **OLIVEA VITICIS** Ono & Hennen.

*Uredo viticis-polygamae* P. Hennings, see **OLIVEA VITICIS** Ono & Hennen.

*Uredo yurimaguasensis* P. Hennings, see **SPHENOSPORA SMILACINA** H. Sydow.

*Uredo wittmackiana* P. Hennings & Klitzing, see **SPHENOSPORA KEVORKIANA** Linder.

*Uredo zizyphi-vulgaris* P. Hennings, see **PHAKOPSORA ZIZYPHI-VULGARIS** Dietel.

*Uredo zorniae* Dietel, see **PUCCINIA ARACHIDIS** Spegazzini var. **OFFUSCATA** (Arthur) Cummins.

**UREDOPELTIS** P. Hennings,

Ann. Mus. Congo Belga 2: 223. 1908. TYPE SPECIES, *Uredopeltis congensis* Hennings, Ann. Mus Congo Belga 2: 223. 1908. On *Markhamia* sp., Bignoniaceae, from Congo, Dembo, Aug 1906, *H. Vanderyst s.n.* Phakopsoraceae.

Spermogonia and aecia unknown. Uredinia subepidermal in origin, erumpent, paraphyses peripheral, united basally, incurved, *Calidion*-type; urediniospores appear sessile in mature sori, but borne singly on inconspicuous intercalary disjunctive cells, echinulate, pores scattered or equatorial. Telia subepidermal in origin, strongly erumpent as cushion-like or irregularly globoid masses, teliospores 1-celled, without pedicels, sometimes appearing in vertical rows, laterally adherent in irregular layers several spores deep.

Traits that may help identify *Uredopeltis* include: telia subepidermal in origin, early erumpent, sometimes appearing superficial, pulvinate to globoid, often irregular in form, blackish, irregularly scattered, often with peripheral paraphyses, and composed of one-celled, adherent, ellipsoidal or polygonal teliospores, these in several irregularly arranged, layers and rows; teliospore walls usually thickened, and pigmented.

The telia are reminiscent of those of the genera *Dasturella*, and *Kweilingia*. Some species of *Phakopsora* are similar except they are subepidermal and not erumpent.

Buriticá (1998) reported two species from the Western Hemisphere, the one listed below and *U. dominicana* on *Croton* sp., Euphorbiaceae, from Mexico and the Dominican Republic. Before Buriticá's report of the two species in the Neotropics, only the type species was known.

**UREDOPELTIS GUETTARDAE** Buriticá & Hennen in Buriticá, Rev. Acad. Colomb. Cienc. 22: 329.

1998. TYPE on *Guettarda viburnoides* Chamisso & Schlechtendal from Brazil, Goiás: 18 kms SW of Jataí, hwy 364, 18 July 1988, *J. F. Hennen, M. W. Hennen & R. M. Lopez-F.-IBI-16685*. (??, IIse/III).

Anamorph

*Physopella guettardae* Buriticá & Hennen in Buriticá, Rev. Acad. Colomb. Cienc. 22: 329. 1998.

TYPE, same specimen as for the teleomorph.

On Rubiaceae

*Guettarda viburnoides* Chamisso & Schlechtendal, Goiás, Sao Paulo (Buriticá, 1998: 329).

*Uredopeltis guettardae* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia scattered on abaxial side of leaves, subepidermal in origin, erumpent, hymenium flat; paraphyses basally subtending and peripheral, 29-34 x 6-8 µm, slightly curved, wall irregularly thickened 1-3 µm, colorless to yellowish; urediniospores 19-24 x 16-18 µm, kidney-shaped, wall evenly about 1 µm thick, finely echinulate, but with a large smooth spot on the concave side, colorless to pale brown, pores 2, equatorial near the edge of the smooth spot. Telia usually in old uredinia, teliospores 20-25 x 13-15 µm, obovoid to ellipsoid, wall thickened apically 2-4 µm, germ pore not seen; many spores united in irregular rows 4-5(-6) spores high, 9-11 spores across, the irregularly globoid mass strongly erumpent (Buriticá & Hennen, 1998).

**UREDOSTILBE** Buriticá & Hennen (anamorph),

Rev. Acad. Colomb. Cienc. 19: 49. TYPE SPECIES *Uredostilbe pistila* Buriticá & Hennen, on *Annona nolosericca* Safford, Annonaceae, from **Honduras**.

*Uredostilbe* is characterized by sori that are surrounded by a single layer of long, straight paraphyses that are loosely united laterally to form a cylindrical, palisade-like structure. Spores are sessile with echinulate walls and sporogenous cells have a distal collar.

*Uredostilbe crucis-filii* Buriticá, see **BATISTOPSORA CRUCIS-FILII** Dianese et al.

**UROMYCES** (Link) Unger, *nom. cons.*

See Laundon (1965A) for details about the typification of *Uromyces*.

In its modern usage *Uromyces* is characterized by pedicellate one-celled teliospores, with or without a single visible germ pore. Its spermogonia are classified as the same type as in *Puccinia*. In fact, except for the one-celled teliospores, in theory *Uromyces* is the same as *Puccinia*.

Arthur (1922) reported that *Uromyces* is a "form genus" that he defined as "Species whose life-cycle is not known, or is not readily assumed from related forms...These genera do not represent the whole cycle of development, and are not based upon type species" Later, he abandoned this usage in favor of using *Uromyces* as a teleomorph genus.

Almeida (1975, 1976, 1977) revised about 35 taxa of Brazilian species of *Uromyces* that parasitize species of Leguminosae and developed the following key.

**Key to help identify species of *Uromyces* on Leguminosae in Brazil based on uredinia and telia**

- |                           |                  |
|---------------------------|------------------|
| 1. Teliospores smooth     | <b>Section A</b> |
| 1. Teliospores ornamented | <b>(2)</b>       |
| 2. Teliospores verrucose  | <b>Section B</b> |
| 2. Teliospores reticulate | <b>Section C</b> |
- Section A. Teliospores smooth**
1. Urediniospores with constant number of germ pores **(2)**
  1. Urediniospores with variable number of germ pores **(6)**
    2. Urediniospores germ pore 1 near the hilum; not distinct **1. *U. belemensis* (*Ormosia*).**
    2. Urediniospores germ pores 2 **(3)**
  3. Germ pores equatorial or slightly above the equator, with caps **(5)**
  3. Germ pores slightly below the equator, without caps, wall smooth around pores, spores obtrianguloid or obovoid in side view, broadly globoid in top view **(4)**
    4. Sori with paraphyses in hymenium, 25-30 x 1.5-2.5 µm, clavate at apex. Urediniospores (23-25 (-27) x (-21)23(-25) µm, obtrianguloid or obovoid in side view, broadly globoid in top view [rhomboid, obovoid, to globose], wall (1-)1.5 µm thick, echinulate (but with small smooth areas around pores), pores 2, slightly subequatorial or equatorial, without caps. Teliospores 25-)35(-41) x (9-)12(-17) µm, oblong, ellipsoid to fusiform, wall 0.5-1 µm thick at sides, 1.5-4 µm at apex, smooth, colorless (Rezende & Dianese, 2003).
      - 2. *U. galactiae* (*Galactia*, *Clitoria*)**
    4. Sori without paraphyses, urediniospores (19-)23-25(-28) x (18-)20-23(-25) µm, obtrianguloid or obovoid in side view, broadly globoid in top view, wall 1-1.5 µm thick, cinnamon-brown, echinulate except around the pores, germ pores 2, slightly below the equator, without caps. Telia mostly on the abaxial side of leaves, scattered or in groups, sometimes associated with veins, compact, pulvinate, yellow-brown, later grayish; teliospores (25-)29-38(-41) x (10-)12-18(-19) µm, mostly fusiform or oblong-ellipsoid, wall 0.5-1 µm thick at sides, 1.5-4 µm at apex, smooth, pale yellowish; pedicel short, to length of spore, less frequently to 60 µm long, colorless, slender (Almeida, 1975).
      - 3. *U. neurocarpi* (*Clitoria*, *Centrosema*).**
  5. Germ pores equatorial or slightly above the equator, indistinct; teliospores mostly with few to many verrucae, rarely smooth. **4. *U. appendiculatus* var. *appendiculatus* (*Phaseolus*, *Vigna*).**
  5. Germ pores slightly above the equator, distinct; teliospores mostly smooth, rarely with few inconspicuous verrucae. **4A. *U. appendiculatus* var. *brasiliensis* (*Phaseolus*).**

6. Urediniospores germ pores (5)6-8, scattered. **5. *U. lathyrinus* (*Lathyrus*, *Vicia*).**  
 6. Urediniospores germ pores 2-5 (7)  
 7. Germ pores (3)4(5) equatorial or nearly equatorial, less frequently scattered, or with 3-4 equatorial and 1 at apex; teliospores smooth. **6. *U. viciae-fabae* (*Lens*, *Vicia*).**  
 7. Germ pores 2-3(4) equatorial or slightly above the equator; teliospores with few to many verrucae or smooth. **7. *U. trifolii* var. *trifolii* (*Trifolium*).**

**Section B. Teliospores verrucose** (add *Uromyces ipatingae* on *Clitoria fairchildiana*)

1. Uredinia formed (2)  
 1. Uredinia unknown (11)  
   2. Uredinia paraphysate (3)  
   2. Uredinia aparaphysate (4)  
 3. Urediniospores germ pores 4-5, equatorial or approximately equatorial, or less frequently with 3-4 equatorial or approximately equatorial and 1 near or at apex.. **8. *U. unionensis* (*Desmodium*).**  
 3. Urediniospores germ pores (3)4-7(8), scattered. **9. *U. hedysari-paniculati* (*Desmodium*).**  
   4. Urediniospores germ pores 2 (5)  
   4. Urediniospores germ pores variable in number (7)  
 5. Germ pores equatorial or slightly above the equator, indistinct; teliospores mostly with few to many verrucae, rarely smooth **3. *U. appendiculatus* var. *appendiculatus* (*Phaseolus*, *Vigna*).**  
 5. Germ pores slightly above the equator, distinct (6)  
   6. Teliospores mostly smooth, rarely with few inconspicuous  
     **4. *U. appendiculatus* var. *brasiliensis* (*Phaseolus*).**  
   6. Teliospores appearing smooth but actually verrucose, verrucae numerous, distributed evenly or irregularly throughout the surface of spore and umbo. **10. *U. bradburyae* (*Centrosema*).**  
 7. Germ pores equatorial or slightly above the equator (8)  
 7. Germ pores scattered (9)  
   8. Germ pores (2)3-4(5); teliospores verrucose-striate. **11. *U. striatus* (*Medicago*).**  
   8. Germ pores 2-3(4); teliospores with few to many verrucae or smooth  
     **7. *U. trifolii* var. *trifolii* (*Trifolium*).**  
 9. Urediniospores with 6-8, mostly 8, germ pores; teliospores verrucose-echinulate  
     **12. *U. crotalariae* (*Crotalaria*).** (10)  
 9. Urediniospores with 3-8 germ pores (10)  
   10. Germ pores 3-6; teliospores densely and minutely verrucose. **13. *U. pisi* (*Pisum*).**  
   10. Germ pores 4-8, mostly 6-8; teliospores sparsely and strongly verrucose  
     **14. *U. anthyllidis* (*Lupinus*).**  
 11. Teliospores varying from verrucose, with irregular warts sometimes variously united or arranged to form a kind of labyrinth, to irregularly reticulate  
     **15. *U. orbicularis* (on *Desmodium*).**  
 11. Teliospores minutely and inconspicuously verrucose, appearing smooth.  
     **16. *U. nervophilus* [*trifolii-repentis* (on *Trifolium*).**

**Section C. Teliospores reticulate**

1. Uredinia unknown (2)  
 1. Uredinia formed (6)  
   2. Teliospores varying from verrucose, with irregular warts sometimes variously united or arranged to form a kind of labyrinth, to irregularly reticulate  
     **15. *U. orbicularis* (on *Desmodium*).** (3).  
   2. Teliospores not as above (3).  
 3. Teliospores minutely reticulate, with meshes about 0.51.5 µm diam (4).  
 3. Teliospores with larger meshes (5).  
   4. Teliospores pale brown, slightly and minutely reticulate, appearing smooth, with meshes about 0.5-1 µm diam; pedicel mostly to 80-100 µm long. **17. *U. goyazensis* (on *Bauhinia*).**  
   4. Teliospores golden or light cinnamon-brown, minutely and uniformly reticulate, with meshes about 1-1.5 µm diam; pedicel usually breaking near the hilum, rarely to about 80 µm long  
     **18. *U. floralis* (on *Bauhinia*).**  
 5. Telia on flowers, without spots, 3-10 mm long; teliospores 18-25 x 18-22 µm, mostly without a papilla at apex; wall 3-3.5 µm thick at sides **19. *U. anthemophilus* (on *Bauhinia*).**  
 5. Telia on leaves, minute, with brown spots, 1-5 mm diam, teliospores (15-)18-22(-24) x (13-)16-18(-20)

- µm, with a papilla at apex; wall 1.5-2.5 µm thick at sides      **20. *U. viegasii* (on *Bauhinia*).**  
6. Uredinia paraphysate (7)  
6. Uredinia aparaphysate (8)
7. Urediniospores with 4-5 equatorial or approximately equatorial, or less frequently with 3-4 equatorial or approximately equatorial and 1 near or at apex germ pores      **8. *U. unionensis* (on *Desmodium*).**  
7. Urediniospores with (3)4-7(8) scattered germ pores      **9. *U. hedysari-paniculati* (on *Desmodium*).**  
8. Teliospores with wall bilaminate (9)  
8. Teliospores with wall single (10)
9. Teliospores distinctly and uniformly reticulate with meshes to about 2-2.5 µm diam; outer wall distinct, sometimes thicker at apex but without an umbo; pedicel usually breaking near the hilum  
**21. *U. bauhiniae* (on *Bauhinia*).**
9. Teliospores reticulate, with meshes variable in shape and size, to about 2-2.5 µm diam; outer wall not distinct, mostly with an umbo at apex; pedicel to about 20-25 µm long, basally rugose  
**22. *U. foveolatus* (on *Bauhinia*).**
10. Teliospores with a broad and distinct papilla or corona at apex (11)  
10. Teliospores not as above (15)
11. Urediniospores with constant number of germ pores (12)  
11. Urediniospores with variable numbers of germ pores (13)
12. Urediniospores 16-23 x 16-20 µm, conspicuously echinulate, with 4 germ pores; teliospores reticulate with meshes variable in shape and size      **23. *U. regius* (on *Bauhinia*).**  
12. Urediniospores 24-28 x 18-21 µm, sparsely echinulate, with 3 germ pores; teliospores indistinctly and minutely reticulate      **24. *U. peraffinis* (on *Bauhinia*).**
13. Teliospores wall 3-3.5 µm thick at sides; urediniospores with 4, rarely 5, germ pores.  
**25. *U. perlebiae* (on *Bauhinia*).**
13. Teliospores wall 1.5-3 µm thick at sides (14)  
14. Telia scattered; teliospore wall 1.5-2.5 µm thick at sides; urediniospores with (3)4-5, rarely 6 or 7, equatorial or nearly equatorial germ pores  
**26. *U. dietelianus* var. *dietelianus* (on *Bauhinia*).**
14. Telia or uredinia mostly arranged linearly along or on the veins; teliospore wall 2-3 µm thick at sides; urediniospores with 3-4, rarely 2, 5 or 6, equatorial germ pores.  
**27. *U. dietelianus* var. *nervicola* (on *Bauhinia*).**
15. Urediniospores with 4 germ pores; teliospores yellow-brown, 18-22 x 16-18 µm, minutely reticulate      **28. *U. hemmendorffi* (on *Bauhinia*).**
15. Urediniospores with variable numbers of germ pores (16)  
16. Urediniospores with 4-5 equatorial or approximately equatorial, rarely 4 equatorial and 1 at apex germ pores, 22-29 x 20-24 µm, conspicuously echinulate; teliospores pale yellow to golden brown, 17-22 x 15-20 µm, wall 2-3 µm thick at sides  
**29. *U. vicosensis* (on *Bauhinia*).**
16. Urediniospores mostly with 3-4 germ pores (17)
17. Teliospores (18-)20-24 x (15-)18-22 µm; wall 2.5-4 µm thick at sides; pedicel to 60-80 µm, rarely to 100 µm long      **30. *U. castaneus* (on *Desmodium*).**
17. Teliospores 18-26 x 13-18 µm; wall 1.5-2 µm thick at sides; pedicel usually breaking near the hilum  
18. Teliospores minutely reticulate, appearing minutely verrucose, with meshes to about 1 µm diam; urediniospores with 3-4 equatorial or supraequatorial germ pores.  
**31. *U. desmodiicola* var. *desmodiicola* (on *Desmodium*).**
18. Teliospores reticulate, with meshes to 1.5-2 µm diam; urediniospores with 3(4), rarely 2, equatorial or slightly supraequatorial germ pores  
**32. *U. desmodiicola* var. *desmodii* (on *Desmodium*).**

**UROMYCES ACTINOSTEMONIS** H. S. Jackson & Holway in Jackson, Mycologia 23: 470. 1931.

TYPE on *Actinostemon concolor* (Spreng.) Mueller-Arg. from **Brazil**, Rio de Janeiro: Gavea, 7 Sept 1921, *Holway-1093*. (Host identification?) (?!/?, II/III).

On Euphorbiaceae.

*Actinostemon concolor* (Spreng.) Mueller-Arg., Rio de Janeiro (Jackson, 1931: 470; IBI-1729).  
*Uromyces actinostemonis* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, mostly on abaxial side, in groups 0.5-1.5 mm across, on discolored spots, occasionally locally systemic in actively growing tissues and then evenly distributed on all parts, sori 0.2-0.2 mm across, often confluent, tardily naked, ruptured epidermis noticeable, powdery, golden brown; urediniospores 15-19 x 12-14  $\mu\text{m}$ , ellipsoid or obovoid, wall 1.5-2  $\mu\text{m}$  thick, finely and closely echinulate, slightly more prominent toward the upper half of spore; pores obscure. Teliospores in uredinia, 30 -40 x 12-20  $\mu\text{m}$ , obovoid or oblong, rounded above, rounded or somewhat narrowed below; wall 1  $\mu\text{m}$  or less thick, smooth, colorless, germinating without dormancy, no evidence of germ pore, pedicel short, colorless (Jackson, 1931).

*Uromyces aeruginosus* Spegazzini, see **PUCINIA ARECHALETAE** Spegazzini.

*Uromyces affines* Winter, Hedwigia 24: 259. 1885. The TYPE of *Uromyces affines* Winter is on *Nothoscordum* sp. and the rust is **UROMYCES PRIMAVERILIS**. The host was mistakenly reported originally as *Hypoxis erecta* Linnaeus. The collection is from **The United States of America**, Missouri: Perryville, *C. H. Demetrio s. n.*  
All rusts reported to be **UROMYCES AFFINIS** Winter from Brazil are *Uredo hypoxydis* (Bresadola) P. Hennings.

*Uromyces albescens* Sydow, see **CHACONIA ALUTACEA** Juel.

**UROMYCES ALSTROEMERIAE** P. Hennings, Hedwigia 38: 248. 1899. TYPE on *Alstroemeria* sp. from **Brazil**, Rio de Janeiro: Serra Itatiaya, 5 Dec 1896, *Ule-2140*. (??,IIpe/III).

Anamorph

*Uredo alstroemeriae* P. Dietel, Hedwigia 36: 35. 1897. TYPE on *Alstroemeria* sp. from **Brazil**, Minas Gerais: Itabira do Campo, Feb 1892, *Ule-1892*.

On Alstroemeriaceae (Amaryllidaceae).

*Alstroemeria aurantica* D. Don, Brasil (Silveira, 1951: 29).

*Alstroemeria caryophyllea* Jacquin, São Paulo (IAC-7383).

*Alstroemeria inodora* Herberet, São Paulo (Jackson, 1926: 157; Laundon, 1965: 46).

*Alstroemeria isabellana* Herbert, São Paulo (Jackson, 1926: 157).

*Alstroemeria nemorosa* Herbert, Rio de Janeiro (Laundon, 1965: 46).

*Alstroemeria* sp., Minas Gerais (Dietel, 1897: 35), Rio de Janeiro (Hennings, 1899Aa: 67; Hennings, 1899: 248; Laundon, 1965:46), São Paulo (IBI-17408).

*Uromyces alstroemeriae* has been reported also from Argentina and Chile.

Uredinia on the abaxial side of leaves, up to 1 mm in diameter, powdery, yellowish, irregularly scattered or in concentric groups up to 6 mm in diameter, urediniospores 23-29 x 20-26  $\mu\text{m}$ , ellipsoid or obovoid, wall 1.5-2  $\mu\text{m}$  thick, yellowish, echinulate, pores 9-12, scattered. Telia like the uredinia but dark brown, semi stromatic, paraphyses yellow-brown, teliospores 25-36 x 20-28  $\mu\text{m}$ , spheroid or ellipsoid, often angular, wall 1-2  $\mu\text{m}$  thick at sides, 2-10  $\mu\text{m}$  above, smooth, yellow-brown, pedicel up to 20  $\mu\text{m}$  long, yellowish. (Laundon, 1965).

*Uromyces alstroemeriae* has been known from Brazil since 1897 but only recently has it become economically important because of the relatively newly developed culture of the hosts as ornamental cut flowers. The flowers are long lasting and can be shipped long distances. New hybrids and varieties with beautiful flowers have been developed that utilize native species in their parentage. Under intensive cultivation in plastic houses and with irrigation the rust develops rapidly. Bright yellow sori develop abundantly and under heavy infections the flower production can be completely ruined.

**UROMYCES ANGURIAE** H S. Jackson & Holway in Jackson, Mycologia 24: 101. 1932. TYPE on *Anguria warmingiana* Cogniaux from **Brazil**, Rio de Janeiro: Petropolis, 29 Dec 1921, *Holway-1432*. (??,IIpe/III).

On Cucurbitaceae.

*Anguria warmingiana* Cogniaux, Rio de Janeiro (Jackson, 1932: 101; PUR-F3606; Silveira, 1977: 41).

*Gurania pycnocephala* Harms, Minas Gerais (Thurston, 1940: 306), Rio de Janeiro (Silveira, 1977: 41).

*Wilbrandia verticillata* (Velloso) Cogn., Rio de Janeiro (*Puttemans-1745*).

*Uromyces anguriae* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, scattered or in groups, subcuticular in origin, slowly erumpent, surrounded by the ruptured epidermis, 0.2-1 mm across, pulverulent, dull cinnamon-brown; urediniospores 24-28 x 18-21  $\mu\text{m}$ , ellipsoid to obovate, wall 1.5-2  $\mu\text{m}$  thick, minutely and sparsely echinulate, cinnamon-brown, pores 2, subequatorial. Telia on abaxial side of leaves, scattered or in groups, 0.2-0.5 mm across, compact, often long covered by the epidermis, slowly erumpent, teliospores 30-38 x 24-27  $\mu\text{m}$ , subglobose or broadly ellipsoid, rounded below, obtuse or acute above, wall 2.5-4  $\mu\text{m}$  thick at sides, chestnut-brown, 6-12  $\mu\text{m}$  thick apically including a paler umbo over the pore, obscurely and very minutely verrucose-rugose, appearing, smooth, pedicel very short, colorless, and deciduous (Jackson, 1932).

*Uromyces poliotelis* Sydow from Costa Rica is the only other rust species that has been reported on *Anguria*. Arthur & Cummins reported mistakenly the host of *Puccinia anguriae* as *Anguria* sp. but we determined it as an unidentified genus in the Sapindaceae and the rust as *Puccinia arechavaletae*.

We have identified tentatively a collection, *Puttemans-1745* recorded as on *Wilbrandia verticillata* from Rio de Janeiro, Corcovado, as *Uromyces anguriae*: teliospores 42-48 x 25-30  $\mu\text{m}$ , irregularly broadly ellipsoid to ellipsoid, obtuse to acute above with a thick pale umbo, rounded below, wall two layered, the outer layer pale and thin but becoming thickened above into the large umbo, (8-)10-14  $\mu\text{m}$  above, 4-5  $\mu\text{m}$  on the sides, inner layer light chestnut-brown, outer layer pale, finely verrucose appearing smooth, pedicel thin-walled, usually broken off at less than 12  $\mu\text{m}$  or to 30-100  $\mu\text{m}$  long if unbroken. These measurements are larger than those reported by Jackson above.

#### Key to help identify species of Uredinales on Cucurbitaceae in the Americas

1. *Aecidium momordicae* (*Momordica*, Brazil)

2. *Puccinia cucumeris* (*Cucumis*, Brazil)

3. *Uromyces*: the following key needs to be redone completely!!

add *Uromyces guraniae* from Colombia

#### *Uromyces guraniae*

Spermogonia, aecia, and uredinia(?) unknown. Urediniospores in telia, 19.26 x 15 - 19  $\mu\text{m}$ , broadly ellipsoid or globoid, wall 1 - 1.5  $\mu\text{m}$  thick, yellowish or pale cinnamon-brown, moderately echinulate; pores 2, equatorial. Telia on abaxial side of leaf, without spots, 1 - 1.5 mm across, scattered, to grouped, round, sometimes confluent, dark brown, soon erumpent powdery; teliospores 15 - 19 x 16 - 24  $\mu\text{m}$ , globoid to ovoid, rounded or sometimes narrowed above; wall 2 - 2.5  $\mu\text{m}$  thick at sides, up to 7  $\mu\text{m}$  thick at apex, light brown but often darker above, pore apical; pedicel up to 40  $\mu\text{m}$  long x 3 - 5  $\mu\text{m}$  wide, hyaline, persistent. (telial description after Mayer, 1913; uredinial description after Kern, *et al.*, 1933)

1. Teliospore wall striate-verucose

*Uromyces novissimus*  
(*Uromyces pentastratus*.)  
(Cayaponia, Brazil)

1. Teliospore wall smooth or finely verrucose

2. Teliospore apex papillate

*Uromyces novissimus*.  
(Cayaponia, Brazil)

2. Teliospore apex round or umbonate

3. Teliospore apex round, finely verrucose

*Uromyces corollocorpi*.

3. Teliospore apex umbonate

4. Teliospore apex about 2-3  $\mu\text{m}$  thick, lateral wall 1  $\mu\text{m}$  or less thick

*Uromyces poliotelis*.  
(*Anguria*, or ? *Gurania*, Costa Rica)

4. Teliospore apex thicker than 2.5  $\mu\text{m}$

5. Teliospore pore normal in appearance, apex about 7-8  $\mu\text{m}$  thick

*Uromyces anguriae*.  
(*Anguria*, Brazil)

5. Teliospore pore very prominent, extending to the central border of the spore



*Uromyces ratus.*

**UROMYCES ANTHEMOPHILUS** Vestergren, Ark. Bot. 4: 24. 1905. TYPE on *Bauhinia longifolia* D. Diedrick, (Leguminosae) from **Brazil**, Mato Grosso: Cuiabá, 17 June 1902, *G. Malme*. (?/?,?/III).  
*Uromyces anthemophilus* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

The species is probably microcyclic and the sori develop on flowers. Compared to *Uromyces floralis* the meshes of the reticulate teliospore walls are larger and the teliospores lack apical papillae.

Spermogonia, aecia and uredinia unknown. Telia developed on flowers without spots, 3-10 mm long, pulverulent, dark brown; teliospores 18-25 x 18-22  $\mu\text{m}$ , globose, subglobose or ovoid, apex rounded, not or barely papillate, wall 3-3.5  $\mu\text{m}$  thick at sides, distinctly and regularly reticulate, pale brown; pedicel slender, colorless, deciduous (Almeida, 1975).

**Rusts on *Bauhinia* in Brazil**

Three teleomorph genera of rusts have been reported on *Bauhinia* world wide: *Cerotelium bauhiniae* Thirumalachar & Yadav from India, *Maravalia bauhiniicola*, reported only from Brazil, and *Uromyces* spp. Two unconnected species of the anamorph genus *Uredo* have been reported from Brazil. The report of *Bauhinia* as a host of *Phakopsora bauhiniicola* Ono, Buriticá & Hennen is questionable. The host is probably *Dioscorea* sp. in the Dioscoreaceae.

About 25 species of *Uromyces* have been reported to infect species of *Bauhinia* worldwide, one from India and Sri Lanka, four from tropical Africa, and the rest from the Neotropics.

The following key is adapted mostly from Almeida (1975) who included 12 species of *Uromyces* on *Bauhinia* in his research on all *Uromyces* species reported on Leguminosae from Brazil. Rezende (1999) carefully reviewed and illustrated five species of *Uromyces* on *Bauhinia* from the Cerrado of Brazil (Rezende and Dianese, 2003). The identification of species is difficult without both uredinia and telia available.

**Key to help identify rust fungi on *Bauhinia* in Brazil**

- A. Sori pale yellowish or whitish, spore walls pale or colorless, urediniospore pores obscure, if teliospores formed, walls smooth
- B. Anamorph spores (19-)20-25(-26)  $\mu\text{m}$  *Maravalia bauhiniicola*  
 Uredinia on abaxial side of leaves, in small groups or forming concentric rings, 0.2-0.8 mm diam, often confluent to 5 mm diam, subepidermal in origin, erumpent, pale yellow or whitish, urediniospores pedicellate, (19-)20-25(-26)  $\mu\text{m}$ , subglobose, obovoid to broadly ellipsoid, walls 1.5-2.5  $\mu\text{m}$  thick, evenly finely echinulate, colorless to pale yellow; germ pores obscure.
- B. Anamorph spores 16-23 x 14-19  $\mu\text{m}$  *Uredo ulei* (probably an anamorph of *Maravalia*)  
 Uredinia on pale yellowish to pale brownish spots 2-4 mm across on both sides of leaves, mostly on abaxial side, sori 0.3-0.5mm across, pale yellowish, usually confluent in groups, spores 16-23 x 14-19  $\mu\text{m}$ , ovoid to ellipsoid, wall 1.5-2  $\mu\text{m}$  thick, echinulae short, germ pores obscure
- B. Anamorph spores 22-35 x 18-23  $\mu\text{m}$  *Uredo amazonensis*  
 Uredinia on pale effused spots on abaxial side of leaves, sori 0.2-0.25mm across, rounded, yellow-brown, scattered or in loose groups, urediniospores 22-35 x 18-23  $\mu\text{m}$ , ovoid to ellipsoid, wall 1.5-2  $\mu\text{m}$  thick, echinulate with long aculeae, yellow-brown, germ pores 3-4
- A. Sori chestnut-brown or darker, urediniospore walls brownish, pores usually visible, teliospores if formed with walls sculptured, mostly reticulate *Uromyces* (1)
1. Uredinia unknown, probably microcyclic (2)
2. Teliospores minutely reticulate, meshes about 0.5-1.5  $\mu\text{m}$  diam (3)
3. Teliospores pale brown, slightly and minutely reticulate, appearing smooth, meshes about 0.5-1  $\mu\text{m}$  diam; pedicel mostly to 80-100  $\mu\text{m}$  long.  
*Uromyces goyazensis*
3. Teliospores golden or light cinnamon-brown, minutely and uniformly reticulate, meshes about 1-1.5  $\mu\text{m}$  diam; pedicel usually breaking near the hilum, rarely to about 80  $\mu\text{m}$  long  
*Uromyces floralis*
2. Teliospores reticulate with larger meshes (4)

4. Telia on flowers, without spots, 3-10 mm long; teliospores 18-25 x 18-22  $\mu\text{m}$ , mostly without a papilla at apex; wall 3-3.5  $\mu\text{m}$  thick at sides  
*Uromyces. anthemophilus*
4. Telia on leaves, minute, with brown spots, 1-5 mm diam, teliospores (15-)18-22(-24) x (13-)16-18(-20)  $\mu\text{m}$ , with a papilla at apex; wall 1.5-2.5  $\mu\text{m}$  thick at sides  
*Uromyces viegasii*
1. Uredinia formed, aparaphysate (5)
5. Teliospore walls bilaminare (6)
6. Teliospores distinctly and uniformly reticulate, meshes to about 2-2.5  $\mu\text{m}$  diam; outer wall distinct, sometimes thicker at apex but without an umbo; pedicel usually breaking near the hilum  
*Uromyces bauhiniae*
6. Teliospores reticulate, meshes variable in shape and size, to about 2-2.5  $\mu\text{m}$  diam; outer wall not distinct, mostly with an umbo at apex; pedicel to about 20-25  $\mu\text{m}$  long, basally rugose  
*Uromyces foveolatus*
5. Teliospore walls single (7)
7. Teliospores with a broad and distinct papilla or corona at apex (8)
8. Urediniospore germ pores a constant number (9)
9. Urediniospores 16-23 x 16-20  $\mu\text{m}$ , conspicuously echinulate, with 4 germ pores; teliospores reticulate with meshes variable in shape and size  
*Uromyces regius*
9. Urediniospores 24-28 x 18-21  $\mu\text{m}$ , sparsely echinulate, with 3 germ pores; teliospores indistinctly and minutely reticulate  
*Uromyces. peraffinis*
8. Urediniospore germ pores a variable number (10)
10. Teliospore wall 3-3.5  $\mu\text{m}$  thick at sides; urediniospore germ pores 4, rarely 5  
*Uromyces perlebiae*
10. Teliospore walls 1.5-3  $\mu\text{m}$  thick at sides (11)
11. Telia scattered; teliospore wall 1.5-2.5  $\mu\text{m}$  thick at sides; urediniospore germ pores (3)4-5, rarely 6 or 7, equatorial or nearly equatorial.  
*Uromyces dietelianus var. dietelianus*
11. Telia or uredinia mostly arranged linearly along or on the veins; teliospore wall 2-3  $\mu\text{m}$  thick at sides; urediniospore germ pores 3-4, rarely 2, 5 or 6, equatorial.  
*Uromyces dietelianus var. nervicola*
7. Teliospores not as above (12)
12. Urediniospore germ pores 4; teliospores yellow-brown, 18-22 x 16-18  $\mu\text{m}$ , minutely reticulate  
*Uromyces hemmendorffii*
12. Urediniospore germ pores variable in number  
Urediniospore germ pores 4-5, equatorial or approximately equatorial, rarely 4 equatorial and 1 at apex, 22-29 x 20-24  $\mu\text{m}$ , conspicuously echinulate; teliospores pale yellow to golden brown, 17-22 x 15-20  $\mu\text{m}$ , wall 2-3  $\mu\text{m}$  thick at sides  
*Uromyces vicosensis*

**UROMYCES ANTHYLLIDIS** Schroeter, Hedwigia 14: 126. 1875. (0/Icv  $\rightleftharpoons$  IIpe/III).

= *Uromyces renovatus* Sydow, Monog. Ured. 2: 113. 1910.

Anamorph

*Uredo anthyllidis* Greville ex Berkeley, Smith, English Flora, 5 (2): 283. 1836.

On Leguminosae.

*Lupinus albus* L., Rio Grande do Sul (Lindquist & Costa Neto, 1963: 126; Almeida, 1975: 46), São Paulo (Viégas, 1945: 69, reported as *Uromyces occidentalis* but reidentified by Almeida).

*Uromyces anthyllidis* has been reported from the New World also only from Argentina on cultivated *Lupinus* sp. (Lindquist, 1982), and more recently on *Melilotus alba* from the Argentine Chaco (Berndt, 2002).

Spermogonia and aecia (not reported from the New World) resembling those of *Uromyces pisi* on *Euphorbia* spp. Uredinia on both sides of leaves, scattered, minute, roundish, ruptured epidermis noticeable, powdery, cinnamon-brown; urediniospores 16-25 µm diam, mostly globoid or subgloboid, wall (1.5-)2-3 (3.5) µm thick, golden-brown, finely echinulate, germ pores 4-8, mostly 6-8, scattered, with colorless, echinulate caps. Telia about chocolate-brown, otherwise as the uredinia; teliospores 17-22 x 15-20 µm, globoid or broadly ellipsoid, wall (1.5-)2-2.5(-3) µm thick, about dark-brown, verrucose, with well developed and sparsely disposed verrucae, with no or a low, paler papilla at apex; pedicel colorless, thin-walled, breaking near the hilum (Almeida, 1975).

Joerstad (1958) reported that the name *Uromyces anthyllidis* is for a collective species with many synonyms, and this name may not be valid for the collective species. But he did not report another name that should be used. We have not tried to include all of the synonyms applied by European workers that are included in this collective species. In the Eastern Hemisphere the uredinial and telial phase has been recorded on at least sixteen genera of legumes (United States Department of Agriculture, National Fungus Collection Specimen Data Base) and its spermogonia and aecia have been reported on *Euphorbia* spp.

*Uromyces appelianus* Gassner, see **UROMYCES NOVISSIMUS** Spegazzini.

**UROMYCES APPENDICULATUS** (Persoon:Persoon) Unger, *Einfl. d. Bodens*, p. 216. 1836. var.

**APPENDICULATUS. (0/Icv/IIpe/III).**

≡ *Uredo appendiculata* Persoon. TYPE on *Phaseolus vulgaris* Linnaeus from Europe, date and locality not reported. Based on telia.

≡ *Uromyces phaseoli* (Persoon) Winter, *Hedwigia* 19: 37. 1880. TYPE same as for *Uredo appendiculata* above.

≡ *Uromyces phaseoli* (Persoon) Winter var. *typica* Arthur, *Man. Rusts U.S. & Canada*, p. 294. 1934.

Anamorphs have not been named.

On Leguminosae:

*Phaseolus caracalla* Linnaeus, Santa Catarina (Hennings, 1896: 223; Almeida, 1975: 34).

*Phaseolus nanus* ?, São Paulo (Hennings, 1902C: 105).

*Phaseolus ovatus* Benthams, Rio Grande do Sul (Joerstad, 1959: 75; Lindquist & Costa Neto, 1963: 126; Almeida 1975: 34).

*Phaseolus vulgaris* Linnaeus, Bahia (Almeida, 1975: 34), Ceará (Almeida: 34), Espírito Santo, (IBI-2848), Federal District (IBI-12506), Minas Gerais (Thurston, 1940: 307; Almeida, 1975: 34; IBI-2023), Paranã (Almeida, 1975: 34; IBI-12157), Pernambuco (Pickel, 1936: 210; Almeida, 1975: 34), Rio Grande do Sul (IBI-9410), São Paulo (Viégas, 1945: 71, IAC-2587).

*Phaseolus* sp., Minas Gerais (IBI-15828); Rio de Janeiro (Jackson, 1931: 351; IBI-1730), Santa Catarina (Pazschke, 1892: 97), São Paulo (Spegazzini, 1889: 482; Sydow, 1907: 354).

*Uromyces appendiculatus* has been reported to be circumglobal in nearly all areas where the hosts are cultivated.

Spermogonia on the adaxial side of leaves, in groups. Aecia on the abaxial side of leaves, in groups, peridium cupulate, whitish, margin erose; aeciospores mostly polygonoid-globoid, minutely verrucose, mostly 18-36 x 16-24 µm, colorless. Uredinia on both sides of leaves, cinnamon-brown, on indistinct spots, scattered or in small groups, 0.2-1 mm across, soon naked, surrounded by the ruptured epidermis; urediniospores mostly obovoid or broadly ellipsoid (18-)24-28(-32) x (18-)20-25(-28) µm, wall 1-2 µm golden-brown, echinulate, with 2 equatorial or slightly above the equator germ pores, indistinct when seen through the wall, caps smooth or rarely with echinulations. Telia on both sides of leaves, blackish brown, scattered or circinate around uredinia, early exposed, pulverulent; teliospores globoid, obovoid or broadly ellipsoid, (24-)28-32(-35) x (19-)22-26(-29) µm, wall 2.5-3.5 µm at sides, 5-8 µm thick at apex, chestnut-brown, with a pale umbo and few to many verrucae scattered or sometimes in lines, rarely smooth; pedicel colorless, collapsing, short to 50 µm long. (Almeida, 1975)

The nomenclature of *Uromyces appendiculatus* is based on Cummins (1978). This species causes one of the most important diseases of common beans (*Phaseolus* spp.) and occurs in most countries where beans are produced. Several varieties of this rust species have been named based on slight morphological differences, including *U. appendiculatus* var. *brasiliensis* Almeida, (*Fitopat. Bras.* 2: 244. 1977) on *Phaseolus longipedunculatus* Martius from São Paulo. Numerous physiological races have been identified by

experimental inoculations of sets of differentially susceptible host varieties. Spermogonia and aecia have not been reported from Brazil, but are known from North America. Breeding for resistant varieties in Brazil has resulted in some varieties that produce very well even when the rust is present.

A very closely related rust on *Vigna* spp., *Uromyces vignae*, has been included as a synonym of this species by some authors.

**UROMYCES APPENDICULATUS** (Persoon) Unger var. **BRASILIENSIS** Almeida.

≡ *Uromyces phaseoli longepedunculati* Viégas, *Bragantia* 5:566. 1944. nom. nudum.

Uredinia long covered by epidermis, later pulverulent; urediniospores mostly 20-29 x 18-26 µm with 2 slightly above the equator germ pores, distinct. Telia as the uredinia; teliospores mostly 29-35 x 20-26 µm, smooth, rarely with few inconspicuous verrucae. (Almeida, 1975).

*Uromyces arachidis* P. Hennings, see **Puccinia arachidis** Spegazzini.

**UROMYCES ASCLEPIADIS** Cooke, *Grevillea* 5: 152. 1877. TYPE on *Asclepias* sp. from **The United States of America**, Maine: Cape Elizabeth, date not reported, *Fuller-80*. (?/?,II/III).

= *Uromyces howei* Peck, Rep. New York State Museum 30: 75. 1879. TYPE on *Asclepias syriaca* Linnaeus from **The United States of America**, New York, North Greenbush

Anamorph

*Uredo asclepiadis* Schweinitz in Berkeley & Curtis, Jour. Acad. Nat. Sci. Philadelphia 2: 282.

1853. TYPE on *Asclepias* sp. from **Surinam**, place and date not reported, *?Weigelt s.n.*

= *Trichobasis howei* Peck, Ann. Rep. New York State Mus. 23: 587. 1873.

≡ *Nigredo* (?) *howei* (Peck) Arthur, N. Am. Fl. 7: 264. 1912.

= *Uredo asclepiadina* Spegazzini, Anal. Mus. Nac. Buenos Aires 19: 316. 1909. TYPE on *Asclepias campestris* DeCandolle from **Argentina**, Jujuy: Jan 1906, *?Spegazzini s.n.*

On Asclepiadaceae

*Asclepias campestris* DeCandolle, Santa Catarina (Hennings, 1896: 225).

*Asclepias curassavica* L., Minas Gerais (Jackson, 1931: 494; Thurston, 1940: 307; IBI-2255),

Rio de Janeiro (Jackson, 1931: 494), São Paulo (Viégas, 1945: 59; IAC-133; IBI-13428).

*Oxypetalum capitatum* Martius & Zuccarini, Paraná (Joerstad, 1956: 454).

*Uromyces asclepiadis* is widespread in the Americas from Argentina to Canada. Species in at least three genera of Asclepiadaceae have been reported as hosts but most common is *Asclepias*. In Latin America the most common host is *Asclepias curassavica*, while in North America at least 12 species of *Asclepias* have been reported as hosts.

Spermogonia and aecia unknown. Uredinia mostly on the abaxial side of leaves, about 0.5 mm across, scattered, powdery, light cinnamon-brown, ruptured epidermis evident, urediniospores 23-28 x 18-25 µm, broadly ellipsoid or globoid, wall 1-1.5 µm thick, golden-brown, evenly echinulate, pores 4, equatorial. Telia similar to the uredinia but chestnut-brown, pulverulent, teliospores 20-30 x 18-23 µm, broadly ellipsoid to globoid, rounded or somewhat obtuse at each end, wall about 1.5 µm thick, a little thicker at apex because of the presence of a small semi-colorless papilla over the pore, chestnut-brown, finely and coarsely verrucose, pedicel colorless, fragile, short (Arthur, 1934).

**UROMYCES ASPILIAE** H. S. Jackson & Holway in Jackson, *Mycologia* 24: 172. 1932. TYPE on

*Aspilia phyllostachya* Baker, Compositae, from **Brazil**, Rio de Janeiro: Petropolis, 3 Nov 1921,

*Holway-1271*. (?/?,IIpe/III).

*Uromyces aspiliae* has been reported only from the type in Brazil. It has also been reported from Argentina.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves, scattered or in groups, 0.3-0.5 mm across, very powdery, ruptured epidermis not evident; urediniospores 24-27 x 21-24 µm, obovoid, ellipsoid, to subtriangular; wall more or less evenly 1.5-2 µm thick, minutely echinulate, chestnut-brown, spines not very close together, pores 2, equatorial. Telia on abaxial side of leaves, scattered, compact, becoming pulvinate, ruptured epidermis not noticeable, chestnut-brown to blackish-brown, becoming ashy-gray by germination; teliospores 27-36 x 18-24 µm, ellipsoid to obovoid, rounded to subobtuse above, rounded to slightly narrowed below; wall 1.5-2.5 µm thick at sides, thickened 8-12 µm above as a broad

somewhat paler umbo, chestnut-brown, smooth; pedicel up to twice the length of the spore or shorter, flexuous, colorless (Jackson, 1932).

**UROMYCES BAUHINIAE** P. Hennings, Hedwigia 34: 90. 1895. TYPE on *Bauhinia* sp. from **Brazil**, Minas Gerais: Paranaíba, July 1892, *Ule-1906*. (?!?,IIpe/III).

= *Uromyces pretextus* Vestergren, Ark. Bot. 4: 19. 1905. Nom. nov. for *U. bauhiniae* P.

Hennings because Vestergren thought that *U. bauhiniae* had been published earlier by Berkeley & Curtis for a different rust.

= *Uromyces guatemalensis* Vestergren, Ark. Bot. 4: 20. 1905. TYPE on *Bauhinia* sp. from **Guatemala**, Retalhuleu, March 1876, *Bernoulli & Cario s.n.*.

Anamorph

*Uredo bauhiniae* Berkeley & Curtis, Proc. Am. Acad. 4: 126. TYPE on *Bauhinia* sp from **Nicaragua**, place and date not recorded, *Wright-s.n.*

On Leguminosae:

*Bauhinia bongardi* Steudel, Mato Grosso (Vestergren, 1905: 20; Almeida, 1975: 53).

*Bauhinia cuyabensis* Steudel, Mato Grosso, (Vestergren, 1905: 20; Almeida 1975: 53).

*Bauhinia hiemalis* Malme, Mato Grosso (Vestergren 1905: 20; Almeida, 1975: 53).

*Bauhinia* sp., Minas Gerais (Hennings, 1895A: 90; Almeida, 1975: 53), Paraíba (Viégas, 1945: 72; IAC-3829), Pernambuco (IBI 14303), Rio de Janeiro (Jackson, 19331: 343; Almeida, 1975: 53), São Paulo (Jackson, 1931: 343; Almeida, 1975: 53).

*Uromyces bauhiniae* has been reported also from Costa Rica, Nicaragua, and Mexico.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, minute, scattered or in groups, cinnamon-brown, or urediniospores mixed with teliospores; urediniospores (18-)22-26 x 17-22(-26) µm, mostly globoid or ellipsoid, wall 1.5-3 µm thick, echinulate, golden-brown or dark golden-brown, germ pores 3-5(6), equatorial, nearly equatorial or somewhat scattered, with no or small, colorless, echinulate caps. Telia mostly on abaxial side of leaves, 0.5-1.5 mm across, blackish brown, scattered or sometimes in groups, confluent, pulverulent, ruptured epidermis inconspicuous, teliospores (20-)22-28(-30) x (18-)22-25(-27) µm, globoid, ellipsoid, obovoid or ovoid, wall conspicuously bilaminate, inner wall 1.5-3 µm thick, chestnut-brown, outer wall distinct, (1-)1.5-2.5(-3) µm thick at sides, about yellowish brown, thinner at base, to 6 µm thick at or near the apex but without an umbo, distinctly and uniformly reticulate with meshes to about 2-2.5 µm diam; pedicel to 40-50 µm long, but usually breaking near the hilum, colorless, thin-walled (Almeida, 1975; Cummins, 1978).

Traits that help identify *Uromyces bauhiniae* include teliospores that have uniformly reticulate walls with a distinct outer layer and without an umbo.

See *Uromyces anthemophilus* for notes on rusts on *Bauhinia*.

*Uromyces bauhiniicola* Arthur, Bot. Gaz, 39: 389, 1905. (0/-/III). TYPE on *Bauhinia pringlei* S.

Watson, Leguminosae, from Mexico, Jalisco: Guadalajara, 28 Sept. 1903, *Holway-5060*.

Cummins (1978) records this species only from Mexico. Viégas (1945: 59; IAC 3094,-3317,-4222) reported this species from São Paulo but Almeida reidentified these specimens: Viégas-3317 as *Uromyces floralis* Vestergren; and Viégas-3094 and Viégas-4222 as *U. dietelianus* var. *nervicola* Almeida.

**UROMYCES BELEMENSIS** Albuquerque & M. M. Figueiredo, Pesq. Agropec. Bras.Ser. Agron. 6: 145.

1971. TYPE on *Ormosia nobilis* Tul., Leguminosae, from **Brazil**, Pará: Belém, Instituto de Pesquisa Experimental Agropecuaria Norte, 28 April 1964, *F. C. Albuquerque*. (?!?,IIpe/III).

*Uromyces belemensis* has been reported only from the TYPE.

Spermogonia and aecia unknown. Uredinia mostly on the adaxial side of leaves, scattered or in small or dense groups, mostly along the veins; numerous, 0.1-0.5 mm diam, rounded, at first covered by epidermis, later pulverulent, cinnamon-brown; urediniospores (20-)24-32(-33) x (18-)22-28 µm, asymmetrical, triangular in one view, obovoid or broadly ellipsoid when turned 90°, wall 1 µm thick, cinnamon-brown, conspicuously echinulate, germ pore 1 near the hilum, not distinct. Telia dark cinnamon-brown or reddish brown, otherwise as the uredinia, or teliospores mostly mixed with urediniospores. Teliospores subgloboid and rounded at apex, lateral view:(20-)22-28(-29) x (24-)26-32(-33) µm, and top view: (26-)29-33(-35) x (24-)26-30(-33) µm, dark cinnamon-brown, wall uniformly 1 µm thick,

smooth, with 1 germ pore at apex; pedicel 6-8  $\mu\text{m}$  wide, to 30  $\mu\text{m}$  long, less frequently to 60  $\mu\text{m}$  long, colorless, some collapsing (Almeida, 1975).

Albuquerque and M. M. Figueiredo (1971) reported that the teliospores of *Uromyces belemensis* resemble those of *Pileolaria* spp. but the urediniospore walls of *Pileolaria* often have spiral sculpture patterns unlike the echinulation sculpture of *U. belemensis*. Also when *Uromyces belemensis* is compared to *Dicheirinia* spp., also on *Ormosia*, *Dicheirinia* spp have uredinia surrounded by numerous paraphyses. These are lacking in *Uromyces belemensis*.

**UROMYCES BIDENTICOLA** Arthur, Manual rusts U. S. & Canada, p. 342. 1934. NEOTYPE on *Bidens squarrosa* Humboldt, Bonpland & Kunth from **Guatemala**, Guatemala City, 31 Dec 1914, *Holway-4*. Neotype chosen by Cummins (1978). (**0/Ipe,IIpe/III**).

Anamorph

- Uredo bidentis* P. Hennings, Hedwigia 35: 251. 1896. LECTOTYPE on *Bidens pilosus* L. from **Brazil**, Santa Catarina: São Francisco, July 1884, *Ule-232*. (Lectotype chosen here).  
 = *Klebahnia bidentis* (P. Hennings) Arthur, N. Amer. Fl. 7: 481. 1922. Arthur described telia but designated a type specimen without telia. Not *Uromyces bidentis* Lagerheim. 1895.  
 = *Puccinia bidentis* Dietel & Holway in Holway, Bot. Gaz. (Crawfordsville) 24: 32. 1897. TYPE on *Bidens* sp. from **Mexico**, Cuernavaca, 23 Sept 1896, *Holway-s.n.* Arthur (1922), Jackson (1932) and Lindquist (1982) cited this name, presumably based on an anamorph, as a synonym of *Uromyces bidenticola*.  
 = *Uredo bidenticola* P. Hennings, Hedwigia 37: 279. 1898. TYPE on *Bidens leucantha* from **Jamaica**, Bog Walk, 3 March 1893.  
 = *Uromyces bidenticola* (P. Hennings) Arthur, Mycologia 9: 71. 1917. Telia not described.  
 = *Uredo bidenticola* Spegazzini, Revista Argentina Bot. 1: 134. 1925. (a lectotype needs to be chosen from the specimens seen by Spegazzini which were from Argentina, Uruguay and Paraguay).

On Compositae.

*Bidens pilosa* L., Minas Gerais (Jackson, 1932: 172; Viégas, 1945: 60), Rio de Janeiro (Hennings, 1896: 251; Jackson, 1932: 172), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 144), São Paulo (Viégas, 1945: 60; IAC-1181).

*Bidens rubifolia* Humbolt, Bonpland & Kunth, Minas Gerais (Jackson, 1932: 172; Viégas, 1945: 60; IAC-5067), Paraná (Joerstad, 1956: 470).

*Bidens* sp., Rio de Janeiro (Jackson, 1932: 172), Santa Catarina (IBI 12952) São Paulo (Jackson, 1932: 172).

*Uromyces bidenticola*, a long cycle, autoecious species with aeciospores and urediniospores morphologically alike, is widespread in tropical and subtropical regions of the world where its weedy hosts occur, especially on *Bidens pilosa*.

Spermogonia on both sides of leaves, few in a group. Aecia on both sides of leaves, around the spermogonia, aeciospores like the urediniospores. Uredinia on both sides of leaves or mostly on abaxial side of leaves, cinnamon brown or darker; urediniospores (22-)26-33(-37) x (19-)21-24(-26)  $\mu\text{m}$ . broadly ellipsoid or obovoid, wall 1.5-2.5  $\mu\text{m}$  thick, cinnamon brown, echinulate except around pores, pores 2, equatorial or slightly above, with obvious caps. Telia mostly on abaxial surface, exposed, compact, cinnamon brown but becoming gray with metabasidia; teliospores (30-)32-40(-45) x (15-)17-20(-23)  $\mu\text{m}$  ellipsoid, oblong ellipsoid or elongately obovoid, wall 1  $\mu\text{m}$  thick at sides, golden brown. (3-)4-8(-10)  $\mu\text{m}$  thick at apex with a colorless umbo; pedicels, to 55  $\mu\text{m}$  long, colorless (Cummins, 1978).

Arthur (1934) and Cummins (1972) reported that *Uromyces bidentis* Lagerheim is a short cycle, correlated species with only teliospores. These two are the only species of *Uromyces* on *Bidens* in the Western Hemisphere. Jackson (1932) suggested that perhaps there is only one species with a variable life cycle. Lindquist (1972) mistakenly listed *Uredo amazonensis* P. Hennings, 1905, as an anamorph synonym. Its host is *Bauhinia* sp., not *Bidens* sp.

Except for the two species of *Uromyces* reported here, *Puccinia iniapii* Buriticá, known only on *Bidens rubifolia* from Ecuador, is the only other rust that has been reported on *Bidens* spp. from the New World.

**UROMYCES BIDENTIS** Lagerheim, in Patouillard & Lagerheim, Bull. Soc. Myc. France 11: 213. 1895. TYPE on *Bidens andicola* from **Ecuador**, Chillo near Quito. June, year not reported, *Lagerheim s.n.* (-/-, -/III).

= *Uromyces densus* Arthur, Mycologia 7: 196. 1915. TYPE on *Bidens pilosa* Linnaeus from Puerto Rico, Ponce, 8 Nov 1913, *F. L. Stevens-4266*.

On Compositae.

*Bidens pilosa* L., Alagoas (Viégas, 1945: 60; IAC-3812), Rio de Janeiro (Dietel, 1899: 249; Jackson, 1932: 173), São Paulo (Viégas, 1945: 60; IAC-4100; Puttemans-1497).

*Bidens* sp., Minas Gerais (Sydow, 1907: 353), Paraíba (Viégas, 1945: 60; IAC-3808), Rio de Janeiro (Jackson, 1932: 173), São Paulo (Viégas, 1945: 60; IAC-707).

*Uromyces bidentis* has been reported with certainty only from the Neotropics. See under *Uromyces bidenticola* for notes.

Spermogonia, aecia and uredinia lacking. Telia on the abaxial surface of leaves in close, circinate groups, exposed, compact, cinnamon brown but soon gray from germination; teliospores (30-)32-40(-45) x (15-)17-20(-23)  $\mu\text{m}$ , mostly oblong ellipsoid or elongately obovoid, wall 1  $\mu\text{m}$  thick at sides, golden brown, 4-9  $\mu\text{m}$  thick at apex with a nearly colorless defined umbo, smooth; pedicel to about 63  $\mu\text{m}$  long, colorless (Cummins, 1978).

**UROMYCES BLAINVILLEAE** Berkeley in Berkeley & Broome, J. Linnean Soc. Bot. 14: 92. 1875.

TYPE on *Blainvillea* sp. from **Sri Lanka** (Ceylon), "Batticabra" (Batticaloa) district, 1858, *Thwaites s.n.* (0/Icv, IIpe/III).

= *Uromyces cuculatus* H. Sydow & P. Sydow, Ann. Mycol. 2: 349. 1904. TYPE on *Zexmenia aurantiaca* Klatt. from **Costa Rica**, ? date, *Tonduz-9836*.

= *Uromyces piauhyensis* P. Hennings, Hedwigia 47: 266. 1908. TYPE on *Wedelia* sp. from **Brazil**, Piauí: reported originally as "Pianhy", Serra Nova, Jan 1907, *Ule-3329*.

Anamorph

*Uredo gaudichaudii* H. Sydow & P. Sydow, Ann. Mycol. 1: 21. 1903. TYPE on *Blainvillea rhomboideae* Cassini from **Brazil**, Rio de Janeiro, date not reported, *Gaudichaud-s.n.*

On Compositae.

*Blainvillea biaristata* DeCandolle, Paraíba (Viégas, 1945: 61; IAC-2685).

*Blainvillea dichotoma* (Murray) Cassini, Bahia (IBI 13607), Rio de Janeiro (Jackson, 1932: 173).

*Blainvillea rhomboidea* Cassini, Federal District (IBI-12470), Minas Gerais (Thurston, 1940: 307; IAC-5059), Paraíba (Viégas, 1945: 61; IAC-3859), Rio de Janeiro (H. & P. Sydow, 1903: 21; Hennings, 1904A: 79; IAC-4660).

*Blainvillea* sp., Federal District (IBI-12470), Minas Gerais (IBI-15343), Rio de Janeiro (HNR-353; Puttemans-336), São Paulo (IBI-16898).

*Wedelia* sp. Piauí (Hennings, 1908: 266).

**Genus unidentified**, Minas Gerais (IBI 15934).

*Uromyces blainvilleae* has been reported from Africa, India and the Neotropics. Other host genera not listed above include *Baltimora*, *Perymenium*, and *Zexmenia*.

Spermogonia on adaxial side of leaves, aecia on abaxial side of leaves, peridium cylindrical, becoming lacerate, whitish; aeciospores 22-26 x 19-24  $\mu\text{m}$ , broadly ellipsoid or globoid, commonly angular, wall 1  $\mu\text{m}$  thick, pale yellowish, prominently verrucose; uredinia on both sides of leaves or mostly on adaxial side, about cinnamon-brown, urediniospores (16-)18-21 x (17-)18-22(-23)  $\mu\text{m}$ , broadly ellipsoid or obovoid with pores in face view, mostly depressed globoid or more or less triangular with pores lateral, wall 1-1.5  $\mu\text{m}$  thick but usually thicker at hilum, about cinnamon-brown, echinulate except around pores, pores 2, equatorial or usually somewhat subequatorial, with slight or no caps. Telia on both sides of leaves or often mostly on adaxial side, exposed, blackish brown, somewhat powdery; teliospores (24-)28-33(-35) x (22-)24-28(-30)  $\mu\text{m}$ , mostly globoid or nearly so, wall (3.5-)4-4.5(-5)  $\mu\text{m}$  thick at sides and deep chestnut-brown, (6-)7-10(-12)  $\mu\text{m}$  apically with a golden defined umbo, the side wall sometimes tending to be bilaminate, conspicuously verrucose with low conical verrucae spaced (2-)2.5-3(-5)  $\mu\text{m}$ , pedicel to 120  $\mu\text{m}$  long, colorless, often flexuous or shorter and straight (Cummins, 1978).

Cummins (1978) reported that "*Uromyces cuculatus* differs from *U. blainvilleae* in having much longer and persistent pedicels on the teliospores and an umbo that is about 1/3 narrower. Possibly, *U. cuculatus* could be considered a variety of *U. blainvilleae*". We are treating these as only one taxon.

See *Puccinia obrepta* for a key to species of rusts on *Wedelia*.

**UROMYCES BOMARIAE** P. Hennings, Hedwigia 38: 67. 1899. TYPE on *Bomarea* sp. from **Brazil**. Rio de Janeiro, Gavea, 14 Dec 1895. *Ule-2169*. (?/?,IIpe/III).

On Alstroemariaceae (Amaryllidaceae).

*Bomarea* sp., Minas Gerais (Thurston, 1940: 307), Rio de Janeiro (Hennings, 1899A: 67; Dietel, 1899: 248; Laundon, 1965: 47), São Paulo (IBI 16833).

*Uromyces bomariae* has been reported only from Brazil.

Urediniospores 24-26 x 22-24 µm, spheroid to broadly ellipsoid, wall about 2 µm thick, yellowish, finely echinulate, pores not seen, telia on the abaxial side of leaves, irregularly scattered, up to 1 mm in diam, often covering entire underside of leaf, black, stromatic-loculate, teliospores 26-36 x 18-24 µm, rather irregular and angular, more or less ellipsoid, or clavate, wall 1.5-2 µm thick at sides, 4-8 above, yellowish-brown, smooth, pedicel of an upper cell 8-12 µm long and a lower cell 4-10 µm long, their walls pale yellowish-brown (Laundon, 1965).

**UROMYCES BONARIENSIS** Spegazzini, as "*bonariensis*", Anal. Soc. Cient. Argentina 10: 133. 1880. TYPE on *Gomphrena elegans* Martius from **Argentina**, Buenos Aires: Boca del Riachuelo, May 1880, *Spegazzini s.n.* (?/?,IIpve/III).

Anamorph

*Uredo argentina* Spegazzini, An. Soc. Cient. Argent. 9:172. 1880. TYPE on *Gomphrena gracilis* from **Argentina**, Buenos Aires: Boca del Riachuelo, Jan 1880, *Spegazzini s.n.*

On Amaranthaceae.

*Gomphrena elegans* Martius, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 122; Laundon, 1965: 22).

*Uromyces bonariensis* has been reported also from Argentina, Ecuador, and Venezuela.

Uredinia on both sides of leaves, mostly on abaxial side, 0.5-1.0mm in diameter, cinnamon-brown, powdery, scattered singly or in concentric groups, on chlorotic spots, urediniospores 22-29 x 20-26 µm, globoid or narrowly ellipsoid, wall (1.5-)2(-2.5) µm thick, golden-yellow, densely echinulate, pores 4-6, scattered. Telia irregularly scattered on both sides of leaves, sometimes on stems, up to 0.5 mm across, black, compact, teliospores 25-32 x 22-26 µm, globoid to ellipsoid, rounded above or sometimes narrowed, rounded or sometimes narrowed below, wall (2.5-)3.5-4 µm thick at sides, (5-)6-8 µm above, chestnut-brown, smooth, pedicel up to 30 µm long, fragil, colorless but pigmented next to the spore (Laundon, 1965; Lindquist, 1982).

The 4-6 scattered pores in the urediniospores and the smaller size of the teliospores (25-32 x 22-26 µm) with much longer pedicels (to 200 µm long) aid in identifying *Uromyces bonariensis* when compared to *Uromyces platensis* (teliospores 32-46 x 18-24 µm) (Lindquist, 1948).

*Uromyces borrieriae* P. Hennings, see **UREDIO BORRERIAE** (P. Hennings) Kern & Whetzel.

**UROMYCES BRADBURYAE** H. S. Jackson & Holway in Jackson, Mycologia 23: 352. 1931. TYPE on *Centrosema virginianum* Bentham, reported originally as "*Bradburya virginiana* (Linnaeus) Kuntze" from **Brazil**, São Paulo, Campos do Jordão, 2 May 1922, *Holway-1801* [and on *Bradburya pubescens* (Benth.) Kuntze, from the same location, 20 Apr 1922, *Holway-1735*]. (?/?,II/III).

On Leguminosae.

*Centrosema pubescens* Bentham, São Paulo (Jackson, 1931: 352; Almeida, 1975: 42).

*Centrosema virginiana* Bentham, São Paulo (Jackson, 1931: 352; Almeida, 1975: 42).

*Uromyces bradburyae* has been reported only from Brazil. The hosts were reported originally as in the genus *Bradburya* but that genus is now considered as a part of *Centrosema*.

Spermogonia and aecia unknown. Uredinia on both sides of leaves or mostly on the adaxial side of leaves, scattered or gregarious, 0.1-0.5 mm across small, round or irregular, light chestnut-brown, somewhat tardily naked, surrounded by the ruptured epidermis, pulverulent; urediniospores 23-28(-31) x 18-24 µm, obovoid, ellipsoid or broadly globoid, wall 1.5-2 µm thick, often 2.5-3 µm thick at apex and base, pale brown to cinnamon-brown, echinulate, germ pores 2, slightly above the equator, distinct, with smooth, colorless caps. Telia dark chestnut-brown, otherwise as the uredinia; teliospores (27-)31-37 x (16-)20-26 µm, mostly ovoid to pear-shaped or broadly ellipsoid, wall 1.5-2 µm thick, light chestnut-brown, with a paler and clearly differentiated umbo, 5-7(-8) µm thick at apex, appearing smooth but actually verrucose, with numerous



verrucae distributed evenly or irregularly throughout the surface of spore and umbo; pedicel, to 20  $\mu\text{m}$  long, less frequently to 40  $\mu\text{m}$  long, mostly collapsing, colorless (Almeida, 1975).

**UROMYCES BRASILIENSIS** Trotter, Ann. Mycol. 2: 533. 1904. *Nom. nov.* for *Uromyces giganteus* Dietel. (**0/Ipe,IIpe/III**).

≡ *Uromyces giganteus* Dietel, Hedwigia 36: 26. 1897. (Not *Uromyces giganteus* Spegazzini, 1879). TYPE on *Jacquemontia* sp. (originally reported as on undetermined Convolvulaceae) from **Brazil**, Minas Gerais: Caraca, March 1892, *Ule-1873*.

= *Uromyces standleyanus* Arthur, Bull. Torr. Bot. Club 51: 57. 1924. TYPE on *Jacquemontia* sp. (mistakenly reported originally as *Gaudichaudia schiedeana* Juss., Malpichiaceae) from **El Salvador**, San Salvador: Toncatepeque, 30-31 Dec 1921, *P. C. Standley-19461*.

Anamorph

*Uromyces gemmatus* Berkeley & Curtis in Berkeley, Jour. Linn. Soc. 10: 357. 1869. TYPE on *Jacquemontia* sp. (originally reported as *Convolvulus* sp.) from Cuba. Only uredinia described. This name needs to be transferred to an anamorph genus.

≡ *Klebahnia gemmata* (Berkeley & Curtis) Arthur, N. Am. Fl. 7: 479. Although Arthur described teliospores, he listed the specimen of Berkeley and Curtis as the type which has only anamorph spores.

= *Uredo jacquemontiae* P. Hennings, Englar Bot. Jharb. 18: 23. 1894. TYPE on *Jacquemontia* sp. from **New Guinea**, "Kaiser Wilhelmsland, Kelana, an der Terrasse", 3 July 1888, *L. Kaernbach-s.n.*

= *Uredo spinulosa* Dietel, Hedwigia 36: 36. 1897. TYPE on *Jacquemontia* sp. (originally reported on undetermined Convolvulaceae) from **Brazil**, Rio de Janeiro: Rio de Janeiro, May 1892, *Ule-2052*. Not *Uredo spinulosa* Saccardo, 1891.

≡ *Uredo dieteliana* Saccardo & Sydow in Saccardo, Syll. Fung. 14: 395. 1899. *Nom. nov.* for *Uredo spinulosa* Dietel.

On Convolvulaceae:

*Jacquemontia ferruginea* Choisy, São Paulo (Jackson, 1931: 498).

*Jacquemontia* sp., Bahia (IBI 15295), Minas Gerais, (Jackson, 1931: 498), Rio de Janeiro (PUR-F3498), Santa Catarina (IBI-12957), São Paulo (Jackson, 1931: 498; IBI-12176).

**Genus undetermined** (probably *Jacquemontia*), Rio de Janeiro (Saccardo, 1899: 395), Santa Catarina (Pazschke, 1892: 97).

*Uromyces brasiliensis* has been reported also from Ecuador, Venezuela, the West Indies, Central America, Mexico, New Guinea, Taiwan, and the Phillipines, only on *Jacquemontia* spp.

Aecia as the uredinia but with spermogonia. Uredinia 0.2-0.7 mm across, on abaxial side of leaves, scattered or in groups, blister-like at first, erumpent, ruptured epidermis conspicuously, powdery, dark cinnamon-brown, urediniospores 29-39 x 23-29  $\mu\text{m}$ , broadly ellipsoid to ovoid, wall 2.5-3.5  $\mu\text{m}$  thick, laminate, outer layer colorless, usually hygroscopic, swelling, echinulate, inner layer cinnamon-brown, echinulae, pores often obscure, 3-6(-8), scattered. Telia like the uredinia but chestnut-brown, teliospores 32-45 x 21-27  $\mu\text{m}$ , ellipsoid to ovoid, rounded above and frequently narrowed below, wall 1-1.5  $\mu\text{m}$  at sides, 7-20  $\mu\text{m}$  above, yellow-brown, usually lighter in the thickened apex, smooth, pedicel about a fourth the length of the spore, fragile, colorless.

Teliospores are variable in size with variably greatly thickened apical walls (Jackson, 1931).

*Uromyces cajaponiae* P. Hennings, see **UROMYCES NOVISSIMUS** Spegazzini.

**UROMYCES CARTHAGENENSIS** Spegazzini, Ann. Mus. Nac. Buenos Aires 6:217. 1898. TYPE on *Manihot carthagensis* (Jacquin) Muell.-Arg. from **Argentina**, Buenos Aires: Santa Catalina, "winter 1889-90", Spegazzini-s.n. (**?/?,IIev,III**).

On Euphorbiaceae

*Manihot* sp., Minas Gerais (Viégas, 1945: 61; IAC-3561).

*Uromyces carthagensis* has been reported only from Argentina and Brazil.

The following six species of *Uromyces* that infect *Manihot* in the Neotropics have been proposed:

1. *Uromyces carthagensis* Spegazzini, sori on stems, petioles and blades on large, twisted orange

cushions.

III-spores 30-36 x 20-24  $\mu\text{m}$ , ellipsoid or ovoid, wall intensely black, and minutely roughened, but with a smooth, paler obtuse umbo, pedicel 20-3-  $\mu\text{m}$  long, colorless.

IIcv-spores *Aecidium* sp.,

2. *Uromyces jatrophae* Dietel & Holway, sori on both sides of leaves.

III-spores, 26-42 x 17-29  $\mu\text{m}$ , ellipsoid to globoid, wall 2.5-5  $\mu\text{m}$  thick, thickened into an acute apex 7-12  $\mu\text{m}$ , laminate, the inner layer chestnut-brown, the outer layer golden-brown, somewhat hygroscopic, and frequently inconspicuous, closely and coarsely verrucose, sometimes forming longitudinal lines, pedicel colorless except with a slightly tinted collar next to the spore, once to one and a half the length of the spore.

Ipe-spores 19-32 x 18-24  $\mu\text{m}$ , ellipsoid or obovoid, wall 1.5-3  $\mu\text{m}$  thick, brownish yellow or hyaline, moderately echinulate, pores obscure, probably 4-6 scattered.

0/Icv

3. *Uromyces manihoticola* P. Hennings, sori on abaxial side of leaves, blackish-brown.

III-spores 26-35  $\mu\text{m}$ , globose to subglobose, wall to 10  $\mu\text{m}$  thick

II spores, unknown

4. *Uromyces manihotis* P. Hennings, sori on peduncles, flowers, leaves, and stems, blackish.

III-spores, 32-45 x 20-30  $\mu\text{m}$ , ellipsoid, ovoid, to oblong, with an apical papilla to 10  $\mu\text{m}$  long; wall up to 7  $\mu\text{m}$  thick, smooth, chestnut-brown; pedicel up to 120  $\mu\text{m}$  long, fairly stout, persistent, yellowish to colorless.

Ipe-spores with  $\pm$  8 scattered pores

5. *Uromyces manihotis-catingae* P. Hennings, sori on adaxial side of leaves, dark brown.

III-spores 30-40 x 25-30  $\mu\text{m}$ , globose, subglobose, or ovoid, with a large apical papilla up to 14  $\mu\text{m}$  high, wall 5-7  $\mu\text{m}$  thick, coarsely and loosely verrucose, chestnut-brown, pedicel to 40  $\mu\text{m}$  long, stout, hyaline to yellowish.

Ipe-spores 20-28 x 15-20  $\mu\text{m}$ , ovoid or ellipsoid, sparsely and weakly echinulate, almost verrucose, pale yellowish-brown. pores 2-3 equatorial.

6. *Uromyces tolerandus* H. S. Jackson & Holway, on abaxial side of leaves.

III-spores 27-38 x 18-22  $\mu\text{m}$ , ellipsoid, rounded below, apex acute, wall 2-3  $\mu\text{m}$ , apex 5-8  $\mu\text{m}$ , evenly, inconspicuously verrucose, chestnut-brown.

II-spores unknown

*Uromyces caryophyllinus* (Schroeter) Winter, see **UROMYCES DIANTHI** (Persoon) Niessel.

**UROMYCES CASTANEUS** P. Sydow & H. Sydow, Mon. Ured. 2: 94. 1910. TYPE on *Desmodium incanum* DeCandolle from **Brazil**, Rio de Janeiro, July 1887, *Ule-666*. (??, Ipe/III).

On Leguminosae.

*Desmodium incanum* DeCandolle, Paraíba (Viégas, 1945: 62; IAC-3836; Almeida, 1975: 63), Pernambuco (Viégas, 1945: 62; IAC-3835; Almeida, 1975: 63), Rio de Janeiro (Sydow, 1910: 94; Jackson, 1931: 352; Almeida, 1975: 63).

*Desmodium* sp., Rio de Janeiro (Jackson, 1931: 352; Almeida, 1975: 63), São Paulo (IBI-13439).

*Uromyces castaneus* has been reported also from Argentina.

Spermatogonia and aecia unknown, Uredinia 0.1-0.5 mm across, mostly on the abaxial side of leaves, more or less scattered or almost uniformly distributed on the entire leaf surface, ruptured epidermis inconspicuous on the lower leaf surface but noticeable or long covered on the upper leaf surface, light cinnamon-brown, pulverulent; urediniospores 15-20 x 14-18(-20)  $\mu\text{m}$ , broadly ellipsoid to subgloboid or globoid, wall 1-1.5(-2)  $\mu\text{m}$  thick, echinulate, golden-yellow to golden-brown, germ pores 3-4, slightly above the equator, with colorless, echinulate caps. Telia dark brown, otherwise as the uredinia or teliospores mixed with urediniospores; teliospores (18-)20-24 x (15-)18-22  $\mu\text{m}$ , globoid to subgloboid or broadly ellipsoid, wall 2.5-4  $\mu\text{m}$  thick at sides, chestnut-brown, minutely and uniformly reticulate with meshes about 1  $\mu\text{m}$  diam, slightly thickened at apex to 5  $\mu\text{m}$ , with a paler, not abruptly differentiated umbo; pedicel to 60-80  $\mu\text{m}$  long, rarely to 100  $\mu\text{m}$  long, colorless, thin-walled, many collapsing (Almeida, 1975).

### Key to help identify species of *Uromyces* on *Desmodium*, Leguminosae, in Brazil

#### Section A. Teliospores verrucose

1. Uredinia paraphysate, with pedicellate spores (*Uredo*) (2)

2. Urediniospores with 4-5 germ pores equatorial or nearly equatorial, or less frequently with 3-4 equatorial or nearly equatorial and 1 near or at apex.

*U. unionensis.*

2. Urediniospores with (3)4-7(8) scattered germ pores

*U. hedysari-paniculati.*

1. Uredinia peridiate, with catenulate spores (*Aecidium*), teliospores verrucose, with irregular warts, these varying from sometimes variously united or irregularly arranged to form a kind of labyrinth

*U. orbicularis.*

### Section B. Teliospores reticulate

1. Uredinia peridiate, with catenulate spores (*Aecidium*, teliospores varying from verrucose, with irregular warts sometimes variously united or arranged to form a kind of labyrinth, to irregularly reticulate

*U. orbicularis.*

1. Uredinia with pedicellate spores (*Uredo* (2)

2. Uredinia paraphysate (3)

3. Urediniospores with 4-5 equatorial or approximately equatorial, or less frequently with 3-4 equatorial or approximately equatorial and 1 near or at apex germ pores

*U. unionensis.*

3. Urediniospores with (3)4-7(8) scattered germ pores

*U. hedysari-paniculati.*

2. Uredinia aparaphysate, teliospores with wall single, urediniospores mostly with 3-4 germ pores

4. Teliospores (18-)20-24 x (15-)18-22  $\mu\text{m}$ ; wall 2.5-4  $\mu\text{m}$  thick at sides; pedicel to 60-80  $\mu\text{m}$ , rarely to 100  $\mu\text{m}$  long

*U. castaneus.*

4. Teliospores 18-26 x 13-18  $\mu\text{m}$ ; wall 1.5-2  $\mu\text{m}$  thick at sides, minutely reticulate, appearing minutely verrucose, with meshes to about 1  $\mu\text{m}$  diam; pedicel usually breaking near the hilum,; urediniospores with 3-4 equatorial or superequatorial germ pores

*U. desmodiicola var. desmodiicola.*

*Uromyces cayaponiae* P. Hennings, see **UROMYCES NOVISSIMUS** Spegazzini.

**UROMYCES CELOSIAE** Dietel & Holway in Holway, Bot. Gaz. (Crawfordsville) 31: 326. 1901.

TYPE on *Iresine latifolia* Bentham & Hooker (mistakenly reported originally as "*Celosia latifolia*") from **Mexico**, Oaxaca, 17 Oct 1899, *Holway-3641*. (??,IIpe/III).

On Amaranthaceae.

*Achyranthes prostrata*, Bahia (IBI 13585).

*Pfaffia erianthos* (Poiret) Kuntze (as "*Iresine erianthos* Poiret"), Rio de Janeiro (Jackson, 1927: 60; IBI-1732 (has dendritic trichomes). Host identification by Laundon).

*Iresine* sp., Rio de Janeiro (Jackson, 1927: 60), São Paulo (IBI 12547A).

**Species undetermined**, São Paulo (Jackson, 1927: 60).

*Uromyces celosiae* has been reported also from Central America, Mexico, Jamaica, and Puerto Rico. Hernández and Hennen (2002) reported *Uromyces celosiae* also from Argentina and on *Chamissoa altissima* (Jacquin) Kunth (Amaranthaceae).

Uredinia on abaxial side of leaves, scattered on large areas, sometimes crowded or occasionally confluent, roundish, 0.2-0.5 mm in diameter, early naked, pulverulent, dark cinnamon-brown, ruptured epidermis conspicuous; urediniospores 24-32 x 19-26 broadly ellipsoid, wall 2-3.5  $\mu\text{m}$  thick, cinnamon-brown, strongly and sparsely echinulate, pores 2, equatorial, distinct. Telia on abaxial side of leaves, scattered in large irregular areas, often crowded and occasionally confluent, 0.2-0.6 mm in diameter, rather early naked, pulverulent, chocolate-brown or blackish, ruptured epidermis conspicuous; teliospores 27-34 x 23-29  $\mu\text{m}$ , globose or broadly ellipsoid, wall 3-5  $\mu\text{m}$  thick, chocolate brown, inconspicuously and closely verrucose, thickened above by a broad pale umbo, 7-9  $\mu\text{m}$  thick, pedicel once to twice length of spore, rather stout, colorless, slightly roughened below (Arthur et al., 1912).

**UROMYCES CELTIDIS** Dietel, Ann. Mycol. 5: 244. 1907. TYPE on *Celtis* sp., Ulmaceae, from **Brazil**, São Paulo: Mandagni, Nov 1906, *A. Usteri-s.n.* (??,?/III).

*Uromyces celtidis* has been reported only from the type.

Telia on brownish spots on abaxial side of leaves, 1-3 mm wide, broadly flattened to convex, floccose, white when dried, not covered by epidermis; teliospores 32-45 x 12-18 µm, ellipsoid to clavate, rounded above, wall very thin, not thickened above, colorless, irregularly striolate, pedicel long, spores germinating (The Sydows, 1910).

The identification of the host is questionable. The rust needs to be compared to *Chaconia apicrassa* Hennen et al. on *Maclura tinctoria*, Moraceae.

**UROMYCES CESTRI** Montagne in Gay, Hist. Fis. Polit. Chile 8: 49. 1852. TYPE on *Cestrum parqui* L'Hérit from **Chile**, Island of Juan Fernandez, date of collection not found, *Botero-1740*.  
(?/?**,IIcv/III**).

≡ *Caecomurus cestri* (Montagne) Kuntze, Rev. Gen. Pl. 3(2): 449. 1889.

≡ *Uromycopsis cestri* (Montagne) Arthur, Résult. Sci. Congr. Internat. Bot. Vienna p. 345. 1906.

Anamorph

***Aecidium cestri*** Montagne, Ann. Sci. Nat. II, 3: 356. 1835. TYPE on *Cestrum parqui* L'Hérit from **Chile**, Island of Juan Fernandez, date of collection not found, *Botero-1740*.

≡ *Uredo cestri* Bertero in Montagne, Ann. Sci. Nat. (Paris) II 3: 356. 1835. TYPE (the same specimen as for *Uromyces cestri*) on *Cestrum parqui* L'Hérit from **Chile**, Island of Juan Fernandez, date of collection not found, *Botero-1740*.

≡ *Pucciniola cestri* (Montagne) Arthur, N. Am. Fl. 7: 452. 1921. Based on *Aecidium cestri* Montagne, an anamorph name.

On Solanaceae.

***Cestrum latifolium*** Lamarck, Pará (PUR-F17291).

***Cestrum schlechtendalii*** Don, São Paulo (Jackson, 1932: 84).

***Cestrum*** sp., Minas Gerais (IBI-15858), Rio de Janeiro (Jackson, 1932: 84), São Paulo (Sydow, 1907: 254; Jackson, 1932: 84; IBI-13372).

*Uromyces cestri* has been reported from Argentina to the United States of America and islands in the Caribbean on nearly 20 species of *Cestrum*.

The life cycle of this rust has been confused. Spermogonia have never been reported but previous authors have stated that this species has aecia, but no uredinia. Obviously, these reports are based on morphological terminology of life cycle stages. The only anamorph sori found are bright yellow orange when fresh, and have the morphology of the genus *Aecidium*. We interpret them as uredinia because these sori are usually scattered over a leaf, often very abundant, spermogonia have never been reported, and telia are often closely associated with them. Probably aecia do occur with the same morphology as these uredinia, but until spermogonia are found with *Aecidium*-like sori, or until experimental inoculations with basidiospores confirm that aecia are formed without spermogonia, we believe that it is best to interpret these *Aecidium cestri* sori as uredinia.

Spermogonia and aecia unknown. Uredinia, *Aecidium cestri* Montagne, mostly on both sides of leaves and on stems, loosely grouped or closely circinnate in hypertrophied spots 2-10 mm across, cupulate or short cylindric, deep seated in mesophyll, peridium whitish, margin erose, usually not or only slightly projecting above the host surface; peridial cells irregularly and narrowly oblong or rhomboid in face view, 32-58 x 12-13 µm, ends overlapping, outer wall 1.5-3 µm thick, closely and finely verrucose, urediniospores 25-37 x 19-26 µm, Anamorph spores 27-31 x 19-23 µm, ellipsoid, oblong ellipsoid, and often angular by mutual pressure, wall 1.5-3 µm thick, finely and closely verrucose, but more than one pattern of verrucae, colorless. Telia mostly on the abaxial side of leaves, loosely grouped in concentric circles or on spots with uredinia, early exposed, compact, becoming slightly pulverulent, blackish-brown, ruptured epidermis evident; teliospores 25-35 x 19-26 µm, ellipsoid, oblong, or globoid, usually rounded above, sometimes slightly narrowed below; wall 2.5-4(-5) µm thick at sides, (4-)5-7(-8) µm thick above, slightly rugose and laminate above, smooth or occasionally loosely and inconspicuously verrucose at sides, chestnut-brown; pedicel once or twice length of spore, colorless or pale yellow, fragile (Hernández & Hennen, 2003).

*Cestrum* is a native American genus with about 175 species. The following key, modified from Arthur (1918) and Lindquist (1982), may help identify the four species of *Uromyces* reported on *Cestrum* spp. Only *Uromyces cestri* has been reported from Brazil. Joerstad (1959) warned that "The species of *Uromyces* on *Cestrum* clearly need revising".

**Key to help identify species of *Uromyces* on *Cestrum*, Solanaceae**

- |   |   |
|---|---|
| 1. Teliospores  | 2.  |
| 1. Anamorph spores, mostly urediniospores ( <i>Aecidium</i> spp.)                   | 5.  |
| 2. Teliospores rostrate   | <i>Uromyces venustus</i> Dietel & Holway (Mexico).                        |
| 2. Teliospores rounded or obtuse  | 3.  |
| 3. Teliospore walls thin, 1.5-2.5 µm thick  |   |
|   | <i>Uromyces maculans</i> (Patouillard) Arthur (Bolivia, Central America). |
| 3. Teliospore walls thicker, 2.5-5 µm   | 4.  |
| 4. Teliospores mostly ellipsoid to narrowly ellipsoid, lateral walls 2.5-4 µm thick |   |
|   | <i>Uromyces cestri</i> Montagne (The Tropical Americas).                  |
| 4. Teliospores mostly globoid to narrowly globoid, lateral walls 4-5 µm thick       |   |
|   | <i>Uromyces cestricola</i> Spegazzini (Argentina).                        |
| 5. Anamorph spores mostly globoid, 24-29 x 18-26 µm                                 | 6.  |
| 5. Anamorph spores mostly oblong, 25-37 x 19-26 µm                                  | 7.  |
| 6. Peridial cells long, 48-67 µm  | <i>Uromyces venustus</i> Dietel & Holway (Mexico).                        |
| 6. Peridial cells short, 24-42  |   |
|   | <i>Uromyces maculans</i> (Patouillard) Arthur (Bolivia, Central America). |
| 7. Peridial cells distinctly verrucose, anamorph sori localized                     |   |
|   | <i>Uromyces cestri</i> . Montagne (The Tropical Americas).                |
| 7. Peridial cells appearing smooth, anamorph sori appear systemic                   |   |
|   | <i>Uromyces cestricola</i> . Spegazzini (Argentina).                      |

*Uromyces chilensis* Dietel & Neger, see **UROMYCES LATHYRINUS** Spegazzini.

**UROMYCES CIRCUMSCRIPTUS** Neger, Anal. Univ. Santiago 1895: 4. 1895. TYPE on *Loranthus verticillatus* Ruiz & Pavon [*Phrygilanthus verticillatus* (Ruiz & pavon) Eichler] from **Chile**, San Juan, date not reported, *Dr. Phillippi-s.n.* (??,IIcv/III).

Anamorph

*Aecidium circumscibens* Neger, Ann. Univ. Chile 90: 328. 1895. TYPE on *Loranthus verticillatus* Ruiz & Pavon [*Phrygilanthus verticillatus* (Ruiz & pavon) Eichler] from **Chile**, San Juan, date not reported, *Dr. Phillippi-s.n.*  
 = *Aecidium bulbifaciens* Neger, Ann. Univ. Chile 90: 329. 1895. TYPE on *Loranthus heterophyllum* Ruiz & Pavon [*Phrygilanthus heterophyllum* (Ruiz & Pavon) Eichler] from **Chile**, at the juncture of Rio Rahue and Rio Bueno, date not published, ?Neger-sn.

On Loranthaceae.

*Loranthus* sp., Brasil (H. Sydow & P. Sydow, Mon. Ured. 2: 244. 1910).

*Struthanthus complexus* Eichler, Rio de Janeiro (Dietel, 1899: 248).

*Uromyces circumscriptus* has been reported also from Chile. Spermogonia have not been reported for *Uromyces circumscriptus* and the *Aecidium circumscibens* sori are intimately associated with telia. Thus, we believe these *Aecidium* sori are uredinia. Lindquist (1982) first connected *Aecidium bulbifaciens* (= *Aecidium circumscibens*) as an anamorph of *Uromyces circumscriptus*.

Cummins (1939) provided the following key for species of *Uromyces* on *Loranthaceae* that occur in the tropics or subtropics of the New World.

**Key to help identify species of *Uromyces* on Loranthaceae in the tropics or subtropics of the New World**

Teliospores longitudinally ridged

Teliospore pedicel long, rugosely inflated

*U. ornatipes* Arthur.  
 [*Phrygilanthus*, **Mexico**].

Teliospore pedicel short, fragile

Teliospores large, 38-50 µm long

*U. euphlebius* Sydow.

Teliospores smaller, 32-37 µm long

*U. socius* Arthur & Holway.  
 [*Struthanthus*, **Mexico**].

Teliospores reticulate, sometimes striately so

Species macrocyclic (uredinia with spores catenulate)

Urediniospores echinulate

*U. loranthi* Jackson & Holway.

- Urediniospores longitudinally ridged [Loranthus, **Brazil**].  
*U. neophytirusae* Jackson  
 [(nom nov. for *U. phytirusae* Mayor), **Colombia**].
- Species demicyclic (Aecia unknown, uredinia with the morphologh of *Aecidium*).  
 Reticulation obscure, pits 0.5-0.8  $\mu\text{m}$  diam.  
 Teliospores ellipsoid, 18-23 x 29-35  $\mu\text{m}$  *U. circumscriptus* Neger.  
 [(*Aecidium circumscribens* Neger) *Loranthus*, **Chile, Argentina, Struthanthus, Brazil**].
- Teliospores oblong-ellipsoid, 15-23 x 33-43  $\mu\text{m}$  *U. urbanianus* P. Hennings  
 [*Antidaphne*, **Colombia, Oryctanthus, Phrygilanthus, Argentina, Brazil, Colombia, Trinidad**].
- Reticulation obvious, pits 1-1.5  $\mu\text{m}$  diam.  
 Teliospores oblong-ellipsoid, 20-25 x 39-53  $\mu\text{m}$  *U. evastigatus* Cummins.  
 [*Phthirusa*, **El Salvador**].

**UROMYCES CISNEROANUS** Spegazzini, Anal. Soc. Cient. Argentina 10: 134. 1880. TYPE on *Sapium* sp. (reported as *Sapium biglandulosum* (Linnaeus) Muell. Arg. [reported as *Excaecaria (Sapium) biglandulasa* var. *serrata*] from **Argentina**, Barracas del Sur, June 1880, *Cisneros-3817*. (?/?, IIpe/III).

= *Uromyces vestitus* Dietel, Anal. Mycol. 6: 94. 1908. TYPE on *Sapium* sp. from **Brazil**, São Paulo: Taragna, 5 May 1907, *Uster-s.n.*

Anamorph

*Uredo cisneroana* Spegazzini, Anal. Soc. Cient. Argentina 17: 119. 1884. TYPE on *Sapium aucuparium* Jacq. from **Paraguay**, Guarapi, Dec 1881, ?Spegazzini-3468.

On Euphorbiaceae.

*Sapium* sp., Rio de Janeiro (Jackson, 1931: 470), São Paulo (Jackson, 1931: 470; Viégas, 1945: 62; IAC-3749).

*Uromyces cisneroanus* has been reported from Argentina, Paraguay, Brazil, and Venezuela.

Spermogonia and aecia unknown. Uredinia 0.5-1 mm across, on yellowish spots on both sides of leaves and on stems, scattered or closely grouped, erumpent, surrounded by the ruptured epidermis, cinnamon-brown, powdery; urediniospores (28-)38-44(46) x 27-34(-39)  $\mu\text{m}$ , oblong, clavate-oblong, some spores asymmetrical, straight or curved: wall 2-2.5  $\mu\text{m}$  thick, sometimes slightly thickened above, echinulate with sharp spines, pores 2(3), equatorial. Telia as ther uredinia but compact and almost black; teliospores 34-50 x 15-23  $\mu\text{m}$ , obovoid to ellipsoid, narrowed above, rounded below; wall 2-layered, outer layer colorless, prolonged above as a yellowish papilla 8-12  $\mu\text{m}$  high, smooth, or with indistinct rough places, inner layer chocolate brown, 2.5-3  $\mu\text{m}$  thick; pedicel thick at attachment region, about as long as or a little longer than the spore (Lindquist, 1982).

We follow Lindquist (1982) who placed *Uromyces vestitus* as a synonym of *U. cisneroanus*.

*Uromyces cissampelidis* Dietel, see **UROMYCES NOVISSIMUS** Spegazzini.

**UROMYCES CLARUS** H. S. Jackson & Holway in Jackson, Mycologia 19: 60. 1927. TYPE on *Iresine celosia* Linnaeus, from **Bolivia**, El Chaco, Sur Yungus, 25 May 1920, *Holway-649*. (?/?, IIpe/III).

On Amaranthaceae.

*Iresine celosia* L., São Paulo (Jackson, 1927: 60; Laundon, 1965: 23).

*Uromyces clarus* has ben reported also from Bolivia, Ecuador, Venezuela, and Trinidad.

Spermogonia and aecia unknown. Uredinia 0.4-0.8 mm across, round or oval on both sides of leaves or mostly adaxial, scattered or in groups in more or less concentric circles, tardily naked, light golden-brown, ruptured epidermis conspicuous and persistent; urediniospores 25-34 x 18-26  $\mu\text{m}$  obovoid, wall 1.5-2  $\mu\text{m}$  thick, prominently obliquely striate, or lines broken into warts, the lines 2-3  $\mu\text{m}$  apart, pores obscure, apparently 4, equatorial. Telia not seen, teliospores in uredinia 26-32 x 20-24  $\mu\text{m}$ , obovoid or ellipsoid, wall 1.5-2  $\mu\text{m}$  thick at sides, 4-7  $\mu\text{m}$  at apex, colorless, pedicel 60-90  $\mu\text{m}$  long, hyaline (Jackson, 1927; Laundon, 1965).

*Uromyces clavatus* Dietel, see **UROMYCES LATHYRINUS** Spegazini.

**UROMYCES CNIDOSCOLI** P. Hennings, Hedwigia 34: 90. 1895. TYPE on *Cnidoscolus vitifolius* (Miller) Pohl from **Brazil**, Goiás: Goiás, Jan 1893, *Ule-1996*. (**0/Icv,IIpe/III**).  
= *Uromyces jatrophicola* P. Hennings, Hedwigia 47: 266. 1908. TYPE on *Cnidoscolus vitifolius* (Miller)Pohl (originally reported as *Jatropha* sp.) from **Brazil**, Bahia: Calderão, Oct 1906, *Ule-3322*.

Anamorph

*Aecidium cnidoscoli* P. Hennings, Hedwigia 34: 102. 1895. TYPE on *Cnidoscolus vitifolius* (Miller) Pohl from **Brazil**, Goiás: Goiás, Jan 1893, *Ule-1997*.

On Euphorbiaceae.

*Cnidoscolus vitifolius* (Miller) Pohl, Bahia (Hennings, 1908: 266; IBI-13615), Goiás (Hennings, 1895A: 90; Hennings, 1895A:102), Mato Grosso do Sul (IBI-14373).

*Uromyces cnidoscoli* has been reported also from Argentina (Berndt, 2002).

Spermogonia mostly on adaxial side of leaves, in small groups. Aecia mostly on the abaxial side of leaves beneath the spermogonia, cupulate; peridial cells 30-40 x 20-26 µm, irregular in shape; aeciospores 21-32 x 17-23 µm, subglobose to ellipsoid; wall (1.5-)2(2.5) µm thick, densely and minutely verrucose, colorless. Uredinia scattered on both sides of leaves but mostly on the abaxial side, about 0.5-0.75 mm in diameter, pale yellow, powdery; urediniospores 19-28 x 17-22 µm, globose, subglobose, or ellipsoid; wall about (1.5-)2(-2.5) µm thick, slightly irregularly to evenly echinulate, spines about 6-7 across at equator, colorless or pale yellowish, pores obscure. Telia scattered mostly on adaxial side of leaves, about 0.5 mm diameter, black, slightly powdery; teliospores (18-)22-32 x (28-)30-34 µm in diameter at equator, flattened globose to globose; wall evenly about 3-4(-5) µm thick, coarsely verrucose-rugose with irregular blunt warts with some partly connected by ridges, nearly smooth around the pedicel, dark chestnut-brown; pedicel 15-20 µm long, swelling to a subglobose shape distally, colorless.

The coarsely verrucose-rugose teliospore walls and the subglobose swellings of the pedicels aid in identifying *Uromyces cnidoscoli*.

*Uromyces jatrophicola* was kept separate by two authors (The Sydows, 1910; Monson, 1983) but Arthur made a note in PUR that it was a synonym of *U. cnidoscoli*. We also believe that it should be cited as a synonym. Some authors have treated *Cnidoscolus* as a subgenus of *Jatropha*.

Berndt (2002) found old aecia on his collection from Argentina but excluded *Aecidium cnidoscoli* as an anamorph because Hennings (1895) described it originally as having spores with smooth walls. But the Sydows (1923) reported the walls as densely, minutely verruculose. Therefore, we include the *Aecidium cnidoscoli* as an anamorph connected to *Uromyces cnidoscoli*.

Berndt (2002) reported his Argentine specimen as: aeciospores 23-31 x 18-24 µm, wall about 1.5 µm thick, slightly thicker at the angles, urediniospores 24-30 x 21.5-26 µm, broadly ellipsoid or obovoid; teliospores 28-34 x 21-25 µm; 28-34 µm in diameter at equator, wall 2-3 µm thick.

**UROMYCES COMMELINAE** Cooke, Trans. Roy. Soc. Edinburg 31: 342. 1888. TYPE on *Commelina* sp. from **South Yemen**, Island of Socotra. (**0/Icv** ⇌ **IIpe/III**).

Synanamorphs

*Uredo commelinae* Spegazzini, Anal. Soc. Cient. Argentina 9: 172. 1880. TYPE reported originally as on *Commelina sulcata* Bentham or Hoffmansseggia, corrected to *Tradescantia gujanensis* Miq. the same year, from **Argentina**, “Rio de La Plata a la Recoleta”, Feb 1880, *Spegazzini s.n.*

= *Uredo commelinaecea* Ellis & Kelsey, Bull. Torrey Bot. Club 24: 209. 1897. TYPE on *Commelina elegans* from The West Indies, date not reported.

= *Uredo ochracea* Dietel, Hedwigia 36: 35. 1897. TYPE on *Commelina* sp. from **Brazil**, Santa Catarina: São Francisco, May 1884, *Ule-138*.

= *Uredo tosenis* P. Hennings, Hedwigia (Beiblatt) 42: 107. 1903. (fide Sydow, P. & H., 1910. p. 352).

= *Uredo spegazzini* DeToni in Saccardo, Syll. Fung. 7: 845. 1888. Nom. nov. for *Uredo commelinae* Spegazzini.

*Aecidium mexicanum* Dietel & Holway in Holway, Bot. Gaz. (Crawfordsville) 24: 36. 1897.

TYPE on *Cissus* sp., Vitaceae, from **Mexico**, near Mexico City, 1 Oct 1896, *Holway s.n.*  
**0/I**, not yet reported from Brazil.

On Commelinaceae: only II, III.

*Commelina* sp., Paraíba (Viégas, 1945: 82; IAC-3801), Santa Catarina (Dietel, 1897: 35), São Paulo (Hennings, 1908: 2).

*Tradescantia elongata* Meyer, Rio de Janeiro (Jackson, 1926: 149), São Paulo (Jackson, 1926: 149; IBI-1733).

*Tradescantia gaudichaudina*, São Paulo (IBI-335).

*Tradescantia sellowiana* Kunth (Viégas, 1945: 82; IAC-3981).

*Tradescantia* sp., São Paulo (Viégas, 1945: 82; IAC-3314; IBI-12).

**Species undetermined**, Rio de Janeiro (Jackson, 1926: 149), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 119).

*Uromyces commelinae* has been reported circumglobally in warm regions under various names. But the complete synonymy of this rust has not been worked out.

Cummins (1963: 77) [Cummins, G. B. 1963. Life cycles of Southwestern rust fungi. *Mycologia* 55: 73-78.] first reported the connection of *Aecidium mexicanum* to *Uromyces commelinae*. No collections of spermogonia and aecia have been reported from Brazil but have been recorded from Venezuela, Mexico, and Texas. See *Puccinia commelinae* for a comparison with that species.

*Uromyces cordiae* P. Hennings, see *Uredo pachystegiae* Dietel (**UROMYCES DOLICHOSPORUS** Dietel & Holway).

**UROMYCES COSTARICENSIS** H. Sydow, *Ann. Mycol.* 23: 312. 1925. TYPE on *Lasiacis sorghoidea* (Desvaux ex Ham.) Hitchcock & Chase fide Hitchcock (originally identified as *Panicum altissimum* Meyer) from **Costa Rica**, Grecia, 19 Jan 1925, *H. Sydow-178*. (??/?? **IIpe/III**).

On Gramineae.

*Lasiacis ligulata* Hitchcock & Chase, Rio de Janeiro (Ramachar & Cummins, 1963: 53).

*Lasiacis sorghoidea* (Desvaux ex Ham.) Hitchcock & Chase, Espírito Santo (IBI-4654).

*Lasiacis* sp., Amapá (IBI 17076), Goiás (IBI-13651), Minas Gerais (IBI-16241), São Paulo (IBI-13033).

*Uromyces costaricensis* has been also from Venezuela, Trinidad, Central America, and the southernmost United States of America.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, yellowish-brown, without paraphyses; urediniospores (21-)24-29(-32) x (16-)20-23(-25)  $\mu\text{m}$ , mostly obovoid; wall mostly about 1(-1.5)  $\mu\text{m}$  thick, echinulate, golden- to near cinnamon-brown, pores 3 or 4, equatorial. Telia on both sides of leaves, chocolate-brown, early exposed, erumpent; teliospores (22-)24-30(-34) x (14-)16-18(-20)  $\mu\text{m}$ , mostly ellipsoid or narrowly obovoid, wall 0.5  $\mu\text{m}$  thick at sides, 2-3  $\mu\text{m}$  thick above, golden to clear chestnut-brown, smooth; pedicels to 45  $\mu\text{m}$  long, thin-walled and collapsing, yellowish (Cummins, 1971).

Thurston (1933) sent the type specimen of *Uromyces costaricensis* to Hitchcock at the U. S. National Herbarium who identified the host as *Lasiacis sorghoidea*.

*Puccinia lasiacidis* Kern from Venezuela and and *Phakopsora lenticularis* (Mains) Buriticá are the only other rusts that have been reported on *Lasiacis*.

*Uromyces costi* P. Hennings, *Hedwigia* 34: 320. 1895. Type same as for *Uromyces dichorisandrae*. A later unnecessary nom. nov. for *U. dichorisandra* P. Hennings.. See **PUCINIA DICHORISANDRAE** (P. Hennings) J. Hennen et al.

**UROMYCES CROTALARIAE** (Arthur) J. W. Baxter, *Mycologia* 54: 439. 1962. (??,II/III).

≡ *Uropyxis crotalariae* Arthur, *Am. Jour. Bot.* 5:429. 1918. TYPE on *Crotalaria vitellina* Ker. from **Guatemala**, Dept. Amatitlan: Laguna, Lake Amatitlan, 17 Jan 1906, *Kellerman-5397*.

≡ *Haplopyxis crotalariae* (Arthur) H. Sydow & P. Sydow *Ann. Mycol.* 17: 105. 1919.

= *Uromyces harmsianus* Doidge [as "(P. Henn.) Doidge"], *Bothalia* 2: 22. 1927. TYPE on *Crotalaria lanceolata* E. Mey. from **South Africa**, Natal: Scotsburgh, 5 July 1913, *Pole-Evans-6834*.

Anamorph

*Uredo harmsiana* P. Hennings, *Hedwigia Beiblatt* 39: (154). 1900. TYPE on *Crotalaria lanceolata* E. Mey. from **South Africa**, Natal, date?, Wood-199.

On Leguminosae



*Crotalaria vitellina* Kern, Rio de Janeiro (Jackson, 1931:346; Baxter, 1962: 439; Almeida 1975: 44).

*Uromyces crotalariae* has been reported also from Central America, Mexico, and South Africa. Only uredinia of *Uromyces crotalariae* have been reported from Brazil, so to confirm its presence in Brazil, new collections with telia are needed.

Spermogonia and aecia unknown. Uredinia mostly on abaxial side of leaves, light cinnamon-brown, ruptured epidermis noticeable, pulverulent; urediniospores 22-30 x 20-24 µm, broadly ellipsoid, obovoid or globoid, wall 1.5-2(-2.5) µm thick, yellowish to golden-brown, echinulate, germ pores 6-8, mostly 8, scattered, with colorless, echinulate caps (Baxter, 1962, p. 437). Telia on abaxial side of leaves, black or chocolate-brown, pulverulent; teliospores oblate-spheroid, bluntly conoid or ovoid, assuming a globoid shape when turned to present the apical pore or point of pedicel attachment in surface view, oblate-spheroid teliospores 27-32 µm broad x 20-27 µm high, conoid or ovoid teliospores 20-27 µm broad x 24-30 µm high; wall bilaminate, inner layer 2-2.5 µm, thinner and papillate at the point of pedicel attachment, chestnut-brown, pore apical, inconspicuous; outer layer swelling in water to a thickness of 3-10 µm sharply indented at the point of pedicel attachment, colorless, yellow or pale cinnamon-brown, verrucose-echinulate, with short conical tubercles; pedicel 12-22 µm long, thin-walled, colorless, usually breaking away at the point of attachment to the spore, occasionally persistent (Almeida, 1975).

Rangel (1916) reported *Uredo crotalariae-vitillinae* also on *Crotalaria vitellina* from Rio de Janeiro. It may also belong here.

*Uromyces cuculatus* H. Sydow & P. Sydow, see **UROMYCES BLAINVILLEAE**

*Uromyces cupaniae* Arthur & Johnston, see **SKIERKA CRISTATA** Mains.

**UROMYCES DACTYLOCTENII** Wakefield & Hansford, Proc. Linn. Soc. Lond. 161: 170. 1949.

TYPE on *Dactyloctenium aegyptium* (Linnaeus.) Beauvois. from **Uganda**, Teso: Katakwi, *Hansford-1653*. (?/\* **Ипе/II**).

Anamorph

*Uredo dactylocteniicola* Spegazzini, Anal. Mus. Nac. Buenos Aires 31: 392. 1922. TYPE on *Dactyloctenium aegyptium* (Linnaeus) Beauvois from **Paraguay**: Asuncion, July 1919, ?Spegazzini-s.n.

≡ *Uromyces dactylocteniicola* (Spegazzini) Lindquist, Notas Mus. La Plata 8: 136. 1943.

TYPE same as for *Uredo dactylocteniicola* Spegazzini. The teliospores described by Lindquist are probably strays from *Uromyces* sp. on *Euphorbia* sp.

On Gramineae

*Microchloa indica* (Linnaeus f.) P. Beauvois, Brazil, locality and date not reported, (Hennen, 1954: 101, *Burchell-s.n.*).

*Uromyces dactyloctenii* has been reported also from Argentina, Paraguay, Kenya, Uganda, and the Philippines on *Dactyloctenium*. Specimens on *Microchloa* from Bolivia, Brazil, and Central Africa were reported originally as *Uromyces microchloae* Sydow (Hennen & Cummins, 1956).

Spermogonia and aecia unknown. Uredinia on both sides of leaves, 1-2 mm long, elliptical to oblong, blister-like, epidermis rupturing tardily and surrounding the sori afterwards, cinnamon-brown, pulverulent; urediniospores 22-27 x 18-24 µm, globoid to broadly ellipsoid, wall 1.5-2.5 µm thick, echinulate, colorless to light golden to pale cinnamon-brown, pores 3-4, equatorial. Telia on both sides of leaves, 0.2-0.4 mm in diameter, intermixed with the uredinia, covered by the epidermis, forming irregular black spots; teliospores 23-30 x 18-24 µm, irregular, globoid, obovoid or pyriform, usually angulate, fragile, wall 1-2 µm thick at sides, 4-5 µm thick at apex, chestnut-brown, smooth, pedicel up to 15 µm long, usually broken off shorter, thin-walled, collapsing laterally, colorless or yellowish, fragil (Cummins, 1971).

*Uromyces dactylocteniicola* (Spegazzini) Lindquist, see **UROMYCES DACTYLOCTENII** Wakefield & Hansford.

*Uromyces densus* Arthur, see **UROMYCES BIDENTIS** Lagerheim.

**UROMYCES DESMODIICOLA** Joerstad var. **DESMODIICOLA**, Ark. Bot. ser. 2, 4: 75. 1959. TYPE on *Desmodium albiflorum* Salzmänn, Leguminosae, from **Brazil**, Rio Grande do Sul: **(0/Icv,IIpeIII)**.

Spermogonia on the adaxial side of leaves, opposite the aecia. Aecia on the abaxial side of leaves, in groups, round, peridium cupulate, margin somewhat erose, whitish; aeciospores-globoid or broadly ellipsoid, mostly with angular edges, 13-19 x 11-17 µm, wall colorless, minutely verrucose, about 1 µm thick. Uredinia mostly on the abaxial side of leaves, paraphysate, minute, scattered or in groups, coalescent, ruptured epidermis noticeable, light cinnamon-brown, pulverulent; urediniospores globoid to broadly ellipsoid, 15-19 x 13-18 µm wall pale golden-brown, 1-1.5 µm, thick, densely echinulate, with 3-4 equatorial or supraequatorial germ pores, without or with small, colorless, echinulate caps. Telia chestnut-brown, otherwise as the uredinia; teliospores ellipsoid or broadly globoid, 18-26 x 13-17 µm wall about light chestnut-brown 1.5-2 µm thick, minutely reticulate, appearing minutely verrucose, with meshes to about 1 µm diam, with a paler to colorless papilla to 4 µm high at apex; pedicel colorless, thin-walled, mostly breaking near the hilum or to about 10 µm long. (Almeida, 1975)

**UROMYCES DESMODIICOLA** Joerstad var. **DESMODII** Almeida, var. nov.

Spermogonia and aecia unknown. Uredinia paraphysate, yellowish, mostly on the abaxial side of leaves, minute, scattered, soon naked, pulverulent; urediniospores globoid to broadly ellipsoid, 15-19 x 13-16 µm wall pale golden-brown, 1-1.5 µm thick, densely echinulate, with 3(4), rarely 2, equatorial or slightly above the equator germ pores, without caps or with small, colorless, echinulate caps. Telia about darkish brown, otherwise as the uredinia; teliospores broadly globoid, ovoid, ellipsoid or obovoid, 18-26 x 13-18 µm, wall about light chestnut-brown, 1.5-2 µm thick at sides, reticulate with meshes to 1.5-2 µm diam, with a paler papilla at apex to 4-5 µm high; pedicel colorless thin-walled, mostly breaking short or near the hilum, less frequently to about 20-35 µm long. (Almeida, 1975)

See *Uromyces castaneus* for a key to the species of *Uromyces* on *Desmodium* in Brazil.

*Uromyces desmodii-leiocarpi* P. Hennings, see **UROMYCES HEDYSARI-PANICULATI** (Schweinitz) Farlow.

**UROMYCES DIANTHI** (Persoon:Persoon) Niessl, Verh. Naturf. Ver. Brunn 10: 162. 1872. TYPE on *Dianthus caryophyllus* Linnaeus, from **Europe** **(0/Icv ≅ IIpe/III)**.

= *Uromyces caryophyllinus* Winter, in Rabenhorst Krypt.-Fl. 1: 149. 1889. TYPE on Anamorph

*Uredo dianthi* Persoon, Synopsis Methodica Fungorum p. 222. 1801. the type has uredinia and telia but only uredinia were described.

On Caryophyllaceae:

*Dianthus caryophyllus* Linnaeus, Minas Gerais (IBI-10581), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 122), São Paulo (Viégas, 1945: 62, IAC-506, IBI-1637).

*Uromyces dianthi* occurs worldwide where carnations are grown. In older literature this species was often reported as *Uromyces caryophyllinus*. Spermogonia and aecia of this heteroecious rust have been reported only from Europe where they occur on *Euphorbia* sp., Euphorbiaceae.

This rust develops on the stems and leaves forming large reddish brown, scattered or circinnate, dusty sori. Under some conditions the disease can be very destructive, killing heavily infected plants.

*Uromyces dichorisandrae* P. Hennings, see **Puccinia dichorisandrae** (P. Hennings) J. Hennen et al.

**UROMYCES DIETELIANUS** Pazschke, Hedwigia 30: 199. 1891. TYPE on *Bauhinia ?grandiflora* Jussieu, Leguminosae, from **Brazil**, Santa Catarina: Tubarão, April 1890, *E. Ule-1013*. **(0/Ipc,IIpe/III)**.

= *Uromyces pannosus* Vestergren, Ark. Bot. 4: 30. 1905. TYPE on *Bauhinia* sp., Leguminosae, from **Brazil**, Rio Grande do Sul: Porto Alegre near Menino Deus, 3 March 1902, *G. Malme-s.n.*

On Leguminosae:

*Uromyces dietelianus* has been reported also from Argentina and Uruguay.

Almeida (1975) was first to describe spermogonia and aecia. He also reidentified a specimen reported by Viégas (1945: 70) and two Holway specimens reported by Jackson (1931: 344), all three collected in São Paul State, as *Uromyces dietelianus* var. *dietelianus*. Viégas and Jackson originally reported these as *Uromyces perlebiae*.

Almeida (1975) separated specimens into two varieties:

1. Uredinia and telia distributed mainly along the leaf veins, urediniospores with (2-)3-4 (5-6) equatorial germ pores, teliospore pedicels not basally rugose *Uromyces dietelianus* var. *nervicola* inedit
1. Uredinia and telia mainly scattered on ab axial side of leaves, urediniospores with (3)4-5, rarely 6 or 7 equatorial germ pores, teliospore pedicels basally rugose *Uromyces dietelianus* var. *dietelianus*

See *Uromyces anthemophilus* for notes on rusts on *Bauhinia*.

#### **UROMYCES DIETELIANUS** Pазschke, Hedwigia 30: 199, 1891. var. **DIETELIANUS**.

On Leguminosae:

*Bauhinia candicans* Bentham, Rio Grande do Sul (Almeida, 1975: 57).

*Bauhinia forficata* Link, São Paulo (Almeida, 1975: 57).

*Bauhinia grandiflora* Jussieu, Santa Catarina (Pазschke, 1892: 97).

*Bauhinia pruinosa* Vogel, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 127; Almeida, 1975: 57).

*Bauhinia* sp., Ro de Janeiro (Dietel, 1899: 248; Sydow, 1907: 353; Jackson, 1931: 343; Almeida, 1975: 57), Rio Grande do Sul (Vestergren, 1905: 30), Santa Catarina (Hennings, 1896: 225; Almeida, 1975: 57), São Paulo (Almeida, 1975: 57; IBI-3305), Brasil (Pазschke, 1891: 199).

Spermogonia on the adaxial side of leaves, few, in groups. Aecia, on the abaxial side of leaves, opposite spermogonia, light cinnamon-brown, in groups, confluent, spores similar to urediniospores. Uredinia on both sides of leaves or mostly on the abaxial side, 0.1-0.5 mm diam, minute, scattered or in small groups, coalescent, pulverulent, yellow-brown to cinnamon-brown; urediniospores (18-)20-27(-29) x (15-)17-22 µm, obovoid, ellipsoid or broadly globoid, wall 1-2 µm thick, minutely echinulate, golden-brown, germ pores (3)4-5, rarely 6 or 7, equatorial or nearly equatorial, with small, colorless, echinulate caps. Telia about chestnut-brown or darkish brown, otherwise as the uredinia; teliospores 22-28(-31) x (15-)17-21(-24) µm, mostly obovoid, ellipsoid or broadly globoid, wall 1.5-2.5 µm thick at sides, pale chestnut-brown to chestnut-brown, reticulate with meshes variable in size and shape to 2-3(-4) µm diam, or sometimes forming a kind of labyrinth, with a paler, distinct and broad papilla or corona to 3-5 µm high, often irregularly undulate or serrate at apex; pedicel breaking near the hilum or to about 25 long, less frequently to 35 µm long, colorless, thin-walled, basally rugose (Almeida, 1975).

#### **UROMYCES DIETELIANUS** Paz. var. **NERVICOLA** Almeida, inedit

On Leguminosae:

*Bauhinia forficata* Link and **B. f.** var. **latifolia** Bentham, Sao Paulo (Almeida 1975: 60).

*Bauhinia* sp., Rio de Janeiro (Almeida 1975: 60).

Spermogonia on the adaxial side of leaves, few, in groups. Aecia, on the adaxial side of leaves, in groups, among or surrounding the spermogonia; aeciospores similar to urediniospores. Uredinia on both sides of leaves or mostly on the adaxial side of leaves, minute or mostly in groups, coalescent, mostly arranged linearly along or on the veins or scattered, pulverulent, cinnamon-brown, or urediniospores not numerous, mixed with teliospores; urediniospores 21-2? x (13-)15-19 µm, mostly ellipsoid or obovoid, wall 1.5-2 µm thick, golden-brown, minutely echinulate to echinulate, germ pores 3-4, rarely 2, 5 or 6, equatorial with small, colorless, echinulate caps. Telia chestnut-brown, otherwise as the uredinia; teliospores 22-31(-33) x 18-24 µm, mostly ellipsoid, obovoid or broadly globoid, wall 2-3 µm thick at sides, light chestnut-brown to chestnut-brown, with a paler, distinct and broad papilla to 3-4 µm high at apex, reticulate with meshes variable in size and shape to 3-0 µm diam; the apex of the papilla usually appearing almost smooth in silhouette; pedicel breaking near the hilum or to 20-30 µm long, less frequently to 40 µm long, colorless, thin-walled, many collapsing, not basally rugose (Almeida, 1975).

*Uromyces dolichi* Cooke, Grevillea 10: 127. 1882. The report on *Eriosema volabile* Micheli

(Leguminosae) from Santa Catarina, *Ule-95* (Pazschke, 1892: 97) is mistaken, the fungus is a *Synchytrium* sp., not rust.

**UROMYCES DOLICHOLI** Arthur, Bull. Torrey Bot. Club 33: 27. 1906. TYPE on *Rhynchosia senna* Gillies ex Hooker var. *texana* (Torrey & Grey) M. C. Johnston, Leguminosae, [identified originally as  $\equiv$  *Dolicholus texensis* (Torrey & Grey) Vail] from **The United States of America**, Texas: San Angelo, 19 Oct 1904, *C. L. Shear-s.n.* (?/?;Ipe/III).

Anamorph

*Uredo pamparum* Spegazzini, Anal., Soc. Cient. Argentina 9: 173. 1880. TYPE on *Rhynchosia* sp., probably *R. senna*, Leguminosae, from **Argentina**, Chacabuco, date?, *F. Lynch-Arribalzaga-s.n.*

= *Uredo dolichi* Arthur, Bull. Torrey Bot. Club 33: 513. 1906. TYPE on *Rhynchosia reticulata* DeCandolle (as *Dolicholus reticulatus* (Sw.) Millspaugh), from **Cuba**, Habana: Aguacate, 23 March 1903, *E. W. D. Holway-s.n.* The host genus was mistakenly reported originally as *Dolichos* and the original description published under the name *Puccinia dolichi* Arthur (Arthur, Bull. Torrey Bot. Club 33: 28. 1906). The teliospores described by Arthur were strays.

*Uromyces dolicholi* Arthur has not been reported from Brazil, but it has been reported from nearby Paraguay, Argentina, and Colombia on *Rhynchosia* sp.

Spermogonia and aecia unknown. Uredinia mostly on abaxial side of leaves, scattered, cinnamon-brown or darker, powdery; urediniospores (19-)21-26(-28) x (17-)18-22(-24)  $\mu$ m, broadly ellipsoid or obovoid; wall (1.5-)2(-2.5)  $\mu$ m thick, about cinnamon-brown, finely and uniformly echinulate, pores (2)3(4), equatorial, or slightly above, with obvious caps. Telia mostly on abaxial side of leaves, exposed, yellowish-brown, a little powdery; teliospores (22-)27-35(-38) x (9-)11-14(-18)  $\mu$ m, narrowly ellipsoid, or elongately obovoid, wall 0.5-1  $\mu$ m thick, at sides, pale golden, 3-6  $\mu$ m thick at apex by a nearly colorless umbo, smooth; pedicels up to 30  $\mu$ m long but usually broken at the hilum, colorless (Cummins, 1978).

If present, the narrowly ellipsoid, of elongately obovoid teliospores with thin (0.5-1  $\mu$ m), pale golden walls, and 3-6  $\mu$ m thick, nearly colorless, apical umbo are helpful in identifying this species.

Arthur et al. (1907-1940; part 11, 1926) and Cummins (1978) identified the rust on *Cajanus cajan* in the New World as *Uromyces dolicholi* but because telia have not been found on *Cajanus cajan* in the New World, we believe that the *Cajanus* rust should be called *Uredo cajani* H. Sydow & P. Sydow. We include collections of rust on *Cajanus* from Brazil under that name.

The rusts *Uromyces dolichi* Cooke, *Uromyces dolicholi* Arthur, *Uredo dolichi* Arthur, *Uredo cajani* H. Sydow & P. Sydow, *Uredo pamparum* Spegazzini, and *Puccinia dolichi* Arthur that have been reported on *Cajanus*, *Dolichos*, and *Rhynchosia* are confusing.

Viennot-Bourgin (1953) identified a rust with uredinia and telia on *Cajanus cajan* (pigeon pea) from the Ivory Coast as *Uromyces dolichi* Cooke and discussed the problems of determining the correct holomorph names for rusts on *Cajanus*. Teliospores of the African *Uromyces dolichi* are reticulate. No telia have been reported in rust collections up to now on *Cajanus cajan* from the New World.

Cummins (1978) identified collections on *Cajanus* from North America consisting of only uredinia as *Uromyces dolicholi* Arthur. Teliospores of *U. dolicholi* are smooth, and its type is on *Rhynchosia senna* Gillies ex Hooker var. *texana* (Torrey & Grey) M. C. Johnston [identified originally as *Dolicholus texensis* (Torrey & Grey) Vail] from Texas.

But no inoculation experiments have been done that demonstrate that the rust on *Rhynchosia* would infect *Cajanus cajan*. Because telia of a *Uromyces* have not been found on *Cajanus* in the New World, we believe it best to identify these rust populations on *Cajanus* as the anamorph taxon *Uredo cajani* as did Hennen and McCain (1993).

When abundant *Uredo cajani* causes defoliation and reduces yield of *Cajanus cajan* ("feijão guando", "pigeon pea"), a leguminous shrub that produces pods with edible seed rich in proteins, and grown in Brazil most often in home gardens.

**UROMYCES DOLICHOSPORUS** Dietel & Holway in Holway, Bot. Gaz. (Crawfordsville) 13: 327.

1901. TYPE on *Tournefortia velutina* Humboldt, Bonpland & Kunth, **Mexico** Oaxaca: Oaxaca, 18 Oct 1899, *Holway-3655*. (0/Ipe,IIpe/III).

$\equiv$  *Klebahnia dolichospora* (Dietel & Holway) Arthur, N. Am. Fl. 7: 480. 1907.

- ≡ *Argomycetella dolichosporus* (Dietel & Holway) H. Sydow, Ann. Mycol. 20: 124. 1922.  
 ≡ *Poliotetium dolichosporum* (Dietel & Holway) Mains, Bull. Torrey Bot. Club 66: 1975. 1939.

## Anamorph

- Uredo pachystegia*** Dietel, Hedwigia 38: 257. 1899. TYPE on *Tournefortia* sp., Boraginaceae (originally reported mistakenly as *Vernonia* sp., Compositae) from **Brazil**, Rio de Janeiro: Corcovado, Dec 1895, *E. Ule-2165*. *Uredo pachystegia* is the anamorph name for both aecia and uredinia of *Uromyces dolichosporus*.  
 = *Uromyces cordiae* P. Hennings Hedwigia Beiblatt 38: (129). 1899. Type on *Tournefortia* sp. (mistakenly reported originally as *Cordia* sp.) from **Brazil**, Rio de Janeiro: Petropolis, 6 Oct, 1896, *E. Ule-2376*. Only uredinia are present. The identification of the host genus is corrected here but was first suggested by The Sydows (1924, p. 567).  
 = *Uromyces tournefortiae* P. Hennings, Hedwigia 47: 267. 1908. TYPE on *Tournefortia* sp. from **Brazil**, Rio de Janeiro: Botanical Garden, *E. Ule-2535*. Only uredinia are present (P. Sydow & H. Sydow, 1910).  
 = *Uredo vernoniae* Mayor, Mem. Soc. Neuch. Sci. Nat. 5: 594. 1913. TYPE on *Tournefortia* sp. (originally reported mistakenly to be on *Vernonia cf. mollis* Humboldt, Bonpland & Kunth) from **Colombia**, Antioquia: between Rio Amaga and Angelopolis, Central Andes, 9 Sept. 1912, *Mayor-172g* (LECTOTYPE). Not *Uredo vernoniae* P. Hennings,  
 ≡ *Uredo anisoderma* P. Sydow & H. Sydow, Monogr. Ured 4: 400. 1924, *nom. nov.* for *Uredo vernoniae* Mayor.

## On Boraginaceae:

***Tournefortia sericea*** Vahl, Minas Gerais (Jackson, 1931: 502), Rio de Janeiro (Jackson, 1931: 502).

***Tournefortia velutina*** Humboldt, Bonpland & Kunth, Rio de Janeiro (Jackson 1931: 502).

***Tournefortia villosa*** Salzman, Minas Gerais (Thurston, 1940: 307).

***Tournefortia*** sp., Minas Gerais (IBI-13178), Rio de Janeiro (Dietel, 1899: 257), São Paulo (Jackson, 1931: 502; IBI-1731), Brazil (Joerstad, 1956: 456).

*Uromyces dolichosporus* has been reported also from Argentina, Bolivia, Ecuador, Venezuela, Cuba, Puerto Rico, Costa Rica, and Mexico.

Spermogonia on the adaxial side of leaves, few, scattered, inconspicuous. Aecia associated with the spermogonia, otherwise like the uredinia. Uredinia 0.2-0.6 mm across, blister-like at first then erumpent, powdery, ruptured epidermis conspicuous, dark cinnamon- to chestnut-brown, more or less in circular groups or scattered over large areas, often on brownish, orbicular spots, on both sides of leaves and on stems. Anamorph spores (30-)32-42(-50) x (19-)21-23(-27) µm, walls 2-2.5 µm thick laterally, usually abruptly thickened 5-10 µm apically, dark to light cinnamon-brown, strongly echinulate, spines (3-)4-7(-8) µm apart, pores (2-)3(4), usually obvious, scattered around sides or more or less equatorial. Telia like the uredinia but pulvinate, orange-yellow or grayish-white by germination, ruptured epidermis inconspicuous; teliospores 39-58 x 13-23, µm, fusiform or cylindrical, usually narrowed above and below, wall 1 µm or less thick, colorless, not thickened at apex, smooth, pedicel once to twice the length of spore, colorless, persistent. Teliospores germinate without dormancy by apical elongation.

The cinnamon- to chestnut-brown, abruptly, apically thickened anamorph spore walls of *Uromyces dolichosporus* are especially useful for identification.

*Uromyces dubiosus* P. Hennings, see **PUCCINIA HYPTIDIS-MUTABILIS** Mayor.

**UROMYCES EMMEORHIZAE** H. Sydow, Ann. Mycol. 28: 38. 1930. TYPE on *Emmeorhiza umbellata* (Sprengel) K. Schumman from **Venezuela**, El Limon, date not reported, *Sydow-296*. (?!?, **Ipe/III**).

## On Rubiaceae.

***Emmeorhiza umbellata*** (Sprengel) Schumann, Rio de Janeiro (Jackson, 1932:100).

*Uromyces emmeorhizae* has been reported from Colombia, Bolivia, Brazil, and Venezuela.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, on indeterminate, yellowish spots, scattered or loosely grouped, minute, punctiform, pulverulent, surrounded by the ruptured epidermis, reddish brown, urediniospores 24-30 x 22-24 µm, globose, broadly ovoid, to pyriform, wall brownish, evenly echinulate, germ pores 2, equatorial. Telia similar to the uredinia but indistinct, blackish brown, teliospores

25-34 x 22-25  $\mu\text{m}$ , globose-ovoid, ellipsoid to pyriform, wall 1.5-2  $\mu\text{m}$  thick laterally, thickened at the apex with a papilla 7-11  $\mu\text{m}$  thick, smooth, chestnut-brown, pedicel up to 30  $\mu\text{m}$  long, 6-8  $\mu\text{m}$  wide, colorless (Sydow, 1930).

**UROMYCES ERAGROSTIDIS** Tracy, Jour. Mycol. 7: 281. 1893. TYPE on *Eragrostis pectinacea* (Michaux) Nees from **The United States of America**, Mississippi: Starkville, Oct 1891, Tracy s.n. (**0/Icv<sup>s</sup> IIpe/III**).

Anamorph

*Aecidium anthericicola* Arthur, Bull. Torrey Bot. Club 45: 149dl. 1918. TYPE on *Anthericum nanum* Baker, Liliaceae, from **Mexico**, Mexico state: near Tlalpam, 30 June 1905, Rose, et al. 8246. Cummins (1963) proved the connection by inoculation using material from Arizona.

On Gramineae.

*Eragrostis ciliaris* (Linnaeus) Link, Rio de Janeiro (PUR-F2354), São Paulo (Viégas, 1945: 63; IAC-1443).

*Eragrostis pilosa* (Linnaeus) Beauvois, Minas Gerais (Thurston, 1940: 307), Rio de Janeiro (PUR-F2355), São Paulo (IAC-1355, -2728).

*Eragrostis virescens* Presl., São Paulo (IAC-7241).

*Uromyces eragrostidis* has been reported also from Bolivia, Peru, Colombia, Venezuela, North America, and Africa and Asia.

Spermogonia and aecia (*Aecidium anthericicola* Arthur; ? = *A. antherici* P. Hennings & Pole Evans, on species of *Anthericum* spp.), aeciospores 19-23 x 16-20  $\mu\text{m}$ , wall 1.5  $\mu\text{m}$  thick, colorless, verrucose. Uredinia on both sides of leaves and on sheaths, yellowish brown; urediniospores (20-)21-29(-31) x (16-)18-23(-26)  $\mu\text{m}$ , mostly broadly ellipsoid or nearly globoid, wall 1.5  $\mu\text{m}$  thick, golden to pale cinnamon-brown, echinulate, pores variable (3)4-8(-10), equatorial or tending equatorial when 3-5, scattered when 5-8, or bizonate when 7-10. Telia blackish brown, early exposed, compact; teliospores (22-)23-31(-34) x (16-)18-23(-25)  $\mu\text{m}$ , mostly obovoid, wall 1.5-2.5(-3)  $\mu\text{m}$  thick at sides, 4-6(-8)  $\mu\text{m}$  at apex, chestnut-brown, smooth; pedicels yellowish to brownish, thin-walled and usually collapsing, to 75  $\mu\text{m}$  long (Cummins, 1971).

We measured urediniospore walls as 2-2.5  $\mu\text{m}$  thick on a specimen from São Paulo Botanical Garden (now Horto Florestal) collected by Puttemans-1773.

*Uromyces eriochloana* H. Sydow & P. Sydow & Butler, see **UROMYCES SETARIAE-ITALICAE** Yoshino.

*Uromyces erythrinae* Lagerheim see **UROMYCES CLITORIAE** Dietel.

**UROMYCES EUPHORBIAE** Cooke & Peck in Peck, Ann. Rept. New York State Mus. 25: 90. 1873.

TYPE reported as on *Euphorbia hypericifolia* L., perhaps *E. maculata* L., from **United States of America**, New York: Albany, date and collector not available. (**0/Icv,IIpe/III**).

= *Uromyces euphorbiicola* (Berkeley Curtis) Tranzschel, Ann. Mycol. 8: 8. 1910.

= *Uromyces euphorbiicola* Tranzschel, Ann. Mycol. 8: 8. 1910.

= *Uromyces tordillensis* Spegazzini Anal. Mus. Nac. Buenos Aires 6: 214. 1899.

Anamorph

*Uredo proëminens* DeCandolle, Fl. France 2: 235. 1805.

≡ *Uredo proëminens* DeCandolle. ex Duby, Bot. Gall. p. 896, 1830.

≡ *Uromyces proëminens* (DeCandolle) Lèveillé, 1847. Teleomorph not described.

≡ *Uromyces proëminens* (DeCandolle) Passerini in Rabenhorst Fung. Eur. No. 1795. 1873. Teleomorph not described.

On Euphorbiaceae.

*Euphorbia heterophylla* L., Rio de Janeiro (Barreto and Evans, 1998).

*Euphorbia hirta* L. (sometimes reported as *Euphorbia pilulifera* L.), Minas Gerais (Thurston, 1940: 309; Viégas & Teixeira, 1945: 50; IAC-5039), Pará (Dietel, 1909: 262; Albuquerque, 1971: 149; IAN-578), Paraíba (Viégas, 1945: 63; IAC-2697), Santa Catarina (Hennings, 1896: 223), Rio de Janeiro (HNR-337; Barreto and Evans, 1998), São Paulo (Jackson, 1931: 471; Viégas, 1945: 63; IAC-66; Joerstad, 1956), Brasil (Tranzschel, 1910; 8).

*Euphorbia* sp., Paraíba (Viégas, 1945: 63; IAC-3804), Rio de Janeiro (Hennings, 1904A: 79), Brasil (Rick, 1908: 106).

*Uromyces euphorbiae*, reported often in older literature as *Uromyces proëminens*, is a widespread species complex reported from throughout warmer regions of the world on many weedy species of *Euphorbia*. Most host species are separated sometimes as *Chamaesyce* spp.

Spermogonia and aecia from systemic infections. Spermogonia on abaxial side of leaves, few, widely scattered. Aecia mostly on adaxial side of leaves, evenly and often densely scattered, short, cupulate; peridium somewhat recurved; peridial cells 18-25 x 13-19  $\mu\text{m}$ , rhomboid, slightly overlapping, outer facing wall 4-7  $\mu\text{m}$  thick, transversely striate to smooth, inner facing wall ca 3  $\mu\text{m}$  thick, somewhat striate and finely verrucose; aeciospores 15-18 x 13-19  $\mu\text{m}$ , globoid to broadly ellipsoid; wall ca 1  $\mu\text{m}$  thick, finely and densely verrucose, pale yellow or colorless. Uredinia on both sides of leaves, 0.4-1 mm across, scattered or sometimes in circular or crowded groups, erumpent, ruptured epidermis not conspicuous, powdery, cinnamon-brown; urediniospores 19-23 x 15-20  $\mu\text{m}$ , globoid or broadly ellipsoid; wall 1.5-2  $\mu\text{m}$ , moderately and sparsely echinulate, golden-brown; pores 3-6, scattered. Telia on both sides of leaves, 0.4-1 mm across, scattered or sometimes in circular groups, erumpent, ruptured epidermis inconspicuous, pulvinate, somewhat powdery, dark chocolate-brown; teliospores 18-26 x 15-18  $\mu\text{m}$ , broadly ellipsoid obovoid, usually rounded at both ends; wall ca 1.5  $\mu\text{m}$  thick, cinnamon-brown, with a lighter colored, flattish or conical papilla over the germ pore, moderately verrucose with verrucae scattered or sometimes arranged in more or less evident longitudinal rows; pedicel short, colorless, deciduous (Arthur, 1912).

Teliospores are mostly verrucose, sometimes having the verrucae in irregular rows, and sometimes almost smooth. In some collections teliospores may be relatively thin-walled (1-1.5  $\mu\text{m}$ ) or in others thicker (2-2.5  $\mu\text{m}$ ). Urediniospores have germ pores often few (3-4) and more or less equatorial, or a few more pores and seemingly scattered.

Some collections have been separated as distinct species or varieties, but there is much intergradation of morphological traits so that distinctly different, morphological taxa cannot be determined.

See Arthur (1934) for additional references for synonyms.

*Uromyces fabae* DeBary, see **UROMYCES VICIAE-FABAE** Schroeter.

**UROMYCES FLORALIS** Vestergren, Ark. Bot. 4: 23. 1905. **(0/-, -/III)**.

= *Uromyces verus* H. S. Jackson & Holway in Jackson, Mycologia 32: 344. 1931. Type on *Bauhinia rufa* Stendel from **Brazil**, Minas Gerais: Belo Horizonte, 21 Nov 1921, *Holway-1319*.

On Leguminosae.

*Bauhinia cuyabensis* Stendel, Mato Grosso (Vestergren, 1905: 223; Almeida, 1975: 50).

*Bauhinia hiemalis* Malme, Mato Grosso (Vestergren, 1905: 23; Almeida, 1975: 50).

*Bauhinia holophylla* Stendel, Minas Gerais (Vestergren, 1905: 23; Almeida, 1975: 50).

*Bauhinia rufa* Stendel, Minas Gerais (Almeida, 1975: 50), São Paulo (Almeida, 1975: 50).

*Bauhinia* sp., São Paulo (Vestergren, 1905: 23; Sydow, 1907: 253; Viégas, 1945: 65; IAC-3295).

*Uromyces floralis* has been reported only from Brazil. The sori of *Uromyces floralis* are on the inflorescences and leaves.

Spermogonia mixed with telia, few, punctiform, or lacking. Aecia and uredinia unknown. Telia, on flowers, stems, or on both sides of leaves, cinnamon-brown, scattered or in groups, coalescent, 1-10 mm to 15 mm long, long covered by the epidermis, later pulverulent, ruptured epidermis conspicuous; teliospores obovoid, globoid or ellipsoid, (17-)20-24(-26) x (15-)17-20  $\mu\text{m}$ , wall golden or light cinnamon-brown, (1.5-)2-2.5(-3)  $\mu\text{m}$  thick, minutely and uniformly reticulate with meshes about 1-1.5  $\mu\text{m}$  diam, slightly thickened at apex with a paler, low papilla to 2  $\mu\text{m}$  high; pedicel usually breaking near the hilum, rarely to about 80  $\mu\text{m}$  long, colorless, thin-walled (Almeida, 1975).

See *Uromyces anthemophilus* for notes on rusts on *Bauhinia*.

**UROMYCES FLOSCOPAE** H. Sydow & P. Sydow, Ann. Mycol. 14: 66. 1916. TYPE on *Floscopa* sp. from **Brazil**, Acre: Rio Acre, Seringal São Francisco, Oct 1911, *Ule-3511* (??, II/III).

Anamorph

*Uredo floscopae* P. Hennings, Hedwigia 43: 164. 1904. LECTOTYPE on *Floscopa peruviana* Hassk. from **Brazil**, Rio Jurua, Cachoeira, May 1901, *Ule-2696*.

On Commelinaceae.

*Floscopa peruviana* Hassk., Amazonas (Hennings, 1904B: 164).

*Floscopa* sp., Seringal, São Francisco (Sydow, 1916: 66).

Only one other collection of *Uromyces floscopae* has been reported: It is on *Floscopa peruviana* from **Peru**, Yurimaguas, Aug 1902, *Ule-3173*.

Spermogonia and aecia unknown. Uredinia on abaxial side of leaves, scattered or in groups, soon erumpent, pulverulent, cinnamon-brown; urediniospores 19-28 x 15-23 µm, globoid, ovoid or ellipsoid, wall 2 µm thick, distinctly echinulate, yellowish-brown, germ pores 2, equatorial. Telia on abaxial side of leaves, scattered, small, relatively compact, reddish brown; teliospores 19-24 x 15-18 µm, ovoid or ellipsoid, rounded or somewhat narrowed at apex, wall 5-9 µm thick at apex, yellowish or bright yellow-brown at sides, colorless or almost so at thickened apex, smooth, pedicel very short (H. & P. Sydow, 1924).

**UROMYCES FOVEOLATUS** Juel, Bih. Till K. Svenska Vet.-Akad. Handl. 23: 16. 1897. TYPE on *Bauhinia* sp. from **Brazil**, Mato Grosso: near Cuiaba, 29 May 1893, *Malme-s.n. (?/?,Ipe/III)*.  
On Leguminosae.

*Bauhinia hirsuta* Vogel, Mato Grosso (Almeida, 1975: 54).

*Bauhinia mirandina* Pittier, Minas Gerais (Almeida, 1975: 54).

*Bauhinia* sp., Mato Grosso (Juel, 1897: 16), Minas Gerais (Almeida, 1975: 54). Rio de Janeiro (Jackson, 1931: 343), São Paulo (Jackson, 1931: 343).

*Uromyces foveolatus* has been reported only from Brazil.

Spermogonia and aecia unknown, Uredinia mostly on the abaxial side of leaves, 0.1-0.5 mm diam, scattered, pulverulent, cinnamon-brown; urediniospores, 22-26(-28) x 20-25 µm, globoid to broadly ellipsoid or obovoid, wall 2-2.5 µm thick, golden-brown to light cinnamon-brown, echinulate, germ pores 4(5), rarely 6 or 3, equatorial, with colorless, echinulate caps. Telia blackish brown, otherwise as the uredinia; teliospores 22-29 x 20-24 µm, globoid to broadly globoid or ellipsoid, wall dark chestnut-brown, bilaminar, distinctly reticulate with meshes to 2-2.5 µm diam, inner wall 1-1.5 µm thick, outer wall not distinct, paler, 1.5-2.5 µm thick, thinner toward the base, and thicker at apex, usually forming a paler and distinct umbo, also reticulate, to 3-5 µm high; pedicel to about 20-25 long, colorless, thin-walled, basally rugose (Almeida, 1975).

See *Uromyces anthemophilus* for notes on rusts on *Bauhinia*.

*Uromyces galactiae* Rezende & Dianese, see **UROMYCES NEUROCARPI** Dietel

*Uromyces gemmatus* Berkeley & Curtis, see **UROMYCES BRASILIENSIS** Trotter.

*Uromyces giganteus* Dietel, see **UROMYCES BRASILIENSIS** Trotter.

**UROMYCES GERANII**\_\_\_\_\_.

On Geraniaceae.

*Geranium* sp., Brazil, state not listed (IBI 17538).

**UROMYCES GOYAZENSIS** P. Hennings, Hedwigia 34: 89. 1895. TYPE on *Bauhinia* from **Brazil**, Goiás: Meiponte, August 1892, *Ule-1907. (-I-, -III)*.

On Leguminosae.

*Bauhinia* sp., Espírito Santo (Viégas, 1945: 65), Goiás (Hennings, 1895A: 89), Almeida, 1975: 49), São Paulo (Almeida, 1975: 49; IAC-1969).

*Uromyces goyazensis* has been reported only from Brazil.

The blackish-brown telia occur on branches of the inflorescence, are confluent and elongate up to 2 cm, and powdery.

Spermogonia, aecia and uredinia unknown. Telia on branches of inflorescence and on fruits, minute, round, or in groups, confluent, 0.2-0.5 cm to 2 cm across, cushion-shaped, ruptured epidermis conspicuous, pulverulent, dark cinnamon-brown; teliospores (18-)20-30(-32) x (15-)18-22(-24) µm, ellipsoid, obovoid or globoid, wall 2-3 µm thick, pale brown, slightly thickened at apex to 2 µm high with a paler, low papilla not abruptly differentiated, slightly and minutely reticulate, appearing smooth, with meshes about 0.5-1 µm diam; pedicel, breaking near the hilum, or mostly to 80-100 µm long, colorless, thin-walled (Almeida, 1975).



See *Uromyces anthemophilus* for notes on rusts on *Bauhinia*.

*Uromyces guatemalensis* Vestergren, see **UROMYCES BAUHINIAE** P. Hennings.

### UROMYCES GURANIAE

Spermogonia, aecia, and uredinia(?) unknown. Urediniospores in telia, 19.26 x 15 - 19  $\mu$ m, broadly ellipsoid or globoid, wall 1 - 1.5  $\mu$ m thick, yellowish or pale cinnamon-brown, moderately echinulate; pores 2, equatorial. Telia on abaxial side of leaf, without spots, 1 - 1.5 mm across, scattered, to grouped, round, sometimes confluent, dark brown, soon erumpent powdery; teliospores 15 - 19 x 16 - 24  $\mu$ m, globoid to ovoid, rounded or sometimes narrowed above; wall 2 - 2.5  $\mu$ m thick at sides, up to 7  $\mu$ m thick at apex, light brown but often darker above, pore apical; pedicel up to 40  $\mu$ m long x 3 - 5  $\mu$ m wide, hyaline, persistent. (telial description after Mayer, 1913; uredinial description after Kern, *et al.*, 1933).

*Uromyces harmsiana* P. Hennings, see **UROMYCES CROTALARIAE** (Arthur) J. W. Baxter.

*Uromyces harmsianus* Doidge, see **UROMYCES CROTALARIAE** (Arthur) J. W. Baxter.

**UROMYCES HEDYSARI-PANICULATI** (Schweinitz) Farlow in Ellis, N. Amer. Fung. no 246. 1879.

NEOTYPE on *Desmodium paniculatum* (Linnaeus) DeCandolle from **The United States of America**, New Jersey: Newfield, 1879, Ellis [Neotype chosen by Cummins (1978) from the exsiccati "North American Fungi number 246"]. (??,II/III).

= *Puccinia hedysari-paniculati* Schweinitz, Schrift. Naturf. Ges. Leipzig 1: 74. 1822.

= *Uromyces desmodii-leiocarpi* P. Hennings, Hedwigia 48: 1. 1909. TYPE on *Desmodium leiocarpum* G. Don from **Brazil**, São Paulo, São Paulo Botanical Garden, July 1902, Puttemans-107.

Anamorph

*Uredo desmodii-tortuosi* P. Hennings, Hedwigia 35: 252. 1896. TYPE on *Desmodium tortuosum* DeCandolle from **Puerto Rico**, Fajardo, 17 April 1885, O. Sintenis-s.n.

= *Uredo desmodiicola* Spegazzini, Anal. Museo. Nac. Buenos Aires (Argentina) 6:234. 1899. TYPE on *Desmodium* sp. from **Argentina**, Buenos Aires: La Plata, Feb 1890, Spegazzini-s.n.

= *Uredo desmodii-leiocarpi* P. Hennings, Hedwigia 41: 107. 1902. TYPE on *Desmodium leiocarpum* G. Don from **Brazil**, São Paulo: São Paulo Botanical Garden, 23 April 1901, G. Don-209.

= *Uredo amagensis* Mayor, Soc. neuchatel. dees Sc. nat. 5: 584. 1913. LECTOTYPE on *Desmodium tortuosum* DeCandolle from **Colombia**, Antioquia: Rio Amaga, 26 Aug 1910, Mayor-267.

On Leguminosae

*Desmodium leiocarpum*, G. Don, São Paulo (Almeida, 1975: 41).

*Desmodium uncinatum* DeCandolle, Rio de Janeiro (Almeida, 1975: 41), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 127; Almeida, 1975: 41), São Paulo (Almeida, 1975: 41).

*Desmodium* sp., Federal District (IBI 12477), Mato Grosso do Sul (IBI 14355), Minas Gerais (Almeida, 1975: 41), Rio de Janeiro (Hennings, 1896: 224; Jackson, 1931: 353; Almeida, 1975: 41), Rio Grande do Sul (Almeida, 1975: 41), São Paulo (Jackson, 1931: 353; Almeida, 1975: 41).

*Uromyces hedysari-paniculati* has been reported as being widespread on many species of *Desmodium* from Argentina to The United States of America.

Spermogonia on the adaxial side of leaves or lacking. Aecia on abaxial side of leaves, on the abaxial side of leaves, in small groups, peridium cupulate, whitish, with erose margin; aeciospores 15-22(-24) x 13-18(-23)  $\mu$ m, globoid or broadly ellipsoid, mostly with angular edges, wall colorless, about 1  $\mu$ m thick, minutely verrucose. Uredinia mostly on the abaxial side of leaves, scattered, minute, with ruptured epidermis noticeable, pulverulent, light cinnamon-brown; paraphyses mostly clavate, many 12-20  $\mu$ m wide apically, colorless; urediniospores 19-24(-26) x 16-22  $\mu$ m, broadly ellipsoid, obovoid or globoid, wall 1-2  $\mu$ m thick, echinulate, golden-brown, germ pores (3)4-7(8), scattered, with colorless, echinulate caps. Telia mostly on

the abaxial side of leaves, or adaxial, darkish brown, otherwise as the uredinia; teliospores 20-29(-32) x 15-22 µm, ovoid, ellipsoid, broadly ellipsoid or subglobose, wall (2-)2.5-3 µm at sides, chocolate-brown or chestnut-brown, with a paler umbo 4-7 µm thick at apex, varying from verrucose, with irregular warts and ridges forming a kind of labyrinth, to irregularly or regularly reticulate; pedicel to 40-60 µm long, colorless, but mostly brownish yellow near hilum, some collapsing (Almeida, 1975).

Almeida (1975) records the more important traits that help to identify *Uromyces hedysari-paniculati* as: uredinia with colorless, mostly clavate paraphyses, many of these 12-20 µm wide apically, urediniospores with (3-)4-7(-8) scattered germ pores, and teliospore walls varying from verrucose with irregular warts and ridges forming a kind of labyrinth to regularly or irregularly reticulate.

The reports of an *Aecidium* sp. as an aecial stage of *Uromyces hedysari-paniculati* in South America requires confirmation.

See *Uromyces castaneus* for a key to the species of *Uromyces* on *Desmodium* in Brazil.

*Uromyces hellerianus* Arthur, see **UROMYCES NOVISSIMUS** Spegazzini.

**UROMYCES HEMMENDORFII** Vestergren, Ark. Bot. 4: 32. 1905. TYPE on *Bauhinia forficata* Link (Leguminosae) from **Brazil**, São Paulo: Fazenda Santa Albertina near Santa Rita do Passa Quatro, 28 Dec 1899, *Hemmendorf*-s.n. (?!?,II/III).

*Uromyces hemmendorffii* has been reported with certainty only from the type.

Spermogonia and aecia unknown. Uredinia not seen. Urediniospores in telia (only a few seen), 23-28 x 15-17 µm, ellipsoid or ovoid, wall 2 µm thick, sparsely echinulate, yellow-brown, germ pores 4, equatorial. Telia on adaxial side of leaves, scattered, punctiform, pulverulent, chestnut-brown; teliospores 18-22 x 16-18 µm, globose, subglobose or broadly ellipsoid, apex rounded, wall, 2.5 µm thick, minutely reticulate, yellow-brown, with a papilla to 2.5 µm high or absent; pedicel short, deciduous (Almeida, 1975).

Traits that help to identify the species are: uredinia without paraphyses, urediniospores with four equatorial germ pores, teliospores 18-22 x 16-18 µm, without a broad and distinct corona or papilla, teliospore walls minutely reticulate, yellow brown, and not bilaminar. The identifications of the collections reported by Viégas (1945) and Jackson (1931) need to be confirmed.

See *Uromyces anthemophilus* for notes on rusts on *Bauhinia*.

**UROMYCES HERTERIANUS** Dietel, Rev. Sudamericana de Botanica 4: 81. 1937. TYPE on *Spermocoe verticillata* Linnaeus from **Uruguay**, Durazno: Rio Yi, 12 March 1928, *Herter*-83168. (?!?,IIpe/III).

On Rubiaceae.

*Spermocoe* sp., São Paulo (IBI 14225).

*Uromyces herterianus* has been reported also from Uruguay and Argentina.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, urediniospores 25-32 x 20-22 µm, ellipsoid to obovoid, the wall 1.5-2 µm, thick, pardo-brillante, echinulate, germ pores 2(-3), equatorial; telia long covered by the epidermis, teliospores 29-43 x 22-29 µm, ellipsoid, globose, or irregularly angular due to pressure, narrowed or truncate above, wall 2-2.5 µm thick laterally, 4-6 µm above, smooth, chestnut-brown, pedicel about the same length as the spore, lightly pigmented (Lindquist, 1982).

See also *Uromyces holmbergii* which appears to be very similar.

**UROMYCES HETERANTHERAE** P. Sydow & H. Sydow. [as "(P. Henn.) Syd."] Mon. Ured. 2: 291. 1910. TYPE. The Sydows did not report the specimen from which they described teliospores. See *Uredo heterantherae* below for two collections reported by Hennings. Presumably the Sydows described teliospores from *Ule-1006*, which was distributed in the excicatti *Rabenhorst & Winter, Fungi europi*, No. 3829, which was cited by the Sydows. (?!?,IIpe/III).

Anamorph

*Uredo heterantherae* P. Hennings, Hedwigia 35: 248. 1896. TYPE on *Heteranthera reniformis* Ruiz & Pavon, Pontederiaceae, from **Brazil**, Santa Catarina: Blumenau. Two collections were reported by Hennings: Nov 1887, *Ule-895*; Tubarão, and Feb 1889, *Ule-1006*. Known only from these two collections.

*Uromyces heterantherae* has been reported only from the two specimens listed above.

Spermogonia and aecia unknown. Uredinia on minute, yellowish to brownish spots both sides of leaves, scattered or sometimes in groups, erumpent, the ruptured epidermis evident, powdery, yellow-brown to brown, urediniospores 18-28 x 18-25  $\mu\text{m}$ , globoid, subgloboid, ovoid to ellipsoid, wall more or less evenly 1-1.5  $\mu\text{m}$  thick, lightly echinulate, yellow to yellow-brown, pores mostly 4 (5-8), equatorial. Teliospores mixed in the uredinia 20-28 x 14-20  $\mu\text{m}$ , ovoid to pyriform, rounded above, wall 6-11  $\mu\text{m}$  thick above, smooth, chestnut-brown, pedicel as long as or somewhat longer than the spore, thick-walled, colorless but colored near the spore, persistent (The Sydows, 1910).

*Uromyces hieronymianus* P. Hennings, see **PROSPODIUM SINGERI** Petrak

**UROMYCES HOLMBERGII** Spegazzini, Bol. Acad. Nac. Cienc. Cordoba 11: 479. 1889. TYPE on *Mitracarpus* sp. from **Brazil**, São Paulo: Apiaby, April 1888, *Puiggari-2607*. (?/Icv/IIpe/III).

Anamorph

*Uredo holmbergii* Spegazzini, Anal. Soc. Cient. Argentina 12: 74. 1881. LECTOTYPE on *Mitracarpus sellowianus* Chamisso & Schlechtendal from **Argentina**, Buenos Aires: FTigre, March 1881, *Holmberg* (LPS-4478). Lectotype designated by Lindquist, 1951: 1-3.

On Rubiaceae.

*Diodia dasycephala* Chamisso & Schlechtendahl, Rio Grande do Sul (Lindquist & Costa Neto, 1967: 62), São Paulo (IBI-16968A).

*Mitracarpus* sp., São Paulo (Spegazzini, 1889; 479).

*Spermococe verticillata* Linnaeus [= *Borreria verticillata* (Linnaeus) Meyer], Pará (Museu Goeldi).

*Uromyces holmbergii* has been reported only from Argentina and Brazil.

Spermogonia unknown. Aecia in small groups on the abaxial side of leaves; peridial cells polygonal, outer facing wall smooth, inner facing wall verucose, aeciospores 14-18 x 16-18  $\mu\text{m}$ , narrowly ellipsoid or polyhedral by compression, wall thin, colorless, with very small spines. Uredinia on both sides of leaves, cinnamon-brown, erumpent, surrounded by the broken epidermis; urediniospores 22-26 x 16-20  $\mu\text{m}$ , ellipsoid to obovoid, wall 1.5-2  $\mu\text{m}$  thick, cinnamon-brown, echinulate, spines easily visible and well spaced, germ pores 2, equatorial. Telia on both sides of leaves and on stems, 0.1-0.7  $\mu\text{m}$  across, long covered by the epidermis, blackish, easily overlooked, those on stems larger and more obvious; teliospores 24-30 x 22-25  $\mu\text{m}$ , ellipsoid, globoid to polyhedral by compression, wall 1.5-2  $\mu\text{m}$  thick at sides, 3.5-4  $\mu\text{m}$  at apex, smooth, chestnut-brown, pedicel as long as or longer than spore, colorless (Lindquist, 1982: 203).

*Uromyces herterianus* Dietel, reported above and recorded on *Spermococe* sp., is very similar. Its teliospores are 29-43 x 22-29  $\mu\text{m}$  with apical walls 4-6  $\mu\text{m}$  thick.

*Uromyces howei* Peck, see **UROMYCES ASCLEPIADIS** Cooke.

*Uromyces hyperici* Curtis, see **UROMYCES TRIQUETRUS** Cooke.

*Uromyces hyperici-frondosi* (Schweinitz) Arthur, see **UROMYCES TRIQUETRUS** Cooke.

**UROMYCES HYPOXIDIS** Cooke, Grevillea 10: 127. 1881.

On Amaryllidaceae.

*Hypoxis decumbens* L., São Paulo (Viégas, 1945: 65; IAC-3219).

*Uromyces imperfectus* Arthur, the report by Thurston, 1940, is erroneous fide Almeida, 1975.

**UROMYCES INDURATUS** H. Sydow & P. Sydow & Holway in Sydow, Ann. Mycol. 1: 16. 1903.

TYPE on *Dicliptera* sp. from **Mexico**: Morelia, 18 Oct 1899, *Holway*-. (?/?/IIcv/III).

≡ *Uromycopsis indurata* (H. Sydow & P. Sydow & Holway) Arthur, Result. Sci. Congr. Intern. Bot., Wien 1905, p. 345. 1906.

≡ *Groveola indurata* (H. Sydow & P. Sydow & Holway) H. Sydow, Ann. Mycol. 19: 173. 1921.

Anamorph

*Aecidium tweedianum* Spegazzini, Anal. Soc. Cient. Argentina 10: 11(?17). 1880. TYPE on

- Dicliptera tweediana* from **Argentina**, Boca del Riachuela, Apr 1880, *Spegazzini-s.n.*  
 ≡ *Pucciniola tweediana* (Spegazzini) Arthur, N. Amer. Flora 7: 453. 1921.  
 ≡ *Uromyces tweedianus* (Spegazzini) Bartholomew, Handbook North American Ured.,  
 ed. 1, p. 73. 1928.

On Acanthaceae.

*Dicliptera squarrosa* Nees, Santa Catarina (Laundon, 1963: 82).

*Dicliptera* sp., Santa Catarina (Hennings, 1896: 254).

*Justicia racemosa* Ruiz & Pavon, Santa Catarina (Hennings, 1896: 254).

*Uromyces induratus* has been reported also from Argentina, Bolivia, and Mexico. Reports of *Aecidium tweedianum* from Ethiopia, India, and Indonesia need to be confirmed.

Spermogonia and aecia unknown. Uredinia reported as aecia (*Aecidium tweedianum*) on abaxial side of leaves, 0.15-0.25 mm diam, cupulate, densely grouped on spots to 8 mm across, causing some hypertrophy, subepidermal in origin, peridial cells 23-32 x 13-19 μm, rectangular to rhomboidal in face view, external walls 4-6 μm thick, striate, internal walls 2-3 μm, labyrinthiform-rugose; urediniospores 16-21 x 13-17 μm in diameter, globoid, often angular, wall 0.75-1 μm thick, irregularly closely and inconspicuously verrucose, colorless. Telia on the abaxial side of leaves, often grouped in close association with the uredinia or on stems, very dark brown, about 1 mm in diameter or up to 3 mm long on stems, stromatic, the paraphyses darkly pigmented, dividing the sorus into a number of chambers; teliospores 25-33 x 13-17 μm, variable, cylindrical, ellipsoidal, fusiform, obovoid, etc., obtuse or acute, wall 1-2 μm thick at sides, 3-6 μm thick above, pale yellowish to colorless, smooth, pedicel about 30 μm long, persistent colored like the spores (Laundon, 1963).

No spermogonia have been reported yet for this species. We consider the *Aecidium sori* as uredinia but they have been reported as aecia. When spermogonia are discovered the aecia will probably have the morphology also of this *Aecidium*.

A report (Hennings, 1896: 257) of *Aecidium wittmackianum* P. Hennings on *Dicliptera* from Santa Catarina is mistaken, the rust is *Aecidium tweedianum* Spegazzini, anamorph of *Uromyces induratus*. *Aecidium wittmackianum* P. Hennings is an anamorph of *Puccinia thunbergiae* M. C. Cooke and has been reported on several genera of Acanthaceae from Africa and Asia.

*Uromyces induratus* is the type of the monotypic genus *Groveola* Sydow, a genus not used any more.

*Uromyces ingaeiphilus* Spegazzini, see **CHACONIA INGAE** (H. Sydow) Cummins.

*Uromyces ingicola* P. Hennings, see **CHACONIA INGAE** (H. Sydow) Cummins.

**UROMYCES INSIGNIS** P. Sydow & H. Sydow, Mon. Ured. 2: 6. 1910. TYPE on *Melanthera* sp. (recorded originally as *Echinocephalum latifolium* Gardner), Compositae, from **Brazil**, place and date not recorded, *Sellow s.n.* (?/?, II/III).

*Uromyces insignis* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

*Uromyces insularis* Arthur, see **UROMYCES NEUROCARPI** Dietel.

**UROMYCES IPATINGAE** Ferreira & Y. Hiratsuka., Fitopat. Bras. 1: 219. 1976. TYPE on

*Clitoria fairchildiana* Howard (= *Clitoria racemosa* Benth) from **Brazil**, Pará:

Anamorph:

**Uredo goeldii** R. T. Almeida, Fitopat. Bras. 1: 219. 1976. TYPE on *Clitoria fairchildiana* Howard (= *Clitoria racemosa* Benth), Leguminosae, from Brazil, Pará (Almeida, 1976: 219, IAN-884

On Leguminosae

*Uromyces janiphae* Arthur, see **UROMYCES JATROPHAE** Dietel & Holway.

**UROMYCES JATROPHAE** Dietel & Holway, Bot. Gaz. (Crawfordsville) 24: 25. 1897. TYPE on

*Jatropha multifida* L. from **Mexico**, Jalisco: Guadalajara, 12 Oct, 1896, *Holway-691*. (?/?, IIpe/III).  
Anamorph.

*Uredo janiphae* Winter, *Grevillea* 15: 86. 1887. TYPE on *Manihot utilissima* Pohl (identified originally as *Janipha manihot*) from **Brazil**, Santa Catarina: São Francisco, June 1885, *Ule-362*.

≡ *Uromyces janiphae* (Winter) Arthur, *Mycologia* 7: 190. 1915. Arthur found telia on a specimen collected by *Holway-5050* at Guadalajara, Mexico. This specimen is the type of *Uromyces dichrous* Vestergren (*Micro. Rar. Sel.* 1516. in 1913) which Arthur termed a “hyponym”.

On Euphorbiaceae.

*Manihot esculenta*, Pernambuco (IBI 15512, as “*Manihot utilissima*”), Santa Catarina (Pazschke, 1892: 97; Hennings, 1896: 248), Sergipe (IBI-10889), São Paulo (Viégas, 1945: 66, Brasil (Winter, 1887: 167).

*Uromyces jatrophae* has been reported also from Colombia, some Caribbean Islands, and Mexico. See *Uromyces carthagenensis* for a comparison of the six species of *Uromyces* known to infect *Manihot*.

*Uromyces jatrophicola* P. Hennings, see **UROMYCES CNIDOSCOLI** P. Hennings.

**UROMYCES JUNCII** (Desmazières) Tulasne, *Ann. Sc. Nat. Ser. II.* 2: 146. 1854. (0/I≠ IIpe/III).

≡ *Puccinia junci* Desmazières, *Pl. Crypt.* p. 81. 1825. TYPE on *Juncus acutiflorus* Hoffmann from **France**, place date, collector not available.

Anamorph

*Aecidium zonale* Duby, *Bot. Gall.* 2: 906. 1830.

On Juncaceae.

*Juncus* sp., Santa Catarina (Hennings, 1896: 226).

*Uromyces junci* has been reported to be widespread in the Americas, from Argentina and Chile to Canada, and in Europe. Hennen and McCain (1991) compared anamorph traits of species of *Uromyces* on *Juncus* from the Americas as follows.

**Key to help identify species of Uromyces on Juncus in the Americas**

- |  |  |
|--|--|
| 1. Uredinospore germination pores two, equatorial                  | <b>2</b>   |
| 1. Uredinospore germination pores more than two or supraequatorial | <b>3</b>   |
| 2. Uredinospores small, 18-28 µm long                              | <i>U. junci</i> . (widespread in the Americas and Europe). |
| 2. Uredinospores larger, 25-36 µm long                             | <i>U. occultus</i> . (Argentina and Brazil).               |
| 3. Germ pores two, supraequatorial                                 | <i>U. silphii</i> . (widespread in the Americas).          |
| 3. Germ pores three to four, equatorial                            | <i>U. junci-effusi</i> . (The United States of America).   |

Arthur (1934) discussed the problems with the taxonomy of species of *Puccinia* and *Uromyces* on *Juncus*. He concluded that *U. junci*, *U. junci-effusi*, and *U. silphii* could be considered as variable forms of one polymorphic species. Lindquist (1982) also reported that *Uromyces silphii* could be considered as a variety of *Uromyces juncii* because of the variability in the position of the germ pores of the uredinospores. But neither Arthur or Lindquist made a formal nomenclatural change. Arthur (1934) reported that *Uromyces junci*, *Uromyces junci-effusi*, and *Uromyces silphii* are correlated with *Puccinia littoralis* Rostrup, a macrocyclic, heteroecious, Eurasian species on *Juncus* that is unknown in The Americas.

*Uromyces lantanae* Spegazzini, see **Puccinia LANTANAE** Farlow.

**UROMYCES LATHYRINUS** Spegazzini, *Anal. Soc. Cient. Argentina* 12: 71. 1881. TYPE on *Lathyrus clymenum* from **Argentina**, Buenos Aires: Boca del Riachuelo, Sept 1880, *Spegazzini-s.n.* (0/I, II/III).

= *Uromyces clavatus* Dietel, *Hedwigia* 36: 27. 1897. TYPE on *Lathyrus magellanicus* Lamarck from **Brazil**, Santa Catarina: Serra Geral, Jan 1891, *Ule-1648*, and *1649*. A lectotype needs to be chosen.

Synanamorphs

*Uromyces chilensis* Dietel & Neger, *Bot. Jahrb. Syst.* 24: 154. 1897. TYPE on *Lathyrus*

*magellanicus* Lamarck and *Lathyrus multiceps* Clos from **Chile**, at the foot of Mount Copahue, date not reported, *F. Neger-s.n.* A lectotype needs to be chosen. Telia not described. The name needs to be transferred to an appropriate anamorph genus.

*Aecidium lathyrinum* Spegazzini, Anal. Soc. Cient. Argentina 12: 78. 1888. TYPE on *Lathyrus clymenium* from **Argentina**, Buenos Aires: Boca del Riachuelo, Sept 1880, *Spegazzini-s.n.*

On Leguminosae.

*Lathyrus magellanicus* Lamarck, Santa Catarina (Dietel, 1897: 27).

*Lathyrus multiceps* Clos, Brasil (Almeida, 1975: 36; Silveira, 1951).

*Vicia tenuifolia* Roth, Brasil (Almeida, 1975: 36; Silveira, 1951).

*Uromyces lathyrinus* has been reported also from Argentina, Chile, and Peru.

Spermogonia on the abaxial side of leaves or caulicolous, a few among the aecia. Aecia densely grouped, peridium whitish to yellowish, margin somewhat erose; aeciospores 15-26 x 13-20  $\mu\text{m}$ , broadly globoid to broadly ellipsoid, mostly with angular edges; wall about 0.5-1  $\mu\text{m}$  thick, colorless, minutely verrucose. Uredinia on both sides of leaves or caulicolous, scattered, minute, ruptured epidermis conspicuous, pulverulent, yellow-brown to light cinnamon-brown; urediniospores 22-29 x 20-25  $\mu\text{m}$ , globoid, obovoid or broadly ellipsoid, wall 1.5-2  $\mu\text{m}$  thick, minutely echinulate, golden-brown, germ pores (5)6-8, scattered, with colorless, minutely echinulate caps. Telia on both sides of leaves or caulicolous, to 1 mm across, scattered, compact, cinnamon-brown becoming grayish; teliospores 30-45 x 13-20  $\mu\text{m}$ , mostly fusiform or clavate, wall about 0.5-1  $\mu\text{m}$  thick at sides, pale yellow-brown, smooth, to 8  $\mu\text{m}$  thick at apex; pedicel to 10  $\mu\text{m}$  wide, breaking short or to 60-70  $\mu\text{m}$  long, colorless, thin-walled (Almeida, 1975).

Almeida (1975) concluded that *Uromyces clavatus* was a synonym of *Uromyces lathyrinus* and traits that help identify *Uromyces lathyrinus* include: teliospore walls smooth, urediniospores with a variable number, (5-)6-8, scattered germ pores.

Lindquist (1982) concluded that there were two species that could be identified as follows:

*Uromyces clavatus* has urediniospores that are 26-30 x 23-28  $\mu\text{m}$  with walls 2.5-3  $\mu\text{m}$  thick; on *Lathyrus* spp.; *Uromyces lathyrinus* has urediniospores that are 21-25 x 16-23  $\mu\text{m}$  with walls 1.5-2  $\mu\text{m}$  thick, on *Vicia* spp.

*Uromyces leptodermus* H. Sydow & P. Sydow, see **UROMYCES SETARIAE-ITALICAE** Yoshino.

*Uromyces loesenerianus* (P. Hennings) P. Sydow & H. Sydow, see **KUEHNEOLA LOESENERIANA** (P. Hennings) H.S. Jackson & Holway.

**UROMYCES LORANTHI** H. S. Jackson & Holway in Jackson, Mycologia 19: 54 1927. TYPE on *Loranthus* sp., Loranthaceae, from **Brazil**, Minas Gerais: Sabará, 2 Dec 1921, *Holway-1358*. (??,II/III).

*Uromyces loranthi* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil. See *Uromyces circumscriptus* for a key to the species of *Uromyces* on Loranthaceae in the New World.

*Uromyces lucumae* Dietel, vide **MARAVALLIA LUCUMAE** (Dietel) Y. Ono.

*Uromyces lupini* Berkeley & Curtis, Proc. Ameri. Acad. Sci. 4: 127. 1858.

Almeida (1975) did not include this species from Brazil. Cummins (1978) recorded this species only from North America. Specimens identified as this species from Brazil are probably misidentified.

**UROMYCES MANIHOTICOLA** P. Hennings, Hedwigia 34: 90. 1895. TYPE on *Manihot coerulescens* Pohl from **Brazil**, Goiás: "oberes Maranhãogebiet", Sept 1892, *Ule-1916*. (-I-, -III).

On Euphorbiaceae.

*Manihot coerulescens* Pohl, Goiás (Hennings, 1895: 90).

*Manihot esculenta*, Minas Gerais (IBI 13499).

*Uromyces manihotica* has been reported only from Brazil. See *Uromyces carthagenensis* for a comparison of the six species of *Uromyces* known to infect *Manihot*.

**UROMYCES MANIHOTIS** P. Hennings, Hedwigia 34: 90. 1895. TYPE on *Manihot* sp. from **Brazil**, Goiás: Goiás, Jan 1893, *Ule-1998*. (??,IIpe/III).

On Euphorbiaceae.

*Manihot esculenta* Cranz, Ceará (IBI 15984), Minas Gerais (PUR-F18709), Pará (IAN-878;), Pernambuco (Pickel, 1936: 209), Rio de Janeiro (Viégas, 1945: 66; IAC-51), São Paulo (Viégas, 1945: 66; IAC-3283).

*Manihot* sp., Goiás (Hennings, 1895A: 90), Paraíba (IBI 15650), Rio de Janeiro (Viégas, 1945: 66).

*Uromyces manihotis* has been reported also from Colombia. See *Uromyces carthagenensis* for a comparison of the six species of *Uromyces* known to infect *Manihot*.

*Uromyces manihotis* is a pathogen of one of the most basic food sources in Brazil. Up to now it has been sporadic with only slight damage. But it may have the potential to become an important limiting factor in *Manihot* production.

**UROMYCES MANIHOTIS-CATINGAE** P. Hennings, Hedwigia 47: 266. 1908. TYPE on *Manihot catinga* Ule from **Brazil**, Bahia: Remanso, Jan 1907, *Ule-3322*. (??,IIpe/III).

On Euphorbiaceae.

*Manihot catinga* Ule, Bahia (Hennings, 1908: 266).

*Manihot glaziovii* Mueller-Arg., Ceará (Sydow, 1916: 65).

*Manihot* sp., Minas Gerais (PUR-F19006), Paraíba (Viégas, 1945: 67; IAC-3821), São Paulo (Viégas, 1945: 67; IAC-3476).

*Uromyces manihotis-catingae* has been reported only from Brazil. See *Uromyces carthagenensis* for a comparison of the six species of *Uromyces* known to infect *Manihot*.

? **UROMYCES MEGALOSPERMUS** Spegazzini, An. Mus. Nac. Buenos Aires 6: 218-219. 1898.

TYPE on *Tessaria absinthioidis*, Compositae, from **Argentina**, Tucumán, Jan 1895, *Spegazzini-s.n.* (??,II/III).

Anamorph

*Uredo tessariae* Spegazzini, Anal. Soc. Cient. Argentina 12: 75. 1881. TYPE on *Tessaria absinthioides*, Compositae, from **Argentina**, "Cordillera de la Rioja", near Vega del Jaguel, March 1879, *Hieronymus*.

≡ *Uromyces tessariae* (Spegazzini) Lindquist, Notas del Museo de La Plata 13 (Bot.): 37. 1949. Lindquist described telia from the type of *Uromyces megalospermus*. The type of *Uredo tessariae* has no telia.

= *Uredo scopigena* P. Hennings, Hedwigia 43: 160. 1904. TYPE on *Tessaria integrifolia* Ruiz & Pavon, Compositae, (not *Eupatorium* sp. as originally reported by Hennings) from **Brazil**, Amazonas: Rio Juruá, Juruá-miri, Aug 1901, *Ule-3082*.

The presence of this rust in Brazil is questionable. The only report is that of *Uredo scopigena* from Amazonas cited above. But Lindquist (1982) recorded *Uredo scopigena* as an anamorph name connected to *Puccinia tessariae* Dietel, not to *Uromyces megalospermus*. However, Lindquist reports that the uredinia of *Uromyces megalospermus* occur on witches' brooms, which is a trait of *Uromyces megalospermus* and not of *Puccinia tessariae*. New collections of this rust are needed to confirm its presence in Brazil.

*Uromyces megalospermus* has been reported also from Argentina, Peru, Venezuela, and Colombia.

*Uromyces medicaginis* Passerini, vide **UROMYCES STRIATUS** Schroeter.

**UROMYCES MICROCHLOAE** Sydow, Ann. Mycol. 1: 15. 1903. The specimens on *Microchloa indica* (Linnaeus) Beauvois, Gramineae, reported as *Uromyces microchloae* (Hennen, 1956: 157) in the original Index have been reidentified as *Uromyces dactyloctenii* Wakefield & Hansford (Cummins, 1971).

**UROMYCES MIKANIAE** Viégas, Bragantia 5: 68. 1945. TYPE on *Mikania* sp., Compositae, from **Brazil**, São Paulo: Alto da Serra, 12 Jan 1936, A. E. Jenkins & H. Krug 1384 (??,IIcv/III).

*Uromyces mikaniae* has been reported only from the type. New collections are needed to determine if this rust still occurs in Brazil.

Spermogonia and aecia unknown. Uredinia in the genus *Aecidium*; scattered in groups on the adaxial side of leaves, cupulate; peridial cells 25-28 x 16-17 µm, polyhedral, outer facing wall transversely striate, inner facing wall smooth; urediniospores 16-20 x 15-16 µm, globoid, polyhedric by pressure; wall very thin, minutely verrucose, pores obscure. Telia mostly on abaxial side of leaves, with brownish paraphyses forming locules 120-140 across x 80-100 µm high, dark brown to blackish, shiny; teliospores 24-40 x 16-20 µm, variable in form, mostly piriform, wall up to 8 µm apically, smooth, brownish; pedicel 20-30 µm long, cylindrical, brownish (Viégas, 1945).

*Uromyces mikaniae* in which telia are loculate and the teliospores are all or mostly one-celled, is a variation of *Puccinia mikaniae*.

See *Chrysocyclus mikaniae* for a key to help identify rusts on *Mikania* in the Neotropics.

**UROMYCES MYRSINES** Dietel, Hedwigia 36: 26. 1897. TYPE on *Myrsine* sp. from **Brazil**, Rio de Janeiro: Serra dos Orgãos, Dec 1891, *Ule-1818*, and Minas Gerais: Oro Preto, Jan 1892, *Ule-1869* (We choose *Ule-1869* as the lectotype here). (-/-, -/III).

= *Uromyces rhapsaneae* P. Hennings, Hedwigia 48: 1. 1908. TYPE on “*Rhapanea* sp.”, Myrsinaceae, from **Brazil**, São Paulo: Osasco, date not reported, *Puttemans-1290*. The host genus was misspelled, it should be *Rapanea*. It is a synonym of *Myrsine*.

= *Uromyces usterianus* Dietel, Ann. Mycol. 6: 96. 1908. TYPE on *Myrsine* sp., originally reported mistakenly as “Myrtaceae”, from **Brazil**, São Paulo, March 1907, *Usteri s.n.*

On Myrsinaceae.

*Ardisia compressa* (Grillo, 1936: 144).

*Icacorea* sp. (*Ardisia*?), São Paulo (Jackson, 1931: 490).

*Myrsine umbellata* Martius, Paraná (Joerstad, 1959: 79), Rio de Janeiro (Jackson, 1931: 490), Rio Grande do Sul (Lindquist & Costa Neto, 1963: 133).

*Myrsine* sp., Minas Gerais (Dietel, 1897: 26), Paraná (Joerstad, 1959: 79), Rio de Janeiro (Dietel, 1897: 26; 1899: 248), São Paulo (Sydow, 1907: 354).

*Rapanea* sp. (now considered as a synonym of *Myrsine*), Federal District (PUR-F19158), São Paulo (Jackson, 1931: 490; Hennings, 1908: 1; *Puttemans-1290*).

**Species undetermined**, São Paulo (Dietel, 1908: 96), Brasil (Rick, 1907: 337).

*Uromyces nerviphilus* (Grognot) Hotson, see **UROMYCES TRIFOLII-REPENTIS** Liro.

**UROMYCES NEUROCARPI** Dietel, Hedwigia 34: 292. 1895. TYPE on *Clitoria laurifolia* Poiret [= *Clitoria cajanifolia* (Presl) Bentham (reported first as *Neurocarpon cajanifolium* Presl)] from **Brazil**, Bahia: date of collection not reported, rust specimen from a phanerogamic specimen in the herbarium at Leipzig University, Germany on a specimen collected by *Lhotsky*. (0/Ipe, IIpe/III).

= *Uromyces rostratus* P. Hennings, Hedwigia 35: 227. 1896. TYPE on *Clitoria* sp. (reported originally erroneously as *Eriosema* sp.) from **Brazil**, Rio de Janeiro, June 1887, *Ule-705*.

= *Uromyces insularis* Arthur, Bull. Torrey Bot. Club 33: 515. TYPE on *Clitoria laurifolia* Poiret [= *Clitoria cajanifolia* (Presl) Bentham] from **Puerto Rico**, near Dorado, 18 May 1887, *I. Urban* from herbarium sheet number 80339 in the Field Museum in **Chicago**.

= *Uromyces erythrinae* Lagerheim in Sydow, P. Sydow & H. Sydow., Monogr. Ured. 2: 357. 1909. TYPE on *Clitoria* sp., mistakenly reported as *Erythrina* sp., from **Ecuador**, Puente de Chimbo, date not reported, *Lagerheim s.n.*

= *Uromyces galactiae* Rezende & Dianese, Fitopatologia Brasileira 28:500. 2003. TYPE on *Galactia peduncularis* (Bentham) Taub. from **Brazil**, Federal District: Planaltina, Ecological Station of Águas Emendadas, 27 Feb 1997, *M. Sanchez-2359*. (?/? , II/III). See description below.

On Leguminosae:

*Centrosema* sp., Pará (IBI-16064A).

*Clitoria laurifolia* Poiret [= *Clitoria cajanifolia* (Presl) Bentham], Bahia (Dietel, 1895: 292; Almeida, 1975: 33; IBI-13697), Pará (Sydow, H. Sydow & P. Sydow, 1910: 78; Almeida, 1975: 33), Rio de Janeiro, (Jackson, 1931: 354; Almeida, 1975: 33; HNR-303), São Paulo (IBI-13767).



?*Clitoria racemosa* Bentham, Pará (Albuquerque, 1971: 149; IAN-557).

*Clitoria falcata* Bentham (= *Clitoria rubiginosa* Jussieu ex Fries), Minas Gerais (Viégas, 1945: 68; Almeida, 1975: 33; IAC-4163).

*Clitoria* sp., Maranhão (IBI 15418), Mato Grosso do Sul (IBI-14349), Minas Gerais (IBI-16327), Pará (Sydow, 1910: 78; Almeida, 1975: 33), São Paulo (IBI-13430).

*Uromyces neurocarpi* has been reported on *Clitoria* spp. also from Ecuador, Colombia, Venezuela, Trinidad, islands of the Caribbean, Central America, and Mexico.

Spermogonia mostly on the adaxial side of leaves, a few among or on opposite side of aecia. Aecia mostly on the abaxial side of leaves, in groups, sometimes in circles around spermogonia, sometimes associated with veins, aeciospores similar to the urediniospores. Uredinia mostly on the abaxial side of leaves, scattered, 0.1-0.5 mm across, dark cinnamon-brown, somewhat pulverulent, ruptured epidermis noticeable; paraphyses not seen; urediniospores (19-)23-25(-28) x (18-)20-23(-25)  $\mu\text{m}$ , obtriangular or obovoid in side view, broadly globose in top view, wall (1-)1.5(-2)  $\mu\text{m}$  thick, cinnamon-brown, echinulate except around the pores, echinulae (1.5-)2-3(-4)  $\mu\text{m}$  apart, germ pores 2, slightly below the equator, opposite on smooth areas on flattened sides, without caps. Telia mostly on the abaxial side of leaves, scattered or in groups, sometimes associated with uredinia and sometimes with veins, compact, pulvinate, yellow-brown, later grayish by germination; teliospores (25-)29-38(-41) x (10-)12-18(-19)  $\mu\text{m}$ , mostly fusiform or oblong-ellipsoid, wall 0.5-1  $\mu\text{m}$  thick at sides, 1.5-4  $\mu\text{m}$  at apex, smooth, pale yellowish; pedicel short, to length of spore, less frequently to 60  $\mu\text{m}$  long, colorless, slender (Almeida, 1975).

Traits that help identify the species include: the pale yellowish to nearly colorless, thin-walled teliospores that germinate without dormancy, the absence of paraphyses in the sori, and the urediniospores that are obtriangular or obovoid in side view, broadly globose in top view, with walls 1-1.5  $\mu\text{m}$  thick, cinnamon-brown, with two, more or less opposite, slightly subequatorial germ pores, and more or less evenly echinulate except for smooth spots around the germ pores.

The Sydows (1910) first placed *Uromyces rostratus* and *U. insularis* as synonyms of *U. neurocarpi*. Buriticá examined the type of *U. erythrinae* in PUR and found that the host is *Clitoria* sp., not *Erythrina*, and the rust is *U. neurocarpi*. Albuquerque's report (1971) is probably an error either in the identification of the host or rust.

Four other species of *Uromyces* have been reported on *Clitoria* spp. in the Western Hemisphere: *U. ipatingae* Ferreira & Y. Hiratsuka from Brazil, *U. yurimaguasensis* P. Hennings from Peru and Central America, *U. clitoriae* Arthur from Mexico, and *U. galactiae* Rezende & Dianese from Brazil, which we include as a synonym of *U. clitoriae*, and except for the reported pedicel-like, hymenial paraphyses, is almost identical to *U. neurocarpi*. See *Ravenelia uleana* for notes on pediceloid paraphyses.

UROMYCES GALACTIAE Rezende & Dianese, Fitopatologia Brasileira 28:500. 2003. TYPE on *Galactia peduncularis* (Bentham) Taub. from **Brazil**, Federal District: Planaltina, Ecological Station of Águas Emendadas, 27 Feb 1997, M. Sanchez-2359. (?!?,II/III).

*Uromyces galactiae* has been reported only from Brazil.

Spermogonia and aecia unknown. Urediniospore and teliospores usually mixed in same sorus. Sori on abaxial side of leaves, subepidermal in origin, erumpent, powdery, golden-brown. Paraphyses in hymenium, 25-30 x 1.5-2.5  $\mu\text{m}$ , clavate at apex. Urediniospores (23-)25(-27) x (-21)23(-25)  $\mu\text{m}$ , rhomboid, obovoid, to globose, wall (1-)1.5  $\mu\text{m}$  thick, echinulate (but with small smooth areas around pores), pores 2 (equatorial). Teliospores (25-)35(-41) x (9-)12(-17)  $\mu\text{m}$ , oblong, ellipsoid, to fusiform, wall 0.5-1  $\mu\text{m}$  thick at sides, 1.5-4  $\mu\text{m}$  at apex, smooth, colorless (Rezende & Dianese, 2003).

Rezende & Dianese (2003) reported *Uromyces galactiae* also on *Clitoria laurifolia* Poir (= *C. cajanifolia*) from the littoral of Bahia and Sao Paulo. *Uromyces neurocarpi* Dietel is the rust most often reported on *C. laurifolia* which is very similar, except for the pedicel-like, hymenial paraphyses reported for *U. galactiae*.

UROMYCES NITEROYENSIS Rangel, Arch. Mus. Nac. Rio de Janeiro 18: 160. 1916. TYPE on

*Setaria* sp. from **Brazil**, Rio de Janeiro: Niteroy, Cubango, *Rangel-1172*. (?!? ≠ IIpe/III).

= *Uromyces puttemansii* Rangel, Arch. Mus. Nac. Rio de Janeiro 18: 159. 1916. TYPE

(uncertain according to Ramachar & Cummins, 1963). Rangel lists two collections, both from **Brazil**, Rio de Janeiro: Paquetá near Rio de Janeiro, June 1914, one on *Setaria asperifoliae* (*Rangel-1211*) and the other on *Melinis minuteiflora* P. Beauvois (as "*Panicum melinis*") (*Rangel-1212*). The only rust that we know of on *Melinis minuteiflora* in Brazil is

*Uromyces setariae-italicae*. Thus, we designate the specimen on *Setaria* as the lectotype of *Uromyces puttemansii*.

= *Uromyces sepultus* Mains, Carnegie Inst. Washington Publ. 461: 99. 1935. TYPE on *Setaria tenax* (L. Rich.) Desvoux from **Mexico**, Swallen-2440.

On Gramineae (Paniceae).

*Panicum antidotale* Retzius, Rio Grande do Sul (PUR-F17741).

*Setaria poiretiana* (Schultes) Kunth [recent authors report as *Setaria sulcata* Raddi], São Paulo (Ramachar & Cummins, 1963: 50).

*Setaria rariflora* Mikan ex Trinius, Rio de Janeiro (Ramachar & Cummins, 1963: 50).

*Setaria tenax* Desvoux, Rio de Janeiro (Ramachar & Cummins, 1963).

*Setaria* sp., Bahia, Rio de Janeiro (Rangel, 1916:; 160-161; Ramachar & Cummins, 1963: 50), Maranhão (IBI 12201), São Paulo (IBI-14688).

*Uromyces niteroyensis* has been reported also from Uruguay and Northern Argentina to Southern Mexico and Cuba.

Spermogonia and aecia unknown. Uredinia on both sides of leaves or mostly on abaxial side, yellowish-brown to cinnamon-brown, with inconspicuous, yellowish, thin-walled paraphyses; urediniospores (26-)29-38(-42) x 20-27 µm, mostly broadly ellipsoid or obovoid, wall 1.5-2 µm thick, cinnamon-brown, echinulate, pores 3(4), equatorial. Telia blackish brown, long covered by epidermis, without paraphyses; teliospores (19-)22-27(-30) x 14-20 µm, variable but mostly angularly obovoid, wall 0.5-1 µm thick at sides, 1.5-2.5 µm at apex, golden to chestnut-brown, smooth; pedicels to 25 µm long, persistent, yellowish, thin-walled and collapsing (Cummins, 1971).

Traits that help to identify *Uromyces niteroyensis* include uredinia that have paraphyses and telia that are covered by the epidermis. No other species of *Uromyces* on Paniceae have paraphyses in their uredinia. Only one other species, *U. setariae-italicae*, has telia covered by the epidermis.

Rangel's (1916) report of *Uromyces niteroyensis* on *Melinis minuteiflora* (as *Uromyces puttemansii* Rangel on *Panicum melinis*) is mistaken as stated above.

**UROMYCES NOVISSIMUS** Spegazzini, Anal. Soc. Cient. Argentina 10: 134. 1880. TYPE on *Cayaponia ficifolia* (Lamarck) Cogniaux (reported originally as *Trianosperma ficifolia*) from **Argentina**, Buenos Aires: "in saepibus de la Boca del Riachuela et del Bagnado de S. José de Flores", May 1880, Spegazzini s.n. (?/?, IIpe/III).

= *Uromyces cissampelidis* Dietel in Earl, Bull. Torrey Bot. Club. 26: 632-633. 1899. TYPE on an undetermined Cucurbitaceae from **Colombia**, Santa Marta, date not reported, Baker-83. (not *Cissampelos* sp., Menispermaceae as was originally reported fide Hennen & McCain, 1993).

= *Uromyces hellerianus* Arthur, Bull. Torrey Bot. Club 31: 2. 1904. TYPE on *Cayaponia racemosa* (Sw.) Cogn. from **Puerto Rico**: Adjuntas road five miles from Ponce, 4 Dec 1902, Heller-6206.

= *Uromyces appelianus* Gassner, Ber. Deutsch. Bot. Ges. 40: 68. 1922. TYPE on *Cayaponia* sp. (reported originally mistakenly as *Passiflora* sp., Passifloraceae) from **Uruguay** and **Brazil**. A lectotype needs to be chosen (see Hennen & Figueiredo, 1981).

= *Uromyces pentastriatus* Viégas, Bragantia 5: 70. 1945. TYPE on *Trianosperma* sp. from **Brazil**, Santa Catarina: Rio Caçador, Wheat Experiment Station, 18 May 1941, Deslandes s.n. (see Lindquist, 1982).

Anamorph

*Uredo novissimus* Spegazzini, Anal. Mus. Nac. Buenos Aires 6: 235. 1899. TYPE on *Cayaponia ficifolia* (Lamarck) Cogn. (reported as "*Trianosperma ficifolia*") from **Argentina** (a lectotype needs to be chosen from specimens indicated by Spegazzini as "in dumetis et saepibus prope La Plata, Tucumán et Salta, aest. 1885-98").

= *Uromyces cayaponiae* P. Hennings (as "*U. cajaponiae*"), TYPE on *Cayaponia* sp. from **Brazil**, Santa Catarina: São Francisco, Jan 1885, Ule-302. The Sydows (1908) reported that only urediniospores are present on the type specimen.

On Cucurbitaceae.

*Cayaponia bonariensis*, Rio Grande do Sul (IBI-12201).

*Cayaponia citrullifolia* (Grisebach) Cogniaux, Paraná (Joerstad, 1956: 478).

*Cayaponia martiana*, Rio Grande do Sul (PUR-F18957).

*Cayaponia racemosa* (Swartz) Cogniaux, Minas Gerais (Thurston, 1940: 308).

*Cayaponia tayuya* Cogniaux, Rio de Janeiro (Jackson, 1932: 102).

*Cayaponia* sp., Rio de Janeiro (Jackson, 1932: 102; IBI-13055), Rio Grande do Sul (Gassner, 1922: 68; IBI 12070).

*Rytidostylis* sp., São Paulo (IBI-17951).

*Trianosperma* sp., Santa Catarina (Viégas, 1945: 70; IAC-3771).

*Uromyces novissimus* has been reported under several names as indicated by the synonyms listed above. The species is widespread in warmer regions of the Western Hemisphere from Argentina to Mexico. In addition to the host genera listed above this rust has been reported on *Abobra* and *Melothria*.

Sori scattered on abaxial side of leaves or on hypertrophied tumors on stems and petioles or on witches' brooms; urediniospores 25-28 x 19-23  $\mu\text{m}$ , subglobose or triangular, wall 1.5-2  $\mu\text{m}$  thick but 2.5-3  $\mu\text{m}$  thick at the base, cinnamon-yellow, with well spaced spines, and two opposite subequatorial pores; teliospores 27-34 x 19-23  $\mu\text{m}$ , globose or broadly ellipsoid, with a well developed apical papilla over the germ pore, wall smooth or with few or many scattered verrucae, or these in irregular lines (Lindquist, 1982).

**UROMYCES OBLECTANEUS** H. S. Jackson & Holway in Jackson, Mycologia 18: 146. 1926. TYPE on *Rhynchospora exaltata* Kunth from **Brazil**, Rio de Janeiro: Sylvestre, 16 Sept 1921, *Holway-1113*. (?!/? $\neq$  **Ipe/III**).

On Cyperaceae.

*Rhynchospora corymbosa* (Linnaeus) Britton, Minas Gerais (Thurston, 1940: 30; mistakenly reported as "*Puccinia oblectaneus* Jackson & Holway.").

*Rhynchospora exaltata* Kunth, Rio de Janeiro (Jackson, 1926: 146; IBI-1745), São Paulo (Jackson, 1926: 143; 1926: 146).

*Rhynchospora* sp., Federal District (IBI 14895), São Paulo (IBI-12530).

*Uromyces oblectaneus* has been reported only from Brazil from the states cited above.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, mostly on the abaxial side of leaves, 0.5-1.5 mm long, oval or elliptic, cinnamon brown, ruptured epidermis persistent and conspicuous; urediniospores 28-32 x 22-26  $\mu\text{m}$ , ellipsoid or obovate, wall 2-3  $\mu\text{m}$  thick, dark cinnamon-brown, sparsely and prominently echinulate, pores 2 or more, commonly 3, approximately equatorial. Telia on the abaxial side of leaves, 0.5-2 mm across, early naked, blackish-brown, ruptured epidermis conspicuous, teliospores 23-34 x 16-20  $\mu\text{m}$ , irregularly ellipsoid or obovoid, rounded, obtuse, or truncate at the apex, rounded, attenuate, or occasionally truncate at the base, wall 1.5-2  $\mu\text{m}$  thick at the sides, 4-9  $\mu\text{m}$  at the apex, smooth, pedicel equaling the spore, firm, tinted (Jackson, 1926).

*Uromyces occidentalis* Dietel, see **UROMYCES ANTHYLLIDIS** Schroeter.

**UROMYCES OCCULTUS** Lindquist, Bol. Soc. Argentina Bot. 3: 222. 1951. TYPE on *Juncus densiflorus* Humboldt, Bonpland & Kunth from **Argentina**, Buenos Aires: Punta Laura, La Plata, Jan 1951, Lindquist s.n. (?!/? $\neq$  **Ipe/III**).

Anamorph

*Uredo macella* H. S. Jackson & Holway in Jackson, Mycologia 18: 150. 1926.

TYPE on *Juncus dombeyanus* Gay from **Chile**, Panamavida, 9 Dec 1919, *Holway-210*.

On Juncaceae.

*Juncus* sp., Minas Gerais (Thurston, 1940: 305), State?/ Posta Cue (Lindquist, 1951: 222).

*Uromyces occultus* has been reported from Argentina, Brazil, and Chile. Hennen and McCain (1991) placed *Uredo macella* as an anamorph. See *Uromyces junci* for a comparison of anamorph traits of species of *Uromyces* on *Juncus* in the Americas.

Traits that may help identify *Uromyces occultus* include: anamorph sori on abaxial side of leaves, very small, long remaining covered by the epidermis, spores obovoid, globoid, ellipsoid, or sometimes irregular, (23-)25-36 x 20-24(-27)  $\mu\text{m}$  in front view, somewhat flattened on the sides with the germ pores (14-18.5  $\mu\text{m}$  wide in side view), wall 1-1.5  $\mu\text{m}$  thick, often to 2.5  $\mu\text{m}$  thick at the pores, cinnamon-brown, echinulate with widely spaced fine spines, germ pores two (rarely three) equatorial and opposite each other..

**UROMYCES ORBICULARIS** Dietel, Hedwigia 36: 28. 1897. TYPE on *Desmodium* sp. from **Brazil**, Santa Catarina: Serra Geral, March 1891, *Ule-1647*. (?!/? $\neq$  **Iciv/III**).

Anamorph

*Aecidium desmodii* P. Hennings, Hedwigia 35: 259. 1896. TYPE on *Desmodium* sp. from **Brazil**, Santa Catarina, locality not recorded, April 1887, Ule-97. *Aecidium desmodii* functions as uredinia and perhaps aecia.

On Leguminosae:

*Desmodium uncinatum* (Jacquin) DeCandolle, Rio de Janeiro, São Paulo (Jackson, 1931: 344).

*Desmodium* sp., Espírito Santo (Almeida, 1975: 47, as *Aecidium desmodii*), Minas Gerais (Jackson, 1931: 344; Thurston, 1940: 309; Almeida, 1975: 47), Santa Catarina (Hennings, 1896: 259; "Serra Geral", Dietel, 1897: 28), Rio de Janeiro (Dietel, 1899: 258; Jackson, 1931: 344;), São Paulo (Hennings, 1908: 3; Jackson, 1931:344; Viégas, 1945: 75; 96-47; IBI-17806).

*Uromyces orbicularis* (or as *Aecidium desmodii*) has been reported also from Argentina, Bolivia, Colombia, and Venezuela.

Spermogonia and aecia unknown. Uredinia, *Aecidium desmodii*, on the abaxial side of leaves, in groups, whitish or pale yellowish, densely aggregated, forming very distinct spots mostly round, 1-4 mm across, peridium cupulate, with margin upright, somewhat erose; urediniospores catenulate, 15-22 x 13-17 µm, globoid or broadly ellipsoid, mostly with angular edges, wall about 1 µm thick, colorless, minutely verrucose. Telia on the adaxial side of leaves, opposite the uredinia, frequently in circles, confluent chocolate-brown, minute, with ruptured epidermis noticeable pulverulent; teliospores 22-31(-33) x 18-24(-26) µm, ellipsoid, obovoid, globoid or subgloboid, wall 2-3 µm thick at sides, chestnut-brown or dark golden-brown, with a paler umbo 3-7 µm high, varying from verrucose with irregular warts sometimes variously united or arranged to form a kind of labyrinth, to irregularly reticulate; pedicel to 35 µm long, rarely to 50 µm long, colorless, thin-walled, many collapsing (Almeida, 1975).

Some previous authors mistakenly have connected *Aecidium desmodii* to *Uromyces hedysari-paniculatus* or have hypothesized that it was a part of an heteroecious species. We connect *Aecidium desmodii* to *Uromyces orbicularis* here for the first time based on morphological similarity. Spermogonia have not been reported for either *Aecidium desmodii* or *Uromyces orbicularis*. Thus, ontogenic aecia are unknown.

See *Uromyces castaneus* for a key to the species of *Uromyces* on *Desmodium* in Brazil.

*Uromyces oxalidis* Pазschke (sic) (Silveira, 1951: 31). The name is an error.

*Uromyces panici-sanguinalis* Rangel, vide **PUCCINIA LEVIS** Saccardo & Bizzozero var. **PANICI-SANGUINALIS** (Rangel) Ramachar & Cummins.

*Uromyces pannosus* Vestergren, vide **UROMYCES DIETELIANUS** Pазschke.

**UROMYCES PEGLERIAE** Pole-Evans ex Sydow, Ann. Mycol. 12: 263. 1914. var. **PEGLERIAE**.

TYPE on *Digitaria ternata* from **South Africa**, Cape Prov.: Kentani, Pegler-7755. (?/?= IIpe/III). = *Uromyces digitariae-adscedentis* Wang, Acta Phytotax. Sinica 10: 296-297. 1965.

Anamorph

*Uredo paspali-longiflorae* Petch, Ann. Roy. Bot. Gard. Peradeniya 6:216. 1917.

= *Uredo tacita* Arthur, Bull. Torrey Bot. Club 60: 476. 1933. TYPE on *Digitaria Gardesii* (Hackel) Parodi, from **Brazil**, São Paulo: Mandaque, 25 May A922, E. W. D. Holway & Mary M. Holway-1887.

On Gramineae.

*Digitaria gardesii* (Hackel) Parodi, São Paulo (Arthur, 1933: 476; Ramachar & Cummins, 1963: 56).

Cummins (1971) reported *Uromyces pegleriae* var. *pegleriae* from Africa, New Guinea, The Philippines, and Brazil. The only collection from The Western Hemisphere is the one cited above as the type of *Uredo tacita*. New collections from Brazil are needed to confirm the presence of this rust from Brazil. *Uromyces pegleriae* var. *beckeropsidis*, the only other variety, has been reported only from the type collection from Erythraea in Africa.

Spermogonia and aecia unknown. Uredinia mostly on adaxial side of leaves, yellowish brown; urediniospores (21-)23-27(-30) x (16-)18-22(-24) µm, mostly broadly ellipsoid, wall 1.5-2 µm thick, echinulate, yellowish to golden, germ pores 7-9, scattered or tending to be bizonate; telia blackish brown,

covered by the epidermis, only tardely or not exposed, sometimes with a few pale golden paraphyses, the sori not loculate, teliospores (22-)25-30(-34) x (15-)17-20(-24)  $\mu\text{m}$ , variable, mostly angularly obovoid, wall (1-)1.5-2(-2.5)  $\mu\text{m}$  thick at sides, 3-5  $\mu\text{m}$  thick apically, chestnut-brown, smooth, pedicels to 60  $\mu\text{m}$  long, usually broken shorter, colorless or brownish, thin-walled and collapsing (Cummins, 1971).

*Uromyces pentastratus* Viégas, see **UROMYCES NOVISSIMUS** Spegazzini.

**UROMYCES PERAFFINIS** Dietel, Ann. Mycol. 20: 249. 1922. TYPE on *Bauhinia* sp., Leguminosae, from **Brazil**, Rio de Janeiro, "museum garden", July 1895, *Ule*. (??,IIpe/III).

*Uromyces peraffinis* has been reported only from the type. Almeida (1975:56.) was unable to find the type specimen.

Spermogonia and aecia unknown. Sori mostly on adaxial side of leaves, scattered, to 0.8 mm. across, naked, pulverulent, chestnut-brown. Urediniospores (mixed with teliospores) 24-28 x 18-21  $\mu\text{m}$ , ellipsoid or obovoid, wall pale brown, sparsely echinulate, germ pores 3. Teliospores 25-33 x 18-23  $\mu\text{m}$ , obovoid, ellipsoid, rarely oblong, with a paler, broad, obtuse, tuberculate, papilla to 6  $\mu\text{m}$  high at apex, wall indistinctly and minutely reticulate, yellow-brown; pedicel slender, fragile (Almeida, 1975).

See *Uromyces anthemophilus* for notes on rusts on *Bauhinia*.

**UROMYCES PERESKIAE** Dietel, Hedwigia 38: 248. 1899. TYPE on *Pereskia* sp., Cactaceae, from **Brazil**, Rio de Janeiro: St. Eduardo, 4 Nov.1895, *Ule*-2153. (0/I,II/ III).

= *Uromyces pereskiae* H. S. Jackson & Holway in Jackson, Mycologia 23: 473. 1931. TYPE on *Pereskia grandifolia*, Cactaceae, Haworth from **Brazil**, Rio de Janeiro: Nictheroy, 18 Sept 1921, *Holway*-1123. Jackson (1931) mistakenly reported the host as belonging to the Hippocrateaceae.

Anamorph

*Aecidium pereskiae* P. Hennings, Hedwigia Beiblatt 37: (206). 1898. TYPE on *Pereskia* sp., Cactaceae, from **Brazil**, Rio de Janeiro: St. Eduardo, 4 Nov.1895, *Ule*-2153.

= *Aecidium pereskiae* H. S. Jackson & Holway in Jackson, Mycologia 23: 473. 1931. TYPE on *Pereskia grandifolia* Haworth from **Brazil**, Rio de Janeiro: Nictheroy, 18 Sept 1921, *Holway*-1123.

On Cactaceae:

*Pereskia grandifolia* Haworth, Rio de Janeiro (Hennings, 1898: (206); Dietel, 1899: 257; Sydow, 1907: 355). Jackson, 1931: 473).

*Pereskia* sp., Rio de Janeiro (Dietel, 1899: 248), São Paulo (IBI 18428).

*Uromyces pereskiae* has been reported also from Argentina (Lindquist, 1982).

Spermogonia and aecia *Aecidium pereskiae* P. Hennings. Uredinia on adaxial side of leaves, gregarious on discolored spots 1.5-2.5 mm across which appear greenish in dried specimens, round, 0.2-0.3 mm across, bullate, deep seated, cinnamon brown, tardily naked, becoming pulverulent, long covered by the firm overarched epidermis; urediniospores 34-41 x 22-26  $\mu\text{m}$ , somewhat irregularly ellipsoid or obovate, wall 1.5-2.5  $\mu\text{m}$  thick, golden brown, sparsely and finely echinulate; pores 3 or 4 in a broad equatorial band. Telia like the uredinia, blackish brown; teliospores 30-38 x 22-26  $\mu\text{m}$ , somewhat irregularly broadly ellipsoid, rounded or truncate below, obtuse above; wall 1.5-2  $\mu\text{m}$  thick, chestnut brown, appearing smooth but with irregularly scattered hyaline tubercles, sometimes arranged in lines and often more prominent at apex; pore prominent at apex but wall not thickened above; pedicel short colorless, usually deciduous (Jackson, 1931).

In publications about this rust the host genus name has been spelled variously as "*Peireskea*", "*Peirescia*", and "*Peireskia*". We use the spelling "*Pereskia*" as named by Miller as given in Willis (1966). Unlike many familiar cacti that have small, fleshy leaves that fall off soon after they are produced, *Pereskia* is one of the few cacti that have broad, flat leaves that usually remain on the plant for a long time. This may have led Jackson (1931) to mistakenly report the host as belonging to the Hippocrateaceae in which is found the genus *Hippocratea* that has *Pereskia* Velloso as a synonym.

The type collection of *Aecidium pereskiae* P. Hennings is the same as that of *Uromyces peireskiae* Dietel but on a different leaf.

Three rust species have been reported on Cactaceae in South America: *Uromyces pereskiae* (anamorph *Aecidium pereskiae*) listed above, *Aecidium cerei* P. Hennings on *Cereus* sp. from Argentina, and *Aecidium opuntiae* Magnus from Argentina and Bolivia, which has been considered as an anamorph of the

heteroecious species *Puccinia opuntiae* Arthur & Holway in Bolivia, with uredinia and telia on *Bouteloua* spp. (Gramineae). *Aecidium opuntiae* has been reported from Mexico on *Opuntia* sp. but no teleomorph connection has been reported there (Hennen & McCain, 1993).

*Uromyces peireskiae* H. S. Jackson & Holway, see **UROMYCES PERESKIAE** Dietel.

**UROMYCES PERLEBIAE** Vestergren, Ark. Bot. 4: 26. 1905. TYPE on *Bauhinia pentandra* Vog., Leguminosae, from **Brazil**, Matto Grosso: Cuiaba, 12 June 1902, *G. Malme-s.n. (?/?, IIpe/III)*.

*Uromyces perlebiae* is known only from the type. New collections are needed to determine if this species is still in Brazil.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, without spots, scattered, minute, pulverulent, cinnamon-brown; urediniospores 22-26 x 21-24 µm, globoid, subgloboid or ellipsoid, wall 1.5-2 µm thick, loosely echinulate, pale yellow, germ pores 4, rarely 5. Telia about chestnut-brown, otherwise as the uredinia; teliospores 22-26 x 20-23 µm, globoid, subgloboid or broadly ellipsoid, wall 3-3.5 µm thick, about chestnut-brown, apex rounded and yellow-brown, corona, 2.5-3 µm, rarely 4 µm high, distinctly reticulate; pedicel same length as spore or a little longer, colorless, subpersistent, moderately thick (Almeida, 1975).

Viégas (1945: 70) and Jackson (1931: 344) originally reported three other specimens as *Uromyces perlebiae*. Almeida (1975) reidentified the specimen reported by Viégas and the two Holway specimens reported by Jackson, all three collected in São Paul State, as *Uromyces dietelianus* var. *dietelianus*.

See *Uromyces anthemophilus* for notes on rusts on *Bauhinia*.

*Uromyces pervius* Spegazzini, see **PUCINA ARECHALETAE** Spegazzini.

*Uromyces phaseoli* (Persoon) Winter, see **UROMYCES APPENDICULATUS** (Persoon) Unger.

*Uromyces phaseoli* (Persoon) Winter var. *typica* Arthur, see **UROMYCES APPENDICULATUS** (Persoon) Unger. var. **APPENDICULATUS**.

*Uromyces piauhyensis* P. Hennings, see **UROMYCES BLAINVILLEAE** H. Sydow and **UROMYCES CUCULATUS** H. Sydow.

**UROMYCES PISI** (DeCandolle) Otth, Mitt. Naturf. Ges. Bern 1863: 87. 1863. (**0,Icv<sup>s</sup> IIpe,III**).

≡ *Puccinia pisi* DeCandolle, Fl. France 2:224. 1805. TYPE on cultivated *Pisum sativum* Linnaeus from **France**.

= *Uromyces pisi* (Persoon) Winter, Pilze Deutschland. p. 163. 1884.

Anamorph

*Uredo appendiculata* b *Uredo pisi-sativi* Persoon, Syn. Meth. Fung. p. 222. 1801.

On Leguminosae

*Pisum sativum* Linnaeus, Rio Grande do Sul (Luz, 1970: Almeida, 1975: 45).

*Uromyces pisi* has been reported only from Brazil and Chile in the Americas but has been reported from Europe, Asia, and Africa. The name *Uromyces pisi-sativi* (Persoon) Liro also has been used for this rust.

Spermogonia on abaxial side of leaves, many, scattered among the aecia. Aecia on abaxial side of leaves, systemic, scattered all over the leaf surface, peridium cupulate, margin revolute, deeply lacinate, whitish; aeciospores 15-24(-26) x 13-18(-20) µm, globoid to ellipsoid, mostly with angulate edges, wall about 1 µm thick, minutely verrucose, colorless. Uredinia mostly on the abaxial side of leaves, to 1 mm diam, scattered, surrounded by the ruptured epidermis, light cinnamon-brown, pulverulent; urediniospores 19-26 x 17-24 µm, mostly globoid to ellipsoid, wall 1.5-2 µm thick, minutely echinulate, golden-brown, germ pores 3-6, scattered, with colorless, echinulate caps. Telia on both sides of leaves, dark brown, surrounded by the ruptured epidermis, scattered or in groups, coalescent, to 2-3 mm diam, pulverulent; teliospores 20-30 x 15-22 µm, mostly globoid to ellipsoid, wall 1.5-2.5 µm thick at sides, light chestnut-brown with a low, paler papilla at apex, densely and minutely verrucose, warts about 1 µm apart, mostly round, evenly distributed on surface of spore and papilla; pedicel, breaking near the hilum or to about 50 µm long, colorless, thin-walled, some collapsing (Almeida, 1975).

Hylander et al. (1953) reported that *Uromyces pisi* is a collective species name that includes six "races or race groups usually considered as species". These are: *Uromyces euphorbiae-corniculati* Jord., on *Lotus* sp.; *Uromyces laburni* (DeCandolle) Oth on *Genista* sp., *Laburnum* sp. and *Sarothamnus* sp.; *Uromyces onobrychidis* Bubak on *Onobrychis* sp.; *Uromyces pisi* on *Lathyrus* sp. and *Pisum sativum*; *Uromyces punctatus* on *Oxytropis* sp.; and *Uromyces striatus* Schroeter on *Medicago* spp. and *Trifolium* spp. Only *Uromyces pisi* and *Uromyces striatus* have been reported from Latin America. As far as has been reported, all have their spermogonia and aecia on *Euphorbia cyparissias* and other closely related species of *Euphorbia*, Euphorbiaceae. But these have not been reported from Latin America.

*Uromyces pisi-sativi* (Persoon) Liro, see **UROMYCES PISI** (DeCandolle) Otth.

**UROMYCES PLATENSIS** Spegazzini, Anal. Soc. Cient Argentina 12: 72. 1882. TYPE on *Pfaffia stenophylla* (Spreng.) Stuchlik from **Argentina**, Buenos Aires: (??,II/III).

Anamorph

*Uredo paranensis* Pennington, Anal. Soc. cient. Argentina 53: 269. 1902. TYPE on *Pfaffia stenophylla* (Sprengel) Stuchl. from **Argentina**, Buenos Aires

On Amaranthaceae

*Pfaffia glomerata* (Sprengel) Pederson., Federal District (Mattos, 1993).

*Uromyces platensis* has been reported only from Argentina and Brazil.

Spermogonia and aecia unknown. Urediniospores in telia, 25-32 x 22-25  $\mu\text{m}$ , ellipsoid to globoid, wall 2.5-3  $\mu\text{m}$  thick, golden-yellow, finely and densely echinulate, pores 4, equatorial. Telia adaxial, in circles up to 2 mm across, subcortical in origin, developing in the cortical parenchyma, opening by slits, compact, blackish, teliospores 29-46 x 18-27  $\mu\text{m}$ , ellipsoid to oblong-ellipsoid, rounded to broadly rounded above and below, wall 3.5  $\mu\text{m}$  thick at sides, 7-10  $\mu\text{m}$  above, laminate, dark brown, smooth; pedicel to more than 200  $\mu\text{m}$  long, thick, hyaline (Lindquist, 1982). Laundon (1965) reported *Uredo paraensis* as: uredenia on adaxial side of leaves, scattered or in groups, minute, yellow-brown; urediniospores 20-25 x 18-23  $\mu\text{m}$ , spheroid to ellipsoid, wall 2  $\mu\text{m}$  thick, densely verrucose-echinulate to verrucose-striate, pores 4-6, scattered (The Sydows, 1924: 495). Laundon (1965) reported telia as: linear along stems for several cms. to 2mm broad but fusing laterally, almost black; teliospores 32-46 x 18-24  $\mu\text{m}$ , ellipsoid to fusiform, sometimes almost cylindrical, mostly rounded above, wall 2.5-4  $\mu\text{m}$  thick at sides, 6-10  $\mu\text{m}$  above, yellow-brown, smooth; pedicels to more than 200  $\mu\text{m}$  long, hyaline.

The host, *Pfaffia glomerata* ("Brazilian ginseng"), is grown in Brazil as a medicinal plant.

Whether or not *Uredo paraensis* is an anamorph is uncertain (Laundon, 1965; Lindquist, 1982).

Write to Diannese for specimens.

**UROMYCES POLYMNIAE** Dietel & Holway in Holway, Bot. Gaz. (Crawfordsville) 31: 327.

LECTOTYPE on *Polymnia maculata* from **Mexico**, Rio Hondo canyon near city of Mexico, 4 Oct 1899, *Holway-3562* (lectotype). (0/Icv,IIpe/III).

Anamorph

*Uredo polymniae* Hennings, Hedwigia. Beiblatt. 38: (129). TYPE on *Polymnia* sp. from **Brazil**, Rio de Janeiro: Nova Friburgo, Jan 1898, *Ule-2529*.

On Compositae

*Polymnia glabrata* DeCandolle, Brazil (Silveira, 1951: 31).

*Polymnia maculata* Cavanilles, Brazil (Sydow, 1909: 7; Silveira 1951: 31).

*Polymnia sylphoides* DeCandolle, Brazil (Silveira, 1951: 31).

*Uromyces polymniae* has been reported also from Argentina, Colombia, and Mexico.

Spermogonia in small groups in adaxial side of leaves. Aecia in circles opposite the spermogonia, peridium delicate, erose; aeciospores (18-)20-28(-30) x (15-)17-21(-23)  $\mu\text{m}$ , globoid or broadly ellipsoid, wall 1.5-3  $\mu\text{m}$  thick, colorless, verrucose. Uredinia mostly on abaxial leaf surface, cinnamon brown; urediniospores (20-)22-25(-27) x (21-)23-27  $\mu\text{m}$ , broadly obovoid or globoid, often slightly wider than high, wall 1-1.5  $\mu\text{m}$  thick but the base slightly thicker, uniformly echinulate, cinnamon brown, pores 2, subequatorial or near hilum, without discernible caps. Telia mostly on abaxial surface, blackish brown, exposed compact; teliospores (26-)3036(-38) x (20-)22-26(-28)  $\mu\text{m}$ , broadly ellipsoid or broadly obovoid, wall 1.5-2(-2.5)  $\mu\text{m}$  thick at sides, (5-)7-10(-12)  $\mu\text{m}$  apically, uniformly chestnut brown or somewhat paler apically; smooth; pedicels to about 60  $\mu\text{m}$  long, slightly yellowish (Cummins, 1978).

**UROMYCES PONTEDERIAE** Gerard, Bull. Torrey Bot. Club 6: 31. 1875. TYPE on *Pontederia cordata* L. from the **United States of America**, New York: Poughkeepsie, date and collector not reported. (??,II/III).

= *Uromyces pontederiae* Spegazzini, An. Soc. Cient. Argentina 26: 12. 1888. TYPE on *Pontederia cordata* L. from **Paraguay**: Aregua, Aug 1883, *Balansa-3949*.

≡ *Uromyces pontederiicola* Spegazzini Rev. Argentina Bot. 1: 143. 1925. (nom. nov. for *Uromyces pontederiae* Spegazzini).

Anamorph

*Uredo pontederiae* Spegazzini Anal. Soc. Cient. Argentina 9: 172. 1880. TYPE on *Pontederia sagittata* from **Argentina**, Buenos Aires: Rio de la Plata, Jan 1880, ?*Spegazzini s.n.*

= *Uredo eichorniae* Fragoso & Cifferi, Estac. Agron. de Moca, ser. B.-Bot. No. 8: 8.

1927. TYPE on *Eichornia crassipes* from the **Dominican Republic**: near Haina, Feb 1926, R. Cifferi *s.n.*

On Pontederiaceae

*Pontederia cordata* L., Goiás (Hennings, 1895: 91) Rio Grande do Sul (Juel, 1897: 17; Joerstad, 1959: 83), Santa Catarina (Pazschke, 1892: 97; Hennings, 1896: 224), São Paulo (*Puttemans-3383* in IBI).

*Uromyces pontederiae* has been reported from Argentina to the eastern United States of America.

Lindquist (1982) reported *Uromyces pontederiae* also on *Eichornia azurea* (Sw.) Kunth from Uruguay.

Urediniospores of *Uredo pontederiae* and *Uredo eichorniae* are morphologically indistinguishable, so we place *Uredo eichorniae* as a synonym, but the two are kept as separate taxa by Charudattan & Conway (1975) because the two populations seem to be host specific and no telia have ever been reported from *Eichornia crassipes*. The rust on *Eichornia* has been reported only from Argentina, Uruguay, and The Dominican Republic.

Spermogonia and aecia unknown. Uredinia 0.3-0.5 mm across, scattered on both sides of leaves on small purplish spots, tardily naked, ruptured epidermis noticeable, light cinnamon-brown, somewhat powdery; urediniospores 23-29 x 18-21 µm ellipsoid; wall 1-1.5 µm thick, [Hennen's measurements from *Puttemans-3383*: (24-)27-30 x 22-23 µm, wall ca 2 µm thick] moderately and sharply echinulate, the spines irregularly (1-, 1.5-)2-3.5(-4) µm apart, pores 4, equatorial, rather obscure. Telia 0.2-0.4 mm across, on both sides of leaves, scattered or sometimes in small groups, sometimes on purplish spots, tardily naked, pulvinate, not powdery, chocolate-brown, ruptured epidermis conspicuous; teliospores 21-29 x 13-18 µm, [Hennen's measurements from *Puttemans-3383*: 30-36(-39) x (-17) 19-22, apic wall 8.5-11, lat wall (2-)2.5-3.5 µm], obovoid or broadly clavate, rounded or obtuse above, usually narrowed below, wall 1-1.5 µm thick at sides, 5-9 µm above, golden-brown, smooth, pedicel 20-50 µm long, tinted (Arthur et al., 1912).

*Uromyces pontederiae* Spegazzini, see **UROMYCES PONTEDERIAE** Gerard.

*Uromyces pontederiicola* Spegazzini, see **UROMYCES PONTEDERIAE** Gerard.

*Uromyces porcencis* Mayor, see **CHACONIA INGAE** (H. Sydow) Cummins.

*Uromyces praetextus* Vestergren, see **UROMYCES BAUHINIAE** P. Hennings.

*Uromyces proeminens* (DeCandolle) Passerini in Rabenhorst, see **UROMYCES EUPHORBIAE** Cook & Peck.

**UROMYCES PRATIAE** Spegazzini, Bol. Acad. Nac. Cienc Cordoba 11: 182, 1888. TYPE on On Campanulaceae

*Pratia repens* Gaudichaud, Brazil (Silveira, 1951: 31).

**UROMYCES PSYCHOTRIAE** P. Hennings, Hedwigia 43: 157. 1904. TYPE on ? *Psychotria* sp., Rubiaceae, from **Brazil**, Amazonas: Rio Juruá, Juruá-Miri, July, 1901, *Ule-3085*. (??,IIpe/III).

Anamorph



*Uredo palicoureae* P. Hennings, Hedwigia 43: 160. 1904. TYPE on ? *Palicourea* sp., Rubiaceae, from **Peru**, Huallaga: Yurimaguas, August 1902, *Ule-3231*.

*Uromyces psychotriae* has been reported from only the two collections listed above. The Sydows (1924) made the connection between the anamorph, *Uredo palicoureae*, and teleomorph of *Uromyces psychotriae* and stated that the identification of the hosts were probably mistaken. Up to now the hosts have not been reidentified.

Spermogonia and aecia unknown. Uredinia on both sides of leaves, loosely scattered on chlorotic leaves of new shoots, and irregularly arranged on the older leaves; sori minute, round, waxy, yellowish to bright rose, fading on drying; urediniospores 14-20 x 12-17  $\mu\text{m}$ , globose to broadly ovoid, walls ca 1.5  $\mu\text{m}$  thick, colorless, closely and finely echinulate, pores obscure. Telia on irregularly scattered reddish leaf spots on abaxial side of the leaves, small and crowded, covered at first with the epidermis, finally erumpent and covered with a whitish dust from the basidiospores from the germinated teliospores; teliospores 20-34 x 10-14  $\mu\text{m}$ , oblong to cylindrical with very thin, smooth, colorless walls, the pedicel colorless, up to 30  $\mu\text{m}$  long. The teliospores germinate in situ resulting in a whitish color to the sori (Sydow, P. & H., 1924).

*Uromyces pulverulentus* Spegazzini, see **YPSILOSPORA TUCUMANENSIS** Hernández & Hennen.

**UROMYCES PURUS** (H. Sydow) Cummins, Mycotaxon 5: 407. 1977. **(0/Ipe,IIpe/III)**.

≡ *Argomycetella pura* H. Sydow, Ann. Mycol. 23: 313. 1925. TYPE on *Vernonia patens* Humboldt, Bonpland & Kunth [*Vernonanthura patens* (Kunth) H. Robinson] from **Costa Rica**, San José, 6 Jan 1925, *Sydow-3*.

≡ *Maravalia pura* (H. Sydow) Mains, Bull. Torrey Bot. Club 66: 178. 1939.

On Compositae

*Vernonia* sp., Rio de Janeiro (IBI-12832).

*Uromyces purus* has been reported also from Costa Rica and Mexico (Cummins, 1978). Telia are whitish, teliospores have colorless, very thin walls and germinate without dormancy by elongation of the apex.

Spermogonia mostly on adaxial leaf surface. Aecia grouped about the spermogonia, otherwise like the uredinia. Uredinia mostly on abaxial surface, scattered, pale cinnamon brown; urediniospores pedicellate, (25-)27-32(-37) x 18-23  $\mu\text{m}$ , obovoid or broadly ellipsoid, wall 1.5-2  $\mu\text{m}$  thick, uniformly echinulate, cinnamon-brown or paler, pores 2, equatorial, with slight caps. Telia on abaxial side of leaves, exposed, whitish, compact; teliospores (25-)28-34(-37) x (15-)16-18(-20)  $\mu\text{m}$ , ellipsoid, ovoid or more or less oblong, wall uniformly 0.5  $\mu\text{m}$  or less thick, smooth, colorless, germinating without dormancy by continued elongation of the apex, without a differentiated germ pore; pedicels colorless, to 30  $\mu\text{m}$  long. (Cummins, 1978).

*Uromyces puttemansii* Rangel, see **UROMYCES NITEROYENSIS** Rangel.

**UROMYCES RATUS** H. S. Jackson & Holway in Jackson, Mycologia 24: 102. 1932. TYPE on

*Cayaponia ternata* Cogniaux from **Brazil**, Rio de Janeiro: Petropolis, 27 Oct 1921, *Holway-1251*.

**(0/Ipe,IIpe/III)**.

On Cucurbitaceae

*Cayaponia pentaphylla* Cogniaux, Minas Gerais (Thurston, 1940: 309).

*Cayaponia ternata* Cogniaux, Rio de Janeiro (Jackson, 1932: 102).

**Undetermined**, Minas Gerais (IBI-14584).

*Uromyces ratus* has been reported only from Brazil.

Spermogonia on both sides of leaves, few, punctiform, subepidermal, deeply embedded, dark brown, 90-105  $\mu\text{m}$  wide, 105-110  $\mu\text{m}$  high, periphyses not exerted. Aecia on both sides of leaves, in groups surrounding the spermogonia, otherwise like the uredinia. Uredinia 0.3-0.8 mm across, scattered or in groups, subepidermal in origin, erumpent, surrounded by the torn epidermis, pulverulent; urediniospores pedicellate, 27-32 x 22-27  $\mu\text{m}$ , ellipsoid to obovoid, frequently triangular, wall 1-1.5  $\mu\text{m}$  thick, sparsely and not very prominently echinulate, cinnamon-brown, pores 2, equatorial or slightly subequatorial. Telia on the abaxial side of leaves, compact, soon naked, ruptured epidermis inconspicuous, chestnut-brown; teliospores 27-38 x 24-27  $\mu\text{m}$ , subglobose or ellipsoid, obtuse above, rounded below, wall 1.5-2  $\mu\text{m}$  thick, thickened above by a

paler outer layer, smooth, pale chestnut-brown, pedicel about twice the length of the spore or shorter, colorless (Jackson, 1932).

**UROMYCES REGIUS** Vestergren, Ark. Bot. 4: 431. 1905. TYPE on *Bauhinia candicans* Benth., Leguminosae, from **Brazil**, Rio Grande do Sul: Cachoeira, 22 Feb 1893, *C.A.M.Lindeman-s.n.* (?/?~~IIpe/III~~).

Spermogonia and aecia unknown. Urediniospores mixed in telia, 16-23 x 16-20 µm, globoid, subgloboid or ovoid, wall 2.0 µm thick, conspicuously echinulate, yellow-brown, germ pores 4. Telia on both sides of leaves, without spots, scattered, punctiform, about chestnut-brown, pulverulent; teliospores 20-27 x 17-20 µm, globoid, subgloboid or ovoid, wall, 2.5 µm thick, reticulate, meshes variable in shape and size, pale chestnut-brown with a yellow-brown corona to 6.0 µm high at apex; pedicel same length of spore, colorless, slender (Almeida, 1975).

See *Uromyces anthemophilus* for notes on rusts on *Bauhinia*.

*Uromyces rhapsaneae* P. Hennings, see **UROMYCES MYRSINES** Dietel.

**UROMYCES RHYNCHOSPORAE** Ellis, J. Mycol. 7:274. 1893. TYPE on *Rhynchospora glomerata* (L.) Vahl from **The United States of America**, New Jersey: Salem County, Pennsville, Oct 1881, *A. Commons s.n.* (?/?~~IIpe/III~~).

Anamorph

*Uromyces rhynchosporicola* P. Hennings, Hedwigia 35: 226. 1896. TYPE on *Rhynchospora* sp. from **Brazil**, ? Santa Catarina, place and date not published. [H. Sydow and P. Sydow (1908) reported that *Uromyces rhynchosporicola* is only an anamorph. Thus the name needs to be transferred to an anamorph genus].

On Cyperaceae

*Rhynchospora scaberrima* Boeckeler, São Paulo (Jackson, 1926: 146).

*Rhynchospora* sp., Brasil (Hennings, 1896: 226).

*Uromyces rhynchosporae* has been reported also from Colombia, Venezuela, The West Indies, and The United States of America.

Arthur (1912) reported that, when compared to other species of *Uromyces* on Cyperaceae, traits that help to identify *Uromyces rhynchosporae* are: urediniospores 18-26 x 13-19 µm, ellipsoid or obovoid, wall 1-1.5 µm thick, golden brown, with 2 equatorial (or slightly superequatorial) germ pores, finely verrucose-echinulate; teliospores 20-29 x 10-15 µm, ellipsoid, cuneiform or clavate, rounded, truncate, or acuminate at apex, usually narrowed below, wall 1-1.5 µm laterally, 5-9 µm at apex, chestnut brown or lighter, sometimes paler below, smooth; pedicel colored, about length of spore.

Jackson (1926), and Arthur (1934), reported that *Uromyces rhynchosporae* is correlated with *Puccinia angustatoides* on *Rhynchospora* spp., which also has been reported from Brazil, and has almost identical urediniospores. Because most collections from South America consist only of uredinia, it may not be possible to identify these uredinial collections with certainty.

*Uromyces rhynchosporicola* P. Hennings, see **UROMYCES RHYNCHOSPORAE** Ellis.

*Uromyces rostratus* P. Hennings, see **UROMYCES NEUROCARPI** Dietel.

**UROMYCES RUMICIS** (Schumacher) Winter, Hedwigia 19: 37. 1880. (**0,Icv~~IIpe/III~~**).

= *Uredo rumicis* Schumacher, Enum. Pl. Saell. 2: 231. 1803. TYPE (fide Hyalander et al, 1953) probably on *Rumex crispus x obtusifolius*, reported originally as *Rumex acutus* Linnaeus from **Denmark**, Zealand, includes telia.

= *Uromyces rumicum* (DeCandolle) Fuckel, Jahrb. Nass. Ver. Nat. 15: 20. 1860. and Jahrb. Nass. Ver. Nat. 23-24: 64. 1869. (see basionym below under anamorph, Hyalander et al, 1953)

Anamorph

*Uredo rumicis* Schumacher, Enum. Pl. Saell. 2: 231. 1803. TYPE (Hyalander et al, 1953) probably on *Rumex crispus x obtusifolius*, reported originally as *Rumex acutus* Linnaeus from **Denmark**, Zealand, includes telia.

= *Uredo bifrons* DeCandolle, Fl. Fr. 2: 229. 1805 (includes telia, Hyalander et al, 1935).

= *Uredo rumicum* DeCandolle, Fl. Fr. 5: 66. 1815 (includes telia, Hylander et al, 1935).

On Polygonaceae

***Rumex obtusifolius*** Linnaeus, Rio Grande do Sul (IBI-12918), São Paulo (IBI-18546).

*Uromyces rumicis* has not been reported from Brazil before. From the Western Hemisphere this rust has been reported from Argentina (Lindquist (1983), Chile (Oehrens, 1963), Ecuador (Sydow, 1939), and Colombia (Buriticá and Pardo-Cardona, 1996), but not from North America. *Uromyces rumicis* is widespread in Eurasia and Africa. Spermogonia and aecia, which are known to occur on *Ranunculus* sp. Ranunculaceae, have been reported only from Europe.

**UROMYCES SCLERIAE** P. Hennings, Hedwigia Beiblatt 38:(67). 1899. TYPE on *Scleria* sp from

**Brazil**, Rio de Janeiro: (?Tijuca) Mauá, 6 April 1897, *Ule-2477*. (?/? ≡ **Ipe/III**).

On Cyperaceae.

***Scleria bracteata***, Maranhão (IBI 15634).

***Scleria macrophylla*** Presl, Brasil (Silveira, 1951:31).

***Scleria paludosa*** Kunth, Pará (Sydow, 1910:78).

***Scleria pratensis*** Lindley, São Paulo (Jackson, 1926:145).

***Scleria* sp.**, Amapá (IBI 16601), Mato Grosso (IBI-16770), Minas Gerais (Thurston, 1940:309), Pará (IBI-13262), Rio de Janeiro (Hennings, 1899A:67), São Paulo (IBI-12418).

*Uromyces scleriae* has been reported to be widespread in warmer regions of Africa, Asia, and the Americas. But the reports outside of the Americas need to be confirmed.

Arthur (1907-1940; 1912) reported traits that may help to identify *Uromyces scleriae* as: uredinia on abaxial side of leaves, 0.2-0.5 mm across, oblong, ruptured epidermis remaining, finally pulverulent, cinnamon-brown, urediniospores 23-35 x 18-26 µm, obovoid or ovoid, walls 1.5-2.5 µm at sides, thickened 3-9 µm at the apex, sparsely echinulate with conical papillae, pores 3, equatorial, obscure. Telia on abaxial side of leaves, as the uredinia but chestnut-brown and not powdery, teliospores 22-38 x 18-24 µm, broadly ellipsoid or obovoid, rounded above, obtuse or sometimes narrowed below, wall 2-3 µm thick at sides, 4-8 µm at apex, smooth, chestnut-brown or paler in less mature spores, pedicel to ca 30 µm but usually shorter, colorless or nearly so.

The apically thickened walls of the urediniospores of *Uromyces scleriae* are especially important for identification. *Puccinia scleriae* and *Uromyces scleriae* may occur on the same host species. *Puccinia scleriae* has urediniospores that are 19-27 x 13-19 µm, walls moderately echinulate and uniformly thin. Important also for identification of *Puccinia scleriae* are the loculate telia with teliospores that are often two or rarely three septate.

*Uromyces sepultus* Mains, see **UROMYCES NITEROYENSIS** Rangel.

**UROMYCES SETARIAE-ITALICAE** Yoshino, Bot. Mag. Tokyo 20: 247. 1906. This name published on 20 Oct 1906. NEOTYPE on *Setaria italica* (Linnaeus) P. Beauvois from **Japan**, Pref.

Kumamoto, Kumamoto, 20 October 1906 (Neotype designated by Ramachar & Cummins, 1963). (?/? ≡ **Ipe/III**).

= *Uromyces leptodermus* H. Sydow & P. Sydow in Sydow & Butler, Ann. Mycol. 4: 430. 1906.

TYPE on *Panicum javanicum* from **India**, Dehra Dun, 22 Sept 1905, *Butler-597*. This name was published 31 Oct 1906, ten days later than *Uromyces setariae-italicae* Yoshino.

Aecial Anamorph see discussion below.

Uredinial Anamorph

***Uredo setariae-italicae*** Dietel, Bot. Jahrb. 32: 632. 1903. LECTOTYPE on *Setaria italica* Kunth var. *germanica* Trin. from Japan, Tokyo, 3 Oct 1901, *S. Kusano -338*. Lectotype chosen here.

= *Puccinia panicola* Arthur, Bull. Torrey Bot. Club 34: 586. 1907. TYPE on *Panicum molle* Swartz from **Cuba**, Santiago de las Vegas, 1 March 1901, *Baker s.n.* Based on uredinia.

= *Uredo panici* P. Hennings, Hedwigia 43: 165. 1904. TYPE on *Panicum* sp. from **Brazil**, Rio Juruá, Juruá-Mirim, Sept 1901, *Ule-3077*. Not *U. panici* Arthur, 1902.

≡ *Uredo henningsii* Saccardo & D. Saccardo, Syll. Fungorum 17: 456. 1905.

Nom. nov. for *Uredo panici* P. Hennings. TYPE same as for *Uredo panici* P.

Hennings.

- = *Uredo isachnes* H. Sydow & P. Sydow in Sydow, H. & P. and E. J. Butler, Ann. Mycol. 4: 444. 1906. TYPE on *Panicum isachnum* from **India**, Poona, 25 Oct 1905., *E. J. Butler-596*.
- = *Uredo panici-prostrati* H. Sydow & P. Sydow in H. Sydow & P. Sydow and E. J. Butler, Ann. Mycol. 4: 44. 1906. TYPE on *Panicum prostratum* from **India**, Nilgiri Hills, December, 1910, *E. J. Butler-593*.
- = *Uredo eriochloae* H. Sydow & P. Sydow in Sydow, H. & P. & E. J. Butler, Ann. Mycol. 4: 444. 1906. TYPE on *Eriochloa polystachya* from **India**, Burhaga, Saran, 17 Nov 1903, *E. J. Butler-586*.
- = *Uredo panici-maximi* Rangel, Arch. Museu Nac. Rio de Janeiro 18: 160. 1916. TYPE on *Panicum maximum* Jacquin from **Brazil**, Rio de Janeiro: Niteroi, June 1915, *Rangel 749*.
- = *Uredo panici-villosi* Petch, An. Roy. Bot. Gard. Peradeniya 7: 295. 1922, TYPE on *Brachiaria villosa* (Lamarck) A. Camus from **Ceylon (Sri Lanka)**, Hakgala, April 1919, *Petch-5977*.
- = *Uredo melinidis* Kern, Mycologia 30: 550. 1938. TYPE on *Melinis minutiflora* P. Beauvois from **Venezuela**, Chacao, 28 April 1934, *Kern & Toro-1722*: .

On Gramineae:

*Eriochloa polystachya* Humboldt, Bonpland and Kunth, Paraña (Viégas, 1943: 83; IAC-2689).

*Melinis minutiflora* P. Beauvois, Minas Gerais (Thurston, 1940: 308), São Paulo (IBI-17895).

*Panicum antidotale* Retz, Minas Gerais (Thurston, 1940: 308).

*Panicum maximum* Jacquin [= *Megathyrsus maximus* (Jacquin) B. K. Simon & S. W. L. Jacobs, 2003; = *Urochloa maxima* (Jacquin) R. D. Webster, 1987], Rio de Janeiro (Rangel, 1916: 160), Brazil (Cummins, 1942: 670; Silveira, 1951: 31; Ramachar & Cummins, 1963: 52), São Paulo (IBI-15572).

*Panicum* sp., Amazonas (Hennings, 1904B: 165; Rio Grande do Sul (Lindquist & Costa Neto, 1963: 117).

*Pennisetum ciliare* (Linnaeus) Link, Rio Grande do Sul (Lindquist & Costa Neto, 1967: 59).

*Setaria poiretiana* Kunth, São Paulo (IBI-1744).

*Setaria rariflora* Mikan, Rio de Janeiro (IBI-1743).

*Setaria* sp., Maranhão (IBI-17097).

*Uromyces setariae-italicae* is circumglobal in warmer regions and has been reported on at least eleven genera of grasses: *Brachiaria*, *Cyrtococcum*, *Eriochloa*, *Melinis*, *Ottochloa*, *Panicum*, *Paspalidium*, *Pennisetum*, *Setaria*, *Stenotaphrum*, and *Urochloa* (Cummins, 1973). The synonymy follows Ramachar & Cummins (1963).

Spermogonia and aecia not known with certainty. Uredinia on both sides of leaves, cinnamon-brown; urediniospores (25-)27-33(-35) x (20-)23-28(-30) µm, broadly obovoid or ellipsoid; wall (1-)1.5(-2) µm thick, cinnamon-brown, echinulate, germ pores 3. equatorial. Telia on both sides of leaves, covered by the epidermis, blackish, small and inconspicuous; teliospores (16-)18-25(-28) x (14-)16-20 µm, variable, mostly angularly globose or obovoid; wall uniformly 1-1.5 µm thick, clear chestnut-brown, smooth, pedicels to 20 µm long but usually broken near the spore, colorless, thin-walled and collapsing (Cummins, 1971).

In Brazil *Uromyces setariae-italicae* is the only rust known on *Panicum maximum* and *Melinis minutiflora*, two of the most common, forage and weedy, introduced African grasses. Until Ramachar & Cummins work (1963), *Uromyces setariae-italicae* was reported often as *Uromyces leptodermus*.

Aecial anamorph: Hennen et al. (1982) listed *Aecidium brasiliense* under the holomorph name *Uromyces setariae-italicae* Yoshino because Cummins (1971) had reported that it was the aecial anamorph. Cummins based this on Narasiman and Thirumalachar's (1964) report that they made successful reciprocal inoculation experiments that proved a connection between an *Aecidium* species on *Cordia rothii* Roemer and Schultes (now *Cordia sinensis* Lamarck) and *Uromyces setariae-italicae* on two species of *Setaria* in Poona, India. They identified the *Cordia* rust as *Aecidium brasillense* P. Hennings because, as they stated, this name was recorded by Sydow and Butler (1906) for a rust on *Cordia rothii* from Poona, India. Narasiman and Thirumalachar gave no descriptive traits of this *Aecidium* nor did they report that any voucher herbarium specimens were preserved from their experimental work. We found no reference to *Aecidium brasillense* in Sydow and Butler's paper (1906) nor did the Sydows (1923) make any reference to it. The first reference to

*Ae. brasilense* in India is in Butler and Bisby, 1931, p. 52. They recorded a collection of *Aecidium* on *Cordia* from Poona, India by Ajrekar but no identifying traits of this rust were recorded.

Sathe (1966) reported a new species, *Aecidium poonensis* Sathe on *Cordia macleodii* Hooker from Poona but made no mention of Butler and Bisby's (1931) nor Narasiman and Thirumalachar's (1964) work, nor did he compare his new species to *Ae. brasilense* nor any other species of *Aecidium*. Narasiman and Thirumalachar's identification of the *Aecidium* material that they used as *Ae. brasilense* cannot now be confirmed.

Experimental inoculations to connect *Ae. brasilense* and *U. setariae-italicae* have never been reported from Brazil, nor has a connection between *U. setariae-italicae* and any *Aecidium* species been reported from any where else except for the work of Narasiman and Thirumalachar as stated above. Because of the uncertainty of the identification of the *Aecidium* sp. used by Narasiman and Thirumalachar, it is premature to accept *Ae. brasilense* as an aecial anamorph of *U. setariae-italicae*.

**UROMYCES SILPHII** Arthur [as "(Syd.) nom. nov."] J. Mycol. 13: 202. 1907. TYPE (proposed lectotype) on *Juncus tenuis* Willdenow from **The United States of America**, Indiana: Lafayette, 3 Apr 1906, Arthur-s.n. in PUR. (0/Icv<sup>s</sup> IIpe/III).

≡ *Uromyces junci-tenuis* P. Sydow & H. Sydow, nom. nov., Monogr. Ured. 2: 289. 1910.

= *Uromyces juncicola* Spegazzini, An. Mus. Nac. (Buenos Aires) 19 (ser.3, 12): 312. 22 Oct 1909. TYPE on *Juncus stipularis* from Argentina, Mendoza: Puente del Inca, Jan -Feb 1908, ? Spegazzini-s.n.

Synanamorphs

On Juncaceae, uredinial anamorph:

*Uredo junci* Str. sensu Spegazzini, Bol. Acad. Nac. Córdoba (Argentina) 11 (2) 183. 1888. (Fungi Fueg. p. 51, #142). (literature citation according to M. L. Farr, 1973). Or *Uredo junci* Spegazzini Anal. Mus. Nac. (Buenos Aires) 12: 312. 1901 (according to Lindquist, 1978).

On Compositae, spermogonial and aecial anamorphs, known only in North America.

*Aecidium compositarum-silphii* Burrill in DeToni, Sac. Syl. Fung. 7: 798. 1888 (literature citation according to Lindquist, 1978).

On Juncaceae

*Juncus* sp., Santa Catarina (Hennings, 1896: 226, reported this collection as *Uromyces junci* but Jackson, 1926, reidentified it as *Uromyces silphii* because the pores in the urediniospores were supraequatorial).

*Uromyces silphii* has been recorded also in Argentina, Chile, Uruguay, Ecuador, Mexico, and The United States of America.

See *Uromyces junci* for a comparison of traits of species of *Uromyces* on *Juncus* in the Americas. Lindquist (1982) reported that *Uromyces silphii* could be considered as a variety of *Uromyces juncii* because of the variability in the position of the germ pores of the urediniospores but he did not make a formal change. Obvious smooth areas occur below the two supraequatorial germ pores in the urediniospores of the Holway collection number 206 from Panamavida, Chile. Arthur (1934) reported that both *Uromyces junci* and *Uromyces silphii* are correlated with *Puccinia littoralis*, a Eurasian species on *Juncus* that is unknown in The Americas.

? **UROMYCES SPERMACOCES** (Schweinitz) M. A. Curtis, Cat. Plants North Carolina, p. 123. 1867. (0/I,II/III).

≡ *Puccinia spermacoces* Schweinitz, Schr. Nat. Ges. Leipzig 1: 74. 1822. TYPE on *Diodia teres* Walt. (reported as *Spermacoces* sp.) from North Carolina, U.S.A.. Not Berkeley & Curtis, 1874.

≡ *Uromyces spermococes* (Schweinitz) Thuemen, mycotheca univ. no. 242. 1875.

On Rubiaceae

*Spermococe tenuior* Linnaeus, Minas Geraes (Thurston, 1940: 309).

*Uromyces spermococes* occurs probably only in North America. The identification of the specimen reported by Thurston needs to be confirmed.

Arthur (1934) speculated that *Puccinia lateritia* is a species correlated with *Uromyces spermococes*.

*Uromyces spermococes* (Schweinitz) Thumen, see **UROMYCES SPERMACOCES** (Schweinitz) M. A.

Curtis.

**UROMYCES STRIATUS** Schroeter, Abh. Schles. Ges. Vaterl. Cult. Nat. Abth. 1869-72: 11. 1870.  
LECTOTYPE on *Medicago lupulina* Linnaeus from Pirscham near Wroclaw (Breslau), **Poland**,  
designated by Hylander, Joerstadt, and Nannfeldt (1953). (**0/Icv**  $\cong$  **IIpe/III**).  
= *Uromyces medicaginis* Passerini, in Thuemen, Herb. Mycol. Oecon. 156. 1896.

Anamorph

*Uredo leguminosarum* forma *medicaginis* Passerini, Comm. Soc. Critt. Bot. Ital. 2: 451. 1867.  
 $\equiv$  *Uromyces medicaginis* (Passerini) Thuemen Herb Myc. Oecon. p. 156. 1867. Telia not  
described.

On Leguminosae

*Medicago sativa* Linnaeus, Minas Gerais (Thurston, 1940: 308; Almeida, 1975: 43; IBI-36330,  
Paraná (Fontoura & Nowacki, 1967/70: 149; Almeida, 1975: 43; IBI-14117), São Paulo  
(Sydow, 1907: 354; Viégas, 1945: 72; Almeida 1975: 43; IAC-235, IBI-2730, *Puttemans-*  
*1636*).

*Uromyces striatus* is distributed worldwide where alfalfa (*Medicago sativa* Linnaeus) is grown.  
Laundon and Waterston (1965) report that infections are often sufficient to cause defoliation which reduces  
the nutritive value of the fodder and reduces the capacity to enrich the soil with nitrogen.  
Spermogonia and aecia have been reported on *Euphorbia cyparissius* Linnaeus, Euphorbiaceae, from Europe  
but not from Latin America.

Spermogonia on adaxial side of leaflets, numerous, scattered. Aecia on adaxial side of leaflets  
among spermogonia, peridium cupulate, white; aeciospores mostly 18-23  $\mu$ m diam, polygonoid or ellipsoid,  
wall 1  $\mu$ m thick, colorless, minutely verrucose. Uredinia mostly on abaxial side of leaflets, , 0.1-0.5 mm  
across, surrounded by the ruptured epidermis, scattered or in small groups, cinnamon-brown, pulverulent;  
urediniospores 18-24(-26) x (16-)18-22  $\mu$ m, globoid, subgloboid or broadly ellipsoid, wall (1-)1.52(-2,5)  $\mu$ m  
thick, echinulate, golden-brown or light cinnamon-brown, germ pores (2)3-4(5), equatorial, less frequently  
slightly above the equator, with colorless, echinulate caps. Telia about dark cinnamon-brown, otherwise as  
the uredinia; teliospores 18-26(-29) x 14-21  $\mu$ m, ellipsoid, obovoid or globoid to subgloboid, wall 1-2  $\mu$ m  
thick, cinnamon-brown or light chestnut-brown, 2-5-4  $\mu$ m thick at apex with a paler papilla, verrucose-striate,  
with ridges or elongated warts disposed longitudinally, sometimes united on the surface of spore; pedicel to  
30  $\mu$ m long, rarely to 40  $\mu$ m long, colorless, thin-walled (Almeida, 1975).

Hylander et al. (1953) reported that *Uromyces pisi* is a collective species name that includes six  
"races or race groups usually considered as species". These are: *Uromyces euphorbiae-corniculati* Jord., on  
*Lotus* sp.; *Uromyces laburni* (DeCandolle) Oth on *Genista* sp., *Laburnum* sp. and *Sarothamnus* sp.; *Uromyces*  
*onobrychidis* Bubak on *Onobrychis* sp.; *Uromyces pisi* on *Lathyrus* sp. and *Pisum sativum*; *Uromyces*  
*punctatus* on *Oxytropis* sp.; and *Uromyces striatus* Schroeter on *Medicago* spp. and *Trifolium* spp. Only  
*Uromyces pisi* and *Uromyces striatus* have been reported from Latin America, the others are from Europe.  
As far as has been reported, all have their spermogonia and aecia on *Euphorbia cyparissias* and other closely  
related species of *Euphorbia*, Euphorbiaceae. But these have not been reported from Latin America.

*Uromyces superfixus* Vestergreen reported on *Bauhinia* sp. from Paraíba by Viégas (1945) but the  
specimen identified later as *Uromyces bauhiniae* P. Hennings by Almeida (1975).

*Uromyces taubertii* P. Hennings, see **SPHENOSPORA PALLIDA** (Winter) Dietel.

**UROMYCES TENER** Schroeter, in P. Hennings, Hedwigia 35: 225. 1896. TYPE on *Manettia gracilis*  
from **Brazil**, Santa Catarina: Serra de Oratorio, April 1889, *Ule-1243*. (**-I,-/III**).

On Rubiaceae

*Manettia gracilis* Chamisso & Schlectendahl, Brazil (Hennings, 1896: 225; Joerstad, 1959: 86).

Joerstad (1959) reported that *Uromyces tener* needs to be compared with *Maravalia manettiae*  
Joerstad from Ecuador.

*Uromyces tessariae* (Spegazzini) Lindquist, see **UROMYCES MEGALOSPERUS** Spegazzini.

**UROMYCES TOLERANDUS** H. S. Jackson & Holway in Jackson, Mycologia 23: 471. 1931. TYPE on

*Manihot* sp. from **Brazil**, São Paulo: Reserva Florestal, 9 May 1922, *Holway-1827*. (?!/?,?/III).  
On Euphorbiaceae

*Manihot* sp., Santa Catarina (Viégas, 1945: 72; IAC-3770), São Paulo (Jackson, 1931: 471; Viégas, 1945: 72; IAC-3755).

*Uromyces tolerandus* has been reported only from Brazil.

Spermogonia, aecia, and uredinia unknown. Telia on abaxial side of leaves, 0.5-1 mm across, chestnut brown, scattered or gregarious in groups to 3 mm. across, tardily naked, pulverulent, ruptured epidermis conspicuous; teliospores 27-38 x 18-22 µm, ellipsoid, acute at apex; rounded below, wall 2-3 µm thick, apex thickened 5-8 µm, finely, evenly, and inconspicuously verrucose, chestnut brown, pedicel equalling the spore or shorter, colorless.

The aspect is not that of a micro-form (Jackson, 1931).

See *Uromyces carthagenensis* for a comparison of the six species of *Uromyces* known to infect *Manihot*.

*Uromyces tournefortiae* P. Hennings, see *Uredo pachystefgiae* Dietel (**UROMYCES DOLICHOSPORUS** Dietel & Holway).

**UROMYCES TRANSVERSALIS** Winter, as "(Thümen) Winter", *Flora* 62: 264. 1884. TYPE on *Tritonia securigera* Ker., Iridaceae, from **South Africa**, Cape of Good Hope: Somerset-East, July 1876, *MacOwan s.n.* Probably the same collection as the type of *Uredo transversalis* Thuemen. (?!/?,IIpe/III).

Anamorph

*Uredo transversalis* Thuemen, *Flora* 1876, p. 570. TYPE on *Tritonia securigera* Ker., Iridaceae, from **South Africa**, Cape of Good Hope: Somerset-East, July 1876, *MacOwan-1254*.

On Iridaceae

*Gladiolus* sp., Minas Gerais (IBI 14208), Pernambuco (IBI 13875), Rio de Janeiro (IBI 14075), São Paulo (Pita, et al., 1982, IBI 13964).

*Uromyces transversalis* on *Gladiolus* sp. has been reported from several countries in Africa and some European countries around the Mediterranean. *Uromyces transversalis*, which also has been reported to infect other genera in the Iridaceae: - *Crocsmia* sp., *Tritonia* sp., and *Watsonia* sp. - in Africa, was only recently introduced in Brazil on cultivated *Gladiolus*. This rust is now widespread in Brazil and has also been seen in Argentina. The specific epithet comes from the disposition of the uredinial and telial sori that are horizontal to the elongated longitudinal leaf veins. The telial sori are under the epidermis and loculate. The locules compress the teliospores resulting in their irregularly polygonal or other shapes. Their pedicels are very short so that some may appear sessile. See Pita, et al. (1981) for more information about this species in Brazil.

Ferreira and Rijkenberg (1990) reported that with scanning electron microscopy they detected urediniospores were produced enteroblastically ("percurrent proliferation"). At first each urediniosporogenous cell produced a distal holoblastic, pedicellate spore, followed successively by up to three more spores, each of these produced enteroblastically from the same sporogenous cell, their initials emerging through the base of the pedicel of the previous spore. When an enteroblastically produce spore come off of the sporogenous cell it leaves a minute collar around the remains of the previous pedicel base.

**UROMYCES TRICHOCLINES** P. Hennings, *Hedwigia Beiblatt* 38: (67). 1899. TYPE on *Trichocline polymorpha* Baker, Compositae, from **Brazil**, Rio de Janeiro: Itocohamy, Feb 1892, *Ule-1860*. (?!/?,IIcv/III).

Anamorph

*Aecidium trichoclinae* P. Hennings, *Hedwigia Beiblatt* 38: (71). 1899. TYPE on the same specimen as for *Uromyces trichoclinae* P. Hennings.

Both anamorph and teleomorph are known only from the same type collection.

No spermogonia were reported so we propose that the name *Aecidium trichoclinae* applies to uredinia and probably to aecia.

The Sydows (1910, 1923) reported telia as on the abaxial side of leaves, very small, compact, dark brown, and in dense groups; teliospores 28-42 x 14-20  $\mu\text{m}$ , fusoid to clavate, rounded to narrowed above, the apical wall thickened up to 11  $\mu\text{m}$ , the lateral wall thin, pale brown. the pedicel about the length of the spore, yellowish. The anamorph peridial cells 24-30 x 15-20  $\mu\text{m}$ , loosely united; spores 16-19 x 15-17  $\mu\text{m}$ , angularly globoid to ovoid, the wall 1-1.5  $\mu\text{m}$ , subcolorless, densely minutely verrucose.

**UROMYCES TRIFOLII-REPENTIS** Liro, Bidr. Kaenned. Finland Nat. Folk 65: 94. 1908 var.

**TRIFOLII-REPENTIS.** TYPE on *Trifolium repens* from **Finland**. Cummins (1983) designated a specimen in H as Lectotype. **(0/Icv,IIpe/III).**

On Leguminosae

*Trifolium* sp., Paraná (Fontoura & Nowacki, 1967/70: 176; Almeida, 1970: 38), Rio Grande do Sol (Almeida (1975: 38).

*Uromyces trifolii-repentis* var. *trifolii-repentis* is the usual rust on the forage plant species *Trifolium hybridum* Linnaeus, *T. repens* Linnaeus, and other species of *Trifolium* circumglobally. *Uromyces trifolii-repentis* var. *fallens* (Arthur) Cummins, the only other variety, is also widespread, but it mostly infects the forage plant species *Trifolium pratense* Linnaeus. (Cummins, 1983)

*Uromyces trifolii-repentis* var. *trifolii-repentis*: Urediniospores with (2-)3(-4), more or less equatorial germ pores with small cuticular caps.

*Uromyces trifolii-repentis* var. *fallens*: Urediniospores with 3-4 equatorial, or more commonly 3-4 equatorial and one apical germ pore, and less commonly 6-7 pores. Cummins (1983)

Walker (1978) clarified the nomenclature of *Uromyces trifolii* (Hedwig ex DeCandolle) Fuckel, which is a microcyclic species on *Trifolium* spp., especially on *T. repens*. We have found no report of this rust from Brazil but it has been reported from Argentina, Chile, and Colombia in South America. It is to be expected in Brazil.

16. **UROMYCES NERVIPHILUS** (Grog.) Hotson, Publ. Puget Sound

Biol. Sta. Univ. Wash. 4: 368. 1925.

*Uromyces flectens* Lagerheim., Svensk Bot. Tidskr. 3: 36. 1909.

Spermogonia mostly on the abaxial side of leaves or mostly on petioles and veins, among the aecia, Aecia in groups, cupulate, margin somewhat erose, yellowish; aeciospores globoid to broadly ellipsoid, mostly with angular edges, mostly 18-24 x 13-20  $\mu\text{m}$ , wall colorless, about 1  $\mu\text{m}$  thick, minutely verrucose. Uredinia unknown. Telia mostly on the abaxial side of leaves chocolate-brown, minute, scattered or in groups, coalescent, frequently elongated, causing hypertrophy on the veins and petioles, long covered by the epidermis, then pulverulent; teliospores ellipsoid, obovoid, globoid or ovoid, (18-)20-28(-30) x 15-22(-25)  $\mu\text{m}$ , wall 1.5-2  $\mu\text{m}$  thick, cinnamon-brown or light chestnut-brown, with a low, round papilla over the pore, paler than spore, minutely and inconspicuously verrucose, appearing smooth; pedicel colorless, thin-walled, breaking near the hilum. (Almeida, 1975)

7. **UROMYCES TRIFOLII** (Hedw. f. ex DC.) Winter, Hedwigia 19: 37, 1880, var. **TRIFOLII.**

*Puccinia trifolii* Hedwig f. ex DC., Flore Fr. 2: 225. 1805,

*Uromyces trifolii* (Hedwig f.) Lev., Ann. Sci. Nat. 1119 8: 371. 1847.

*Uromyces trifolii-repentis* Liro, Acta Soc. Fauna Flora Fenn. 29, no 6, p. 15. 1906.

*Uromyces hybridi* W. H. Davis, Mycologia 10: 212. 1924.

Spermogonia mostly on the adaxial side of leaves, in groups. Aecia on both sides of leaves in groups, peridium cupulate, margin erose, yellowish; aeciospores mostly globoid or with angular edges 15-21(-24) x 13-17(-20)  $\mu\text{m}$  wall 1  $\mu\text{m}$  thick, finely verrucose, colorless. Uredinia on both sides of leaves, light cinnamon-brown, scattered, rounded, 0.1-0.5 mm across, surrounded by the ruptured epidermis, pulverulent; urediniospores globoid to broadly ellipsoid, (21-)24-28(-30) x (18-)20-23  $\mu\text{m}$ , wall 1.5-  $\mu\text{m}$  thick, golden-brown, echinulate, 2-3(4) equatorial or slightly above the equator germ pores, with colorless, echinulate caps, Telia mostly on the abaxial side of leaves, chestnut-brown, otherwise as the uredinia; teliospores globoid to broadly ellipsoid, (20-)22-28(-30) x (16-)18-24  $\mu\text{m}$ , wall 1.5-2  $\mu\text{m}$  thick, cinnamon-brown, with a low colorless papilla over the pore, and few to many verrucae, scattered or frequently in lines, or smooth; pedicel colorless, thin-walled, short, rarely to 30  $\mu\text{m}$  long. (Almeida, 1975)

**UROMYCES TRIQUETRUS** Cooke (as "triquetra"), Proc. Portland Soc. Nat. Hist. 1: 184. 1862. TYPE



- on *Hypericum* sp. from **The United States of America**, Maine: Scarboro, Westbrook, date not reported, *E.C. Bolles s.n.* (0/Icv,IIpe+?IIcv/III).
- = *Uromyces hyperici* Curtis, Cat. Pl. North Carolina, p. 123. 1867.
- = *Uromyces hyperici-frondosi* Arthur [ as "(Schw.)" Arthur], Minnesota Acad. Nat. Sci. ser. 2, 2: 15. 1883. A lectotype needs to be chosen from the specimens with telia studied by Arthur.  
 ≡ *Nigredo hyperici-frondosi* (Arthur) Arthur, as "(Schw.) n.n.", Résult. Sci. Congr. Bot. Vienna, p.344. 1906.
- = *Uromyces pachycephelus* Neger, Anal. Univ. Chile 93: 785. 1896. TYPE on *Hypericum chilense* from **Chile**, near Concepcion, date not reported, *Neger s.n.*
- = *Uromyces hypericinus* Spegazzini, Anal. Mus. Nac. de Buenos Aires 19: 311. 1909. TYPE on *Hypericum brasiliensis* from **Argentina**, Chaco: Ipana near Formosa, Oct 1881, *Spegazzini s.n.*
- ? *Uredo hyperici* Schweinitz.

## Anamorphs

- Aecidium hyperici-frondosi* Schweinitz, Schr. Nat. Ges. Leipzig 1: 68. 1822. TYPE on *Hypericum aureum* Barton (recorded originally as *Hypericum frondosum* Michaux) from **The United States of America**, North Carolina: Narrows of Yadkin, date not reported, *Schweinitz s.n.* This anamorph functions as aecia and possibly also as uredinia.
- = *Aecidium minutissimum* Gerard, Bull. Torrey Bot. Club 5: 40. 1874. TYPE on *Hypericum mutilum* from **The United States of America**, New York: Poughkeepsie, Oct-Nov, year not reported, *Gerard s.n.*
- Uredo hyperici* Sprengel in Linnaeus, Syst. Veg. 4: 572. 1827. TYPE not determined. This anamorph functions as urdedinia.
- = *Trichobasis hyperici* W. Gerard, Bull. Torrey Bot. Club 4: 47. 1873. TYPE not determined.

The teleomorph and anamorph synonymy are too extensive to include all here. See Arthur (N. Amer. Fl. 7: 261. 1912; and Man. Rusts in United States and Canada, 1934), and Lindquist (1983) for other synonyms.

## On Clusiaceae (Hypericaceae, Guttiferae)

*Hypericum brasiliense* Choisy, Minas Gerais ( Joerstad, 1959: 68), Rio de Janeiro (Jackson 1931: 481), São Paulo (Jackson, 1931: 481; IBI-16968A).

*Hypericum mutilum* Linnaeus, Minas Gerais (Joerstad, 1959: 68).

*Hypericum* sp., Minas Gerais (Jackson, 1931: 481), São Paulo (Jackson, 1931: 481).

*Uromyces triquetrus* has been reported as widespread in the New World from Argentina to southern Canada. It has been reported in the Old World from South Africa, China, and Japan.

Arthur (1883) reported observations suggesting the interesting possibility that *Aecidium hyperici-frondosi* may function as either aecia or uredinia, while *Uredo hyperici* functions as uredinia. These observations also suggest an evolutionary loss of the *Uredo hyperici* morph from the life cycle and a change in the function of the *Aecidium* anamorph from an aecial role to an uredinial role.

*Uromyces tweedianus* (Spegazzini) Bartholomew, see **UROMYCES INDURATUS** H. Sydow, P. Sydow & Holway.

**UROMYCES ULEANUS** Dietel, Hedwigia 36:27. 1897. TYPE on *Euphorbia* sp. from **Brazil**, Santa Catarina: Serra Geral, Jan 1891, *Ule-1731*, and March, 1891, *Ule-1732*. One of these two specimens needs to be designated as a lectotype. (??,IIpe/III).

## On Euphorbiaceae

*Euphorbia* sp., Brasil (Dietel, 1897: 27; Tranzschel, 1910: 11.).

**UROMYCES UNIONENSIS** Viégas, Bragantia 5: 73. 1945. TYPE on *Desmodium* sp. (reported as *Meibomia* sp.) from **Brazil**, Alagoas: União, Oct 1939, *Deslandes-436* (??,IIpe/III).

## On Leguminosae

*Desmodium* sp., Alagoas (Viégas, 1945: 73; Almeida, 1975: 39; IAC-3816).

*Uromyces unionensis* has been reported only from Brazil.

Spermogonia and aecia unknown. Uredinia mostly on the abaxial side of leaves, scattered or confluent, minute, round, at first covered by epidermis, later pulverulent, light cinnamon-brown, paraphyses inconspicuous, capitate or clavate, 10-20  $\mu\text{m}$  wide apically, thin walled, collapsing, colorless, urediniospores 18-28(-29) x (16-)18-22(-24)  $\mu\text{m}$ , globoid, obovoid or broadly ellipsoid, wall 1-1.5  $\mu\text{m}$  thick, pale yellow or pale yellow-brown, echinulate, germ pores 4-5, equatorial or approximately equatorial, less frequently with 3-4 equatorial or approximately equatorial and 1 near or at apex. Telia blackish brown, otherwise as the uredinia or teliospores sometimes mixed with urediniospores; teliospores 24 -29(-32) x 22-28  $\mu\text{m}$ , ovoid or globoid-ellipsoid, wall 3-4  $\mu\text{m}$  thick at sides, 5-7  $\mu\text{m}$  thick at apex, dark chestnut-brown, with a paler, not clearly differentiated papilla at apex, varying from verrucose, with round, elongate and irregular warts more prominent toward the apex or these united to form a kind of labyrinth, to irregularly reticulate; pedicel to 40  $\mu\text{m}$  long, colorless, mostly collapsing (Almeida, 1975).

See *Uromyces castaneus* for a key to the species of *Uromyces* on *Desmodium* in Brazil.

**UROMYCES URBANIANUS** P. Hennings, Hedwigia 36: 213. 1897. TYPE on *Orycanthus spicatus* from **Trinidad**, St. Anna, date not reported, *J. H. Hart-6099*. (?/?,**IIcv,III**).

On Loranthaceae

*Struthanthus complexus* Eichler, Rio de Jaeniro (PUR-F2699).

*Uromyces urbanianus* has been reported also from Argentina, Colombia, and Trinidad, and also on the host genera *Antidaphne* and *Phrygillanthus*.

See *Uromyces circumscriptus* for a key to species of *Uromyces* on Loranthaceae in the New World.

*Uromyces usterianus* Dietel, see **UROMYCES MYRSINES** Dietel.

*Uromyces usterii* Spegazzini, see **KUEHNEOLA LOESENERIANA** (P. Hennings) H.S. Jackson & Holway.

*Uromyces verus* H. S. Jackson & Holway, see **UROMYCES FLORALIS** Vestergren.

*Uromyces vestitus* Dietel, see **TRACHYSPORA VESTITA** (Dietel) Lindquist.

**UROMYCES VICIAE-FABAE** Schroeter, Hedwigia 14: 161. 1857. TYPE (Neotype designated by Cummins, 1978) on *Vicia faba* Linnaeus, locality and date of collection not recorded, in the Persoon herbarium in Leiden, The Netherlands. (**0/Icv,IIpe/III**) or **?(0/Icv + Ipe,IIpe/III)** or **?(0/Icv,IIcv/III)**.

Anamorph

*Uredo viciae-fabae* Persoon, Synopsis Methodica Fungorum, p. 221. 1801. Telia present but not described.

= *Uromyces fabae* DeBary, Ann. Soc. Nat Bot ser. 4, 20: 80. 1863. Telia not described.

On Leguminosae

*Lens culinaris* Medicus, Rio Grande do Sul (Lindquist & Costa Neto, 1963: 1929; Almeida, 1975:37).

*Vicia faba* Linnaeus (*Faba vulgaris* Moench), Minas Gerais (Thurston, 1940:307; Almeida, 1975: 37), Paraná (Fontoura & Noawacki, 1967/70: 178), Rio Grande do Sul (Juel, 1897: 16; Almeida, 1975: 37), São Paulo (Hennings, 1902D: 295); Viégas, 1945: 64; Almeida, 1975: 37; IAC-273; IBI-3535).

*Vicia* sp. São Paulo (Viégas, 1945: 64; Almeida, 1975: 37; IAC-1500).

*Uromyces viciae-fabae* has been reported circumglobally mostly on cultivated species of *Lathyrus*, *Lens*, *Orobis*, *Pisum*, and *Vicia*. Laundon and Waterston (1965) reported that "although widespread this pathogen usually causes only slight injury". But Lindquist (1982) stated that "This autoecious species ...is very common and very damaging to cultivated broad bean ("habas") and lentils ("lentejas"). Epiphytotics induced by this pathogen constitute a limiting factor for the cultivation of lentils in all of Latin America.

Spermogonia mostly on the adaxial side of leaves, in groups. Aecia mostly on the abaxial side of leaves, in groups, peridium cupulate, whitish, margin erose; aeciospores 18-26 x 15-21  $\mu\text{m}$ , mostly broadly ellipsoid, wall 1.0-1.5  $\mu\text{m}$  thick, colorless, densely and finely verrucose. Uredinia on both sides of leaves, scattered. 0.1-1 mm across, mostly rounded, yellow-brown or light cinnamon-brown, surrounded by the

ruptured epidermis, pulverulent; urediniospores (20-)22-30(-32) x (18-)19-24(-26)  $\mu\text{m}$ , ellipsoid, obovoid or globoid, wall 1.5-2  $\mu\text{m}$  thick, light golden-brown, echinulate, germ pores (3)4(5) equatorial or nearly equatorial, less frequently scattered, or with 3-4 equatorial and 1 at apex, with colorless, echinulate caps. Telia blackish brown, compact, otherwise as the uredinia; teliospores (22-)24-35(-38) x (18-)20-26  $\mu\text{m}$ , ovoid, obovoid, subgloboid or broadly ellipsoid, wall 1.5-2.5  $\mu\text{m}$  thick at sides, 5-10  $\mu\text{m}$  at apex, chestnut-brown, smooth; pedicel to 40  $\mu\text{m}$ , less frequently to 65  $\mu\text{m}$  long, yellowish brown or only near the spore, mostly collapsing (Almeida, 1975).

*Uromyces viciae-fabae* has been used extensively as an experimental organism to study rust biology. Experimental inoculations reviewed by Wilson and Henderson (1966) suggested that the life cycle may be variable. In Canada inoculations with basidiospores resulted in two forms of aecia, some having the morphology of *Aecidium* and some having the form of *Uredo*. In India uredinia were produced that had the morphology of *Aecidium* at temperatures between 17° and 22° C, while above 25° C the uredinia had the morphology of *Uredo*.

**UROMYCES VICINUS** H. S. Jackson & Holway in Jackson, *Mycologia* 23: 499. 1931. TYPE on *Ipomoea* sp., from **Brazil**, São Paulo: Juquery, 12 June 1922, *Holway-1961*. (?/?,IIep/III).

On Convolvulaceae:

*Ipomoea* sp. Minas Gerais (Jackson, 1931: 499; IBI-13529); Rio Grande do Sul (IBI-17419); Rio de Janeiro (Jackson, 1931: 499); São Paulo (Jackson, 1931: 499, IBI-18368).

*Uromyces vicinus* has been reported only from Brazil.

We found paraphyses in our collections that we describe here but Jackson (1931) did not include them in his description.

Spermogonia and aecia unknown. Uredinia scattered or in groups on both sides of leaves but mostly on the abaxial side, 0.2-0.4 mm across, early naked, ruptured epidermis noticeable, powdery, cinnamon-brown, paraphyses peripheral, numerous, 45-75 x 4-8  $\mu\text{m}$ , mostly collapsed, usually capitate, the head 17-19  $\mu\text{m}$  in diameter, wall about 0.75  $\mu\text{m}$  thick, urediniospores 24-28 x 19-22  $\mu\text{m}$ , ellipsoid to obovoid, wall 1  $\mu\text{m}$  thick or less, closely and finely echinulate, pale golden brown, pores obscure, 2 or 3, equatorial. Telia like the uredinia but blackish-brown, compact; teliospores 28-37 x 18-23  $\mu\text{m}$ , ellipsoid, obovoid, or oblong, somewhat variable, rounded or obtuse above, rounded or often somewhat narrowed below, wall 1  $\mu\text{m}$  thick at sides, 6-12  $\mu\text{m}$  thick above and often somewhat lamellate, chestnut-brown, smooth; pedicel short, deciduous, colorless or slightly tinted next to the spore (Jackson, 1931).

**UROMYCES VIÇOSENSIS** Almeida, *Fitopat. Bras.* 2: 56. 1977. TYPE on *Bauhinia* sp., Leguminosae, from **Brazil**, Minas Gerais, Viçosa, date not reported, A. S. *Mueller-741*. (0/Ipe,IIpe/III).

*Uromyces viçosensis* has been reported only from Brazil.

Spermogonia few to many, in groups, on spots to 5 mm diam. on the adaxial side of leaves. Aecia and aeciospores like the urediniospores, in groups, coalescent, cinnamon-brown, opposite the spermogonia. Uredinia mostly on the abaxial side of leaves, minute, scattered, or in small groups, coalescent, cinnamon-brown, pulverulent; urediniospores 22-29 x 20-24  $\mu\text{m}$ , obovoid, broadly globoid or broadly ellipsoid, wall 2-2.5(-3)  $\mu\text{m}$  thick, conspicuously echinulate, yellow-brown to cinnamon-brown, germ pores 4-5 equatorial or approximately equatorial, rarely 4 equatorial and 1 at apex, without or with small, colorless echinulate caps. Telia on adaxial side of leaves, minute, scattered or mostly in groups, coalescent, ruptured epidermis conspicuous, among or surrounding the spermogonia, cinnamon-brown to reddish brown; teliospores 17-22 x 15-20  $\mu\text{m}$ , mostly globoid or broadly ellipsoid, wall 2-3  $\mu\text{m}$  thick at sides, pale yellow to golden-brown, reticulate, with salient reticula and meshes variable to about 2  $\mu\text{m}$  diam, at apex with a paler umbo to 2-2.5  $\mu\text{m}$  high; pedicel colorless, thin-walled, breaking near the hilum.

The combination of the larger, cinnamon-brown urediniospores, which are conspicuously echinulate and have 4-5 equatorial germ pores, and the smaller, pale yellow to golden-brown teliospores makes this species distinct (Almeida, 1975).

See *Uromyces anthemophilus* for notes on rusts on *Bauhinia*.

**UROMYCES VIEGASII** R. Almeida, *Fitopat. Bras.* 2: 55-56. 1977. TYPE on *Bauhinia forficata* Link, Leguminosae, from **Brazil**, São Paulo: São José do Rio Pardo, date not reported, A. S. *Costa*. (0/-,-/III).

*Uromyces viegasii* has been reported only from Brazil.

Spermogonia few, on adaxial side of leaves. Aecia and uredinia unknown. Telia on both sides of leaves on brown spots 1-5 mm diam, surrounded by a yellow halo, minute, cinnamon-brown, scattered or in groups, sometimes in circles around the spermogonia, long covered by the epidermis, later pulverulent, ruptured epidermis conspicuous, teliospores (15-)18-22(-24) x (13-)16-18(-20)  $\mu\text{m}$ , globose or ellipsoid, wall 1.5-2.5  $\mu\text{m}$  thick at sides, golden to golden-brown, reticulate, with meshes of variable size and shape to about 2-2.5  $\mu\text{m}$  diam; at the apex the reticula are more salient and paler, forming a low and distinct papilla to 2-5(-3)  $\mu\text{m}$  high; pedicel to 10-15  $\mu\text{m}$  long, breaking near the hilum, colorless, thin-walled. (Almeida, 1975).  
See *Uromyces anthemophilus* for notes on rusts on *Bauhinia*.

**UROMYCES VIGNAE** Barclay, J. Asia. Soc. Bengal 60: 211. 1891. TYPE on *Vigna vexillata* Linnaeus) A. Rich. from near Simla, **India**, date not reported, Barclay. (0/Icv, IIpe/III).

On Leguminosae:

*Vigna unguiculata*, Maranhão (IBI 15505), Paraíba (IBI-15455), Pernambuco (IBI 15460), Piauí (IBI 15454).

*Lablab purpureus*. São Paulo (IBI-17620A, II).

*Uromyces vignae* is widespread on *Vigna* spp. and related genera. It has been reported often as *U. appendiculatus*, which is considered as conspecific by some authors, but *U. vignae* is characterized by having two supraequatorial, evident germ pores in the urediniospores instead of two equatorial, often obscure pores as in *U. appendiculatus*. Also the walls of the teliospores appear smooth while in *U. appendiculatus* the teliospore walls are often irregularly sculptured. *Uromyces vignae* is an important rust for the Northeast of Brazil on fajão de vara (*Vigna unguiculata*).

We identified a specimen from HBG labeled as *Ule-2327*, on *Vigna luteola* from Rio de Janeiro; Copacabana, 1 Aug 1897, as *Uromyces vignae*. It has uredinia scattered on both sides of leaflets, blister-like at first, erumpent, surrounded by the broken epidermis, cinnamon-brown, powdery; urediniospores 26-29(-36) x 23-25  $\mu\text{m}$ , ellipsoid, globose to obovoid, wall 1.5-2  $\mu\text{m}$  thick, cinnamon brown, echinulate but with irregular smooth spots on the sides, pores 2, supraequatorial. Telia like the uredinia but chestnut-brown and smaller, teliospores (29-)32-39 x 22-27  $\mu\text{m}$ , ellipsoid, broadly ellipsoid to obovoid, often somewhat narrowed above as a broad umbo, rounded or slightly narrowed below, wall about 2  $\mu\text{m}$  thick laterally, 3-5.5  $\mu\text{m}$  thick apically, cinnamon-brown, very finely, irregularly verrucose, appearing almost smooth, pedicel usually broken at the spore.

**UROMYCES WULFFIAE** P. Hennings, Hedwigia 43: 158. 1904. TYPE on *Wulffia* sp., Compositae, from **Brazil**, Amazonas: Rio Juruá, Juruá-miri, August 1901, *E. Ule-2687*. (-/-, -/III).

On Compositae:

*Wulffia baccata* Kuntze, Pará (IAN-631).

*Wulffia* sp., Amazonas (Hennings 1904B: 158).

*Uromyces wulffiae* has been reported only from Brazil.

Spermogonia, aecia, and uredinia unknown. Telia on circular or angular discolored spots on both sides of leaves, scattered or in groups; teliospores 20-35 x 14-18  $\mu\text{m}$ , oblong, piriform, subfusoid to clavate, the wall thickened at the apex which appears flattened, rounded, papillate, to crenate (Sydows, 1910).

Although Hennings (1904) described urediniospores for *Uromyces wulffiae*, the Sydows (1910) found none when they examined the same specimen. The species is treated here as a microcyclic form.

The teliospores of *Uromyces wulffiae* are much narrower (14-18  $\mu\text{m}$ ) than those of *Uromyces wulffiae-stenoglossae* (20-26  $\mu\text{m}$ ), the only other species of *Uromyces* reported on *Wulffia*.

**UROMYCES WULFFIAE-STENOGLOSSAE** Dietel, Ann. Mycol. 6: 96. 1908. TYPE on *Wulffia stenoglossae* from **Brazil**, Pará: Marco, Jan 1908, *C. F. Baker*. (?/?, II/III).

On Compositae:

*Wulffia baccata* (Linnaeus f.) Kuntze, Amapá (IBI-16092); Maranhão (IBI-16113), Pará (Albuquerque, 1971: 149; IBI-13622; IAN-549).

*Wulffia maculata* DeCandolle, São Paulo (Jackson, 1932: 174).

*Wulffia maculata* var. *oblongifolia* (DeCandolle) O. E. Schultz, Rio de Janeiro (Jackson, 1932).

*Wulffia stenoglossa* DeCandolle, Pará (Dietel, 1908: 96; Dietel, 1909: 262).

*Wulffia* sp., Minas Gerais (IBI 16311), Paraíba (Viégas, 1945: 74; IAC-3673), São Paulo

(Jackson, 1932: 174; IBI-12141).

*Uromyces wulfffiae-stenoglossae* has been reported also from Venezuela, Guyana, and Trinidad.

Spermogonia and aecia unknown. Uredinia scattered on both sides of leaves, punctiform, chestnut-brown, on irregular yellowish leaf spots; urediniospores 24-28 x 21-25 µm, broadly ellipsoid to globoid or pyriform, wall 1.5 µm thick, sparsely echinulate, chestnut-brown, pores 2, subequatorial; teliospores 26-36 x 20-26 µm, ellipsoid, obovoid, subglobose, sometimes angular, wall 1-1.5 µm thick at sides, 5-8 µm above, pale brown, smooth, pedicel to 60 µm long, colorless, subpersistent.

The teliospores of *Uromyces wulfffiae-stenoglossae* are much broader (20-26 µm) than those of *U. wulfffiae* (14-18 µm), the only other species of *Uromyces* reported on *Wulffia*.

#### UROMYCLADIUM McAlpine,

Ann. Mycol. 3: 303-323 (321). 1905. TYPE SPECIES *Uromycladium simplex* McAlpine.

Spermogonia subepidermal, Group VI (type 5 or perhaps sometimes type 7). Aecia subepidermal in origin, erumpent, *Uredo* type, aeciospores borne singly on pedicels, walls verrucose or reticulate, pores equatorial. Uredinia and urediniospores like the aecia and aeciospores but not associated with spermogonia. Telia subepidermal in origin, erumpent, teliospores composed of 1 probasidial cell, with one to three borne on a usually branched and septate pedicel that may also bear a hygroscopic sporelike cyst, germ pore 1, the teliospore walls usually pigmented, smooth or sculptured, metabasidia external (Cummins and Hiratsuka, 2003).

McAlpine (1906) reported mesospores in three species of *Uromycladium* in Australia, including *U. alpinum*. These mesospores are unusual because they are reported not to have any germ pores and they have not been reported to germinate. Thus, they may be a special sort of paraphyses.

A genus of about 7 species mostly confined to Australia, New Zealand, and surrounding areas, all parasites of *Acacia* and *Albizia* species (Leguminosae) native to that area. *Uromycladium alpinum* has been reported also from South Africa and Brazil on introduced *Acacia mearnsii*. Some species are microcyclic, and some cause conspicuous branch galls and distortions of hosts.

**UROMYCLADIUM ALPINUM** McAlpine, Ann. Mycol. 3: 308. 1905. TYPE: a lectotype needs to be designated from one of the collections with telia on *Acacia* from **Australia** listed by McAlpine in the original description. **(0/Ipe, IpeX/III).**

On Leguminosae

*Acacia mearnsii* De Wildeman [≡ *Racosperma mearnsii* (De Wildeman) Pedley], Rio Grande do Sul (Santos and Ferreira, 2002).

*Uromycladium alpinum*, a native rust on at least six species of *Acacia* in Australia, has been reported also from New Zealand and South Africa on introduced *Acacia mearnsii* (Morris et al., 1988).

Spermogonia on both sides of phyllodes, minute, black, shining and punctiform. Aecia surrounding or accompanied by the spermogonia, subepidermal in origin, erumpent, powdery, aeciospores 35-51(-58) x 21-26 µm, shortly elongate clavate, occasionally oval or oblong, wall scarcely thickened at apex, warted equally all over, yellowish- to golden-brown, germ pores 3-5 ("on one face"), equatorial. Uredinia like the aecia but without spermogonia. Mesospores not uncommon in uredinia, 15-25 x 10-15 µm, ellipsoid to oblong or obovate, rounded at apex, wall evenly thick, smooth, without apical germ pore, pedicel colorless (McAlpine, 1906). Teliospores at first intermixed with urediniospores, two teliospores and a cyst borne on one pedicel, spores composed of one probasidial cell, 19-22 x 25-30 µm, depressed globose to subglobose, wall very slightly thickened at apex, smooth, brown to dark brown, vesicle on pedicel immediately below a septum below the two spores, about 25 µm diam., globose or slightly ellipsoid, colorless

Santos and Ferreira (2002) reported only uredinia from Brazil. They gave the following traits: uredinia 0.1-0.25 mm across, without paraphyses; urediniospores 23-42 x 14-23 µm, ellipsoid, obovoid, rounded to narrowed at apex, or sometimes more pointed and wall thickened, as shown by a photographic illustration, and germ pores 4-5, equatorial. They did not state the sort of spore wall sculpture.

McAlpine (1906) reported traits that help to identify *Uromycladium alpinum* include two teliospores and one cyst on a pedicel, and urediniospores sub-clavate, evenly warted all over, and the urediniospore scarcely thickened at the apex.

*Acacia mearnsii* was introduced into Brazil and many other countries from Australia as a source of tannin, charcoal production, and wood pulp, but has escaped to become a weedy species difficult to control.

*Uromycladium cubense* Arthur & J. R. Johnston, see **DIABOLE CUBENSIS** (Arthur & J. R. Johnston) Arthur.

***Uromycopsis* Arthur,**

Résult Sci. Congr. Bot. Vienne p. 345. 1906. TYPE SPECIES: *Uredo excavata* DeCandolle on *Euphorbia dulcis*, Euphorbiaceae, from Europe.

Arthur (1921) placed *Uromycopsis* as a synonym of *Pucciniola* with 25 species in North America. Previously these species were in *Uromyces*. Arthur (1906, 1921) proposed that *Pucciniola* be based on a confusing mixture of variations in the morphological and ontogenic concepts of life cycles. In ontogenic terminology the species are long cycled and autoecous, both the uredinia and aecia, when known, have the morphology of the anamorph genus *Aecidium*. In herbarium specimens, aecia can be identified only if spermogonia are present. In morphologic terminology the species have no uredinia. Teliospores are one-celled as in *Uromyces*. *Pucciniola* (= *Uromycopsis*), with its one-celled teliospores, is parallel to *Allodus* with its two-celled teliospores as in *Puccinia*. Later, Arthur (1934) abandoned the use of *Allodus* and *Pucciniola* (= *Uromycopsis*). Most of the species are now placed in *Puccinia* and *Uromyces* respectively.

*Uromycopsis cestri* (Montagne) Arthur, see ***Aecidium cestri* Montagne (UROMYCES CESTRI Montagne).**

*Uromycopsis indurata* (H. Sydow & P. Sydow & Holway) Arthur, see **UROMYCES INDURATUS H. Sydow, P. Sydow & Holway.**

**UROPYXIS Schroeter,**

Hedwigia 14: 165. 1875. TYPE SPECIES: *Uropyxis amorphae* (M. A. Curtis) Schroeter.

A genus of about 15 species, mostly on Leguminosae in North America and Africa. Species that are included in *Uropyxis* but may not belong include *U. arisanensis* (Hiratsuka & Hashioka) S Ito & Murayama on Cucurbitaceae from Taiwan, and *U. rickiana* listed below on Bignoniaceae. The genus is characterized by two celled teliospores with two germ pores in each cell, and type seven spermogonia (Baxter, 1959).

*Uropyxis crotalariae* Arthur, see **UROMYCES CROTALARIAE** (Arthur) J. W. Baxter.

*Uropyxis reticulata* Cummins, see **UROPYXIS RICKIANA** P. Magnus.

**UROPYXIS RICKIANA** P. Magnus, Hedwigia 45: 176. 1906. TYPE on unidentified Bignoniaceae [now considered to be *Macfadyena*, probably *M. unguis-cati* (Linnaeus.) A. Gentry] from **Brazil**, Santa Catarina: São Leopoldo, 1905, *J. Rick* (HBG; isotypes Rick, *Fungi Austro-Americani No. 105*). **(0/Ippe,IIpre/III).**

= *Uropyxis reticulata* Cummins, Mycologia 31: 171. 1939. TYPE on *Macfadyena unguis-cati* (Linnaeus) A. Gentry from **Argentina**, LaPlata, Feb 1937, *J. C. Lindquist s.n.*

On Bignoniaceae

***Macfadyena unguis-cati*** (Linnaeus.) A. Gentry, Pará (*Albuquerque-881*), São Paulo (IBI-14271).

*Uropyxis rickiana* has been reported from Argentina and Brazil.

Spermogonia on both sides of leaves on hemispherical galls and on hypertrophied areas of various sizes on petioles and stems. Aecia, develop around the spermogonia, dark brown, without paraphyses, spores borne singly on pedicels, variable in size and shape, (25-)28-35(-36) x (19-)22-25(-30) µm, mostly obovoid, wall 2-3(-3.5) µm thick, cinnamon to chestnut brown, reticulate with meshes 2-3 µm diam and narrow separating ridges, pores 2, equatorial in slightly flattened sides. Uredinia on the abaxial side of leaves, small, scattered, not causing hypertrophy, dark brown, without paraphyses, urediniospores quite regular in shape and size, 25-32 x 21-25 µm, mostly obovoid, wall 2-2.5 µm thick, about cinnamon-brown, reticulate as the aeciospores, pores 2, equatorial. Telia associated with spermogonia and aecia on small or large (to 6 cm diam) galls, chocolate brown, forming in fissures of the galls, teliospores (32-)35-42(-46) x (20-)23-27(-30) µm, mostly broadly oblong-ellipsoid, wall 2.5-3.5 thick, chestnut brown, very inconspicuously bilaminate in lactophenol mounts, verrucose with mostly discrete low warts or low rounded cones, pores equatorial, one in each cell, pedicel to 100 µm long, thick-walled, colorless, terete but rugose in lower ½ or 1/3, persistent.

*Uropyxis rickiana* is distinctive because of the reticulate walls of the aeciospores and urediniospores, and the perennial woody galls that probably produce teliospores for many years. The uredinia and some teliospores occur only on new leaves. The reticulate walls of the anamorph spores, the non-laminate walls of the teliospores, and the host family Bignoniaceae suggest that this species is misplaced in *Uropyxis*. But a better genus is unknown. Baxter (1959) suggested that *Uropyxis reticulata* Cummins could be considered as a variety of *U. rickiana*. We see no reason for keeping *U. reticulata* as a separate taxon.

#### YPSILOSPORA Cummins,

Bull. Torrey Bot. Club 68: 47. 1941. TYPE SPECIES, *Ypsilospora baphiae* Cummins.

Spermogonia Group VI, type 7 (known only for the type, a microcyclic species). Aecia and uredinia with spores very similar and echinulate walls. Teliospores composed of two, laterally free, thin-walled, colorless, probasidial cells that arise at the distal end of an elongated pedicel. The pedicel arises from a well defined sporogenous cell that may produce both urediniospores and teliospores.

In addition to the type, one other species is also known from Africa, both on *Baphia* spp., Leguminosae. In the New World this genus has been reported only from the one species listed below. This New World rust has long been known as *Uredo ingae*. This anamorph was mistakenly thought by some mycologists to be part of the life cycle of *Chaconia ingae* (H. Sydow) Cummins, but Mains (1932) correctly separated it from *Chaconia*. After teliospores were found in a collection made in 1994 from Tucumán, Argentina, it became possible to recognize that the anamorph had been known in Brazil since 1899 [Hennings, 1899: (69)].

**YPSILOSPORA TUCUMANENSIS** J. R. Hernández & J. F. Hennen, Mycologia 95: 751. 2003. TYPE on *Inga edulis* Martius from **Argentina**, Tucumán: San Miguel de Tucumán (Quinta Agronómica), 6 April 1994, J. F. Hennen, M. M. Hennen & J. R. Hernández-94-96. (?/Ipe,IIpe/III).

Anamorph

*Uredo ingae* P. Hennings, Hedwigia Beiblatt 38: (69). 1899. TYPE on *Inga* sp. from **Brazil**, Santa Catarina: Hennings lists three collections by Ule, one each from Blumenau, *Ule-1591* (the lectotype chosen by Mains, 1932), São Francisco, *Ule-1592*, and Campo Bello, *Ule-2104*. This anamorph name is for both aecia and uredinia.  
 ≡ *Ravenelia ingae* (P. Hennings) Arthur, N. Am. Fl. 7: 132. 1907. Telia not described.  
 ≡ *Haploravenelia ingae* (Arthur) Syd., Ann. Mycol. 19: 165. 1921.  
 = *Uromyces pulverulentus* Spegazzini, Rev. Argent. Bot. 1: 143-144. 1925. TYPE on *Inga* sp. from **Argentina**, Isla Martin Garcia, 23 Nov 1923, *Spegazzini s.n.* Telia not described.

On Leguminosae

*Inga* sp., Rio de Janeiro (BPI-18886), Santa Catarina (Hennings, 1889: (69), São Paulo (BPI 18884).

Although the teleomorph of *Ypsilospora tucumanensis* has been reported only from the type, its anamorph, *Uredo ingae*, has been known in Brazil since 1899 (Hennings, 1899: (69), and has been reported from Argentina, Venezuela, Costa Rica, El Salvador, Guatemala, Honduras, and Puerto Rico.

Spermogonia not seen. Aecia on both sides of hypertrophied leaves, petioles, young buds, branches, and flowering parts causing large, brown, powdery abnormal growths, subepidermal in origin, erumpent, without paraphyses; aeciospores pedicellate, (16-)20-22(-28) x (13-)14-16(-17) µm, obovoid to ellipsoid, short clavate, or irregular, attenuate at base; walls 2-4 µm at sides, often a little thicker at apex, finely echinulate, hyaline, germination pores 3-4, equatorial. Uredinia on abaxial side of leaves, whitish, scattered; urediniospores similar to the aeciospores. Teliospores in uredinia, composed of two, laterally free probasidial cells attached to the distal end of a hypha-like pedicel, suggesting the letter Y, each propasidial cell 30-70 x 10-20 µm, clavate to narrowly ellipsoid, wall thin, 1 µm or less, hyaline, germ pore not differentiated, metabasidia develop without dormancy by apical elongation of probasidia.

The anamorph *Uredo ingae* was mistakenly thought by some mycologists to be part of the life cycle of *Chaconia ingae* (H. Sydow) Cummins, but Mains (1932) correctly separated it from *Chaconia*.

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#### Host Families / Rust Genera Index for Rust fungi in Brazil

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PUCCINIA

**GESNERIACEAE**

PUCCINIA



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Aecidium

**LECYTHIDACEAE**CEROTELIUM *Physopella***LEGUMINOSAE**DIABOLE RAVENELIA SPHAEROPHRAGMIUM *Uredo* SORATEA PUCCINIA *Peridipes*  
MARAVALLIA *Milesia* UROMYCES ANTHOMYCES ESALQUE HAPALOPHRAGMIUM  
DIORCHIDIUM PHAKOPSORA *Aecidium* DICHEIRINIA CROSSOPSORA CHACONIA  
YPSILOSPORA APRA DIABOLE DIORCHIDIELLA PHAKOPSORA ANTHOMYCES**ILIACEAE**PUCCINIA *Aecidium* SPHENOSPORA**LINACEAE**

MELAMPSORA

**LOGANIACEAE**

PUCCINIA

**LORANTHACEAE***Aecidium* UROMYCES**LYTHRACEAE**PHAKOPSORA *Milesia Uredo***MALPIGHIACEAE**PUCCINIA *Uredo Aecidium* CROSSOPSORA *Malupa***MALVACEAE**

PUCCINIA PHAKOPSORA CATENULOPSORA

**MARANTACEAE**PUCCINIA *Uredo* CEROTELIUM *Physopella***MELIACEAE**PHAKOPSORA *Malupa Aecidium Uredo***MENISPERMACEAE***Aecidium***MONIMIACEAE***Aecidium***MORACEAE**CEROTELIUM *Uredo Malupa* PHAKOPSORA *Physopella* CHACONIA PHYSOPELLA**MUSACEAE**, vide Heliconiaceae**MYRSINACEAE**UROMYCES *Uredo***MYRTACEAE**PUCCINIA PHAKOSPORA *Uredo***ONAGRACEAE**PUCCINIA *Aecidium* CEROTELIUM**ORCHIDACEAE***Uredo* CLADOMA SPHENOSPORA PUCCINIA**PALMAE**

CERRADOA

**PASSIFLORACEAE**

PUCCINIA

**PHYTOLACCACEAE***Aecidium* PUCCINIA**PINACEAE**

ULEIELLA

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UROMYCES

**PTERIDOPHYTA***Uredo* DESMELLA *Calidion* PUCCINIA UREDINOPSIS**RANUNCULACEAE**COLEOSPORIUM ? *Aecidium***RHAMNACEAE**PHAKOPSORA *Malupa* PUCCINIA *Uredo***ROSACEAE**

PUCCINIASTRUM FROMMEËLLA TRANZSCHELIA PHRAGMIDIUM KUEHNEOLA

PUCCINIASTRUM *Uredo***RUBIACEAE**PUCCINIA PHAKOPSORA *Aecidium Uredo Aecidium* HEMILEIA DIORCHIDIUM UROMYCESCEROTELIUM *Uredendo Physopella***RUTACEAE***Aecidium* PUCCINIA *Aecidium***SALICACEAE**MELAMPSORA *Uredo***SAPINDACEAE**PUCCINIA SKIERKA *Aecidium***SAPOTACEAE***Uredo* MARAVALIA ACHROTELIUM**SCHIZAEACEAE (see PTERIDOPHYTES)****SCROPHULARIACEAE**PUCCINIA *Uredo***SOLANACEAE***Aecidium* PUCCINIA ENDOPHYLLUM CHRYSOCYCLUS UROMYCES CROSSOPSORA*Uredo* DIDYMOPSORA PUCCINIOSIRA**STERCULIACEAE**

PUCCINIA

**TILIACEAE**PUCCINIA *Uredo* DIDYMOPSORA

PUCCINIOSIRA

**ULMACEAE**UROMYCES *Uredo***UMBELLIFERAE**

PUCCINIA

**URTICACEAE**

PUCCINIA

**VALERIANACEAE**

PUCCINIA

**VERBENACEAE***Aecidium* PROSPIDIUM PUCCINIA *Uredo* ENDOPHYLLUM OLIVEA**VITACEAE**

ENDOPHYLLUM PHAKOPSORA  
**VOCHYSIACEAE**  
 APLOPSORA *Macabuna*  
**ZINGIBERACEAE**  
 PUCCINIA

### Plant rust fungi of Brazil, HOST – RUST INDEX

1. Host plant family names are size 10 point, all CAPS, not in italic, and bold. Example: **ACANTHACEAE**.
2. Host plant genera names are size 10 point, not all caps, in *italic* and bold. Example: ***Aphelandra***.
3. Accepted rust fungus teleomorph species names are size 10 point, all CAPS, not bold, not in *italic*. Example: PUCCINIA VARIOIDES Joerstad.
4. Accepted rust fungus anamorph species names are size 10 point, not bold, in *italic*. Example: *Uredostilbe crucis-filii* Buriticá.

#### ACANTHACEAE

##### ***Aphelandra***

PUCCINIA VARIOIDES Joerstad

##### ***Dicliptera***

UROMYCES INDURATUS H. Sydow & P. Sydow & Holway

##### ***Elytraria***

PUCCINIA LANTANAE Farlow

##### ***Jacobinia***

*Uredo cyrtantherae* H. S. Jackson & Holway

##### ***Justicia***

PUCCINIA JUSTICIAE Puttemans

UROMYCES INDURATUS H. Sydow & P.  
 Sydow & Holway

##### ***Ruellia***

PUCCINIA BONAIRIENSIS P. Hennings

PUCCINIA PARANAHYBAE P. Hennings

? PUCCINIA RUELLIAE Lagerheim

##### **Genus undetermined**

*Aecidium cytarrioides* P. Hennings

*Aecidium meiapontense* P. Hennings

PUCCINIA VARIA Arthur

**ALSTROEMERIACEAE (see  
AMARYLLIDACEAE)**

**AMARANTHACEAE**

***Achyranthes***

Puccinia mogiphanis Arthur  
Uromyces celosiae Dietel & Holway

***Alternanthera***

*Aecidium alternantherae* H. S. Jackson & Holway  
Puccinia mogiphanis Arthur

***Gomphrena***

Uromyces bonariensis Spegazzini

***Iresine***

Puccinia macroпода Spegazzini  
Uromyces celosiae Dietel & Holway  
Uromyces clarus H. S. Jackson & Holway

***Mogiphanes***

Puccinia mogiphanis Arthur

***Pfaffia***

Uromyces celosiae Dietel & Holway

***Telanthera***

Puccinia mogiphanis Arthur

**Genus undetermined**

*Aecidium pratae* H. S. Jackson & Holway  
Uromyces celosiae Dietel & Holway

**AMARYLLIDACEAE (includes  
ALSTROEMERIACEAE)**

***Alstroemeria***

Uromyces alstroemeriae P. Hennings

***Bomarea***

Puccinia bomariae P. Hennings  
Uromyces bomariae P. Hennings  
*Uredo bomareae* Lagerheim

***Hypoxis***

Uromyces affinis Winter  
Uromyces hypoxydis Cooke

**ANACARDIACEAE**

***Mauria***

*Uredo rhombica* Spegazzini (KIMUROMYCES  
CERRADENSIS Dianese et al.)

***Astronium***

Leptinia brasiliensis Juel  
KIMUROMYCES CERRADENSIS Dianese et  
al.

*Uredo rhombica* Spegazzini (KIMUROMYCES  
CERRADENSIS Dianese et al.)

**ANNONACEAE**

***Annona***

*Aecidium annonae* P. Hennings  
BATISTOPSORA CRUCIS-FILII Dianese et al.  
PHAKOPSORA NEOCHERIMOLIAE Buriticá  
& Hennen

*Uredostilbe crucis-filii* Buriticá [BATISTOPSORA  
CRUCIS-FILII Dianese et al.]

***Duguetia***

*Aecidium duguetiae* Hariot  
DIETELIA DUGUETIAE (Thurston) Buriticá &  
Hennen

***Guatteria***

*Aecidium amazonense* P. Hennings  
*Aecidium guatteriae* Dietel  
*Aecidium rionegrense* P. Hennings

***Unonopsis***

*Aecidium juruense* P. Hennings

***Xylopi***

*Aecidium xylopi* P. Hennings  
CEROTELIUM XYLOPIAE Buriticá & Hennen  
DASYSPORA GREGARIA (G. Kunze) P.  
Hennings

**Genus undetermined**

*Aecidium annonae* P. Hennings

**APOCYNACEAE**

***Condylocarpon***

*Malupa condylocarpi* (H. S. Jackson & Holway) Buriticá & Hennen (≡ *Uredo condylocarpi* H. S. Jackson &  
Holway)

***Echites***

CROSSOPSORA ANGUSTA Joerstad  
*Malupa joerstadae* Buriticá & Hennen

***Forsteronia***

*Uredo forsteroniae* Hennings

***Mandevilla***

CROSSOPSORA STEVENSII H. Sydow  
(Colombia, Venezuela, etc.)

***Plumeria***

COLEOSPORIUM PLUMERIAE Patouillard

***Tabernaemontana***

*Aecidium ochraceum* Spegazzini  
*Hemileia juruensis* Sydow (≡ *Pelastoma*  
*spinosa* J.Hennen & M.B.Figueiredo sp. nov. ined.)

***Vinca***

PUCCINIA VINCAE Berkeley

**Genus undetermined**

*Malupa condylocarpi* (H. S. Jackson & Holway)  
Buriticá & Hennen

PELASTOMA BICRASSA J.Hennen &  
M.B.Figueiredo, sp. nov. ined.

PELASTOMA COLOMBIANA (Buriticá) J.F.  
Hennen & M.B. Figueiredo, comb. nov. .ined.

*Synoma maculosa* J.F. Hennen & M.B.  
Figueiredo sp. nov. ined.

*Uredo apocynaceae* P. Hennings

**ARACEAE**

***Anthurium***

*Uredo anthurii* (Hariot) Saccardo

**ARECACEAE (PALMAEA)**

***Attalea***

CERRADOA PALMAEA Hennen & Ono

**Genus undetermined**

CERRADOA PALMAEA Hennen & Ono

**ASCLEPIADACEAE**

***Amphistelma***

Puccinia CYNANCHI Berkeley & Curtis (= *Puccinia obliqua* Berkeley & Curtis)

***Araujia***

Puccinia ARAUJAE Lèveille

***Asclepias***

Puccinia CONCRESCENS Ellis & Everhart

Uromyces ASCLEPIADIS Cooke

***Calostigma***

Puccinia ROULINIAE P. Hennings

***Cyathostelma***

CROSSOPSORA ASCLEPIDIACEAE Buriticá  
& Hennen

*Malupa peckoltiae* (Sydow) Buriticá & Hennen

***Ditassa***

Puccinia CYNANCHI Berkeley & Curtis (= *Puccinia obliqua* Berkeley & Curtis)

***Gonolobus***

Puccinia CYNANCHI Berkeley & Curtis (= *Puccinia obliqua* Berkeley & Curtis)

***Hemipogon***

Puccinia CYNANCHI Berkeley & Curtis (= *Puccinia hemipogonis* P. Hennings)

***Jobinia***

Puccinia IMACULATA Juel

***Metastelma***

Puccinia CYNANCHI Berkeley & Curtis (= *Puccinia obliqua* Berkeley & Curtis)

Puccinia ROULINIAE P. Hennings

***Oxypetalum***

CROSSOPSORA MATELEAE Dale

Puccinia ARAUJAE Lèveillé

Puccinia CYNANCHI Berkeley & Curtis (= *Puccinia obliqua* Berkeley & Curtis)

Uromyces ASCLEPIADIS Cooke

***Oxystelma***

Puccinia CYNANCHI Berkeley & Curtis (= *Puccinia obliqua* Berkeley & Curtis)

***Peckoltia***

CROSSOPSORA ASCLEPIDIACEAE Buriticá  
& Hennen

*Malupa peckoltiae* (Sydow) Buriticá & Hennen

***Roulinia***

Puccinia ROULINIAE P. Hennings

***Schubertia***

CROSSOPSORA ASCLEPIDIACEAE Buriticá  
& Hennen

***Tassadia***

Puccinia ROULINIAE P. Hennings (= Puccinia tassadiae Sydow)

***Widgrenia***

Puccinia ARAUJAE Léveillé

**Genus undetermined**

CROSSOPSORA ASCLEPIDIACEAE Buriticá & Hennen

Puccinia ARAUJAE Léveillé

Puccinia CYNANCHI Berkeley & Curtis (= Puccinia obliqua Berkeley & Curtis)

**ASTERACEAE, see COMPOSITAE****BASELLACEAE*****Boussingaultia***

*Aecidium chrysanthum* H. Sydow & P. Sydow

**BERBERIDACEAE*****Berberis***

*Aecidium leveilleianum* P. Magnus

*Aecidium tubiforme* Dietel & Neger

CUMMINSIELLA SANTA McCain & Hennen

Puccinia MAYER-ALBERTI P. Magnus

**BIGNONIACEAE*****Adenocalymna***

*Macabuna adenocalymmatis* (P. Hennings) Buriticá & Hennen

PHRAGMIDIELLA MINUTA (Arthur) Buriticá & Hennen

PHRAGMIDIELLA PAULISTA Buriticá & Hennen

***Amphilophium***

PROSPIDIUM PITHECOCTENII (Pazschke) Cummins

***Anemopaegma***

PROSPIDIUM ANEMOPAEGMATIS (P. Hennings) Cummins

PROSPIDIUM EVERNIUM H. Sydow

***Arrabidaea***

DIPYXIS VIEGASII (Joerstad) Cummins & J. W. Baxter

*Macabuna adenocalymmatis* (P. Hennings) Buriticá & Hennen

*Macabuna arrabidaea* (Hennings) Buriticá & Hennen

*Macabuna marnavea* Buriticá & Hennen

PHAKOPSORA ARRABIDAEAE Buriticá & Hennen

PHRAGMIDIELLA HOLWAYI (H. S. Jackson) Buriticá

PHRAGMIDIELLA MINUTA (Arthur) Buriticá & Hennen

PHRAGMIDIELLA PAULISTA Buriticá &

- Hennen  
*Physopella cerotelioides* (H. S. Jackson & Holway) Buriticá & Hennen  
 PROSPODIUM ARRABIDAEAE H. S. Jackson & Holway  
***Bignonia (Macfadyena)***  
 PROSPODIUM BIGNONIACEARUM (Spegazzini) Cummins  
*Uredo bignoniacearum* Spegazzini  
 UROPYXIS RETICULATA Cummins  
***Clytostoma***  
 PROSPODIUM SINGERI Petrak  
*Uredo hieronymianus* (P. Hennings) H. Sydow & P. Sydow  
***Cremastus***  
 PROSPODIUM CREMASTUM H. S. Jackson & Holway  
***Cuspidaria***  
 Prosopodium festivum H. Sydow  
***Dombeya***  
*Uredo dombeyae* Lindquist  
***Fredericia***  
 PHRAGMIDIELLA MINUTA (Arthur) Buriticá & Hennen  
***Jacaranda***  
*Aecidium circinatum* Winter  
*Aecidium jacarandae* P. Hennings  
*Aecidium puttemansianum* P. Hennings  
***Lundia***  
 PROSPODIUM CYANTHIFORME Cummins  
 PROSPODIUM LUNDIAE H. S. Jackson & Holway  
***Mansoa***  
 PROSPODIUM LAEVIGATUM Hennen & Sotão  
***Memora***  
 POROTENUS BIBASIPORULUS Hennen & Sotão  
 POROTENUS BIPORUS Hennen & Sotão  
 POROTENUS CONCAVUS Viégas  
 POROTENUS MEMORAE Albuquerque  
***Pithecoctenium***  
 PROSPODIUM AMPHILOPHI (Dietel & Holway) Arthur  
 PROSPODIUM HOLWAY H. S. Jackson  
 PROSPODIUM PITHECOCTENII (Pazschke) Cummins  
***Pleonotoma***  
 PROSPODIUM ANOMALUM H. S. Jackson & Holway.  
***Pyrostegia***  
 PROSPODIUM IMPOLITUM H. S. Jackson & Holway  
***Stenolobium***  
*Aecidium circinatum* Winter  
***Stizophyllum***



PROSPODIUM STIZOPHYLLII H. S. Jackson  
& Holway

***Tabebuia***

*Canasta tabebuiae* (Kern) Sotão & Hennen

PROSPODIUM BICOLOR Ferreira & Hennen

PROSPODIUM PALMATUM H. S. Jackson &  
Holway

PROSPODIUM TABEBUIICOLA Hennen &  
Cummins. var. TABEBUIICOLA

PROSPODIUM TABEBUIICOLA Hennen &

Cummins, var. MELGACENSIS Sotão & Hennen

PROSPODIUM TECOMICOLA (Spegazzini) H.

S. Jackson & Holway

*Uredo longiaculeata* P. Hennings

***Tecoma***

PROSPODIUM APPENDICULATUM (Winter)  
Arthur

PROSPODIUM ELEGANS (Schroeter)

Cummins

*Uredo cuticulosa* Ellis & Everhart

***Xylophragma***

CROSSOPSORA CRASSA Buriticá & Hennen

*Malupa crassa* Buriticá & Hennen

**Genus undetermined**

*Macabuna arrabideae* (Hennings) Buriticá &  
Hennen

*Macabuna daleae* Buriticá & Hennen

PHRAGMIDIELLA BIGNONIACEARUM  
(Dale) Buriticá & Hennen

PHRAGMIDIELLA HOLWAYI (H. S. Jackson)  
Buriticá

PROSPODIUM AMAPAENSIS Hennen &  
Sotão

PROSPODIUM ANOMALUM H. S. Jackson &  
Holway

PROSPODIUM APPENDICULATOIDES (P.  
Hennings) Cummins

PROSPODIUM COMPRESSUM (Dietel)  
Cummins

PROSPODIUM ELEGANS (Schroeter)  
Cummins

PROSPODIUM PIRACICABANUM Viégas

UROPYXIS RICKIANA P. Magnus

**BIXACEAE**

***Bixa***

CROSSOPSORA BIXAE Buriticá

*Malupa bixae* (Arthur) Buriticá

**BLECHNACEAE (see PTERIDOPHYTA)**

**BORAGINACEAE**

***Cordia***

*Aecidium brasiliense* Dietel

*Aecidium cordiae* P. Hennings

*Aecidium lindavianum* P. Sydow & H. Sydow  
*Caecoma cordiae* (P. Hennings) J. Hernández &  
 J. Hennen, ? inedit.

Puccinia cordiae Arthur

Uromyces setariae-italicae Yoshino

***Tournefortia***

*Aecidium tournefortiae* P. Hennings

Uromyces dolichosporus Dietel &  
 Holway.

**BROMELIACEAE**

***Pitcairnia***

Puccinia pitcairniae Lagerheim

***Nidularium***

Uredo nidularii P. Hennings

**BURSERACEAE**

***Protium***

Puccinia bursa Hennen, A. A. Carvalho, &  
 M. B. Figueiredo sp. nov. inedit.

***Tetragastris***

Puccinia pennae Sotão & Hennen sp. nov.,  
 inedit.

**CACTACEAE**

***Pereskia***

*Aecidium pereskiae* P. Hennings  
 Uromyces pereskiae Dietel

**CALYCERACEAE**

***Acicarpa***

Puccinia melanosora Spegazzini

**CAMPANULACEAE**

***Pratia***

Uromyces pratiae Spegazzini

**CANNACEAE**

***Canna***

Puccinia thaliae Dietel

**CARYOCARACEAE**

***Caryocar***

Cerotelium giacomettii J. C. Dianese et  
 al.

*Milesia uberabensis* (P. Hennings) Hennen et al.

**CARYOPHYLLACEAE**

***Arenaria***

Puccinia modica Holway

Uredo arenariicola P. Hennings

***Dianthus***

Uromyces dianthi Niessl

**CELASTRACEAE (incl.**

**HIPPOCRATEACEAE)**

***Hippocratea***

BOTRYORHIZA HIPPOCRATEAE Whetzel &  
Olive

**CHRYSOBALANACEAE*****Licania***

*Uredo licaniae* P. Hennings

***Couepia***

*Intrapes paliformis* Hennen & M. B. Figueiredo

**CLUSIACEAE (GUTTIFERAE,  
HYPERICACEAE)*****Clusia***

CHACONIA BREVENSIS Sotão & Hennen,  
ined.

***Hypericum***

UROMYCES HYPERICI-FRONDOSI

(Schweinitz) Arthur

UROMYCES TRIQUETRUS Cooke

***Kielmeyra***

PHAKOPSORA BUTLERI Dianese, Santos &  
Medeiros

*Milesia brasiliae* Buriticá & Hennen

**COMBRETACEAE*****Terminalia***

PHAKOPSORA CHAVESII Dianese, Santos &  
Medeiros

**COMMELINACEAE*****Commelina***

PUCCINIA COMMELINAE Holway

UROMYCES COMMELINAE Cooke

***Floscopa***

*Uredo floscopae* P. Hennings

UROMYCES FLOSCOPAE Sydow

***Tradescantia***

PHAKOSPORA TECTA H. S. Jackson & Holway

? PUCCINIA COMMELINAE Holway

UROMYCES COMMELINAE Cooke

**Genus undetermined**

UROMYCES COMMELINAE Cooke

**COMPOSITAE*****Acanthospermum***

PUCCINIA CNICI-OLERACEI Persoon ex  
Desmazières

***Achyrocline***

PUCCINIA ACHYROCLINES (P. Hennings) H.  
S. Jackson & Holway

*Uredo achyroclines* P. Hennings

***Artemisia***

PUCCINIA TANACETI DeCandolle

***Aspilia***

PUCCINIA ASPILIAE Dietel

PUCCINIA CONFORMATA H. Sydow

UROMYCES ASPILIAE H. S. Jackson &

Holway

**Aster (*Stenachaeum*)**

Puccinia CNICI-OLERACEI Persoon

*Aecidium microsporum* Dietel

**Baccharis**

*Aecidium baccharidis* Dietel

*Aecidium domingensis* Kern & Cifferri

*Aecidium pachycephallum* Dietel

Puccinia ALBULA H. S. Jackson & Holway

Puccinia ALIA H. S. Jackson & Holway

Puccinia BACCHARIDIS Dietel & Holway

Puccinia BACCHARIDIS-CASSINOIDES P.

Hennings

Puccinia CONSULTA H.S. Jackson &

Holway

Puccinia CONYZAE P. Hennings

Puccinia EVADENS Harkness

Puccinia EXORNATA Arthur

Puccinia HENNINGSII Dietel

Puccinia IMPROCERA H. S. Jackson &

Holway

Puccinia INDAGATA H. S. Jackson &

Holway

Puccinia ITATIAYENSIS Lindquist

?Puccinia MOLLERIANA P. Hennings

Puccinia PRAEDICTA H.S. Jackson &

Holway

Puccinia RUDERARIA H.S. Jackson &

Holway

*Uredo baccharidicola* Spegazzini

**Bidens**

*Uredo bidentis* P. Hennings

Uromyces BIDENTICOLA Arthur

Uromyces BIDENTIS Lagerheim

**Blainvillea**

Uromyces BLAINVILLEAE Berkeley

**Calea**

Puccinia CALEAE Arthur var. CALEAE

Puccinia PROMATENSIS R. Berndt

Puccinia ULEANA P. Hennings

*Uredo caleae* Mayor

**Calendula**

Coleosporium TUSSILAGINIS (Persoon)

Léveillé

**Centratherum**

*Uredo alagoinhensis* Urban

**Chrysanthemum**

Puccinia TANACETI DeCandolle var.

TANACETI

Puccinia HORIANA P. Hennings

**Chuquiraga**

*Aecidium chuquiraguae* H. S. Jackson & Holway

Didymopsora CHUQUIRAGUAE Dietel

**Cichorium**

Puccinia HIERACII (Roehling) Martius

**Cineraria**

COLEOSPORIUM TUSSILAGINIS (Persoon)  
Léveillé

***Conyza***

CIONOTHRIX USNEOIDES (P. Hennings) H.  
Sydow & P. Sydow

PUCCINIA CONYZAE P. Hennings

PUCCINIA CYPERI Arthur

***Echinocephalum***

UROMYCES INSIGNIS Sydow

***Elephantopus (Pseudelephantopus,  
Orthopappus)***

COLEOSPORIUM VERNONIAE Berkeley &  
Curtis

***Eleutheranthera***

PUCCINIA CNICI-OLERACEI Persoon ex  
Desmazieres

***Emilia***

COLEOSPORIUM TUSSILAGINIS (Persoon)  
Léveillé

PUCCINIA CNICI-OLERACEI Persoon ex  
Desmazieres

***Erigeron***

*Aecidiolum eregerontis* Spegazzini

*Aecidium erigeronatum* Schweinitz

*Aecidium spegazzinii* De Toni

PUCCINIA CYPERI Arthur

***Eupatorium***

*Aecidium eupatorii* Dietel

CIONOTHRIX PRAELONGA (Winter) Arthur

PUCCINIA EUPATORII Dietel

PUCCINIA EUPATORII-COLUMBIANI

Mayor

PUCCINIA MELANTHERAE P. Hennings

PUCCINIA NOACKII Sydow

*Uredo eupatoriicola* P. Hennings

*Uredo tessariae* Spegazzini

***Gnaphalium***

PUCCINIA GNAPHALIICOLA P. Hennings

***Helianthus***

PUCCINIA HELIANTHI Schweinitz

***Heterothalamus***

PUCCINIA HENNINGSII Dietel

***Jungia***

PUCCINIA JUNGIAE P. Hennings

***Melampodium***

PUCCINIA CNICI-OLERACEI Persoon ex  
Desmazieres

***Melanthera***

PUCCINIA MELANTHERAE P. Hennings

***Mikania***

*Aecidium mikaniae* P. Hennings

CHRYSOCYCLUS MIKANIAE (Arthur) H.  
Sydow

DIETELIA PORTORICENSIS (Whetzel &  
Olive) Buriticá & Hennen

PUCCINIA GRANCHACOENSIS Joerstad

- Puccinia mikaniae H. S. Jackson & Holway  
 Puccinia mikaniifolia H. S. Jackson & Holway  
 Puccinia spegazzini De Toni  
 Uromyces mikaniae Viégas  
*Orthopappus, see Elephantopus*  
*Parthenium*  
 Puccinia schileana Spegazzini var. PARTHENIICOLA (H. S. Jackson) Lindquist  
*Picrosia*  
 Puccinia argentina Spegazzini (=Puccinia picrosiae Sydow)  
*Piptocarpha*  
 Aecidium piptocarphae P. Hennings  
 Puccinia macumba J. Hennen & M. B. Figueiredo sp. nov. inedit  
 Puccinia manoelae J. Hennen & M. B. Figueiredo sp. nov. inedit.  
 Puccinia pipta J. Hennen & M. B. Figueiredo sp. nov. inedit  
 Puccinia piptocarphae P. Hennings  
 Puccinia seorsa H. S. Jackson & Holway  
 Puccinia valentula H. S. Jackson & Holway  
*Pluchea*  
 Puccinia ocellifera Cummins  
*Polymnia*  
 Uromyces polymniae Dietel & Holway  
*Porophyllum*  
 Puccinia porophylli P. Hennings  
*Pseudelephantopus, see Elephantopus*  
*Pterocaulon*  
 Puccinia pterocauli P. Hennings  
*Senecio*  
 Aecidium kiehlianum Viégas  
 Aecidium senecionis-acanthifolii Dietel  
 Coleosporium tussilaginis (Persoon) Lévillé  
 Puccinia procerula H. S. Jackson & Holway  
 Puccinia proluviosa H.S. Jackson & Holway  
*Solidago*  
 Coleosporium ? asteris  
*Sparganophorus*  
 Uredo sparganophori P. Hennings  
*Spilanthes*  
 Puccinia cnici-oleracei Persoon ex Desmazières  
*Stenachaenium*  
 Puccinia cnici-oleracei Persoon ex Desmazieres  
*Stevia*  
 Aecidium minimum H.S. Jackson & Holway  
 Aecidium steviae P. Hennings

**Tagetes**

PUCCINIA TAGETICOLA Dietel &amp; Holway

**Taraxacum**

PUCCINIA HIERACII (Roehling) Martius

**Tessaria**

? UROMYCES MEGALOSPERMUS

Spegazzini

**Trichocline**

UROMYCES TRICHOCLINES P. Hennings

**Vanillosmopsis**

PUCCINIA VELATA Dietel

*Uredo illaudanda* H. S. Jackson & Holway**Verbesina**

PUCCINIA IRREGULARIS Dietel

PUCCINIA VERBESINAE P. Hennings

PUCCINIA VERBESINAE-DENTATAE

(Sydow) H. S. Jackson &amp; Holway

*Uredo helianthi* Schweinitz**Vernonia***Aecidium santanense* Lindquist*Aecidium vernoniae* P. HenningsPUCCINIA AGNITIONALIS H. S. Jackson &  
HolwayPUCCINIA ALLAUDABALIS H. S. Jackson &  
Holway

PUCCINIA BACCHARIDICOLA P. Hennings

PUCCINIA BECKI Mayor

PUCCINIA CALLOSA Joerstad

PUCCINIA DEPRECANEA H. S. Jackson &  
Holway

PUCCINIA FAUSTA H. S. Jackson &amp; Holway

PUCCINIA FUNDATA H. S. Jackson &  
HolwayPUCCINIA IMPETRABILIS H. S. Jackson &  
HolwayPUCCINIA IMPROVISA H.S. Jackson &  
HolwayPUCCINIA INAEQUATA H. S. Jackson &  
Holway

PUCCINIA LORENTZII P. Hennings

PUCCINIA MEMBRANACEA P. Dietel

PUCCINIA NEOROTUNDATA Cummins

PUCCINIA PERTRITA H. S. Jackson &  
HolwayPUCCINIA PESTIBILIS H. S. Jackson &  
Holway

PUCCINIA PINGUIS Dietel

PUCCINIA SEMIINSCULPTA Arthur

PUCCINIA VENIABILIS H. S. Jackson &  
Holway

PUCCINIA VERNONIPHILA Spegazzini

UROMYCES PURUS (H. Sydow) Cummins

**Wedelia**

UROMYCES BLAINVILLEAE Berkeley

PUCCINIA OBREPTA H. S. Jackson &amp; Holway

PUCCINIA WEDELICOLA H. S. Jackson &amp;

Holway

***Wulffia***

*Aecidium wulffiae* P. Hennings  
 UROMYCES WULFFIAE P. Hennings  
 UROMYCES WULFFIAE-STENOGLOSSAE  
 Dietel

***Youngia***

Puccinia CREPIDIS Schroeter

**Genus undetermined**

Puccinia CIRCINANS Dietel  
 Puccinia INCONSPICUA Dietel  
 Puccinia VELATA Dietel

**CONVOLVULACEAE**

***Breweria***, see ***Jaquemontia***

***Convolvulus***

Puccinia CONVOLVULI Castagne  
*Aecidium calystegiae* Desm.  
*Uredo bete* var. *convolvuli* Persoon

***Dichondra***

Puccinia DICHONDRAE Montagne

***Evolvulus***

Puccinia LITHOSPERMI Ellis & Kellerman  
 Puccinia TUYUTENSIS Spegazzini

***Ipomoea***

*Aecidium convolvulinum* Spegazzini  
*Aecidium distinguendum* P. Sydow & H. Sydow  
*Caecoma ipomoea* Link  
 COLEOSPORIUM IPOMOEAE Burrill  
 Puccinia CRASSIPES Berkeley & Curtis  
 Puccinia OPULENTA Spegazzini  
 Puccinia PUTA H. S. Jackson & Holway  
 UROMYCES VICINUS H. S. Jackson &  
 Holway

***Jaquemontia***

Puccinia SIMASII Rangel  
 UROMYCES BRASILIENSIS Trotter

***Operculina***

*Uredo laeticolor* Arthur

***Quamoclit***

Puccinia CRASSIPES Berkeley & Curtis

**CORNACEAE**

***Griselinia***

Puccinia GRISELINIAE Pazschke

**CUCURBITACEAE**

***Anguria***

UROMYCES ANGURIA H. S. Jackson & Holway

***Cayaponia***

UROMYCES CAYAPONIAE P. Hennings  
 UROMYCES NOVISSIMUS Spegazzini  
 UROMYCES PENTASTRIATUS Viégas  
 UROMYCES RATUS H. S. Jackson & Holway

***Cucumis***

Puccinia CUCUMERIS P. Hennings



***Momordica****Aecidium momordicae* Juel***Trianosperma***

UROMYCES PENTASTRIATUS Viégas

***Wilbrandia***UROMYCES ANGURIA H. S. Jackson &  
Holway**CYPERACEAE*****Carex***

PUCCINIA DIOICAE P. Magnus

PUCCINIA JOERSTADIANA Lindquist

PUCCINIA MINUTA Dietel

***Cyperus***

? PUCCINIA ANGUSTATOIDES R.E. Stone

PUCCINIA CYPERI Arthur

PUCCINIA CYPER-TAGETIFORMIS (P.  
Hennings) Kern

PUCCINIA FLAVO-VIRENS H. S. Jackson

PUCCINIA MARISCI Mayor

PUCCINIA OBVOLUTA H. S. Jackson &  
Holway

PUCCINIA SUBCORONATA P. Hennings

? *Uredo cypericola* P. Hennings*Uredo nociviola* H. S. Jackson & Holway*Uredo torulini* P. Hennings***Eleocharis***

PUCCINIA LIBERTA Kern

***Fimbristylis***

PUCCINIA FIMBRISTYLIDIS Arthur

***Fuirena***

PUCCINIA FUIRENICOLA Kern et al.

*Uredo fuirenae* P. Hennings***Kyllinga****Uredo kyllingiae* P. Hennings***Mariscus***

PUCCINIA MARISCI Mayor

***Rhynchospora***

PUCCINIA ANGUSTATOIDES Stone

PUCCINIA CYPERI Arthur

UROMYCES OBLELCTANEUS H. S. Jackson  
& Holway

UROMYCES RHYNCOSPORAE Ellis

***Scleria***

PUCCINIA SCLERIAE (Pazschke) Arthur

UROMYCES SCLERIAE P. Hennings

**Torulinum** (see *Cyperus*)**DIOSCOREACEAE*****Dioscorea***

SPHENOSPORA PALLIDA (Winter) Dietel

*Uredo dioscoreicola* Kern et al.**EBENACEAE*****Diospyros****Aecidium calosporum* Juel

*Aecidium mulleri* Thurston

*Aecidium ulei* P. Hennings

### ERICACEAE

? *Gaylussacia*

? PUCCINIASTRUM GEOPPERTIANUM

(Kuehn) Klebahn

### ERYTHROXYLACEAE

*Erythroxyton*

*Milesia erythroxyli* (Graziani) Buriticá &  
Hennen

PHAKOPSORA COCA Buriticá & Hennen

MARAVALIA ERYTHROXYLI (Viégas) Ono  
& Hennen

### EUPHORBIACEAE

*Acalypha*

*Uredo paulistana* Spegazzini

*Actinostemon*

UROMYCES ACTINOSTEMONIS H. S.

Jackson

*Alchornea*

OLIVEA CAPITULIFORMIS Arthur

*Uredo alchorneae* P. Hennings

*Uredo capituliformis* P. Hennings (OLIVEA  
CAPITULIFORMIS Arthur)

*Anisophyllum*, *see Euphorbia*

UROMYCES EUPHORBIAE Cooke & Peck

*Chamaesyce*, *see Euphorbia*

UROMYCES EUPHORBIAE Cooke & Peck

*Cnidoscopus*

*Aecidium cnidoscoli* P. Hennings (UROMYCES CNIDOSCOLI P. Hennings)

UROMYCES CNIDOSCOLI P. Hennings

*Croton*

*Aeciure crotonis* (P. Hennings) Buriticá &  
Hennen (ARTHURIA CATENULATA H. S. Jackson & Holway)

*Aeciure demicycla* Buriticá & Hennen  
(ARTHURIA DEMICYCLA. Buriticá & Hennen )

ARTHURIA CATENULATA H. S. Jackson &  
Holway

ARTHURIA DEMICYCLA. Buriticá & Hennen

PHAKOPSORA ARGENTINENSIS

(Spegazzini) Arthur

PHAKOPSORA PAVIDA Buriticá & Hennen

*Milesia pavida* (H. S. Jackson & Holway)

Buriticá & Hennen (PHAKOPSORA PAVIDA Buriticá & Hennen)

*Uredo valentula* H. S. Jackson & Holway

*Dalechampia*

*Aecidium cornu-cervi* P. Hennings

*Aecidium dalechampiae* P. Hennings

*Aecidium dalechampiicola* P. Hennings

*Euphorbia*

*Aecidium euphorbiae* Gmelin

MELAMPSORA EUPHORBIAE (Schubert)

Castagne

*Uredo proeminens* DeCandolle (UROMYCES  
EUPHORBIAE Cooke & Peck)  
UROMYCES EUPHORBIAE Cooke & Peck  
UROMYCES EUPHORBIICOLA Berkeley &  
Curtis  
Uromyces proeminens (DeCandolle) Passerini in  
Rabenhorst, see UROMYCES EUPHORBIAE Cooke & Peck  
UROMYCES ULEANUS Dietel

***Jatropha***

PHAKOPSORA ARTHURIANA Buriticá &  
Hennen  
*Malupa jatrophiicola* (Arthur) Buriticá & Hennen  
UROMYCES CNIDOSCOLI P. Hennings  
UROMYCES JATROPHICOLA P. Hennings

***Joanesia***

PUCCINIA JOANESIAE P. Hennings  
*Uredo maciensis* P. Hennings

***Mabea***

*Aecidium mabeae* Thurston

***Manihot***

UROMYCES CARTHAGENENSIS Spegazzini  
UROMYCES JATROPHE Dietel & Holway  
UROMYCES MANIHOTICOLA P. Hennings  
UROMYCES MANIHOTIS P. Hennings  
UROMYCES MANIHOTIS-CATINGAE P.  
Hennings  
UROMYCES TOLELRANDUS H. S. Jackson  
& Holway

***Maprounea***

*Aecidium maprouneae* P. Hennings var.  
*maprouneae*  
*Aecidium maprouneae* P. Hennings var.  
*noncrassatum* Hennen & Sotão  
CHACONIA MAPROUNEAE (Viégas) Ono &  
Hennen  
*Uredo maprouneae* P. Hennings

***Pera***

MARAVALIA PERAE Hennen & Figueiredo,  
sp. nova, ined

***Phyllanthus***

PHAKOPSORA TIJUCAE Buriticá & Hennen  
PHAKOPSORA ULEI (H. Sydow & P. Sydow)  
Buriticá & Hennen  
*Milesia phyllanthi* (Hennings) Buriticá &  
Hennen  
*Milesia tijucae* (H. S. Jackson & Holway)  
Buriticá & Hennen

***Plukenetia***

*Aecidium cornu-cerve* P. Hennings.

***Sapium***

UROMYCES CISNEROANUS Spegazzini

***Sebastiana***

MARAVALIA SEBASTIANAE Lindquist  
*Uredo sebastianae* Winter

**GENTIANACEAE**

*Lisiathus*

PUCCINIA LISIANTHI H. S. Jackson &amp; Holway

**GERANIACEAE***Pelargonium*

PUCCINIA PELARGONII-ZONALIS Doidge

**GESNERIACEAE****Genus undetermined,***? Codonanthe*

PUCCINIA GESNERACEARUM Dietel

**GRAMINEAE***Andropogon*

PUCCINIA POSADENSIS Saccardo &amp; Trotter

PUCCINIA VERSICOLOR Dietel &amp; Holway

*Antheophora*PUCCINIA ANTHEPHORAE Arthur &  
Johnston

PUCCINIA CENCHRI Dietel &amp; Holway

*Uredo antheophorae* H. Sydow & P. Sydow*Avena*

PUCCINIA CORONATA Corda

PUCCINIA GRAMINIS Persoon

PUCCINIA RECONDITA Roberge ex  
Desmazières*Bambusa*

KWEILINGIA DIVINA (H. Sydow) Buriticá

*Physopella inflexa* (Ito) Buriticá & Hennen*Bothriochloa*

PUCCINIA INFUSCANS Arthur &amp; Holway

*Brachiaria*PUCCINIA LEVIS (Saccardo & Bizzozero)  
Magnus*Briza*

PUCCINIA GRAMINIS Persoon

PUCCINIA RECONDITA Roberge ex  
Desmazières*Bromus*

PUCCINIA BRACHYPODII-PHOENICOIDIS

Guyot &amp; Malencon var. CHISOSANA (Cummins) Cummins

PUCCINIA RECONDITA Roberge ex  
Desmazières*Calamagrostis*

PUCCINIA AZTECA Cummins &amp; Hennen

PUCCINIA BRACHYPODII Otth var.

ARRHENATHERI (Klebahn) Cummins &amp; H. C. Green

PUCCINIA GRAMINIS Persoon

PUCCINIA POARUM Nielson

*Uredo paulensis* P. Hennings*Cenchrus*PUCCINIA CENCHRI Dietel & Holway var.  
CENCHRI*Uredo cenchrophila* Spegazzini*Chloris*

PUCCINIA CACABATA Arthur

- Puccinia chloridis Spegazzini  
*Uredo gayanae* Lindquist  
**Cynodon**  
 Puccinia cynodontis Lacroix  
**Digitaria**  
 Puccinia esclavensis Dietel & Holway  
 Puccinia oahuensis Ellis & Everhart  
 Puccinia pseudoatra Cummins  
 Puccinia substriata Ellis &  
     Bartholomew vars.  
 Uromyces pegleriae P. Evans  
**Echinochloa**  
 Puccinia abnormis P. Hennings  
**Eragrostis**  
 Uromyces eragrostidis Tracy  
**Erianthus**  
 Puccinia erianthicola Cummins  
 Puccinia microspora Dietel  
**Eriochloa**  
 Uromyces setariae-italicae Yoshino  
**Festuca**  
 ? Puccinia sessilis Schneider  
**Gouinea**  
 Puccinia guaranitica Spegazzini  
**Gymnopogon**  
 Puccinia boutelouae (Jennings) Holway  
 Puccinia gymnopegonicola Hennen  
**Hackelochloa, see Mnesithea**  
**Heteropogon**  
 Puccinia versicolor Dietel & Holway  
**Hordeum**  
 Puccinia graminis Persoon  
 Puccinia recondita Roberge ex  
     Desmazières  
**Ichnanthus**  
 Puccinia ichnanthi Mains  
 Puccinia inclita Arthur  
**Imperata**  
 Puccinia microspora Dietel  
 Puccinia posadensis Saccardo & Trotter  
**Lasiacis**  
 Uromyces costaricensis Sydow  
**Lolium**  
 Puccinia coronata Corda  
 Puccinia graminis Persoon  
**Manisuris, see Mnesithea**  
**Mnesithea**  
 Puccinia levis (Saccardo & Bezzzero)  
     Magnus var. LEVIS  
**Melica**  
 Puccinia schedonnardi Kellerman &  
     Swingle  
**Melinis**  
*Uredo melinidis* Kern  
 Uromyces setariae-italicae Yoshino  
**Microchloa**

UROMYCES DACTYLOCTENII Wakefield &  
Hansford

***Nassella***

PUCGINIA NASSELLAE Arthur & Holway

***Olyra***

PHAKOPSORA PHAKOPSOROIDES (Arthur  
& Mains) Buriticá & Hennen

*Physopella phakopsoroides* Cummins &  
Ramachar

PUCGINIA DEFORMATA Berkeley & Curtis

PUCGINIA FACETA Sydow

PUCGINIA OBLIQUO-SEPTATA Viennot-  
Bourgin

*Uredo bambusarum* P. Hennings

***Panicum***

PHAKOPSORA CAMELIAE (Arthur) Buriticá

*Physopella cameliae* (Mayor) Cummins &  
Ramachar

PUCGINIA ABNORMIS P. Hennings

PUCGINIA DOLOSA Arthur & Fromme vars.

PUCGINIA HUBERI P. Hennings

PUCGINIA LEVIS (Saccardo & Bizzozero)  
Magnus vars.

PUCGINIA MILLEGRANAE Cummins

PUCGINIA NEGRENSIS P. Hennings

PUCGINIA PUTEMANSII P. Hennings

UROMYCES NITEROYENSIS Rangel

UROMYCES SETARIAE-ITALICAE Yoshino

***Pariana***

PUCGINIA BAMBUSARUM Arthur

*Uredo olyrae* P. Hennings

***Paspalum***

PHAKOPSORA COMPRESSA (Arthur &  
Holway) Buriticá & Hennen

*Physopella paspalicola* (Hennings) Buriticá &  
Hennen

PUCGINIA CHAETOCLOAE Arthur

PUCGINIA DOLOSA Arthur & Fromme

PUCGINIA LEVIS (Saccardo & Bizzozero) P.  
Magnus vars.

PUCGINIA PUTTEMANSII P. Hennings

PUCGINIA SUBSTRIATA Ellis &  
Bartholomew vars.

*Uredo chaetochloae* Arthur

***Pennisetum***

PHAKOPSORA APODA (Hariot & Patouillard)  
Mains

*Physopella apoda* Buriticá & Hennen

PUCGINIA GYMNOTHRICHIS P. Hennings

UROMYCES SETARIAE-ITALICAE Yoshino

***Phalaris***

PUCGINIA BRACHYPODII Oth var.

ARRHENATHERI (Klebahn) Cummins & H. C. Green

***Phleum***

PUCCINIA BRACHYPODII var.  
ARRHENATHERI (Klebahn) Cummins & H. C. Green

***Phragmites***

PUCCINIA PHRAGMITIS (Schumann)  
Koernicke

***Piptochaetium***

PUCCINIA PIPTOCHAETII Dietel & Neger

***Poa***

PUCCINIA BRACHYPODII Otth var. POAE-  
NEMORALIS (Otth) Cummins & H.C. Greene

PUCCINIA POARUM Nielsen

*Uredo poae-sudeticae* Westendorp

***Polypogon***

PUCCINIA POLYPOGONIS Spegazzini

***Rhynchelytrum***

PUCCINIA LEVIS (Saccardo & Bizzozero)  
Magnus var. TRICHOLAENAE

***Secale***

PUCCINIA GRAMINIS Persoon

PUCCINIA RECONDITA Roberge ex  
Desmazières

***Setaria***

PHAKOPSORA CAMELIAE (Arthur) Buriticá

*Physopella cameliae* (Mayor) Cummins &  
Ramachar

PUCCINIA SUBSTRIATA Ellis &  
Bartholomew vars.

UROMYCES NITEROYENSIS Rangel

UROMYCES SETARIAE-ITALICAE Yoshino

***Sorghastrum***

PUCCINIA VIRGATA Ellis & Everhart

***Sorghum***

PUCCINIA PURPUREA Cooke

***Spartina***

PUCCINIA SPARGANIOIDES Ellis &  
Bartholomew

***Stipa, see Nassella***

***Tricholaena, see Rhynchelytrum***

PUCCINIA LEVIS (Saccardo & Bizzozero)  
Magnus vars. TRICHOLAENAE

***Tripsacum***

PUCCINIA POLYSORA Underwood

***Triticum***

PUCCINIA GRAMINIS Persoon

PUCCINIA RECONDITA Roberge ex  
Desmazières

PUCCINIA STRIIFORMIS Westendorp

***Vulpia***

PUCCINIA HORDEI Otth

***Zea***

PHAKOPSORA ZEA (Mains) Buriticá

PUCCINIA POLYSORA Underwood

PUCCINIA SORGHI Schweinitz

*Uredendo zae* (Cummins & Ramachar) Buriticá

***Zoyisia***

Puccinia zoysiae Dietel

**GUTTIFERAE (see CLUSIACEAE)**

**HELICONIACEAE**

***Heliconia***

*Physopella rectangulata* (Albuquerque) Buriticá  
& Hennen

Puccinia heliconiae (Dietel) Arthur

*Uredo heliconiae* Dietel

*Uredo rectangulata* Albuquerque

***Musa***

*Uredo heliconiae* Dietel

**HIPPOCRATEACEAE see  
CELASTRACEAE**

**HYPERICACEAE (see CLUSIACEAE)**

**IRIDACEAE**

***Gladiolus***

Uromyces transversalis

***Sisyrinchium***

Puccinia sisyrinchii Montero

Puccinia staminea Dietel

**Genus undetermined**

*Uredo tenebrosa* H. S. Jackson & Holway

**JUNCACEAE**

***Juncus***

*Uredo macella* H. S. Jackson & Holway

Uromyces junci (Desmazières) Tulasne

Uromyces occultus Lindquist

**LABIATEAE**

***Coleus***

*Uredo palliduscula* Spegazzini

***Cunila***

*Aecidium glechonis* Spegazzini

Puccinia cunilae Dietel

*Uredo glechonis* P. Hennings

***Glechon***

*Aecidium glechonis* Spegazzini

***Hyptis***

Puccinia cavatica H. S. Jackson &  
Holway

Puccinia gibertii Spegazzini

? Puccinia neohyptidis Laundon

Puccinia hyptidis-mutabilis Mayor

Puccinia insititia Arthur

Puccinia medellinensis Mayor

*Uredo hammari* P. Hennings

*Uredo hyptidis* P. Hennings

***Leonotis***

Puccinia leonotidicola P. Hennings

***Leucas***



Puccinia leucadis P. & H. Sydow

***Mentha***

Puccinia menthae Persoon

***Salvia***

Puccinia conspersa Dietel var.

CONSPERSA

Puccinia farinacea Long

*Uredo salviae* Dietel

***Stachys***

Puccinia pallidissima Spegazzini

**LAURACEAE**

***Nectandra***

*Aecidium mulleri* Thurston, see under ***Diospyros***,

**Ebenaceae**

*Aecidium nectandrae* H. S. Jackson & Holway

**LECYTHIDACEAE**

***Eschweilera***

Cerotelium nuxae Buriticá & Hennen

*Physopella jaranae* (Albuquerque) Buriticá &

Hennen

**LEGUMINOSAE**

***Acacia***

Diabole cubensis (Arthur & Johnston)

Arthur (Host is probably *Mimosa* sp., not *Acacia*)

Ravenelia hieronymi Spegazzini

Ravenelia idonea H. S. Jackson &

Holway

Ravenelia irregularis H. S. Jackson &

Holway

Ravenelia leucaenae-

microphyllae Dietel

Ravenelia rata H. S. Jackson & Holway

Sphaerophragmium silveirae

Spegazzini

*Uredo alemquerensis* Spegazzini

***Albizia***

Sphaerophragmium acaciae (Cooke)

Magnus

***Andira***

Ravenelia goyazensis P. Hennings

***Apuleia***

Soratea sp. nov. Hennen

***Arachis***

Puccinia arachidis Spegazzini var.

ARACHIDIS

*Peridipes arachidis* (Lagerheim) Buriticá &

Hennen

***Bauhinia***

Maravalia bauhiniicola (Cummins) Y.

Ono

*Milesia bauhiniicola* Ono, Buriticá & Hennen

Phakopsora bauhiniicola Ono,

## Buriticá &amp; Hennen

Uredo amazonensis P. Hennings  
 Uredo ulei P. Hennings  
 UROMYCES ANTHEMOPHILUS Vestergren  
 UROMYCES BAUHINIAE P. Hennings  
 UROMYCES DIETELIANUS Pazschke vars.  
 UROMYCES FLORALIS Vestergren  
 UROMYCES FOVEOLATUS Juel  
 UROMYCES GOYAZENSIS P. Hennings  
 UROMYCES HEMMENDORFII Vestergren  
 UROMYCES PERAFFINIS Dietel  
 UROMYCES PERLEBIAE Vestergren  
 UROMYCES REGIUS Vestergren  
 UROMYCES VICOSENSIS Almeida  
 UROMYCES VIEGASII Almeida

**Bradburya, see Centrosema****Caesalpinia**

ANTHOMYCES BRASILIENSIS Dietel  
 ESALQUE HOLWAYI (H. S. Jackson) Hennen,  
 Figueiredo, & Carvalho  
 HALALOPHRAGMIUM HOLWAYI (Jackson)  
 Sydow  
 RAVENELIA COHNIANA P. Hennings  
 RAVENELIA PILEOLARIOIDES Sydow

**Cajanus**

*Uredo cajani* Sydow

**Calliandra**

RAVENELIA AFFINIS Sydow  
 RAVENELIA ARMATA Sydow  
 RAVENELIA DIETELIANA P. Hennings  
 RAVENELIA PAZSCHKEANA Dietel  
 SPHAEROPHRAGMIUM DEBILE Sydow  
*Uredo longipedis* P. Hennings

**Cassia (includes Chamacrista, and Senna)**

RAVENELIA DENTIFERA Hennen &  
 Cummins  
 RAVENELIA FACETA H. S. Jackson &  
 Holway  
 RAVENELIA FIMBRIATA  
 RAVENELIA MACROCARPA Sydow  
 RAVENELIA MICROCYSTIS Pazschke  
 RAVENELIA MICROSPORA Dietel  
 RAVENELIA ULEANA P. Hennings  
*Uredo cassiae-rugosae* Thurston  
*Uredo cassicola* P. Hennings  
*Uredo cyclogena* Spegazzini, (RAVENELIA  
 MACROCARPA H. Sydow & P. Sydow).

**Centrosema**

*Uredo centrosema* Viégas  
 UROMYCES BRADBURYAE H. S. Jackson &  
 Holway

**Clitoria**

*Uredo goeldii* R. T. Almeida  
 UROMYCES NEUROCARPI Dietel

**Copaifera**

DIORCHIDIUM COPAIFERAE (P. Sydow &  
H. Sydow) Cummins & Y. Hiratsuka

***Crotalaria***

PHAKOPSORA CROTALARIAE (Dietel)

Arthur

PHAKOPSORA MEIBOMIAE Arthur

*Uredo crotalariae* Dietel

*Uredo harmsiana* P. Hennings

UROMYCES CROTALARIAE (Arthur) J. W.

Baxter

***Dalbergia***

SORATAEA VENTURAE (Dianese L. T. P.

Santos, R. B. Medeiros, & M. Sanchez) Hennen & Figueiredo

SORATEA sp. nov.

SPHAEROPHRAGMIUM DALBERGIAE

Dietel

*Uredo dalbergiae* P. Hennings

***Derris***

RAVENELIA BAKERIANA Dietel

RAVENELIA LONCHOCARPI Lagerheim &

Dietel

SORATEA sp. nov. Albuquerque

***Desmodium***

*Aecidium desmodii* P. Hennings

PHAKOPSORA Meibomiae Arthur

*Uredo microthelis* Spegazzini

UROMYCES CASTANEUS Sydow

UROMYCES DESMODIICOLA Joerstad

UROMYCES HEDYSARI-PANICULATI

(Schweinitz) Farlow

UROMYCES ORBICULARIS Dietel

UROMYCES UNIONENSIS Viégas

***Dipterix***

*Uredo* sp. nov.

***Dolichos***

PHAKOPSORA Meibomiae Arthur

***Eriosema***

*Uredo eriosemae* H.S. Jackson & Holway

***Erythrina***

DICHEIRINIA BINATA (Berkeley & Curtis)

Arthur

RAVENELIA PLATENSIS Spegazzini

***Glycine***

PHAKOPSORA Meibomiae Arthur

***Hymenaea***

CROSSOPSORA HYMENAEAE Dianese,

Buriticá, & Hennen

*Peridipes hymenaeae* (Mayor) Buriticá &

Hennen

***Indigofera***

RAVENELIA INDIGOFERAE Tranzschel

***Inga***

CHACONIA INGAE (H.Sydow) Cummins

DICHEIRINIA SUPERBA H. S. Jackson &

Holway

*Uredo excipulata* H. Sydow & P. Sydow

- Uredo ingae* P. Hennings  
 YPSILOSPORA TUCMENSIS Hernández &  
 Hennen
- Lathyrus**  
 UROMYCES LATHYRINUS Spegazzini
- Lens**  
 UROMYCES VICIAE-FABAE (Persoon)  
 Schroeter
- Leucaena**  
 RAVENELIA LEUCAENAE-  
 MICROPHYLLAE Dietel  
 RAVENELIA PAZSCHKEANA Dietel
- Lonchocarpus**  
 DICHEIRINIA MANAOSENSIS (P. Hennings)  
 Cummins  
 RAVENELIA ATROCRUSTACEA P. Hennings  
 RAVENELIA BAKERIANA Dietel  
 RAVENELIA LONCHOCARPI Lagerheim &  
 Dietel  
 RAVENELIA PILEOLARIOIDES Sydow
- Lupinus**  
 UROMYCES ANTHYLLIDIS Schroeter  
 UROMYCES LUPINI Berkeley & Curtis  
*Uredo anthyllidis* Greville ex Berkeley
- Machaerium**  
*Uredo machaerii* Dietel
- Macroptillium**  
 PHAKOPSORA Meibomiae Arthur  
 UROMYCES APPENDICULATUS (Persoon)  
 Unger
- Medicago**  
 UROMYCES STRIATUS Schroeter
- Mimosa**  
 APRA BISPORA Hennen & F. O. Freire  
 DIABOLE CUBENSIS (Arthur & J. R.  
 Johnston) Arthur  
 DIORCHIDIELLA AUSTRALIS (Spegazzini)  
 Lindquist  
 DIORCHIDIELLA VERLANDII F. A. Ferreira  
 & A. O. Carvalho  
 RAVENELIA BAHIENSIS P. Hennings  
 RAVENELIA IDONEA H. S. Jackson &  
 Holway  
*Uredo mimosa-invisae* Viégas
- Ormosia**  
 DICHEIRINIA ANTUNII Hennen & Cummins  
 DICHEIRINIA ORMOSIAE (Arthur) Cummins  
 DICHEIRINIA SOLENOIDES (P. Hennings)  
 Cummins, see *D. uleana*  
 DICHEIRINIA ULEANA Hennen & Cummins  
 UROMYCES BELEMENSIS Albuquerque &  
 M. M. Figueriedo
- Peltogyne**  
*Uredo hymenaeae* Mayor
- Phaseolus**

- PHAKOPSORA PACHYRHIZI Sydow  
 UROMYCES APPENDICULATUS (Persoon)  
   Unger var. APPENDICULATUS  
 UROMYCES APPENDICULATUS (Persoon)  
   Unger var. BRASILIENSIS R. Tavares
- Piptadenia**  
 ANTHOMYCES BRASILIENSIS Dietel  
 DIORCHIDIUM PUIGGARII Spegazzini  
 RAVENELIA HENNINGSIANA Dietel  
 RAVENELIA SIMPLEX Dietel  
*Uredo villis* (Sydow) J. W. Baxter
- Pisum**  
 UROMYCES PISI (DeCandolle) Oth
- Pithecellobium (Pithecolobium)**  
 CHACONIA ALUTACEA Juel  
 DIORCHIDIUM ACANTHOSTEPHUM H.  
   Sydow & P. Sydow  
 RAVENELIA MINUTA Sydow  
 RAVENELIA PILEOLARIOIDES Sydow  
 RAVENELIA PITHECOLOBII Arthur  
*Uredo amazonica* (Sydow) J. W. Baxter  
*Uredo bomfinensis* P. Hennings  
*Uredo pithicobii* P. Hennings
- Platymiscium**  
*Uredo* sp. nov.
- Poiretia**  
 PUCCINIA BERGII Spegazzini
- Rhynchosia**  
 UROMYCES DOLICHI Arthur
- Senna (see Cassia)**
- Stryphnodendron**  
 CHACONIA BRASILIENSIS Ono & Hennen
- Stylosanthes**  
 PUCCINIA STYLOSANTHIS (P. Hennings)  
   Viégas
- Swartzia**  
 MARAVALIA AMAZONENSIS (Albuquerque)  
   Ono  
 MARAVALIA SWARTZIAE Ono
- Tephrosia**  
*Uredo tephrosiicola* P. Hennings, from Peru
- Trifolium**  
 UROMYCES NERVIPHILUS (Grognot) [??]  
   Hotson  
 UROMYCES TRIFOLII (Hedwig) Lévillé
- Vicia**  
 UROMYCES LATHRINUS Spegazzini  
 UROMYCES VICIAE-FABAE (Persoon)  
   Schroeter
- Vigna**  
 PHAKOPSORA MEIBOMIAE Arthur  
 UROMYCES APPENDICULATUS (Persoon)  
   Unger
- Zornia**  
 PUCCINIA ARACHIDIS Spegazzini var. OFFUSCATA (Arthur) Cummins  
*Uredo zorniae* Dietel

**Genus undetermined**

ANTHOMYCES BRAZILIENSIS Dietel  
 RAVENELIA PAZSCHKEANA Dietel  
 RAVENELIA SYDOWIANA Rick  
 RAVENELIA THEISSENIANA Sydow

**LILIACEAE*****Allium***

PUCCINIA ALLII Rudolphi

***Smilax***

*Aecidium smilacinum* Lindquist (not *Aecidium smilacinum* Tranzschel)

PUCCINIA SMILACIS Schweinitz

SPHENOSPORA SMILACINA Sydow

**LINACEAE*****Linum***

MELAMPSORA LINI (Ehrenberg) Lèveillé

**LOGANIACEAE*****Spigelia***

PUCCINIA SPIGELIAE Sydow

**LORANTHACEAE*****Loranthus***

*Aecidium circumscribens* Neger

*Aecidium goyazense* P. Hennings

*Aecidium loranthi* Thuemen

UROMYCES CIRCUMSCRIPTUS Neger

UROMYCES LORANTHI H. S. Jackson & Holway

***Phoradendron***

*Aecidium loranthi* Thuemen

***Phthirusa***

*Aecidium goyazense* P. Hennings

***Struthanthus***

*Aecidium struthanthi* H. S. Jackson & Holway

UROMYCES CIRCUMSCRIPTUS Neger

UROMYCES URBANIANUS P. Hennings

**LYTHRACEAE*****Cuphea***

PHAKOPSORA CUPHEAE Buriticá

*Milesia cupheae* (P. Hennings) Buriticá

***Lafoensia***

*Uredo lafoensiae* H. S. Jackson & Holway

**MALPIGHIACEAE*****Banisteria***

PUCCINIA BANISTERIAE P. Hennings

PUCCINIA INRECTA H. S. JACKSON &

Holway (host is probably *Peixotoa*)

PUCCINIA SANGUIOLENTA P. Hennings

*Uredo banisteriicola* P. Hennings

***Banisteriopsis***

Puccinia banisteriae P. Hennings

**Byrsonima**

*Aecidium byrsonimatis* P. Hennings

*Aecidium vinnulum* H. S. Jackson & Holway

Crossoporsora byrsonimatis (P.

Hennings) R. S. Peterson

Crossoporsora notata (Arthur & J.R.

Johnston) Arthur

*Malupa notata* (Arthur) Buriticá

**Dicella**

Puccinia barretoii Hennen

**Heteropterys**

? Puccinia banisteriae P. Hennings

Puccinia barbatula Arthur & J. R.

Johnston

Puccinia heteropteridis Thuemen

Puccinia picturata H. S. Jackson & Holway

Puccinia sanguinolenta P. Hennings

*Uredo uleana* Dietel

**Peixotoa**

Puccinia inrecta H. S. Jackson & Holway

**Stigmaphyllon**

Puccinia inflata Arthur

Puccinia insueta Winter

**Genus undetermined**

Puccinia usterii Dietel

**MALVACEAE**

**Abutilon**

Puccinia heterospora Berkeley & Curtis

Puccinia sherardiana Koernicke

**Althea**

Puccinia malvacearum Bertero ex

Montane

**Anoda**

Puccinia malvacearum Bertero ex

Montane

**Gaya**

Puccinia heterospora Berkeley & Curtis

**Gossypium**

Phakopsora gossypii (Lagerheim)

Hiratsuka

**Hibiscus**

Catenulopsora praelonga

(Spegazzini) Buriticá

Puccinia heterospora Berkeley & Curtis

Puccinia malvacearum Bertero ex

Montane

**Malva**

Puccinia malvacearum Bertero ex

Montane

Puccinia sherardiana Koernicke

**Malvastrum**

Catenulopsora praelonga

(Spegazzini) Buriticá

Puccinia malvacearum Bertero ex Montane

Puccinia SHERARDIANA Koernicke

*Malvaviscus*

CATENULOPSORA PRAELONGA

(Spegazzini) Buriticá

*Pavonia*

CATENULOPSORA PRAELONGA

(Spegazzini) Buriticá

Puccinia EXILIS Sydow

*Pseudabutilon*

Puccinia HETEROSPORA Berkeley & Curtis

*Sida*

Puccinia HETEROSPORA Berkeley & Curtis

Puccinia MALVACEARUM Bertero ex

Montane

Puccinia SHERARDIANA Koernicke

*Wissadula*

Puccinia HETEROSPORA Berkeley & Curtis

**MARANTACEAE**

*Ctenanthe*

Puccinia THALIAE

*Ischnosiphon*

Puccinia THALIAE Dietel

*Uredo ischnosyphonis* P. Hennings

*Maranta*

Puccinia THALIAE Dietel

*Thalia*

Puccinia THALIAE Dietel

**Genus undetermined**

CEROTELIUM RECTANGULATA Buriticá &

Hennen

*Physopella rectanulata* (Albuquerque) Buriticá

& Hennen

**MELIACEAE**

*Cedrella*

PHAKOPSORA CHEOANA Cummins

*Malupa cheoana* Buriticá & Hennen

*Guarea*

*Aecidium guareae* P. Hennings

*Aecidium miryense* P. Hennings

*Trichilia*

*Uredo trichiliae* Arthur

**MENISPERMACEAE**

**Genus undetermined**

*Aecidium usterianum* Spegazzini

**MONIMIACEAE**

*Mollinedia*

*Aecidium invallatum* P. Hennings

**Genus undetermined**

*Aecidium pusillum* Dietel

**MORACEAE**

*Chlorophora*



CEROTELIUM FICI (Castagne) Arthur

**Dorstenia**

*Uredo consanguinea* Sydow

**Ficus**

CEROTELIUM FICICOLA Buriticá & Hennen

*Cerotelium fici* (Castagne) Arthur

*Malupa fici* (Castagne) Buriticá

PHAKOPSORA NISHIDANA Ito

*Physopella ficicola* (Spegazzini) Buriticá &  
Hennen

*Uredo ficina* Juel

**Maclura**

CHACONIA APICRASSA Hennen et al.

PHYSOPELLA MACLURAE Arthur

*Uredo celtidis* Pазschke

*Uredo ficina* Juel

**MUSACEAE**, vide Heliconiaceae

**MYRSINACEAE**

**Ardisia**

UROMYCES MYRSINES Dietel

**Icacorea**

UROMYCES MYRSINES Dietel

**Myrsine**

*Uredo myrsines* Dietel

UROMYCES MYRSINES Dietel

**Rapanea**

UROMYCES MYRSINES Dietel

**MYRTACEAE**

**Abbevillea**

PUCCINIA PSIDII Winter

**Callistemon**

PUCCINIA PSIDII Winter

**Campomanesia**

PHAKOSPORA JUELLII Sydow (nom. nud.??)

PUCCINIA PSIDII Winter (see PHAKOSPORA  
MYRTA)

**Eucalyptus**

PUCCINIA PSIDII Winter

**Eugenia**

PUCCINIA PSIDII Winter

**Jambosa**

PUCCINIA PSIDII Winter

**Marlierea**

PUCCINIA PSIDII Winter

**Melaleuca**

PUCCINIA PSIDII Winter

**Myrcia**

PUCCINIA PSIDII Winter

**Myrciaria**

PUCCINIA PSIDII Winter

**Phyllocalyx**

PUCCINIA PSIDII Winter

**Pimenta**

Puccinia psidii Winter

*Pseudomyrcianthes*

Puccinia psidii Winter

*Psidium*

Puccinia psidii Winter

*Syzygium*

Puccinia psidii Winter

**Genus undetermined**

Puccinia psidii Winter

*Uredo seclusa* H. S. Jackson & Holway

## ONAGRACEAE

*Fuchsia*

? Puccinia fuchsiae Sydow & Holway

*Jussiaea*

*Aecidium jussiaeae* Segazzini

Puccinia jussiaeae Spegazzini

Puccinia pulverulenta Greville

*Ludwigia*

*Aecidium jussiaeae* Segazzini

Cerotelium mariaae Buriticá & Hennen

Puccinia jusieuae Spegazzini

## ORCHIDACEAE

*Catasetum*

*Uredo carnosae* Spegazzini

*Cattleya*

Cladoma behnickiana (P. Hennings)

J.Hennen comb. nov.

*Cyrtopodium*

*Uredo nigropunctata* P. Hennings

*Epidendrum*

Cladoma behnickiana (P. Hennings)

J.Hennen comb. nov.

*Uredo epidendri* P. Hennings

*Natylia*

Sphenospora kevorkianii Linder

*Oncidium*

Cladoma behnickiana (P. Hennings)

J.Hennen comb. nov.

Puccinia oncidii Cummins

*Uredo behnickiana* P. Hennings

*Uredo oncidii* P. Hennings

*Prescottia*

Sphenospora kevorkianii Linder

*Spiranthes*

*Uredo lynchii* Plowright

*Stanhopea*

Sphenospora kevorkianii Linder

*Stenorrhynchus*

*Uredo epidendri* P. Hennings

*Uredo neopustulata* Cummins

*Zygotaxis*

Sphenospora kevorkianii Linder

**Genus undetermined**

**PALMAE***Attalea*

CERRADOA PALMAEA Hennen &amp; Ono

**Genus undetermined**

CERRADOA PALMAEA Hennen &amp; Ono

**PASSIFLORACEAE***Passiflora*

PUCCINIA SCLERIAE (Pazschke) Arthur

**PHYTOLACCACEAE***Phytolacca**Aecidium talini* Spegazzini (PUCCINIA LEPTOCHLOAE Arthur & Fromme)

PUCCINIA PINDORAMAE Viégas

*Rivina*PUCCINIA RAUNKAERII Ferdinansen &  
Winge**PINACEAE***Araucaria*

ULEIELLA PARADOXA Schroeter

**PIPERACEAE***Peperomia**Uredo peperomiae* P. Hennings*Piper*

CROSSOPSORA PIPERIS R. Berndt et al.

*Uredo peperomiae* P. Hennings*Malupa piperinum* Buriticá & Hennen**POLYGALACEAE***Polygala**Uredo peribebuyensis* Spegazzini**POLYGONACEAE***Coccoloba*CEROTELIUM COCCOLOBAE Buriticá &  
Hennen*Physopella coccolobae* (Hennings) Buriticá &  
Hennen [CEROTELIUM COCCOLOBAE].*Polygonum*

PUCCINIA POLYGONI-AMPHIBII Persoon

PUCCINIA SOLMSII P. Hennings

*Rumex*

UROMYCES RUMICIS (Schweinitz) Winter

**POLYPODIACEAE (see PTERIDOPHYTA)****PONTEDERIACEAE***Heteranthera*UROMYCES HETERANTHERAE (P.  
Hennings) Sydow*Pontederia*

UROMYCES PONTEDERIAE Gerard

**PTERIDOPHYTA**

***Adiantum***

*Uredo viegasii* Joerstad

***Anemia***

DESMELLA ANEMIAE H. Sydow & P. Sydow

***Blechnum***

DESMELLA ANEMIAE H. Sydow & P. Sydow

***Cyclosorus (Thelypteris)***

DESMELLA ANEMIAE H. Sydow & P. Sydow

***Gymnogramma***

DESMELLA ANEMIAE H. Sydow & P. Sydow

***Lindsaya***

*Calidion lindsaeae* (P. Hennings) Sydow

***Lygodium***

PUCCINIA LYGODII Arthur

***Nephrolepis***

DESMELLA ANEMIAE H. Sydow & P. Sydow

***Polypodium***

*Calidion lindsaeae* (P. Hennings) Sydow

***Pteridis***

UREDINOPSIS PTERIDIS Dietel & Holway

***Thelypteris (Cyclosorus)***

DESMELLA ANEMIAE H. Sydow & P. Sydow

**Genus undetermined,**

DESMELLA ANEMIAE H. Sydow & P. Sydow

**RANUNCULACEAE*****Clematis***

COLEOSPORIUM CLEMATIDIS Barclay

***Ranunculus***

? *Aecidium ranunculi* Schweinitz

**RHAMNACEAE*****Colubrina***

PHAKOPSORA COLUBRINAE Viégas

*Malupa colubrinae* (Cummins) Buriticá &  
Hennen

***Gouania***

PUCCINIA GOUANIAE Holway

PUCCINIA INVAGINATA Arthur & Johnston

PUCCINIA PARAENSIS Dietel

***Hovenia***

PHAKOPSORA COLUBRINAE Viégas

*Malupa colubrinae* (Cummins) Buriticá &  
Hennen (*Uredo hoveniae* Lindquist &  
Costa Neto )

***Reissekia***

*Uredo reissekiae* Sydow

***Scutia***

PUCCINIA SCUTIAE Lindquist

***Zizyphus***

PHAKOPSORA ZIZYPHI-VULGARIS Dietel

*Malupa zizyphi-vulgaris* (P. Hennings) Buriticá  
& Hennen

**ROSACEAE*****Agrimonia***

PUCINIISTRUM AGRIMONIAE (Dietel)

Tranzschel

**Duchesnea**

FROMMELLA MEXICANA (Mains) J. W.

McCain & Hennen var. INDICAE J. W. McCain & Hennen

**Prunus**

TRANZSCHELIA PRUNI-SPINOSAE var.

DISCOLOR

**Rosa**

PHRAGMIDIUM MUCRONATUM (Persoon)

Schlectendal

PHRAGMIDIUM TUBERCULATUM J.

Mueller

**Rubus**

KUEHNEOLA LOESENERIANA (Arthur) H.

S. Jackson & Holway

PUCINIISTRUM AMERICANUM (Farlow)

Arthur

*Uredo loeseneriana* P. Hennings

**RUBIACEAE**

**Alibertia**

PUCINIA FARAMEAE Kern, Ciferri &

Thurston

**Alseis**

PHAKOPSORA MELANOTIS Sydow

**Basanacantha**

*Aecidium randiae* P. Hennings

**Borreria**

*Aecidium borriericola* H. S. Jackson & Holway

*Aecidium holwayi* H. S. Jackson

PUCINIA LATERITIA Berkeley & Curtis III

*Uredo borrieriae* (P. Hennings) Kern & Whetzel

**Cephalanthus**

*Aecidium cephalanthi-peruviani* P. Hennings

**Coccocypselum**

*Aecidium coccocypseli* H. S. Jackson & Holway

PUCINIA COCCOCYPSELI H. S. Jackson &

Holway

**Coffea**

HEMILEIA VASTATRIX Berkeley & Broome

**Diodia**

PUCINIA LATERITIA Berkeley & Curtis

UROMYCES HOLMBERGII Spegazzini

**Emmeorrhiza**

UROMYCES EMMEORRHIZAE Sydow

**Geophila**

DIORCHIDIUM AMAPAENSIS Hennen &

Sotão

**Hemidiodia**

PUCINIA LATERITIA Berkeley & Curtis III

**Ixora**

*Uredo psychotriicola* P. Hennings

**Manettia**

PUCINIA NEIDERLEINII P. Hennings III

UROMYCES TENER Schroeter

**Mitracarpus**

UROMYCES HOLMBERGII Spegazzini

**Oldenlandia**

Puccinia Oldenlandiicola P. Hennings

**Palicourea**

Puccinia Falax Arthur II/III

Puccinia Palicoureae Mains II/III

*Uredo fallaciosa* Arthur

*Uredo palicoureae* P. Hennings

*Uredo psychotriicola* U P. Hennings

**Posoqueria**

*Aecidium posoquariae* Dietel

**Psychotria**

*Aecidium iquitosense* P. Hennings

*Aecidium psychotriae* P. Hennings

Puccinia Psychotriae P. Hennings.

*Uredo fallaciosa* Arthur II/III

*Uredo psychotriicola* P. Hennings

Uromyces Psychotriae P. Hennings

**Randia**

Cerotelium Figueiredeae Buriticá &  
Hennen

*Uredendo figueiredeae* Buriticá & Hennen

**Sabicea**

Cerotelium Sabiceae Buriticá & Hennen

*Physopella sabiceicola* (Arthur) Buriticá &  
Hennen

**Sickingia**

*Aecidium mattogrossense* Juel

**Spermacoce**

Puccinia Lateritia Berkeley & Curtis III.

? Uromyces Spermococes (Schweinitz)  
M. A. Curtis

**Tocoyena**

Phakopsora Tocoyenae Buriticá &  
Hennen

*Physopella tocoyena* Buriticá & Hennen

**RUTACEAE****Dictyolma**

*Aecidium xanthoxylinum* Spegazzini

**Pilocarpus**

Puccinia Pilocarpi Cooke

**Zanthoxylum** (previously spelled *Xanthoxylum*)

*Aecidium rickii* P. Sydow & H. Sydow

*Aecidium xanthoxyli* Peck

*Aecidium xanthoxylinum* Spegazzini

**SALICACEAE****Populus**

Melampsora Allii-Populina Klebahn

Melampsora Medusae Thuemen

Melampsora Occidentalis H. S.  
Jackson

Melampsora Populnea (Persoon)

Karsten  
 MELAMPOSRA ROSTRUPII Wagner  
*Uredo acidioides* DeCandolle  
**Salix**  
 MELAMPOSRA ABIETI-CAPREARUM  
 Tubeuf  
 MELAMPOSRA ALLI-POPULINA Klebahn  
 MELAMPOSRA EPITEA Thuemen

#### SAPINDACEAE

**Cardiospermum**  
 PUCCINIA ARECHAVALETAE Spegazzini  
**Cupania**  
 SKIERKA CRISTATA (Spegazzini) Mains  
 SKIERKA sp. nov. Hennen & M. B. Figueiredo  
**Paulinia**  
 PUCCINIA ARECHAVALETAE Spegazzini  
**Serjania**  
*Aecidium serjaniae* P. Hennings  
 PUCCINIA ARECHAVALETAE Spegazzini  
**Strauches**  
*Aecidium uredinoides* P. Hennings  
**Thouinia**  
 PUCCINIA ARECHAVALETAE Spegazzini  
**Urvillea**  
 PUCCINIA ARECHAVALETAE Spegazzini  
**Genus undetermined**  
 PUCCINIA ARECHAVALETAE Spegazzini

#### SAPOTACEAE

**Chrysophyllum**  
*Uredo chrysophylli* Sydow  
*Uredo chrysophyllicola* P. Hennings  
**Lucuma**  
 MARAVALIA LUCUMAE (Dietel) Y. Ono  
**Mimusops**  
*Uredo confluens* P. Hennings  
**Palaquium**  
 MARAVALIA PALAQUII (Cummins) Y. Ono  
*Uredo palaquii* P. Hennings  
**Pouteria**  
 ACHROTELIUM LUCUMAE Cummins  
*Uredo lucumae* Ur Arthur & Johnston  
**Genus undetermined**  
*Uredo agnostica* Spegazzini

#### SCHIZAEACEAE (see PTERIDOPHYTES)

#### SCROPHULARIACEAE

**Antirrhinum**  
 PUCCINIA ANTIRRHINI Dietel & Holway  
**Buchnera**  
 PUCCINIA BUCHNERAE Cummins  
*Uredo cumula* Arthur

#### SOLANACEAE

***Acnistus****Aecidium solaninum* Spegazzini

PUCCINIA ARAUCANA Dietel &amp; Neger

PUCCINIA SOLANINA Spegazzini

***Capsicum***

ENDOPHYLLUM PAMPEANUM (Spegazzini)

Lindquist

PUCCINIA PAMPEANA Spegazzini

***Cestrum***

CHRYSOCYCLUS CESTRI (Dietel &amp; P.

Hennings) Sydow

UROMYCES CESTRI Montero

***Cyphomandra***

CROSSOPSORA ULEANA (H. Sydow &amp; P.

Sydow) R. H. Peterson

***Melananthus****Aecidium melantheri* P. Hennings***Nicotiana****Uredo nicotianae* Anastasia et al.***Salpichroa***

ENDOPHYLLUM PAMPEANUM (Spegazzini)

Lindquist

PUCCINIA PAMPEANA Spegazzini

***Solanum****Aecidium uleanum* Pazschke

CHRYSOCYCLUS CESTRI (Dietel &amp; P.

Hennings) Sydow

CROSSOPSORA ULEANA (H. Sydow &amp; P.

Sydow) R. H. Peterson

DIDYMOPSIS SOLANI (P. Hennings) Dietel

DIDYMOPSIS SOLANI-ARGENTEI (P.

Hennings) Dietel

PUCCINIA CLAVIFORMIS Lagerheim

PUCCINIA SOLANI-TRISTIS P. Hennings

PUCCINIA SUBSTRIATA Ellis &amp;

Bartholomew vars.

PUCCINIOSIRA HOLWAYI Jackson.

**STERCULIACEAE*****Byttneria*** (Buettneria)

PUCCINIA FILOPES Arthur &amp; Holway

***Melochia***

PUCCINIA FILOPES Arthur &amp; Holway

**Genus undetermined***Aecidium subincarnatum* P. Hennings (Host is in

Celastraceae)

**TILIACEAE*****Heliocarpus***

PUCCINIA HELIOCARPI P. &amp; H. Sydow

***Luehea****Uredo lueheae* Spegazzini***Triumfetta***

DIDYMOPSIS TRIUMFETTAE H. S.

Jackson &amp; Holway

PUCCINIA HETEROSPORA Berkeley &amp; Curtis



PUCCINIOSIRA PALLIDULA (Spegazzini) P.  
Hennings

#### ULMACEAE

##### *Celtis*

? UROMYCES CELTIDIS Dietel  
*Uredo celtidis* Pazschke (Host is *Maclura*,  
Moraceae)

#### UMBELLIFERAE

##### *Apium*

?PUCCINIA APII Desmazières

##### *Hydrocotyle*

PUCCINIA HYDROCOTYLES Cooke

#### URTICACEAE

##### *Boehmeria*

PUCCINIA BOEHMERIAE P. Hennings

#### VALERIANACEAE

##### *Valeriana*

PUCCINIA VINULLA H. S. Jackson & Holway

#### VERBENACEAE

##### *Lantana*

*Aecidium lantanae* Mayor  
PROSPODIUM TUBERCULATUM  
(Spegazzini) Arthur

PUCCINIA LANTANAE Farlow

*Uredo tuberculata* Spegazzini

##### *Lippia*

*Aecidium lippiae-sidoidis* Sydow  
PROSPODIUM LIPPIAE (Spegazzini) Arthur.

PROSPODIUM PARAGUAYENSE

(Spegazzini) Spegazzini

PROSPODIUM PERUVIANUM (P. Sydow &  
H. Sydow) Cummins

PROSPODIUM VONGUNTENII (Mayor)  
Dietel

PUCCINIA LANTANAE Farlow

PUCCINIA MAIAE H. S. Jackson

##### *Stachytarpheta*

ENDOPHYLLUM STACHYTARPHETAE (P.  
Hennings) Whetzel & Olive

##### *Valerianodes*

PUCCINIA URBANIANA P. Hennings

##### *Verbena*

PUCCINIA VERBENEIPHILA Lindquist

##### *Vitex*

OLIVEA MOGIENSIS Hennen & Figueredo, sp.  
nov., ined

OLIVEA VITICIS Ono & Hennen

*Uredo viticis* Juel

#### VITACEAE

*Cissus*

ENDOPHYLLUM CIRCUMSCRIPTUM  
Whetzel & Olive

*Vitis*

PHAKOPSORA NEOVITIS Ono

**VOCHYSIACEAE***Qualea*

APLOPSORA HENNENII J. Dianese & L. T. P.  
Santos

*Macabuna qualeae* Buriticá & Hennen

**ZINGIBERACEAE***Costus*

PUCCINIA COSTI (P. Hennings) H. Sydow &  
P. Sydow