

MYCOTAXON

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ENTOLOMATACEAE IN EASTERN NORTH AMERICA I: new species of *Claudopus* and *Rhodocybe* from the Southern Appalachian Mountains.

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SUMMARY: Two new species are described, *Rhodocybe pallida* and *Claudopus vinaceocontusus*. A study of the micromorphological features of the type collection of *Claudopus mephiticus* is presented and discussed because of its similarity in stature and odor to *C. vinaceocontusus*.

The Southern Appalachian Mountains offer a rich plant and fungal biota. In particular, members of the Entolomataceae Kot. & Pouz. (Agaricales, Basidiomycota) are particularly well represented in this region. Hesler (1967) published a floristic study of the agaric genus *Entoloma* (Fr.) Kummer (Entolomataceae) for the southeastern United States in which he treated approximately 200 taxa. By far, the majority of these species were found in the Appalachian Mountain regions. In addition, and of even greater significance, nearly 50% of the taxa in Hesler's publication were described as new to science. Since that time no other accounts of new members of this family from this area have appeared in the literature.

During a recent study of the Entolomataceae in selected areas of the southeastern United States, two undescribed species were discovered in the Southern Appalachian Mountains. The following report describes these new taxa and discusses their relationships and placement in the family.

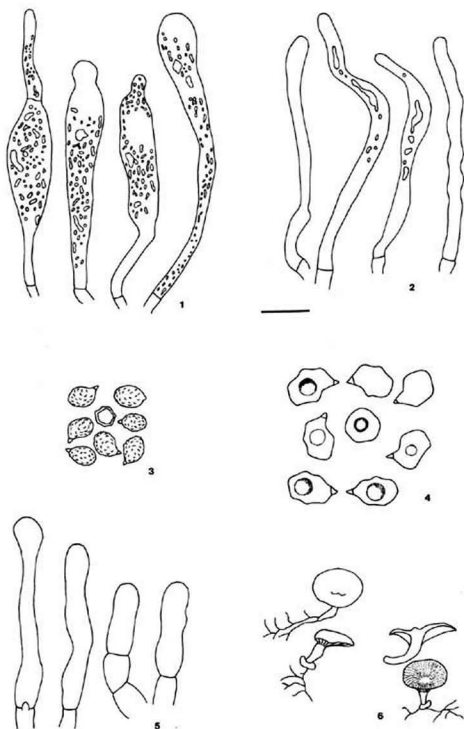
Methods used were those of Baroni (1981). Color designations are from Kornerup and Wanscher (1978). All measurements of microscopic structures were made in 3% KOH. The following notations are used: E = length/width of individual spores, indicated as a range in n spores measured; E^m = mean of E ; L^m = mean length; W^m = mean width; n = number of objects measured; L in $180\text{ deg} = 9$, signifies that 9 lamellae are attached to the stipe over one-half of its circumference, implying that there are generally 18 lamellae per mature pileus.

Rhodocybe pallida Baroni, sp. nov. (Figs. 1-3 and 12-13)

Pileus cremeus vel pallide griseo-bubalinus, 9-13 mm latus, convexus, demum depressus, glabrescens, laevis interdum rimulosus. Lamellae subdecurrentes, griseo-bubalinae, confertae, angustae. Stipes glabrescens, cum pileo concolor. Basidiosporae ellipsoideae vel ovoidae, aliter typicae enim Rhodocybes. Cheilo- et pleurocystidia similia, pseudocystidiorum instar, contentis aureo-ochraceis, versiformia, interdum prominentiis cylindricis ad basim septatis. Hyphae pileipellis filmaentosae, repentes, haud incrustatae. Hyphae efibulatae.

Pileus pale sordid cream (near 4A2 but with a slight grayish hue) to pale grayish buff, some with irregularly patterned yellowish (4A3-4) shallow cracks, not changing color when bruised; 9-13 mm broad, broadly convex, becoming shallowly depressed over disc, dry, mat to glabrescent, smooth or with shallow random cracks; margin inrolled. Flesh white, solid, 1 mm thick. Odor not distinctive. Taste mild. Lamellae grayish buff, short decurrent, narrow (to .75 mm broad), close, edges concolorous and even. Stipe concolorous with pileus or with more obvious cream yellow (4A3) over lower 1/3, with a sparse white mycelioid covering over base, 17-20 mm long, 1.5-2.5 mm thick, equal, terete, central; surface dry, glabrescent or merely fine appressed fibrillose over apex and less so toward base; solid and white within.

Basidiospores 5.4-7.2 x 3.6-5 μm ($E = 1.26-1.67$, $E^m = 1.48$, $L^m = 6.11$, $W^m = 4.16$, $n = 20$), short ellipsoid to ovoid in lateral views, rounded angular in polar view, with low but distinct undulate-pustulate ornamentation, ornamentation obscure on largest spores; walls thin and often readily collapsing, strongly and continuously cyanophilic, hyaline in KOH, inamyloid. Basidia 19.8-27 x 5.4-7.2 μm , 4-sterigmate with some rarely 1-sterigmate, narrowly clavate, lacking cyanophilic bodies; thin-walled or rarely thick-walled. Cheilocystidia and pleurocystidia (pseudocystidia) similar, 28.7-59 x 6.3-8.1 μm , thin-walled, variable but often clavate to broadly ventricose rostrate to lageniform, apical cylindrical proliferations often septate at their base; arising mostly from the subhymenium or trama; contents sparse to dense and granular, shiny refractive, deep golden to reddish ochre in KOH. Lamellar trama of parallel, cylindrical to mostly inflated hyphae, 3.6-14.4 μm in diam, with scattered undulate, golden oleiferous hyphae also present; subhymenium composed of a narrow band, 9-13.5 μm thick, of tightly interwoven, narrow, cylindrical hyphae, 2.7-3.6 μm in diam. Pileal context of loosely interwoven, cylindrical hyphae, 2.7-9 μm in diam. Pileipellis a compact, hyaline or pale melleous layer in KOH, not well-differentiated from the context; hyphae repent, interwoven, cylindrical, 2.7-5.4 μm in diam, not encrusted. Stipitipellis a compact hyaline layer of repent, parallel, non-



Figs. 1-3: *Rhodocybe pallida* (HOLOTYPE). 1. Hymenial pseudocystidia. 2. Caulocystidia. 3. Basidiospores. Figs. 4-6: *Claudopus vinaceocontusus* (HOLOTYPE). 4. Basidiospores. 5. Caulocystidia. 6. Basidiomata (x1.5). Scale bar = 10 μ m.

encrusted, cylindric hyphae, 1.8–3.6 μm in diam, producing scattered clusters of caulocystidia at the apex. *Caulocystidia* composed of entangled, erect, cylindric end cells, 42.3–73 x 2.7–4.5 μm , with 30–50% of these cells containing shiny golden amorphous bodies in KOH. Clamp connections absent.

Terrestrial under mixed hardwoods (*Fagus grandifolia* Ehrh., *Tilia* sp., *Carya* sp., *Quercus rubra* L., *Liriodendron tulipifera* L., etc.) and *Pinus strobus* L. and *Tsuga canadensis* (L.) Carr.

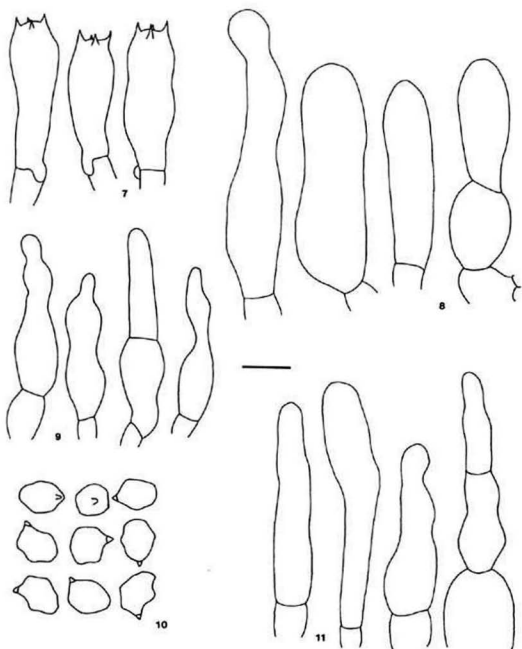
Type: UNITED STATES. North Carolina. Swain Co.: Great Smoky Mountains National Park, Indian Creek, 29 July 1987, Baroni 5596 (leg. D. Desjardin) (HOLOTYPE: TENN)

Rhodocybe pallida belongs in section *Rhodocybe* due to its distinctive basidiospore morphology, hymenial pseudocystidia with brightly colored content, lack of clamp connections and centrally stipitate basidiomata. This particular species is unusual in the section because of its pale colors. At the present time, only one other species in section *Rhodocybe*, *Rhodocybe retroflexa* (Berk. & Br.) Pegler, is known to produce pale cream buff basidiomata. However, *R. retroflexa* can be distinguished by its lignicolous habitat, brownish tinted pileus disc, adnexed lamellae, subangular spores in profile view and pseudoparenchymatous subhymenium (Pegler, 1977). In addition, *R. retroflexa* is known only from the type locality of Peradeniya, Sri Lanka.

There are now 26 species described in section *Rhodocybe* world wide. Recently, following a revision of *Rhodocybe* (Baroni, 1981), a number of investigators have contributed to our knowledge of this section (Halling and Baroni, 1985; Horak, 1978, 1979, 1980; Noordeloos, 1979; Ovrebo and Baroni, 1988; Baroni and Horak, in preparation). A revised key to this section of *Rhodocybe* will be published in the near future.

Claudopus vinaceocontusus Baroni, sp. nov. (Figs. 4–6 and 14)

Pileus sordidus pallide griseo-bubalinusve, purpurascens ubi contusus, 2–10 mm latus, convexus, circularis vel dimidiatus, sericeus. Contextus purpurascens. Odor pungens, dysodes. Lamellae adnatae vel subdecurrentes, pallide carnaeae, latae. Stipes cum pileo concolor, eccentricus, 3–5 mm longus, 1–2 mm crassus, pubescens, rhizoideis e basi ramosis, ubique purpurascens ubi contusus. Basidiosporae angulatae. Cystidia nulla. Hyphae pileipellis filamentosae, repentes, haud incrustatae. Hyphis dispersis fibulatis.



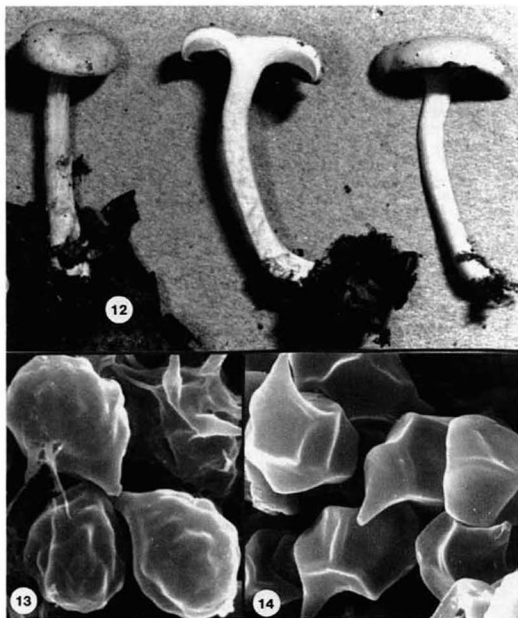
Figs. 7-11: *Claudopus mephiticus* (HOLOTYPE). 7. Basidia. 8. Caulocystidia. 9. Cheilocystidia. 10. Basidiospores. 11. Pilocystidia. Scale bar = 10 μm .

Pileus sordid off white to pale grayish buff (much paler than 5B2), turning quickly light vinaceous when bruised (drying a dark reddish brown); 2-10 mm broad, convex to broadly convex, with a shallowly depressed and low papillate disc, circular to \pm dimidiate on some, dry, densely radiate sericeous or appressed fibrillose, the fibrils turning vinaceous when bruised, margin inrolled. Flesh dingy whitish, quickly becoming vinaceous-purple when exposed and then rapidly fading, 0.2-0.5 mm thick. Odor strong of garlic, especially when basidiomata kept enclosed in collecting packet for a short time. Taste not tested. Lamel-lae pallid at first, soon fleshy pink, adnate or becoming short decurrent, broad (to 1 mm broad), subdistant (L in $180^\circ = 9$), 2-3 tiers lamellulae, occasionally forked, edges concolorous, even. Stipe concolorous with pileus, 3-5 mm long, 1-2 mm thick at apex, mostly tapered downwards or equal, eccentric; surface dry, densely whitish fibrillose to erect pubescent overall, white mycelioid at base in a pad-like mat, with thin white rhizoids radiating out through substrate, basal covering and rhizoids rapidly turning bright vinaceous-purple when bruised; context solid, white, but rapidly bright vinaceous-purple when exposed, then fading.

Basidiospores (8.1-)9.5-10.8 x 6.3-7.2 μm ($E = 1.25-1.67$, $E^m = 1.48$, $L^m = 9.68$, $W^m = 6.56$, $n = 21$ from the Holotype; 8.5-10 x 6-7.5 μm , $E = 1.23-1.54$, $E^m = 1.38$, $L^m = 9.38$, $W^m = 6.79$, $n = 12$ from DAOM 194866), ellipsoid in lateral view with 6-8 sharp or rounded angles, 5-6 rounded angular in polar view; walls strongly cyanophilic. Basidia 26.1-31.4 x 9-9.9 μm , 4-sterigmate, short broad clavate; filled with diffuse vinaceous pigment in H_2O or KOH mounts (especially evident in polar views). Hymenial cystidia not differentiated. Lamellar trama of \pm parallel, cylindrical to inflated hyphae, 3.6-18 μm in diam. Pileal context of radially arranged, mostly inflated hyphae, 9.9-18 μm in diam, and with some intermixed cylindrical hyphae, 2.7-5.4 μm in diam; pale vinaceous in KOH. Pileipellis a repent, hyaline layer of radially arranged to interwoven, cylindrical hyphae, 2.7-9 μm in diam, not encrusted, end cells cylindrical to subclavate or some bullet shaped. Stip-itipellis a compact hyaline layer of repent, parallel, non-encrusted, cylindrical hyphae, 2.7-8.1 μm in diam, producing numerous caulocystidia. Caulocystidia mostly cylindrical or cylindrical-capitate, 15.3-38.6 x 4.5-6.3 μm , hyaline in KOH. Clamp connections present at base of basidia, on hyphae of lamellar trama, widely scattered on stipe surface.

On moss covered log in mixed hardwoods (Holotype), or scattered on a sandy loam soil along a bank.

Type: UNITED STATES. North Carolina. Macon Co.: Coweeta Hydrologic Research Station, along Ball Creek Road, 13 August 1987,



Figs. 12-13: *Rhodocybe pallida* (HOLOTYPE). 12. Basidiomata (approx. x2). 13. Basidiospores (approx. x6,000). Fig. 14: *Claudopus vinaceocontusus* (HOLOTYPE), basidiospores (approx. x3,500).

Baroni 5695 (leg. D. Desjardin) (HOLOTYPE: TENN). Florida. Alachua Co.: vicinity of Gainesville, 9 August 1985, DAOM 194866 (S. A. Red-head 5144)

Claudopus vinaceocontusus is easily distinguished by its small size, strong odor of garlic and by the obvious vinaceous-purple color change of most parts of the basidiomata when they are injured. *Claudopus mephiticus* Murr. is also reported with a decided garlic odor (and taste) (Murrill, 1915 and 1917; Hesler, 1967), but the basidiomata have much larger dimensions with the pileus ranging from 15-50 mm in diameter, the pileus is pale greenish at first, there are no color changes of the flesh upon injury, and cheilocystidia are present in the hymenium (Hesler, 1967). Each of these characters reported for *C. mephiticus* is distinctly different from those found on *C. vinaceocontusus*. However, because of the similar and very unusual garlic odor shared by *C. vinaceocontusus* and *C. mephiticus*, a description of the latter is given below. The following macroscopic description in quotes is from the original by Murrill, while the microscopic description (not in quotes) and illustrations are from a recent study of the holotype of *C. mephiticus*.

***Claudopus mephiticus* Murr., MYCOLOGIA 7:290. 1915.**

= *Entoloma mephiticum* (Murr.) Hesler, Beih. Nova Hed. 23:14. 1967.
(Figs. 7-11)

"Pileus eccentric, convex to nearly plane, somewhat depressed at the center, cespitose, 2.5-5 cm broad; surface dry, glabrous, slightly concentrically sulcate, greenish-white when young, dull-white or yellowish-white when old, margin concolorous, undulate; context white, with a very decided mephitic or garlic odor and taste; lamellae sinuate, subdistant, broad, slightly serrate on the edges, white, becoming rose-colored at maturity; spores angular, rose-colored, uniguttulate, $9 \times 7 \mu$; stipe short, subcylindric, very eccentric, solid, pruinose, white, 1-1.5 cm. long, 4-6 mm. thick."

Basidiospores (8) $9-10.8 \times 6.3-7.2 \mu\text{m}$ ($E = 1.13-1.5$, $E^M = 1.33$, $L^m = 9.41$, $W^m = 7.06$, $n = 20$), 5-6 angled in lateral views, 5-6 rounded angles in polar view, walls cyanophilic on younger spores, less reactive or acyanophilic on older spores. Basidia $24.3-32.4 \times 8.1-11.7 \mu\text{m}$, 4-sterigmate, broadly clavate, a few with scattered irregular sized, cyanophilic bodies. Cheilocystidia scattered along the edges, cylindric to

cylindric-capitate or ventricose-rostrate, otherwise versiform, occasionally septate and/or occasionally with distinctly constricted apices on rostrate forms, thin-walled, hyaline, 30-81 x 7.2-13 μ m. Pleurocystidia absent. Lamellar trama of parallel to interwoven, cylindric to inflated hyphae, 3.6-9 μ m in diam; subhymenium pseudoparenchymatous-like, but truly of tightly interwoven cylindric hyphae, 4.5-8.1 μ m diam. Pileal context of radially arranged, mostly inflated hyphae, 2.7-18 μ m diam. Pileipellis an entangled layer of cylindric, hyaline hyphae, 6.3-11.7 μ m in diam, not well-differentiated from the context, but with widely scattered, narrow, finely incrustated hyphae; end cells repent or entangled ascending, \pm cystidioid and mostly cylindric, 34.1-81 x 6.3-11.7 μ m. Stipitipellis an entangled to repent layer of parallel, non-incrustated, cylindric to inflated hyphae, 3.6-18 μ m in diam, producing repent to occasionally projecting end cells (caulocystidia). Caulocystidia clavate or irregularly swollen, 29.6-63 x 6.3-18 μ m, hyaline. Clamp connections abundant at base of basidia, scattered to infrequent in subhymenium and hyphae of lamellar trama.

On fallen dead branches.

Type: UNITED STATES. Minnesota. Minnehaha Park, 30 July 1915, M. W. Smith (M. S. Whetstone 60) (HOLOTYPE: NY).

It is obvious that *C. mephiticus* is not similar to *C. vinaceocontusus* in either macroscopic or microscopic features. In addition, I concur with Hesler's description of the microscopic features for *C. mephiticus* in the sense that this species does possess "hyphoid" pilocystidia (Hesler, 1963). However, Hesler was unable to demonstrate cheilocystidia for the type collection, even though he describes this feature for his collection from Tennessee. Obviously the type of *C. mephiticus* possesses distinctive cheilocystidia (see Fig. 9), but these structures were collapsed and needed to be carefully re-inflated using the techniques of Bas (1969 - these techniques deserve careful consideration by all individuals who study type materials). Unfortunately, Hesler's unpublished notes distinctly indicate that his Tennessee collection obviously lacked a stipe. After examining his collection (Hesler TENN 25656), which now consists of approximately 1/4 of a pileus with lamellae, it can only be stated that Hesler's collection is not *C. vinaceocontusus*. However, because of the odor, taste, spore size, cheilocystidia and restricted presence of clamp connections at the base of the hymenial elements (my observations on TENN 25656), Hesler's collection is close to *C. mephiticus*.

At the present time in *Claudopus*, it seems injudicious to expand species concepts to include entities which may possess well-developed stipes on some mature basidiomata and at the same time lack any form

of stipe on other mature basidiomata. Until such a case of morphological plasticity in stipe production has been positively shown for this species, or at least in the genus, it must be assumed that Hesler's collection (TENN 25656) represents yet another undescribed mephetic species of *Claudopus*. This species (TENN 25656) certainly needs to be recollected from the type local and redescribed. I consider the present material too meager to be useful enough to serve as a holotype. Therefore, contrary to Hesler's (1967) report, *C. mephiticus* is still only known from the type locality in Minnesota, USA in North America.

ACKNOWLEDGEMENTS

This work would not have been possible without grants from the University of Tennessee under the auspices of the L. R. Hesler Visiting Professorship in Botany, and from the Highlands Biological Research Station. The two new species described herein must ultimately be attributed to the collecting acumen of Dr. Dennis Desjardin, his keen sense of finding the unusual deserves recognition. Dr. Roy Halling kindly arranged for the loan of *Claudopus mephiticus* Murrill. Dr. D. P. Rogers corrected the latin diagnoses, his expertise is sincerely appreciated. Both Drs. Halling and Rogers helped to improve this work by kindly providing critical presubmission reviews. Ms. Dawn Van Hall, photographic department SUNY - College at Cortland, produced black and white negatives from the original color photographs of specimens. The use of the SEM facilities at the Center for Ultrastructural Studies, Environmental Science and Forestry College - SUNY at Syracuse, is also gratefully acknowledged.

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CONTRIBUTION TO THE LICHEN FLORA OF BRAZIL. XXIV. LICHENS FROM NOVA PETROPOLIS, RIO GRANDE DO SUL STATE.*

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ABSTRACT: Twenty two lichens collected in the Municipality of Nova Petropolis, Rio Grande do Sul State, Brazil, are listed. Two species are added to the State flora and six to the Rio Grande do Sul Highlands lichen flora.

In this paper the authors listed twenty two lichens collected in the Municipality of Nova Petropolis as an additional contribution to the study of this group in the Highlands of Rio Grande do Sul, Brazil. The area visited, during April 1988, is placed 4 km N from Nova Petropolis City (29°22'S-51°08'W, alt. ca. 600 m) along the road BR 116 which connects this City with Caxias do Sul City. The collection sites (very close one from another) can be briefly described as follows: CASCATA DO RASCHE (CR): a small waterfall surrounded by a very dense shrubby vegetation.

PIA (P): is a place well known through its dairy industry. The gatherings were made in the slope of a small hill with numerous boulders partially shaded by shrubs and low trees.

Two identical series were made with the lichens gathered and deposited in the Herbarium of the Departamento de Botânica, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil and in the private herbarium of the senior author.

Buellia contiguella (Vain.) Malme

P: on rocks (88/70).

Caloplaca crocea (Kreplh.) Haf. & Poelt

P: on trunk of a isolated tree (88/72).

Cladonia ceratophylla (Sw.) Spreng.

P: on rocks (88/51).

Dictyonema glabratum (Spreng.) D. Hawksw.

P: on rocks (88/53).

Diploschistes cinereoaeisius (Sw. ex Ach.) Vain.

P: on perpendicular rocks (88/58) det. H. T. Lumbsch

* Field work was supported by grant 870.513.8 ROSTLAC/UNESCO.

Heterodermia lutescens (Kurok.) Follm.

CR: on trunk of shrubs (88/48.a.).

P: on mossy rocks, shaded place (88/68).

Heterodermia vulgaris (Vain.) Follm. & Redón

CR: on trunk of shrubs (88/48.b.).

Lecidea oreinodes (Körb.) Weber & Hertel

P: on rocks (88/52).

Leptogium cyanescens (Ach.) Körb.

P: on mossy rocks (88/69).

Parmelina muelleri (Vain.) Hale

CR: on trunk of shrubs (88/47). Known in the State from only one collection made in the Central Lowlands (Osorio et al. 1980:5).

Parmotrema mellissii (Dodge) Hale

P: on rocks (88/73).

Parmotrema reticulatum (Tayl.) Choisy

P: on rocks (88/63).

Parmotrema tinctorum (Nyl.) Hale

P: on rocks (88/60).

Peltigera austroamericana Zahlbr.

P: rocks, shaded place (88/50).

Pseudocyphellaria aurata (Ach.) Vain.

CR: on trunk of shrubs (88/46).

P: on trunk of a tree (88/66).

Pseudoparmelia caroliniana (Nyl.) HaleP: on rocks with mosses and Polypodium (88/56, 88/64).Pseudoparmelia texana (Tuck.) Hale

P: on rocks (88/61).

Punctelia constantimontium Sérus.P: on rocks with mosses and Polypodium (88/67).Ramalina celastri (Spreng.) Krog & Swinsc.

CR: on branches of shrubs (88/49).

P: on branches of shrubs (88/74).

Relicina abstrusa (Vain.) Hale

P: on perpendicular rocks, shaded place (88/59). Formerly known from the Municipality of Cambara do Sul, in the north eastern part of Rio Grande do Sul Highlands (Fleig 1985:86).

Sticta weigeli (Ach.) Vain.P.: on rocks with mosses and Polypodium (88/54).Xanthoparmelia farinosa (Vain.) Nash, Elix & Johnston

P: on rocks (88/62, 88/71).

RESULTS AND CONCLUSIONS.

The Municipality of Nova Petropolis, situated ca. 75 km N from Porto Alegre City, is unknown from a lichenological point of view. No records could be found in the literature at our disposal.

The results of the study of the lichens gathered are as follows:

- Buellia contiguella and Diploschistes cinereocaesius are added to the known flora of the State.
- Buellia contiguella, Diploschistes cinereocaesius, Heterodermia lutescens, Parmelina muelleri, Punctelia constantimontium and Xanthoparmelia farinosa are reported to the Rio Grande do Sul Highlands for the first time.
- The remaining listed species have been already quoted from Rio Grande do Sul Highlands in former contributions of the authors.

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NIDULISPORA GEN. NOV., A HYPHOMYCETE GENUS WITH CRATERIFORM CONIDIA

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A new genus **Nidulispora**, based on the new species **N. quadrifida** isolated from submerged decaying twigs in Malaysia is described and illustrated. It is compared with several other hyphomycetes with composite conidia.

In our continuing studies on microfungi inhabiting submerged decaying plant litter from freshwater streams in Malaysia, it is by no means uncommon to find on such substrates microfungi which by their often bizarre peculiarities, are immediately recognised as distinct genera, e.g. **Satchmopsis** (Sutton, 1975), **Beverwykella** (Tubaki, 1975a, Nawawi & Kuthubutheen, 1988) and **Cancellidium** (Tubaki, 1975b, Webster & Davey, 1980) to name a few. The fungus described below as **Nidulispora quadrifida** falls in this category.

Nidulispora gen. nov.

Coloniae sparsae, late effusae. Mycelium plerumque superficiale sed in substrato immersum, ex hyphis pallide brunneis vel brunneis, laevibus vel verrucatis, septatis compositum. Conidiophora semimacronematosa, mononematosa, erecta, brevia, ex mycelio superficiali terminalia et lateralia oriunda. Cellulae conidiogenae integratae, terminales, holoblasticae, singulae in quoque conidiophora. Conidia solitaria, sicca crateriformia, e aliquot cellulis basali constantia et ramis dichotomis ramosis, euseptatis; apicem versus pallidiora curvata composita.

Species typica: **Nidulispora quadrifida** sp. nov.

Colonies sparse, widely effuse. **Mycelium** mostly superficial, partly immersed in the substratum, composed of pale brown to brown, smooth to verruculose, branched, septate hyphae. **Conidiophores** semi-macronematous, mononematous, erect, short,

arising terminally and laterally from the superficial mycelium. **Conidiogenous cells** integrated, terminal, holoblastic, single on each conidiophore. **Conidia**, solitary, dry, crateriform, with several dichotomously branched, euseptate, attenuated, curved ascending arms arising from several basal cells.

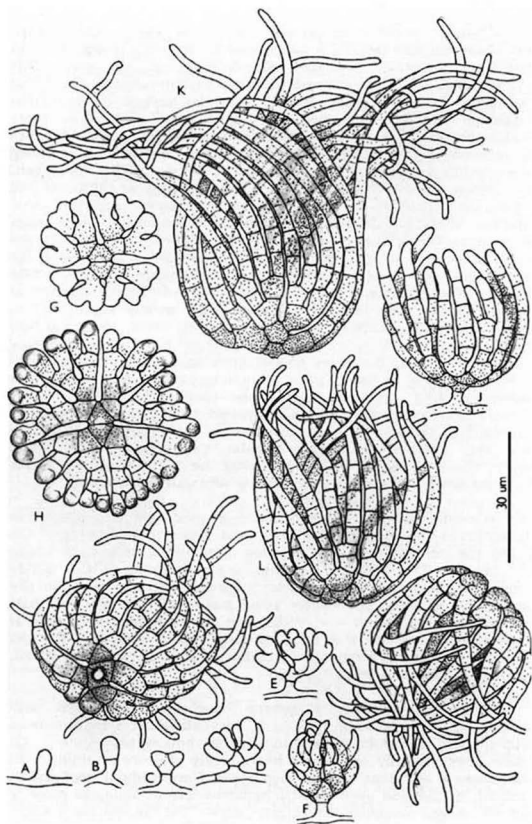
Nidulispora quadrifida sp. nov. Figs. 1 - 2

Coloniae sparsae, late effusae. Mycelium plerumque superficiale sed in substrato immersum, ex hyphis pallide brunneis, laevibus vel verrucatis, septatis, immersis compositum, ex quibus exoritur reticulum hypharum superficialium brunnearum, ramosarum, septatarum 2 - 3 μm diam. Conidiophora semimacronematosa, mononematosa, brevia, 10 - 15 μm x 2.5 - 3.5 μm , brunnea, ex mycelio superficiali terminalia et lateralialia oriunda. Cellulae conidiogenae integratae, terminales, holoblasticae, singulae in quoque conidiophora. Conidia solitaria, sicca, crateriformia, 32 - 52 μm x 40 - 60 μm , e aliquot cellulis basali constantia et 18 - 32 ramis dichotomis ramosis, 5 - 7 euseptata, apicem versus pallidiora, curvata composita. Conidiorum secessio schizolytica.

In ramunculus emortuos ignotes, Bukit Rengit Forest Reserve, Pahang, Malaysia, Oct., 1988, A.J. Kuthubutheen IMI 334130, holotypus.

Colonies sparse, widely effuse. **Mycelium** mostly superficial but partly immersed in the substratum, composed of pale brown to brown, branched, septate immersed hyphae giving rise to a network of brown, smooth to verruculose, sparsely branched, septate, superficial 2 - 3 μm wide hyphae. **Conidiophores** semimacronematous, mononematous, short 0 - 2 septate, up to 10 - 15 μm high x 2.5 - 3.5 μm wide, arising terminally and laterally from the superficial mycelium. **Conidiogenous cells** integrated, terminal, holoblastic, single on each conidiophore. **Conidia** solitary, dry, crateriform, 32 - 52 μm wide, 40 - 60 μm high, brown below, becoming lighter above, consisting of a small basal cell 4 - 5 μm wide, 5 - 6 μm high, merging into a 6-celled basal plate from which arises 18 - 32 dichotomously branched, 5 - 7 euseptate, curved, attenuate arms, encircling a hollow, air-filled space. **Conidial secession** schizolytic.

Fig. 1. **Nidulispora quadrifida**. A-F, Stages in conidial formation on agar; G-J, conidial formation and maturation on twigs; K-L, mature conidia.



Many conidia at various stages of development were examined on the decaying twigs, and from these it was easy to build up in detail a picture of conidium development. This picture was later confirmed by observations on the course of individual conidium development. On the natural substrate the conidium starts as a swollen cell at the end of a short conidiophore. It swells somewhat and the apex branches dichotomously and soon two oblique septa are formed, dividing the conidium initial into a 3-celled structure. The lower cell, measuring 4 - 5 μm long, 5 - 6 μm wide remains as the basal cell while the other two continue to branch dichotomously from their apices. These dichotomous branching occur at least 3 more times leading to the formation of a structure with 32 arms. Septa are laid down with progressive branching and at the same time the arms curve gently upward, forming a bowl-shaped base. The free ends of the arms continue to elongate, curve further inwardly and at the same time become narrower with widely spaced septa. The subhyaline, filiform ends criss-cross over one another, enclosing a hollow space within which air is trapped. In many conidia observed, the arms do not grow straight up but curve to one side. Due to the regular branching pattern the conidium is divided into 4 segments, hence the specific epithet. This is clearly seen when a conidium is viewed from below. Sometimes one-half is more widely separated than the other (Fig. 2) along one axis. Where branching is regular, the conidium is furnished with 32 arms, but this number may be as low as 18. This happens when some of the developing arms stop branching.

Conidia germinate readily on agar media by producing germ tubes from the tips of the arms and from the basal cell. On CMA the colonies are slow growing, attaining a diam of 8 mm in 14 days at 25 - 28°C. Colonies are greyish black with fluffy aerial mycelium, reverse black. Sporulation was poor on dry agar, but occurred abundantly when pieces of colonies were half submerged in water. Conidia are formed on short lateral conidiophores or at the ends of long repent hyphae. Conidia formed in cultures tend to be smaller, many appearing abnormal, with only several arms.

Several hyphomycete genera have been described with composite conidia, some producing very elaborate structure from cup-shaped, umbrella-shaped to globose hollow propagules. Of these there is only one which bears really close relationship with *Nidulispora* and that is the monotypic *Cancellidium applanatum* Tubaki, a common aero-aquatic hyphomycete in Malaysia growing on submerged decaying leaves and twigs. The conidia are broadly

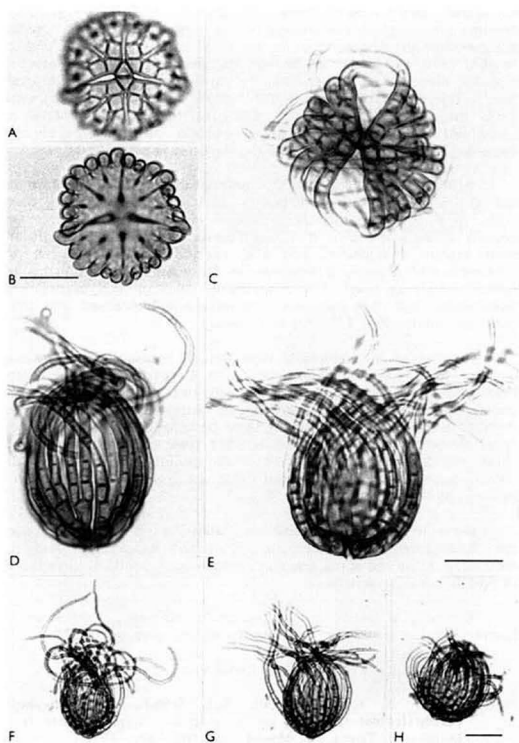


Fig. 2. *Nidulispora quadrifida*. A-B, a developing conidium showing dichotomous branching and segmentation; C-H, conidia from twigs. Bars = 20 μ m.

ellipsoidal in surface view, flattened dorsiventrally like a flattened wine-glass. They develop at the apex of short semimacronematous conidiophores by repeated division of the globose conidiogenous cell to form a basal pad consisting of several cells thick. From around the peripheral cells a series of parallel contiguous, finger-like, septate hyphae grows out which finally curve inward to close the hollow structure. At the same time the cells in the centre elongate to produce a series of branched, moniloid chains of subhyaline cells which become enclosed within (Fig. 3). Conidial secession is schizolytic.

Although the conidia in *C. applanatum* and *N. quadrifida* are not entirely dissimilar inasmuch as they consist of several basal cells with many parallelly arranged arms, in detail the two genera differ markedly. In *C. applanatum* the mature conidia are dark brown throughout, and the vertical ascending arms are coherent and adpressed whereas in *N. quadrifida* the arms are formed from at least 2 - 3 series of dichotomous branches or branchings, and they are not coherent and adpressed and their ends are subhyaline, filiform and free.

Conidia of *N. quadrifida* superficially resemble the detached conidia of *Cryptocoryneum* Fckl. and *Cryptocoryneopsis* Sutton (1980) in being composite. In these two genera their conidia consist of several apical, central cap cells with pendulous rather than ascending arms, but when they become detached from their conidiophores there is little to indicate their previous orientation. However, detailed comparison of their conidiogenesis and conidia shows the two genera to be quite distinct from *N. quadrifida* in a number of features.

None of the genera discussed above have conidia in which the arrangements and orientation of the basal cells and the ascending recurved arms are so carefully and regularly ordered as in *Nidulispora quadrifida*.

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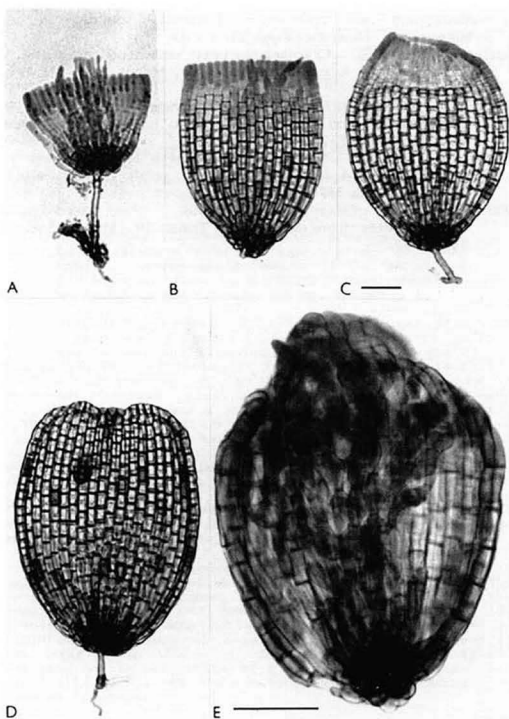


Fig. 3. *Cancellidium applanatum* A-C, three stages in conidial formation from a leaf. D-E, two mature conidia, one in optical section to show the moniliod chain of cells enclosed within. Bars = 20 μ m.

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A PRELIMINARY CHECKLIST OF THE AGARICALES OF TULSA COUNTY, OKLAHOMA

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Northeast Oklahoma with its predominantly oak forests supports a diverse agaric flora. Over 100 species, representing 13 families in the Agaricales, are reported from Tulsa County. This checklist establishes ranges extension for many species.

Oklahoma is a state of tremendous floral diversity ranging from the deciduous forests of the eastern part of the state through the grasslands in the central portion to the coniferous vegetation of the Rocky Mountain foothills in the far reaches of the panhandle. Tulsa County in northeast Oklahoma is situated on the boundary between a tall-grass prairie and a post oak-blackjack oak community. Within the county there are many scattered stands of woodland areas that have not been modified by human activity. Tulsa has a mild continental climate with an average of 99 cm of rain per year. The summers are hot and the winters cool; both spring and fall are normally wet with mild temperatures. The climate during the spring and fall is ideal for fungal growth, and mushrooms along with other basidiomycete fruiting bodies are common on lawns and trees, and in fields, parks, and forests.

No thorough taxonomic studies of the fleshy fungi in Oklahoma have been published. Cooke (1983) reported on the fungi collected on August 11, 1979 during a foray of the Mycological Society of America. During that foray, 132 species of fungi were collected including 31 species of basidiomycetes; however, only one species was a member of the Agaricales. Recently Smith and Pfiester (1988) reported on the collection of a single specimen of *Lepiota procera* in leaf litter on a pathway at Lake Thunderbird in central Oklahoma.

For the past two and one-half years a study has been in progress to identify airborne basidiospores along with other allergenic spores from the Tulsa atmosphere. To aid in the identification of basidiospores, field studies have been carried out in conjunction with the air sampling.

Fresh fruiting bodies of basidiomycetes have been collected and identified; spores from these specimens have been used to prepare permanent reference slides (Levetin, 1989). This paper presents a working checklist on the members of the Agaricales which have been collected and identified during this study.

METHODS AND HABITATS

Although the majority of specimens were collected since October 1986, previous field work (from 1972-1986) by the senior author had identified the most common species in the area. Mushrooms were collected from urban and rural wooded areas as well as urban lawns, fields, and parks. Specific wooded areas used as collecting sites include Mohawk Park, Haikey Creek Park, and Turkey Mountain. Mohawk Park, the largest site, is in the northern part of the county. This 2820 acre city park contains a zoo, nature trails, a golf course, and picnic areas as well as extensive tracts of undeveloped woodlands. Both Haikey Creek Park, a county park in the southeastern part of Tulsa County, and Turkey Mountain, an urban wilderness area maintained by the city, contain large stands of wooded areas. Standard collecting techniques were used, and specimens were identified, dried, and housed in the Barclay Herbarium of The University of Tulsa.

RESULTS AND DISCUSSION

A large number of Agaricales occur in Tulsa County. In addition to the 112 species listed in Table 1, many other specimens were identified only to genus level. These are being withheld for further taxonomic study. As a result this report represents only a fraction of the agaric flora that was collected. It should also be pointed out that the focus of this study related to airborne basidiospores as allergens; therefore, the major emphasis was placed on collecting mushrooms from populated urban areas. Additional collecting in rural areas outside the city will significantly expand the list.

The families Amanitaceae and Tricholomataceae are well represented in the Tulsa area. *Amanita vaginata* is widespread in spring and fall in both wooded areas and beneath hardwoods on lawns. Other prevalent species of *Amanita* include *A. inaurata*, *A. virosa*, and *A. rubescens*. Surprisingly, the latter two species were frequently collected in urban areas usually beneath oaks. *Amanita thiersii* can often be found on lawns in late summer; this large *Amanita* with scaly cap and shaggy stalk has previously been reported only from Texas and Mississippi (Jenkins, 1986; Weber and Smith, 1985). Although amanitas form mycorrhizal relationships and are usually found associated with trees (Singer, 1986) *A. thiersii* seems to

Table 1. SPECIES COLLECTED IN TULSA COUNTY, OKLAHOMA

AGARICACEAE	
<i>Agaricus abruptibulbus</i> Pk.	<i>Tylophilus felleus</i> (Bull.: Fr.) Karst.
<i>Agaricus arvensis</i> Schaeff.: Fr.	<i>Tylophilus indecisus</i> (Pk.) Murr.
<i>Agaricus auricolor</i> Krieger	<i>Tylophilus pseudoscaber</i> (Secr.) Sm. & Thiers.
<i>Agaricus campestris</i> L.: Fr.	
<i>Agaricus xanthodermoides</i> Murr.	
AMANITACEAE	
<i>Amanita arkanasana</i> Rosen	
<i>Amanita bisporigera</i> Atk.	
<i>Amanita citrina</i> (Schaeff.) S.F.Gray	
<i>Amanita flavoconia</i> Atk.	
<i>Amanita flavorubescens</i> Atk.	
<i>Amanita fulva</i> (Schaeff.) Secr.	
<i>Amanita inaurata</i> Secr.	
<i>Amanita pantherina</i> var. <i>multisquamosa</i> (Pk.) Jenk.	
<i>Amanita praegraveolens</i> (Murr.) Sing.	
<i>Amanita rubescens</i> (Pers.: Fr.) S.F. Gray	
<i>Amanita thiersii</i> Bas	
<i>Amanita vaginata</i> (Bull.: Fr.) Vitt.	
<i>Amanita verna</i> (Bull.: Fr.) Vitt.	
<i>Amanita virosa</i> Secr.	
COPRINACEAE	
	<i>Coprinus comatus</i> (Muller: Fr.) S.F. Gray
	<i>Coprinus micaceus</i> (Bull.: Fr.) Fr.
	<i>Coprinus plicatilis</i> (Curt.: Fr.) Fr.
	<i>Coprinus quadrifidus</i> Pk.
	<i>Coprinus radicans</i> (Desm.) Fr.
	<i>Panaeolina foenisecii</i> (Pers.: Fr.) Maire
	<i>Panaeolus fimicola</i> (Fr.) Gill.
	<i>Panaeolus subalteatus</i> (Berk & Br.) Sacc.
	<i>Psathyrella candolleana</i> (Fr.) Maire
	<i>Psathyrella hydrophila</i> (Bull.) Maire
	<i>Psathyrella velutina</i> (Pers.: Fr.) Sing.
	<i>Pseudocoprinus dessemnatus</i> (Pers.: Fr.) Kühner
BOLBITIACEAE	
<i>Conocybe lactea</i> (Lge.) Métrod	
<i>Conocybe tenera</i> (Schaeff.: Fr.) Kühner	
<i>Agrocybe dura</i> (Bolt.: Fr.) Sing.	
<i>Agrocybe pediades</i> (Pers.: Fr.) Fayod	
BOLETACEAE	
<i>Boletus affinis</i> Pk.	
<i>Boletus bicolor</i> Pk.	
<i>Boletus fraternus</i> Pk.	
<i>Boletus parasiticus</i> Bull.: Fr.	
<i>Boletus variipes</i> Pk.	
<i>Gyrodon meruloides</i> (Schw.) Sing.	
<i>Leccinum rugosiceps</i> (Pk.) Sing.	
<i>Strobilomyces floccopus</i> (Vahl: Fr.) Karst.	
CORTINARIACEAE	
	<i>Cortinarius alboviolaceus</i> (Pers.: Fr.) Fr.
	<i>Cortinarius violaceus</i> (L.: Fr.) Fr.
	<i>Crepidotus mollis</i> (Schaeff.: Fr.) Kummer
	<i>Gymnopilus fulvosquamulosus</i> Hes.
	<i>Inocybe fastigata</i> (Schaeff.: Fr.) Quéf.
	<i>Inocybe napipes</i> J. Lange
HYGROPHORACEAE	
	<i>Hygrophorus agathosmus</i> (Fr.) Fr.
	<i>Hygrophorus conicus</i> (Fr.) Fr.
	<i>Hygrophorus flavescens</i> (Kauff.) Sm. & Hes.
	<i>Hygrophorus puniceus</i> (Fr.) Fr.
	<i>Hygrophorus russula</i> (Fr.) Quéf.
	<i>Hygrophorus virgineus</i> (Fr.) Fr.

LEPIOTACEAE

- Chlorophyllum molybdites*
(Meyer: Fr.) Mass
Lepiota americana Pk.
Lepiota procera (Scop.: Fr.)
S.F. Gray
Leucocoprinus breviramus H.V.
Smith & Weber
Leucocoprinus luteus (Bolt.)
Godfrin
Leucocoprinus longistriatus
(Pk.) H.V. Smith & Weber

PLUTACEAE

- Pluteus cervinus* (Schaeff.:
Fr.) Kummer
Pluteus pellitus (Pers.: Fr.)
Kummer

RHODOPHYLLACEAE

- Entoloma clypeatum* (L.: Fr.)
Kummer
Clitopilus prunulus (Scop.:
Fr.) Kummer

RUSSULACEAE

- Lactarius chrysorheus* Fr.
Lactarius oculatus (Pk.)
Burlingham
Lactarius subdulcis (Pers.:
Fr.) S.F. Gray
Lactarius volemus (Fr.: Fr.)
Fr.
Lactarius yazoensis Hes. & Sm.
Russula compacta Frost
Russula foetens Fr.
Russula virescens Fr.

STROPHARIACEAE

- Naematoloma fasciculare* (Huds.:
Fr.) Karst.
Pholiota erinaceola (Pk.) Pk.
Pholiota subcaerulia Sm. & Hes.
Stropharia coronilla (Bull.:
Fr.) Quél.
Stropharia melanosperma (Bull.:
Fr.) Quél.

TRICHOLOMATACEAE

- Armillariella mellea* (Vahl :
Fr.) Karst.

- Armillariella tabescens* (Scop.:
Fr.) Sing.
Clitocybe gigantea (Sow.: Fr.)
Quél.
Clitocybe nuda (Bull.: Fr.)
Bigl. & Sm.
Clitocybe odora (Bull.: Fr.)
Kummer
Clitocybe tarda Pk.
Clitocybe umbrinipes Bigl. &
Sm.
Collybia dryophila (Bull.: Fr.)
Kummer
Collybia maculata (Alb. &
Schw.: Fr.) Kummer
Fluammulina velutipes (Curt.:
Fr.) Karst.
Hypsizyugus tessulatus (Bull.:
Fr.) Sing.
Laccaria laccata (Scop.: Fr.)
Berk. & Br.
Lentinellus ursinus (Fr.)
Kühner
Marasmiellus nigripes (Schw.)
Sing.
Marasmius capillaris Morg.
Marasmius oreades (Bolt.: Fr.)
Fr.
Marasmius rotula (Scop.: Fr.)
Fr.
Marasmius siccus (Schw.) Fr.
Melanoleuca meleleuca (Pers.:
Fr.) Murr.
Mycena leiana (Berk.) Sacc.
Omphalotus illudens (Schw.)
Bresinsky & Besl.
Oudemansiella radicata (Rel.:
Fr.) Sing.
Panus rudis Fr.
Panus tigrinus (Bull. ex Fr.)
Sing.
Phyllotopsis nidulans (Pers.:
Fr.) Sing.
Pleurotus ostreatus (Jacq.:
Fr.) Kummer
Rhodotus palmatus (Bull.: Fr.)
Maire
Tricholoma columbetta (Fr.)
Kummer
Tricholoma virgatum (Fr.: Fr.)
Kummer
Tricholomopsis platyphylla
(Pers.: Fr.) Sing.
Xeromphalina campanella
(Batsch: Fr.) Kühner & Maire

be an exception since it was collected on open lawns. *Amanita praegraveolens*, while not as common as *A. thiersii*, also occurs on open lawns. In the U.S. the genus *Amanita* attains its greatest diversity in the southeastern states (Arora, 1986) with its dominant oak-hickory-pine communities. It appears that the Amanitaceae may be an important part of the agaric flora of the post oak-blackjack oak community in this area as well.

In the Tricholomataceae two species, *Armillariella tabescens* and *Pleurotus ostreatus*, are among the most frequently sighted mushrooms in both urban and wooded areas. *Armillariella* which occurs in the late summer and fall is especially abundant during October. Numerous fruitings can be found on decaying hardwoods throughout the city. *Pleurotus ostreatus* can occur at any time of the year, but is usually encountered in the late fall and winter. Fresh clusters of *P. ostreatus* have been collected in December, January, and February during mild weather. *Flammulina velutipes* has also been collected during the winter and is abundant in spring. *Oudemansiella radicata* is commonly found from the spring through the fall on both urban lawns and in wooded areas. Fruiting bodies of *Clitocybe* and *Tricholoma* species are fairly common, especially in the fall, but many of these require further study for species identification.

In urban areas *Agaricus* and *Coprinus* species are ubiquitous in the spring and fall but can occur virtually year round. They are especially prominent after the sporadic rainy periods of summer. In addition to the species listed, other specimens in these genera have been collected. *Pluteus cervinus* and species of both *Russula* and *Lactarius* are also abundant in late spring and fall on urban lawns as well as wooded areas. After moderate to heavy rains during the summer and fall, *Chlorophyllum molybdites* can be found in large numbers on lawns throughout the city. This mushroom is conspicuous not only because it is abundant but also because of its large size with the cap often reaching 25 cm in diameter.

During late spring and early summer, numerous small ephemeral mushrooms can also be found on lawns amongst the blades of grass. *Agrocybe pediades*, *Conocybe lactea*, *Coprinus plicatilis*, *Marasmius oreades*, *Panaeolina foenicisii* and *Psathyrella* species are the most frequently encountered of these small mushrooms. *Clitocybe tarda*, also found on lawns, is less common but more distinctive because of its slightly larger size and lilac color.

This first report on the Agaricales from northeast Oklahoma represents range extensions of many species and shows that the area supports a rich assortment of fleshy fungi. While some of the mushrooms listed can be found throughout North America, others such as *Armillariella tabescens*, *Chlorophyllum molybdites*, *Omphalotus illudens*,

Tylophilus indecisus, *Leccinum rugosiceps*, and *Boletus fraternus* are more common in the South (Weber and Smith, 1985; Lewis and McGraw, 1984). Also *Lactarius yazoensis*, *Amanita thiersii*, *A. arkansana*, and *A. praegraveolens* have only been reported in the South (Weber and Smith, 1985; Jenkins, 1986). Clearly, more field work and more taxonomic work needs to be done to fully understand the diversity that is present.

ACKNOWLEDGEMENT

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TELEOMORPH-ANAMORPH CONNECTIONS AND CORRELATIONS
IN SOME XYLARIA SPECIES

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ABSTRACT

Cultures and anamorphs of three penzigoid fungi show conclusively that they are, in fact, *Xylaria* species. *Xylaria enteroleuca* had previously been transferred from *Penzigia*. The new combination, *X. atosphaerica*, is made. A fungus much like *Penzigia indica* is likewise a *Xylaria*, but a new combination is not made owing to differences between the teleomorph of type material from India and our material from South America. Cultures of *X. enterogena* and *X. telfairii* are very similar, reinforcing the concept that these taxa are closely related or perhaps conspecific. Cultures from fungi close to *X. cubensis* and *X. allantoidea* reinforce the impression that these taxa are members of a complicated and poorly understood complex. Cultures from temperate and tropical collections of *X. curta* and *X. microceras*, respectively, are compared. Small differences between temperate and tropical teleomorphs of these two species are reflected in the corresponding cultures, indicating infraspecific variation. *Xylaria arbuscula* and *X. feejeensis* are cosmopolitan species that have been cultured previously. Additional cultural and anamorphic data are presented here. Cultures and anamorphs are described for *X. adscendens* and *X. tentaculata*.

INTRODUCTION

Xylaria Hill ex Schrank is increasingly recognized as a diverse and complicated assemblage of taxa. It has become apparent that the biology and systematics of *Xylaria* and its allies can be understood only after consideration of the holomorphs. Moreover, xylariaceous fungi are frequently implicated as endophytes and cultures usually are sterile or produce only the anamorph. Cultural representatives of the Xylariaceae ordinarily can be identified only after comparison with cultures that originated from identified teleomorphic material. Cultural and other data are presented for 14 *Xylarias* in order to complement and supplement our understanding of these fungi.

MATERIALS AND METHODS

All cultures were initiated from multiple ascospores dissected from perithecia that had been rehydrated with sterile distilled water. Colonies were incubated on Difco oatmeal agar in 9 cm diam plastic Petri dishes at ca. 20 C and under alternating daily periods of ca. 12 h fluorescent light and 12 h darkness. Conidiophores were usually observed after rolling stromata over a slide previously coated by a thin layer of water-soluble mucilage glue (LePage's brand). Excess conidia were thus pulled off first, allowing for clearer viewing of the conidiogenous cells which were last to be torn from their palisades. The glue is transparent and dissolved after water and a coverslip were added. Measurements of all structures except ascus rings were recorded from specimens mounted in water; the rings were stained with Melzer's iodine reagent. Brightfield (BF) and Nomarski differential interference contrast (DIC) microscope techniques were used.

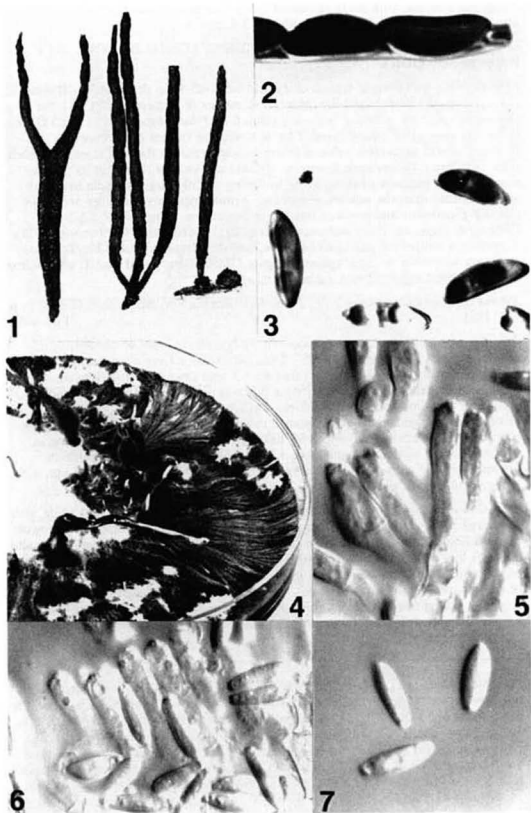
Specimens deposited in the personal collection of J. D. Rogers are designated JDR.

Xylaria adscendens (Fr.) Fr., Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1, p. 128. 1851. Figs. 1-7.

Stromata cylindrical, tapering to pointed, sterile apices, fertile portions 3.5-5.5 cm x 2.5-5 mm, stipes slender, short, sometimes 2 or 3 fused at or near slightly swollen and strigose base, 3-7 mm high x 1-1.5 mm broad. Exterior black, wrinkled and roughened by ostiolar papillae, with remnants of superficial dark brown layer wearing away in longitudinal strips; hollow. Perithecia globose, ca. 0.5 mm diam. Ostioles papillate, surrounded by whitish discs in old specimens. Asci 8-spored, cylindrical, stipitate, spore-bearing portions 70-85 x 4.5-5 μ m, stipes 50-60 x 2-3 μ m, with apical ring bluing in Melzer's iodine reagent, quadrate, 1.5-2 μ m. Ascospores blackish-brown, unicellular, ellipsoid-inequilateral, smooth, 10-10.5(-11) x 4-4.5 μ m, with straight, full-length to nearly full-length germ slit.

Colonies reaching edge of Petri dish in 2 wk, at first white, appressed, velvety, with plumose margins, turning canary yellow and darkening from center outwards to olive-black. Centers of colonies frequently becoming covered with cottony mycelium that reaches to the Petri dish lid. Reverse uncolored. Stromata cylindrical, unbranched, up to 3 cm long x 2 mm diam, pale pink when young and remaining pink internally, exterior turning yellow, then black from base upward, becoming villous with olive-gray hyphae in 2-3 wk. Anamorph rare, produced in drying cultures on upper surfaces of some stromata. Conidiophores upright in palisades, branched near base, white in mass. Conidiogenous cells terminal, cylindrical, 15-25 x 4-5 μ m, covered with denticulate conidial secession scars. Conidia produced holoblastically in sympodial sequence, hyaline, smooth,

Figs. 1-7. *Xylaria adscendens* (AR 3119). 1. Stromata, X 1.0. 2. Ascus tip stained with Melzer's reagent and ascospores, X 2250. 3. Ascospores. Germ slit visible on left spore, X 1500. 4. Culture, X 1.3. 5. Conidiogenous cells, with apical secession scars visible, X 1375. 6. Conidiogenous palisade, X 1500. 7. Conidia, X 1500. Figs. 2, 5, 6 and 7 by DIC. Fig. 3 by BF.



elongated ellipsoid with small flattened bases indicating former points of attachment to conidiogenous cells, 10-12 x 2-3 μ m.

SPECIMEN EXAMINED AND CULTURED: FRENCH GUIANA: A. Y. Rossman 3119 (JDR).

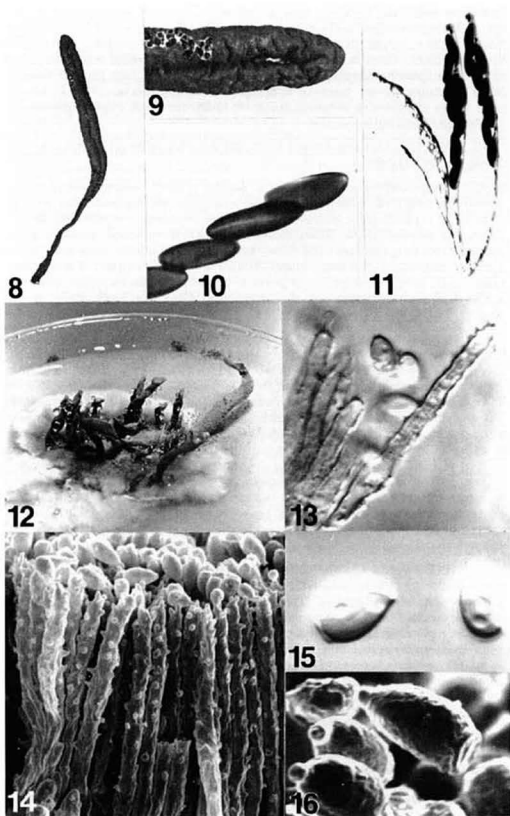
NOTE: This collection is typical of *Xylaria adscendens* as described by Dennis (1961), Rogers (1984a), and San Martín Gonzales & Rogers (1989). As the above authors have noted, it is closely related to *Xylaria hypoxylon* (L.:Fr.) Grev.; in fact, Dennis (1957) considered it to be a tropical variant of this species. As Rogers (1984a) suspected, cultural features help separate these species from each other and from *Xylaria mali* Fromme. *Xylaria adscendens* differs in its production of yellow pigment in culture and in having slightly larger conidia in nature and in culture than the other two species. *Xylaria hypoxylon* cultures are never brightly pigmented and produce conidia in nature averaging 7-10.7 x 2-3 μ m (Rogers & Samuels, 1986, and unpublished data). According to Fromme (1928), *X. mali* is a temperate pathogen of apple, and in culture produces black, villose stromata with white to pink apices. Rogers (1984a) also noted that *X. adscendens* has never been reported as a pathogen of apple.

Xylaria cf. *allantoidea* (Berk.) Fr., Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1, p. 127. 1851. Figs. 8-16.

Stromata clavate to cigar-shaped (fusoid) with rounded fertile apices, on slender stipes. Fertile portions 3.5-7.5 cm high x 0.8-1.5 cm diam, inrolled and hollow except for a layer of brown tissue ca. 1 mm deep below perithecia. Stipes cylindrical to strap-like, 2-4.5 cm long x 2-3 mm diam. Exterior black, smooth except for inrolling and large wrinkles. Perithecia globose, ca. 0.5 mm diam. Ostioles finely papillate. Asci 8-spored, cylindrical, long-stipitate, spore-bearing portions 75-100 x 5.5-8 μ m, stipes 85-100 x 2-3 μ m, with apical rings bluing in Melzer's iodine reagent, urn-shaped, 3.5-5 x 2.5-4 μ m. Ascospores blackish-brown, narrowly ellipsoid-inequilateral, smooth, 12-13.5(-14) x 4-4.5(-5) μ m, with straight, full-length germ slit.

Colonies slow-growing, reaching ca. 3-4 cm diam in 4 wk, at first white with submerged margins, and faint, irregular, concentric zones, darkening to yellowish tan and finally dark gray. Reverse colored dark brown towards center. Stromata more or less cylindrical, tapering towards apices, unbranched except at point of contact with Petri dish lid, up to 4 cm long x 1-2 mm diam, developing at centers of colonies and peripheries of zones. Stromata at first yellowish-tan (manila-colored), paling to off-white in areas of conidial production. Conidium-bearing regions on upper surfaces of stromata. Conidiophores upright in palisades,

Figs. 8-16. *Xylaria* cf. *allantoidea* (AR 3221). 8. Stroma, X 0.4. 9. Stromatal tip showing inrolling; perithecia exposed at left, X 1.5. 10. Ascospores, one with germ slit evident, X 1400. 11. Asci with tips stained in Melzer's reagent, X 500. 12. Culture, X 1.5. 13. Conidiogenous cells with lateral and apical secession scars evident, X 1200. 14. Conidiogenous palisade with secession scars evident on individual cells, X 1200. 15. Conidia, with apical corona evident on left spore, X 2750. 16. Conidia, with apical corona evident on upper spore, X 4000. Figs. 11, 13, 15 by DIC. Fig. 10 by BF. Figs. 14, 16 by scanning electron microscopy.



branched near base, brown in mass, sloughing off in small, dusty clumps to reveal the dark gray stromatal surface underneath. Conidiogenous cells terminal, cylindrical, 35-50 x 3-4 μm , densely covered with small, jagged to denticulate conidial secession scars. Conidia produced holoblastically in sympodial sequence. Conidia hyaline (pale buff in mass), smooth, ovoid to obovoid, with small flattened bases indicating former points of attachment to conidiogenous cell, 7-11 x 4-4.5 μm . Some conidia with flattened apices or small, corona-like apical processes. Conidia germinating in culture.

SPECIMEN EXAMINED AND CULTURED: FRENCH GUIANA: A. Y. Rossman 3221 (JDR).

NOTES: This collection is very close to Rogers' (1984b) concept of *Xylaria allantoidea* (Berk.) Fr., having ascospores approximately the same size (Rogers cites 10-12 x 3.5-4.5 μm), with easily discernible straight germ slits slightly shorter than spore length. The collection differs from typical *X. allantoidea* in that the stromata, especially the stipes, are uncharacteristically long and slender. It bears some superficial resemblance to *Xylaria nigrescens* (Sacc.) Lloyd, especially in the hollow inrolled fertile portions of the stromata, but these two species are separable on ascospore size and morphology (San Martín Gonzales & Rogers, 1989).

In culture, our collection of *X. allantoidea* does not produce truly flabelliform coremia as does *X. cubensis*. As Rogers (1984b) has discussed, the anamorph of *X. allantoidea* was considered by Petch (1924) to be flabelliform, but Petch's corresponding description of the teleomorph indicates that he was dealing with *X. cubensis*. Our culture of *Xylaria allantoidea* produces conidia abundantly, but on cylindrical stromata that branch infrequently and usually only when in contact with the Petri dish lid. In addition, the colonies are slow-growing, unlike *X. cubensis* which exhibits rapid and unrestricted growth (Rogers, 1984b). Our culture of *X. allantoidea* is similar to *Xylaria poitei* (Lév.) Fr. in its restricted growth and prolific production of conidia, most of which have a distinctive apical structure (Rogers & Callan, 1986b). Conidia of the former do not usually develop such a prominent corona as in *X. poitei*, but many are apically flattened when viewed by light microscopy. These two species, however, appear to be closely related.

It is noteworthy that the culture and anamorph described here are very much like some cultures isolated by our colleague Y.-M. Ju from *X. allantoidea* teleomorphs collected in Asia. On the other hand, we have examined some other cultures, isolated from *X. allantoidea* teleomorphs collected in South America, that cover plates in 10-14 da and produce stromata in 30 da. In growth rate and color these cultures resemble those of *X. cubensis* (Rogers, 1984b; see notes on *X. sp. aff. cubensis* herein). However, flabellate stromata are not formed and conidia are rarely formed. The conidia that are formed do so only after ca. 2 months and are 5-7 x 2.5-3.5 μm .

Rogers (1984b) hypothesized that *X. allantoidea*, like *X. cubensis*, produces conidia on coremia that do not produce perithecia. Indeed, to our knowledge, collections to date have not revealed teleomorphic stromata covered with remnants of the anamorph. Stromata are consistently smooth and devoid of conidiogenous remnants. Additional field observations of developing stromata are needed to determine if the anamorphs and teleomorphs of these fungi are

produced on independent structures. See Notes on *Xylaria* sp. aff. *ubensis* herein.

Xylaria arbuscula Sacc., *Michelia* 1:249. 1878.

Figs. 64 and 65.

For description of teleomorph see Rogers et al (1988).

Colonies covering Petri dish in 2-3 wk, at first whitish, velvety to felty or floccose, often strongly zonate, becoming overlain with a brownish to blackish gray layer of coarse felty mycelium, the surface of which later becomes flocculose and lighter in patches. Reverse uncolored to light brown. Stromata usually forming in regular, more or less concentric zones, cylindrical, ca. 1-3 cm tall x 1-3 mm diam, blackish gray and felty except for white, velvety conidiogenous regions and growing tips, with tan to white fleshy interiors. Conidiophores formed in powdery palisades on upper surfaces of stromata or in loose tufts ca. 1 mm tall x 1 mm diam, on surface of colony. No apparent morphological difference between conidiogenous structures from either location. Conidiophores frequently branched near base, white in mass. Conidiogenous cells terminal, cylindrical, 5-15 x 3-4 μm , bearing denticular, usually apical conidial secession scars. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, narrowly ellipsoid, occasionally with slightly pointed apices, with small, flattened bases indicating former points of attachment to conidiogenous cells, (3-)4.5-5.0(-6) x 2.0-2.5(-3) μm . Conidia apparently not germinating in culture.

SPECIMENS EXAMINED AND CULTURED: BRAZIL: Estado de Amazonas, 0.3 km S of central portion of Serra Araca and 0.8 km E of Rio Jauari, elev. 60 m, 00°49'N, 63°19'W, G. J. Samuels 748, 13.III.1984 (NY; JDR). CANARY ISLANDS: Tenerife, on wood, Baudet 2392, 2.II.1985 (JDR).

NOTES: Our cultures of *X. arbuscula* are similar to those described by Martin (1970) especially those isolates producing strongly delimited zones and black stromata with white apices. Rogers and Samuels (1986) cultured New Zealand specimens and found them to be astromatic with yellow-tan to orange-tan mycelium. Rick (1935) mentioned slender, tomentose, conidium-bearing stromata with white to rose apices in nature. He did not describe the conidia. Our colonies were entirely black and white, with no additional colors apparent. The specimen from the Canary Islands tended to produce fewer and more robust stromata than South American collections, but shared the same anamorphic features and dimensions.

Xylaria atosphaerica (Cooke & Masee) Callan & J. D. Rogers, comb. nov.

Figs. 17-24.

Basionym: *Hypoxylon atosphaericum* Cooke & Masee, *Grevillea* 22:68. 1894.

Kretzschmaria atosphaerica (Cooke & Masee) P. Martin, *J. S. African Botany* 36:79. 1970.

Penzigia atosphaerica (Cooke & Masee) J. H. Miller, *Mycol. Explor. Venezuela, Monogr. Univ. Puerto Rico, ser. B, 2, p. 212. 1934.*

Stromata scattered over surface of bark, pulvinate, irregular in outline, faintly moriform, with a narrow central connective; fertile portion 1.5-4 mm diam x 1-2 mm high; connective more or less cylindrical, 1 mm x 1 mm, slightly wider at apex. Exterior brownish-black, roughened by fine cracks and ostioles; interior

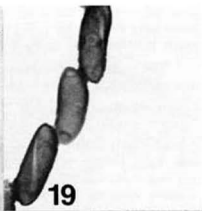
whitish to pale tan, corky. Perithecia globose, 0.5-1.0 mm diam. Ostioles inconspicuous, faintly papillate. Asci 8-spored, cylindrical, stipitate, spore-bearing portions 105-120 x 7-9 μm , stipes 60-90 x 3-4 μm , with apical rings bluing in Melzer's iodine reagent, cylindrical, 5-6 μm tall x 4-4.5 μm broad. Ascospores brownish-black, ellipsoid-inequilateral, smooth, (17-)18-20(-21) x 6-7 μm , with germ slit diagonal, ca. 3/4 spore-length.

Colonies covering Petri dish in 2 wk, at first white, velvety, with floccose margins, zonate, with radiating ridges, darkening to charcoal gray from center outwards. Dark layer overlain with a thin, felty layer of white, often tightly coiled mycelium which becomes canary yellow. Reverse grayish pink, soon deepening to gray. Stromata abundant, cylindrical, 2-4 cm tall x 1-2 mm diam, unbranched or branched once to several times at point of contact with lid of Petri dish, initially white, soon darkening to charcoal gray, then covered with parallel strands of yellow hyphae. Interior white, fleshy. Conidiogenous regions on upper stromatal surfaces. Conidiophores upright in palisades, unbranched to sparingly branched near base, white in mass, eventually sloughing off in flakes to reveal the darkened stromatal surface below. Conidiogenous cells terminal, cylindrical, 40-60 x 3-5 μm , bearing lateral and apical denticulate conidial secession scars. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, obovoid to obclavate, with flattened bases indicating former points of attachment to conidiogenous cell, (7-)7.5-9 x 3-3.5 μm . Conidia germinating in culture.

SPECIMEN EXAMINED AND CULTURED: FRENCH GUIANA: G. J. Samuels 4494 (NY; JDR).

NOTES: The teleomorph of this collection corresponds closely with the description of this species (as *Penzigia atosphaerica*) by Rogers et al (1987). The generic concept of *Penzigia* is ill-defined (Rawla & Narula, 1983; Miller, 1961; Dennis, 1961; Rogers, 1981), and we suspect that most (if not all) of its species may eventually be accommodated in either *Xylaria* or *Hypoxylon*, based primarily on the nature of cultures produced by these fungi. Apart from its reduced pulvinate stroma, there are no other features of *X. atosphaerica* that differ significantly from typical members of the genus. In culture (Fig. 20), stromata have an upright, cylindrical habit and bear palisades of conidiophores, as is typical of most *Xylaria* species. If this fungus were to be considered an *Hypoxylon* species, the anamorph would most likely be in the form of individual conidiophores scattered over the surface of the colony independent of developing teleomorphic stromata. The differences among stromata collected from nature and those produced in culture is great and invites speculation as to the nature of the environmental factors that dictate the development of one form instead of the other. However, other species of *Xylaria* also produce a range of morphologies, some of which are penzigoid, e.g. *Xylaria anisopleura* and *X. scntposa* (Rogers & Callan, 1986a).

Figs. 17-24. *Xylaria atosphaerica* (GS 4494). 17. Penzigoid stromata, X 3.5. 18. Ascus tip stained in Melzer's reagent (arrow), X 1800. 19. Ascospores, one showing sigmoid germ slit, X 1000. 20. Culture, X 0.9. 21. Conidiogenous cell covered with secession scars, X 2100. 22. Conidiogenous cells branching from conidiophore. Note apical secession scars, X 2100. 23. Conidia, X 875. 24. Germinating conidium, X 810. Figs. 21-24 by DIC. Figs. 18 and 19 by BF.



Regardless of their stromatal configuration, cultures derived from these different forms were very similar. Therefore, it is possible that *X. atrosphaerica* exists in nature in other, more typically xylarioid forms as well.

The strikingly pigmented colonies of *X. atrosphaerica* are reminiscent of *X. coccophora* Mont. (Rogers et al, 1988).

Xylaria enteroleuca (Speg.) P. Martin, J. S. African Bot. 36:100. 1970.

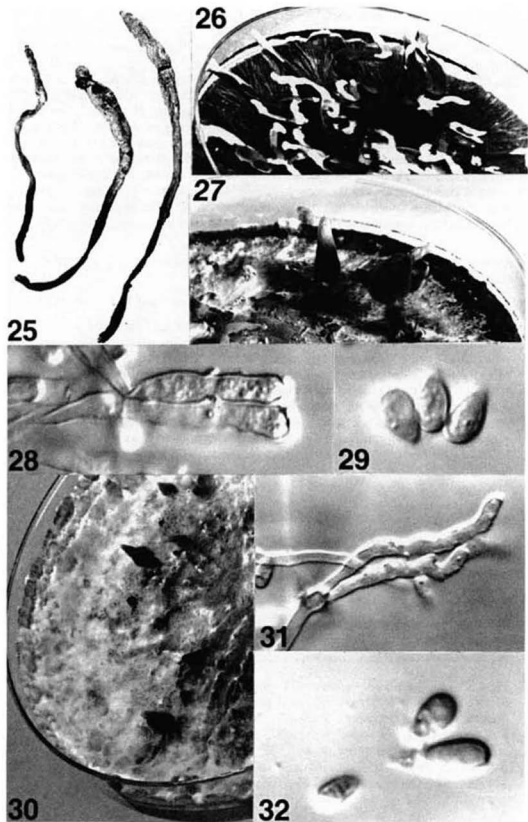
Figs. 33-42.

Stromata peltate to flattened conic, with perithecial ostioles on upper, flattened surfaces only, 5-15 mm diam x 2-3 mm deep; stipes narrow, central, up to 5 mm long x 2-3 mm diam, mostly reduced to a short, narrow connective. Exterior of young stromata silvery-tan, splitting in long fissures to expose blackened layer below. Interior white, corky. Perithecia globose, 0.5-0.75 mm diam. Ostioles indistinct to hemispherical. Asci 8-spored, cylindrical, long-stipitate, spore-bearing portions 90-95 x 7-8 μ m, stipes 80-110 x 4-5 μ m, with apical rings bluing in Melzer's iodine reagent, rectangular to cuneiform, 1 μ m tall x 2 μ m broad. Ascospores brownish-black, broadly ellipsoid-inequilateral with a tiny cellular appendage on one end of immature spores, smooth, 11-13 x 6-7(-8) μ m, with germ slit straight, full-length, indistinct.

Colonies covering Petri dish in ca. 2 wk, at first white, cottony, zonate, darkening to gray in scattered patches. Reverse uncolored. Stromata developing over surface of colony in irregular zones, most numerous at periphery, highly variable in shape, those toward center tending to be slender, more or less cylindrical, 1-2 cm high x 1-2 mm diam, fragile, branching once to many times along main axis, especially where contact is made with Petri dish lid, those towards periphery of cultures often pulvinate, up to 0.5 cm high x 1 cm diam, or strongly flabelliform, up to 1 cm high x 1 cm broad. Stromata at first white to pale rose, becoming covered from the base upward with dense, brownish gray villose hyphae. Conidium-bearing regions on upper surfaces of stromata. Conidiophores upright in palisades, branched near base, pale olive-gray in mass, sloughing off in flakes as stromata mature. Conidiogenous cells terminal, cylindrical to faintly geniculated, 40-50 x 2.5-3 μ m, pale brown in mass, smooth-walled, bearing minutely discoid to punctate conidial secession scars. Conidia produced holoblastically in sympodial sequence. Conidia hyaline (pale olive-brown in mass) smooth, oblong to obovate, with flattened bases indicating former points of attachment to conidiogenous cell, 4.5-7 x 2-3 μ m.

SPECIMEN EXAMINED AND CULTURED: USA: Hawaii, on dying moss-covered *Macadamia* trunk, W. H. Ko, I.VIII.1988 (JDR).

Figs. 25-32. 25 and 26. *Xylaria cf curta* (AR 3226). 25. Stromata, X 0.4. 26. Culture, X 0.75. 27-29. *Xylaria curta* (Samuels & Rodrigues). 27. Culture, X 1.8. 28. Conidiogenous cells with secession scars visible, X 1500. 29. Conidia, X 1170. 30-32. *Xylaria feejeensis*. 30. Culture, X 1.3. 31. Conidiogenous cell with geniculations and secession scars visible, X 750. 32. Conidia, X 1500. Figs. 28 and 29, 31 and 32 by DIC.



NOTES: This is another penzigoid species [\equiv *Penzigia enteroleuca* (Speg.) J. H. Miller] that is proven by culture to be a *Xylaria*. *Xylaria enteroleuca* is difficult to separate from *X. berteri* (Mont.) Cooke [\equiv *Penzigia berteri* (Mont.) J. H. Miller] and might ultimately prove to be conspecific with it. The present material best fits Miller's concept of *X. enteroleuca* (as *Penzigia*) "in the absence of the coarse scales and in being cupulate-depressed rather than convex" (Chardon et al, 1940). Martin (1970) cultured both *X. berteri* and *X. enteroleuca*. His description of *X. berteri* cultures seem similar to ours in producing stromata that were highly variable in size, were pink and gray in color, and that bore gray masses of conidia 3.7-7.6 x 1.4-2.3 μ m (Martin, 1970). Following his description of *X. enteroleuca* cultures he remarked: "This species is similar to *X. berteri*, differing in minor stromal characters and in the slower growth rate in culture." In any case, we suspect that this fungus is allied to *X. cubensis* (Mont.) Fr. in producing separate and distinct anamorphic and teleomorphic structures in nature (see Rogers, 1984b).

Xylaria curta Fr., Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1, p. 126. 1851.

Temperate Collection

Figs. 27-29.

A general description of the teleomorph can be found in Rogers (1983).

Colonies reaching edge of Petri dish in ca. 2 wk, at first white, velvety, appressed, then floccose, pale pink to tan, overlain with irregular patches of blackish hyphae. Reverse faintly pink. Stromata cylindrical with acute apices, broadening at base with age, 1-3 cm long x 0.5-1.0 cm diam, at first pale pinkish tan, then dark olive gray as conidiogenous layer develops. Conidia produced over entire surface of stromata, sloughing off in flakes from base upwards as stromata elongate, replaced with a dense, blackish-olive villose covering of hyphae ca. 1-2 mm long. Conidiophores upright in palisades, branched near base, olive-gray in mass. Conidiogenous cells terminal, cylindrical, 45-55 x 4(-5) μ m, covered with discoid to crateriform conidial secession scars. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, lacrymoid to obovate with small flattened bases indicating former points of attachment to conidiogenous cell, (5-)6-7(-7.5 x 3-4 μ m. Conidia rarely germinating in culture.

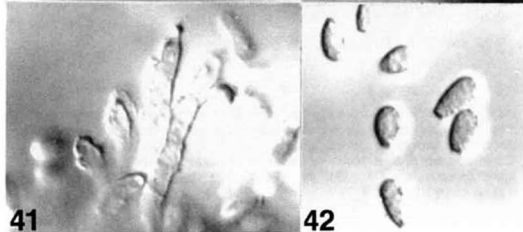
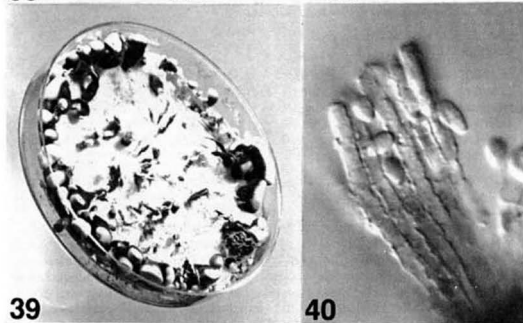
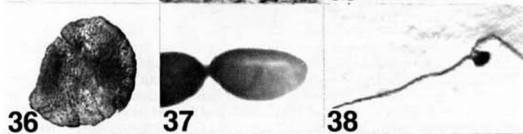
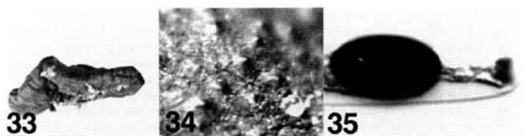
SPECIMEN EXAMINED AND CULTURED: USA: New York, Hamilton Co., Racquette Lake, on *Fagus sylvatica*, G. J. Samuels & K. F. Rodrigues, 6.IX.1986 (NY; JDR).

Xylaria cf. curta Fr. Tropical collection.

Figs. 25 and 26.

Stromata cylindrical, stipitate, occasionally branched with two fertile portions from common stipe, fertile portions 4.5-5.5 cm x 3-5 mm, stipes 1.5-2.5

Figs. 33-42. *Xylaria enteroleuca*. 33. Stroma viewed from side, X 2.5. 34. Stromatal surface with hemispherical perithecial ostioles, x 12. 35. Ascus apical part showing one ascospore and tip stained with Melzer's reagent, X 2300. 36. Stroma viewed from above, X 2.5. 37. Ascospore with germ slit visible, X 1700. 38. Germinating ascospore, X 460. 39. Culture, X 0.7. 40. Conidiogenous palisade, X 1600. 41. Conidiogenous cells with conidial secession scars evident, X 2000. 42. Conidia, X 2000. Figs. 38, 40-42 by DIC. Fig. 35 by BF.



cm x 2.5-4 mm. Exterior light brown, highly wrinkled, cracked around perithecial ostioles to expose black underlying layer. Interior white, corky. Stipes externally brownish-black, slightly felty towards base. Perithecia globose, ca. 0.5-0.75 mm diam. Ostioles discoid to hemispherical, pale brown. Asci 8-spored, cylindrical, long-stipitate, spore-bearing portions 60-75 x 5-6 μm , stipes 75-115 x 4-4.5 μm , with apical ring bluing in Melzer's iodine reagent, urn-shaped, 4 μm high x 2 μm broad. Ascospores blackish-brown, ellipsoid-inequilateral, smooth, (8-)8.5-9.5 x 4-4.5 μm , with straight, full-length germ slit and small cellular appendage on one end when immature.

Colonies covering Petri dish in 3 wk, at first white, velvety, appressed, azonate, with narrowly plumose margins, soon darkening from center outwards to dull black and becoming overlain in places by feathery tufts of white hyphae. Reverse tan. Stromata scattered over surface of colony but most common at periphery, cylindrical, 1-2.5 cm long x 1-3 mm diam, unbranched, or occasionally branched at point of contact with Petri dish lid, at first white to pale tan, darkening from base upwards with a blackened layer which eventually becomes villose. No conidiogenous structures observed.

SPECIMEN EXAMINED AND CULTURED: FRENCH GUIANA: A.Y. Rossman 3226 (JDR).

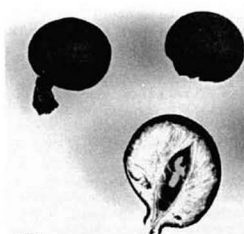
NOTES: Rogers (1983) has discussed *Xylaria curta* in detail and our temperate collection agrees with his description. Our culture is described herein in order to supplement Rogers' observations (1983), which were from colonies on potato dextrose agar amended with yeast extract. Generally, cultures are more robust on oatmeal agar, but conidial measurements are similar. Both descriptions agree with those of Martin (1970).

As Rogers (1983) noted, the type of this species is based on an Hawaiian specimen, and Dennis (1956) described the stromata, especially immature specimens, as being covered with white or cream-colored scales. The teleomorph of this tropical collection remains tan at maturity and is longer overall and with more elongated slender stipes than most temperate material. Moreover, ascus tips are also larger, up to 4 μm high compared to 2 μm , but ascospores are identical with those of temperate collections. Cultures of the tropical collection have some similarities such as villose stromata, but differ in their distinctive plumose margins. The differences depicted above indicate that there is variation among collections of *Xylaria curta*. Unfortunately, an anamorph was not produced in our culture.

Xylaria enterogena (Mont.) Fr., Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1, p. 127. 1851.

Fig. 72.

Figs. 43-49. *Xylaria obovata* (Lodge 186). 43. Stromata, one on lower right in longitudinal section, X 1.2. 44. Ascus tip in Melzer's reagent, X 2000. 45. Ascospores with germ slits evident, X 1300. 46. Culture, X 1.1. 47. Conidiogenous cells, X 1000. 48. Palisade of conidiogenous cells, some with apical secession scars, X 1380. 49. Conidia, X 1200. Figs. 47-49 by DIC. Figs. 44 and 45 by BF.



43



44



45



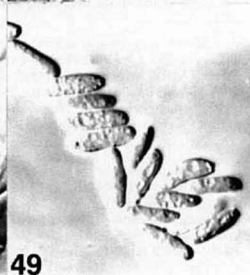
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48



49

Stromata cylindrical, clavate, short-stipitate, fertile portions 1-2 cm x 4-6 mm, stipes cylindrical to strap-like, 2-4 mm tall x 2 mm broad, smooth. Exterior pale yellowish cream overlying a blackened layer. Interior tan, darkening and degenerating in fertile portion which becomes hollow when mature. Perithecia globose, ca. 0.5 mm diam. Ostioles punctate, inconspicuous. Asci 8-spored, cylindrical, short-stipitate, spore-bearing parts 105-140 x (7-9)-11 μm , stipes 50-65 x 3-3.5 μm , with apical ring bluing in Melzer's iodine reagent, cylindrical to urn-shaped, 7 μm high x 4 μm broad. Ascospores brownish black, unicellular, ellipsoid-inequilateral, with ends slightly pinched, smooth, 17-20(-20.5) x 6-7 μm with germ slit diagonal, ca. 2/3 spore-length.

Colonies reaching edge of Petri dish in 2 wk, at first white, velvety, appressed, strongly zonate, with floccose, lobed margins, darkening at center to olive gray and covered with tightly coiled hyphae. Reverse uncolored. Stromata developing from mycelial strands or fans at periphery of zones which turn upward and elongate perpendicular to the colony surface, cylindrical, 0.2-0.5 cm tall x 0.5-1 mm diam, white, darkening at base which becomes covered by a thin layer of coiled, olive-gray hyphae. No conidiogenous structures observed.

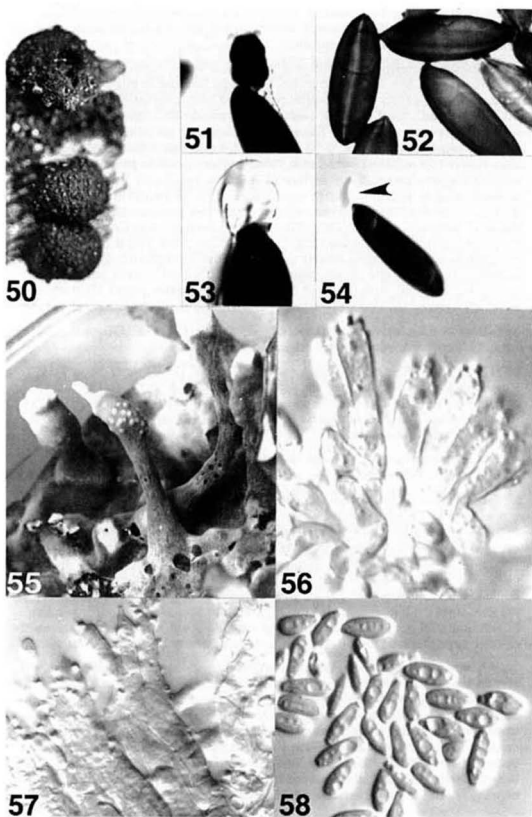
SPECIMENS EXAMINED AND CULTURED: FRENCH GUIANA: A. Y. Rossman 3157, 3275 (JDR).

NOTES: *Xylaria enterogena* has been separated from *X. telfairii* on the more yellow color and the smaller size of the stromata and smaller ascospores of the former (Rogers et al, 1988), and the fact that ascospore germ slits of *X. enterogena* tend to spiral while those of *X. telfairii* are straight (Martin, 1970, San Martín Gonzales & Rogers, 1989). Our specimens exhibit these differences, but cultures from collections of both species are virtually identical. If, indeed, these fungi are separate species, it is not possible to separate them using features of the cultures described herein.

Xylaria feejeensis (Berk.) Fr. Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1, p. 128. 1851. Figs. 30-32.

Stromata cylindrical to spatulate, 3-4 cm total height x 0.5 cm - 1 cm diam, fertile portions 1.5-3 cm tall x 0.7-1 cm diam, stalks 1-2 cm tall x 3-0.5 mm diam. Exterior black, wrinkled, roughened with perithecial ostioles and cracked into small plates. Interior white, corky. Perithecia 0.3-0.5 mm diam. Ostioles hemispherical, prominent. Asci 8-spored, cylindrical, long-stipitate, spore-bearing portions 55-65 x 4-6 μm , stipes 85-100 x 2.5-3 μm , with apical ring bluing in

Figs. 50-58. *Penzigia cf. indica*. 50. Stromata (GS 4420), X 4. 51. Ascus tip in Melzer's reagent (GS 4418), X 1330. 52. Ascospores, spore on left with germ slit evident (GS 4418), X 760. 53. Ascus tip of isotype material (Narula 16235) remaining unstained in Melzer's reagent, X 1700. 54. Ascospore (GS 4418) with hyaline apical appendage evident, X 2000. 55. Culture (GS 4418); perithecial initials evident on central stroma, X 2.5. 56. Young conidiogenous cells with apical secession scars (GS 4418), X 2000. 57. Palisade of mature conidiogenous cells; lateral scars evident (GS 4418), X 1250. 58. Conidia (GS 4418), X 1250. Figs. 51, 53, 54-58 by DIC. Fig. 52 by BF.



Melzer's iodine reagent, quadrate, 1.5-2 x 2 μm . Ascospores brownish-black, unicellular, broadly ellipsoid-inequilateral, smooth, 8-9 x 4-4.5 μm , with straight, somewhat faint, full-length germ slit.

Colonies covering Petri dish in 3 wk, at first white, velvety, appressed, with uneven, more or less concentric zones, becoming floccose at edge of Petri dish, turning tan, then blackening towards center and becoming overlain with white floccose hyphae. Most colonies eventually furrowed with radiating depressions at maturity. Reverse uncolored. Stromata developing at periphery and on radiating edges of colonies, cylindrical, 0.5-1 cm tall x 3-4 mm diam, pulvinate when young, later covered from base upward with velvety, villose black hyphae. Conidium-bearing regions developing on surface of colony in small tufts independent of stromata and on young, pulvinate stromata prior to the production of villose basal hyphae. Conidiophores in dense, whitish to pale tan palisades, sloughing off in flakes as stromata age, unbranched to branched several times from base. Conidiogenous cells terminal, cylindrical, 15-30 x 4-5 μm , with lateral and terminal crateriform scars indicating former sites of conidial attachment. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, obovoid to ellipsoid, with flattened bases indicating former points of attachment to conidiogenous cell, 5-6 x (2-)3 μm . No germinated conidia observed.

SPECIMEN EXAMINED AND CULTURED: PUERTO RICO: Luquillo Mts., El Verde, on wood, D. J. Lodge 424, 1988 (JDR).

NOTES: This collection of *X. feejeensis* fits Dennis' (1956) description well. Rogers et al (1987) noted that this species is allied to *X. curta*, and similarities in the cultures of these two fungi are evident, especially with respect to the villose dark stromata. Cultures of *Xylaria feejeensis* more closely resemble temperate than tropical *X. curta* cultures.

Xylaria microceras (Mont.) Fr., Nova Acta Regiae Soc. Upsal. (ser. 3) 1, p. 128. 1851. Tropical Collection.

Fig. 63.

Stromata cylindrical with slender stipes and acute apices, simple or with a few branches. Fertile portions 1-2 cm tall x 1-3 mm diam (larger diam = branched stromata), stipes 3-5 mm tall x 0.5-1 mm diam. Exterior with tan external layer peeling away in longitudinal strips to reveal blackened layer beneath. Interior tissue white, fragile. Perithecia globose, ca. 0.25-0.5 mm diam. Ostioles punctuate. Asci 8-spored, cylindrical, stipitate, spore-bearing portions 80-90 x 4-4.5 μm , stipes 90-120 x 2 μm , with apical ring bluing in Melzer's iodine reagent, inverted hat-shaped, 2-3 μm high x 2 μm broad. Ascospores blackish-brown, unicellular, ellipsoid-inequilateral, smooth, 10-11 x 3-4 μm , with a minute, cellular appendage on either end, and a straight, nearly full-length germ slit.

Colonies covering Petri dish in 3 wk, at first white, velvety, appressed, with several irregularly-scalloped concentric zones, darkening to gray at center, which in turn is covered with whitish plumose hyphal strands radiating outward toward edge of colonies. Surface dry, rugulose towards periphery. Reverse at first uncolored, darkening to gray as colony ages. Stromata developing at center of colonies, cylindrical to flabellate, ca. 1 cm tall x 0.5-4 mm diam, unbranched to branched several times from base, often densely cespitose, initially white to pale tan, darkening to charcoal from base upwards except for growing tips. Conidium-bearing regions arising in small, pulvinate clumps on surface of colony apart from

stromata, and on upper surfaces of stromata. Conidiophores upright in palisades, unbranched to sparingly branched near base, pale tan to gray in mass, eventually sloughing off in flakes. Conidiogenous cells terminal, cylindrical, 10-15 μm x 2-2.5 μm , bearing denticulate conidial secession scars. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, obovoid to obclavate, guttulate, with flattened bases indicating former points of attachment to conidiogenous cell, 5-6(-6.5) x 2-2.5 μm . Conidia germinating in large numbers in culture.

SPECIMEN EXAMINED AND CULTURED: PUERTO RICO: Luquillo Mts., El Verde, on wood, D. J. Lodge 418, 3.VII.1988 (JDR).

Xylaria microceras. Temperate collection.

Figs. 61 and 62.

Teleomorph as described earlier herein and by Dennis (1956).

Colonies covering Petri dish in 4 wk, with mycelium at first white, floccose, zonate towards center, darkening to pale yellowish-brown. Stromata narrowly cylindrical, unbranched, up to 5 mm tall x 1 mm diam, produced in concentric rings at periphery of zones, at first white then tan and dotted with amber exudation droplets, then covered except for growing tips with a thin, grayish-black layer. Conidium-bearing regions on upper surfaces of stromata, in sparse, tan to whitish palisades. Conidiophores upright, sparingly branched near base, white to tan in mass, smooth-walled. Conidiogenous cells terminal, cylindrical, 10-20 x 3-4 μm , bearing denticular conidial secession scars. Conidia hyaline, smooth, guttulate, narrowly obovoid to obclavate, with flattened bases indicating former points of attachment to conidiogenous cell, (4.5-)5-6 x 2-2.5 μm . Conidia germinating soon after formation in culture.

SPECIMEN EXAMINED AND CULTURED: USA: Illinois, Piatt Co., Allerton Park, on wood, S. Bissonette, 22.IX.1988 (JDR).

NOTES: The above-cited *Xylaria microceras* collections all seem typical of the species as described by Dennis (1956). There were a few differences between the temperate and tropical cultures, however. The collection from Puerto Rico produced fewer, more robust stromata which were usually colored black and white. On the other hand, the collection from Illinois produced prolific numbers of stromata which were pigmented pale tan. Conidia were the same size, and germinated in culture soon after formation. These cultures differ significantly from those of the allied species, *Xylaria coccophora* Mont., which has larger conidia 8-9 x 3-4 μm , and cultures with yellow-pigmented hyphae (Rogers et al, 1988).

Xylaria obovata (Berk.) Fr., Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1, p. 127. 1851.

Figs. 43-49.

Stromata globose to subglobose, sessile to short-stipitate, fertile portions 0.5-5 cm tall x 0.5-1.3 cm diam, stipes when present cylindrical, 1-5 mm long x 2 mm diam. Exterior smooth, very hard, brownish to black when young and covered with a thin tan to brownish layer cracked into minute plates. Interior reddish tan, disintegrating at center in mature stromata. Perithecia globose, ca. 1 mm diam. Ostioles discoid, inconspicuous. Asci 8-spored, stipitate, cylindrical, spore-bearing portions 150-180 x 10-12 μm , stipes 80-100 x 2.5-4 μm , with apical ring bluing in Melzer's iodine reagent, urn-shaped to cylindrical, 4-5 μm high x 4-5 μm broad. Ascospores smooth, brownish-black, unicellular, ellipsoid-

inequilateral, (24-)26-30(-31) x (6.5-)7-8 μm , with straight germ slit 1/2-2/3 spore-length.

Colonies covering Petri dish in 3-4 wk, at first hyaline, submerged, then whitish, zonate, floccose, surface becoming brownish black and overlain with scattered patches of thin, white, floccose mycelium. Reverse tan to reddish brown. Stromata developing in waves at peripheries of zones, cylindrical to clavate to spatulate, fragile, 1-2 cm tall x 1-5 mm diam, initially white, becoming covered with white conidiogenous palisades under which the tissue becomes brownish black. Conidiogenous layer sloughing off to expose darkened layer beneath. Conidiophores sparingly branched near base, in dense palisades. Conidiogenous cells terminal, cylindrical, 16-25(-28) x 3-4 μm , hyaline to faintly grayish brown, with apical, conical secession scars. Conidia produced holoblastically in sympodial succession. Conidia hyaline, smooth, oval to obclavate, 8-10 (-10.5) x 3-3.5 μm , with truncate bases indicating former points of attachment to conidiogenous cells. Conidia germinating in culture.

SPECIMENS EXAMINED AND CULTURED: PUERTO RICO: Luquillo Mts., El Verde, D. J. Lodge 186, 5.II.1986 (JDR).

NOTES: These collections of *Xylaria obovata* are similar to Dennis' (1956) description of this species. Stromata are typically smooth, with subglobose fertile portions which become hollow with age. Dennis (1956) considered *X. obovata* a tropical form of *Xylaria polymorpha*, and certainly the two species are very similar in ascospore size and morphology, but the former lacks the roughened warty stromatal exterior so typical of the *X. polymorpha* species complex (Rogers & Callan, 1986a). In addition, the colonial morphology differs from *X. polymorpha* and related species (Rogers & Callan, 1986a) in that conidiogenous palisades remain white in mass instead of darkening with age to olive-gray. Rick (1935) and Theissen (1909) both noted that immature, conidium-bearing stromata were silvery-gray. It would appear that *X. obovata* is not a member of the tropical *X. polymorpha* species complex.

Xylaria sp. aff. *cubensis* (Mont.) Fr., Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1, p. 126. 1851. Figs. 59 and 60.

Stromata fusiform, stipitate, fertile portions 4.5 cm x 1.3 cm (widest at center), stipes 2.5 cm x 4 mm. Exterior smooth, dark brown over black with fine cracks and ostiolar papillae. Texture hard, brittle. Interior white, becoming hollow in center. Perithecia globose, ca. 0.3-0.5 mm diam. Ostioles finely papillate. Asci 8-spored, cylindrical, long-stipitate, spore-bearing portions 50-64 x 7-11 μm , stipes 90-115 x 2 μm , with apical ring bluing in Melzer's iodine reagent, urn-shaped, 2-3 μm high x 2 μm broad. Ascospores brownish-black, unicellular, ellipsoid-inequilateral, smooth, 9-10.5 x 4-5 μm , with germ slit faint, full-length.

Colonies covering Petri dish in 3 wk, at first white, velvety, appressed, faintly zonate, darkening from center outward with a thin, gray layer of pale tan to white floccose hyphae. Reverse uncolored. Stromata at first cylindrical with uppermost half soon broadening, sometimes branching to become flabelliform, 1-2 cm tall x 0.2-1 cm diam, developing at surface and periphery of colony, initially white, then darkening from base upward to charcoal, the flabelliform portion deepening to pinkish or grayish tan. Conidium-bearing regions covering entire surface of young stromata and upper flabelliform surfaces of older stromata.

Conidiophores upright in dense, dry palisades, unbranched, or branched once or more from a common base. Palisades sloughing off in dusty flakes to accumulate in small, grayish-tan heaps underneath stromata. Conidiogenous cells terminal, cylindrical, 10-20 μm long x 3 μm diam, hyaline to tan, covered terminally and laterally with denticulate to crateriform conidial secession scars indicating former sites of conidial attachment. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, obovoid to ellipsoid, with flattened bases indicating former points of attachment to conidiogenous cell, 5-6 x 2-2.5 μm .

SPECIMEN EXAMINED AND CULTURED: PUERTO RICO: Luquillo Mts., El Verde, on dead branch, D. J. Lodge 415, 30.IX.1988 (JDR).

NOTES: The teleomorph of this fungus has characteristics of both *X. cubensis* and *X. allantoidea*. In stature and ascospore size it resembles the former species, in color the latter species. Dennis (1970) recognized the difficulty in delineating taxa of this group and put several species into synonymy with *X. papyrifera* [as *Xylosphaera papyrifera* (Fr.) Dennis]; *X. cubensis* was reduced to subspecies *cubensis* (Mont.) Dennis.

Cultures of this fungus bear flabellate stromata much like those of *X. cubensis*, but conidial color in mass tends to be tan rather than pink, in this characteristic resembling *X. cf. allantoidea* (see earlier herein). It is suspected that this fungus and others in this complex produce separate and distinct anamorphic and teleomorphic stromata. If field studies confirm these suspicions the anamorph described here should be considered a *Xylocoremium* Rogers.

Xylaria telfairii Berk. & Fr., Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1, p. 127. 1851.

Fig. 73.

Stromata cylindrical to clavate, stipitate, occasionally branched so that two fertile portions share a common stipe, fertile portions 1.5-3 cm x 4-5 mm, stipes narrow, strap-like, 1.7-4.5 cm x 1.5-3 mm. Exterior smooth, unwrinkled, with fine longitudinal cracks, manila-colored to buff (pale umber) overlying black layer. Interior white, corky, degenerating in fertile portion which becomes hollow with age. Perithecia globose, ca. 0.5-1 mm diam. Ostioles umbilicate, sometimes slightly raised. Asci 8-spored, cylindrical, stipitate, spore-bearing portions ca. 135 x 11 μm , stipes 95-100 x 3 μm , with apical ring bluing in Melzer's iodine reagent, coffin-shaped to rectangular, 7-10 μm high x 4 μm broad. Ascospores smooth, brownish-black, ellipsoid-inequilateral, concave on germ slit side, (19.5-)20-22(-22.5) x 6-7 μm , with straight inconspicuous germ slit ca. 2/3-3/4 spore-length.

Colonies covering Petri dish in ca. 2.5 wk, at first white, velvety, appressed, zonate, with finely lobed margins. Lobes at periphery of zones becoming raised above colony surface, developing into loosely-formed stromatal-like tufts ca. 1 cm x 1-2 mm. Slightly more robust, pale tan to orange-tan stromata occasionally developing, but remaining sterile. Colonies darkening from center outwards with an olive gray, velvety layer of hyphae. Surface hyphae usually tightly coiled. Reverse uncolored. No conidiogenous structures observed.

SPECIMEN EXAMINED AND CULTURED: FRENCH GUIANA: A. Y. Rossman, 3378 (JDR).

NOTES: Dennis (1956) considered *X. enterogena* to be a small form of *X. telfairii*. Cultures from collections referable to *X. enterogena* and *X. telfairii*,

respectively, are nearly identical, thus adding support to Dennis' contention. See Notes on *X. enterogena* herein.

Xylaria tentaculata Berk. & Br., *Grevillea* 4:48. 1875.

Figs. 66-71.

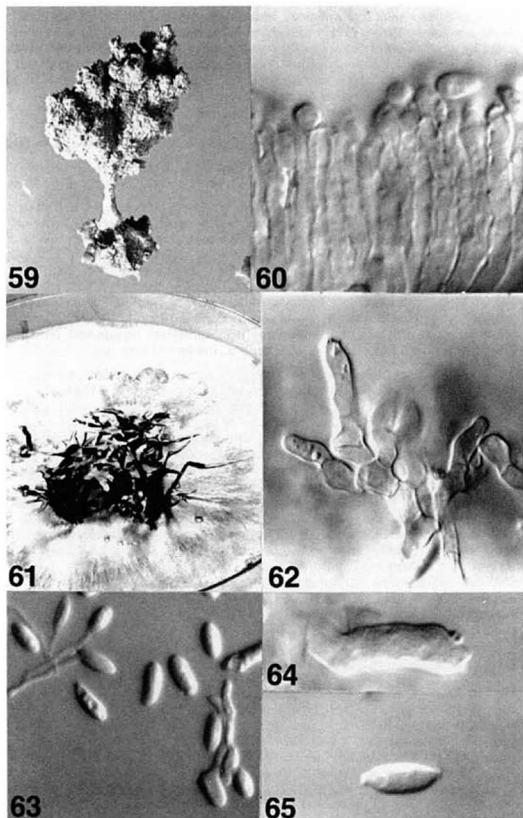
Stromata when immature bearing the anamorph on long, pale grayish tan, unbranched, tapering, tentacle-like appendages 0.5-2 cm long x \leq 0.3 mm diam, bases attached to apex of stipe. Conidiogenous cells in palisades over surfaces of appendages, cylindrical, 20-30 x 5-6 μ m, covered with conical conidial secession scars. Conidia hyaline, verruculose, subglobose, with flattened bases indicating former points of attachment to conidiogenous cells, 6-9(-10) x 4.5-5 μ m. Stipes of stromata blackish brown, glabrous, cylindrical, 1-3 cm tall x 0.5-1 mm diam. Perithecia forming at base of tentacles which dehisce to leave denticulate pegs. Perithecial outlines prominent. Perithecia globose, ca. 0.5-0.75 mm diam, often collapsed around ostioles. Ostioles papillate. Asci 8-spored, cylindrical, short-stipitate, spore-bearing portions 120-150 x 9-11 μ m, stipes 20-30 x 3-5 μ m, with apical ring bluing in Melzer's iodine reagent, urn-shaped in optical section, 10 μ m high x 6 μ m broad. Ascospores smooth, brown, unicellular, ellipsoid-inequilateral, 20-22 x (6-7)-8 μ m, with straight, spore-length germ slit and globose, hyaline noncellular appendage on each end.

Colonies covering Petri dish in ca. 2 wk, at first white, velvety, becoming floccose towards periphery; floccose patches thickening and forming pulvinate to subglobose sclerotium-like bodies of dense tissue which develop a thin black outer layer as colonies mature. Reverse uncolored. Stromata infrequently formed, usually near center of colonies, at first cylindrical, robust, exterior blackened except for white growing tip, interior fleshy, becoming spathulate after coming into contact with Petri dish lid, 2-4 cm tall x 2-4 mm diam, up to 1.5 cm broad at spathulate apex. No conidiogenous structures observed in culture.

SPECIMEN EXAMINED AND CULTURED: USA: Tennessee, Blount Co., Bote Mt. Trail area near Crib Gap, Cades Cove Rd., on soil and leaf mulch under mixed hardwoods, *Tsuga* and *Pinus*, D. E. Desjardin, 31.VIII.1986 (JDR).

NOTES: *Xylaria tentaculata* was described by Berkeley and Broome on what might have been an entirely anamorphic collection. Lloyd (1924) stated that there were no specimens bearing perithecia in the type collection, and that "There is no evidence that Berkeley ever saw the fertile form although his descriptions seem to fit it." Berkeley and Broome, however, described stromata as showing ostioles. Thus, there is the possibility that type stromata had teleomorphic structures, although perhaps immature. It is also possible that a part of the type was lost.

Figs. 59-65. Figs. 59 and 60. *Xylaria* sp. aff. *cupensis*. 59. Flabelliform coremium from culture, X 3.8. 60. Palisade of conidiogenous cells, X 2000. Figs. 61-63. *Xylaria microceras*. 61. Culture, X 1.4. 62. Conidiogenous cells with apical secession scars, X 2200. 63. Germinating conidia, X 2200. Figs. 64 and 65. *Xylaria arbuscula* (Canary Islands). 64. Conidiogenous cell with single secession scar evident, X 2250. 65. Conidium, X 3000. Figs. 60, 62-65 by DIC.



The developmental morphology, including perithecial formation, was elucidated in detail by Brown (1913) who showed that the conidia-bearing arms originated by the division of the apex of the young stalk. Brown described the conidia as "...hyaline, somewhat vacuolate, elliptical to pyriform with a rather prominent and slightly roughened spore wall" which is very similar to the conidial characteristics observed in the collection described above. Our description of the teleomorph is also similar to Brown's. Although no anamorph was produced in this culture, it was striking in the production of sclerotium-like structures and stromata that were very robust and several times the diameter of those in nature.

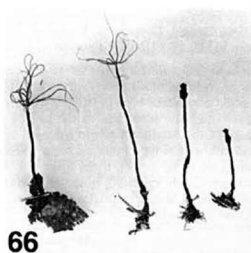
Penzigia cf. indica Rawla & Narula, Indian Phytopath. 37:312. 1984.

Figs. 50-58.

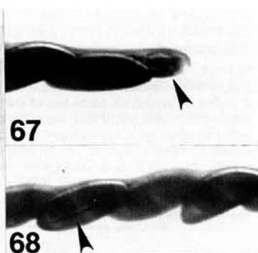
Stromata on surface of bark, solitary to cespitose, pulvinate, 4-6 mm diam x 2 mm tall, attached to substrate by a short, narrow central connective. Exterior dull black, warty, moriform, with remnants of a paler, tan to brown external layer remaining on surface in the form of small plates or scales. Interior white, fragile. Perithecia globose to subglobose, 1-1.5 mm diam. Ostioles papillate. Asci 8-spored, cylindrical, stipitate, spore-bearing portions 150-200 x 18-24 μm , stipes 60-100 x 5-6 μm , with apical ring bluing in Melzer's iodine reagent, massive, more or less cylindrical or with a slight central constriction, 12-14 x 6 μm . Ascospores brownish-black, ellipsoid, often with noncellular appendage on one end, smooth, (35-)36-40(-41) x 12-14 (-15) μm , with straight, full-length germ slit.

Colonies reaching edge of Petri dish in ca. 3.5 wk, at first white, velvety, faintly zonate, surface becoming irregularly rugose, covered with a black, carbonaceous layer. Reverse pale orange-tan. Stromata scattered over colony surface but most frequently forming at edge of Petri dish, 1-3 cm tall x 1-4 mm diam, cylindrical to capitate to spatulate, unbranched, or apex with multiple digitate projections, some of which develop further into branches. Capitate stromata developing perithecial-like projections which never mature to produce asci. Stromata initially white, then darkening to black except at the growing tip, eventually covered by a white or pale yellow layer on upper surfaces, which later bear conidiophores. Conidiophores upright in palisades, branched near base, white in mass, eventually sloughing off in flakes to reveal the blackened stromatal layer beneath. Conidiogenous cells terminal, cylindrical, 15-30 x 3.5-4.5 μm , covered with crateriform conidial secession scars. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, narrowly ellipsoid to subcylindrical, with small, flattened bases indicating former points of attachment to conidiogenous cell, 6-7.5 x 2-2.5(-3) μm . Conidia germinating in culture.

Figs. 66-73. Figs. 66-71. *Xylaria tentaculata*. 66. Stromata, two on left bearing conidial appendages, two on right with perithecia, X 1. 67. Ascus tip in Melzer's reagent (arrow), X 1000. 68. Lower part of same ascus; left ascospore with germ slit evident (arrow), X 1000. 69. Culture, with sclerotium-like structures evident, X 0.8. 70. Conidiogenous cells with prominent apical secession scars, X 1200. 71. Conidium, X 2000. 72. *Xylaria enterogena*. Culture, X 0.55. 73. *Xylaria telfairii* culture, X 1.8. Figs. 67 and 68, 70 and 71 by DIC.



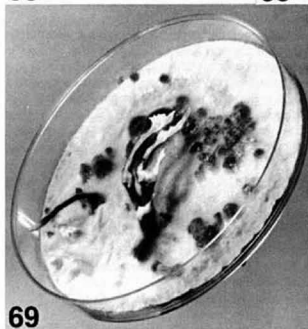
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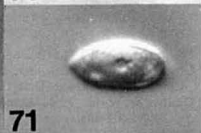
68



69



70



71



72



73

SPECIMENS EXAMINED: FRENCH GUIANA: G. J. Samuels 4418, 4420 (BOTH CULTURED) (NY; JDR); INDIA: Bengal, Darjeeling, Tiger Hill, on dead angiospermous stumps, A. M. Narula 16235, 19.VIII.1980 (isotype in JDR).

NOTES: The two South American collections differ in a number of ways from Indian isotype material examined. Rawla & Narula (1984) described ascus tips of *P. indica* as inamyloid; ascus tips of our collections stain blue in Melzer's iodine reagent. We also noted that ascospores, although the same size as the isotype material, often were appendaged. Stromata of the South American material also tended to be more robust. As we have no cultures of type material from India, it is difficult to tell if these are regional variations, or if, in fact, these fungi are different subtaxa. Cultures are striking and definitely xylarioid, however, and if cultural features are found to be similar for typical Indian collections, this species should be removed from *Penzigia* and placed in *Xylaria*.

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FIRST RECORD OF CATENARIA AUXILIARIS IN ILLINOIS

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The soybean cyst nematode (*Heterodera glycines* Ichinohe), a major yield-limiting pest of soybean (*Glycine max* (L.) Merr.), is present in all counties in central and southern Illinois (Melton *et al.*, 1988). Carris *et al.*, (1989) found 71 species of fungi associated with cysts of the nematode in two Illinois fields. As reported herein, further investigations on the interactions of fungi and the soybean cyst nematode have revealed the presence of another cyst-inhabiting fungus, *Catenaria auxiliaris* (Kühn) Tribe, in Illinois.

Catenaria auxiliaris has been reported as a parasite of female sugar beet cyst nematodes, *Heterodera schachtii* Schmidt, in England, the Netherlands, Germany, Sweden, Czechoslovakia and California (Tribe, 1977). Kerry and Crump (1977) observed the fungus as a parasite of the cereal cyst nematode, *Heterodera avenae* Woll., in England. Other host and geographical records include *H. avenae* in Australia (Stirling and Kerry, 1983), *Heterodera latipons* Franklin and *H. avenae* in Bulgaria (Stoyanov, 1982), and *Heterodera humuli* Filipjev in the Ukrainian SSR (Mikhajljukov, 1976). Crump *et al.*, (1983) observed the fungus in 0.7% of *H. glycines* cysts from one site in Tennessee, and 0.4% of *Heterodera zaeae* Koshy, Swarup, and Sethi cysts from Maryland. The only report of the fungus from a host other than cyst nematodes is the observation of the fungus in a single larva of the large elm bark beetle, *Scolytus scolytus* F., in England (Doberski and Tribe, 1978).

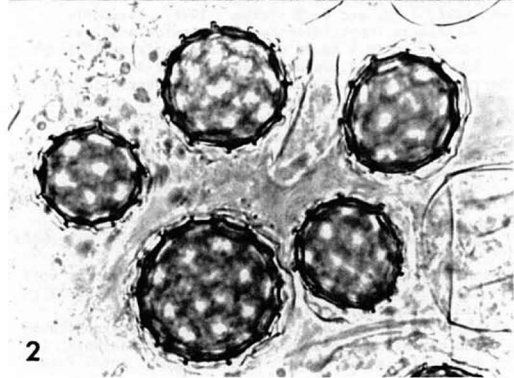
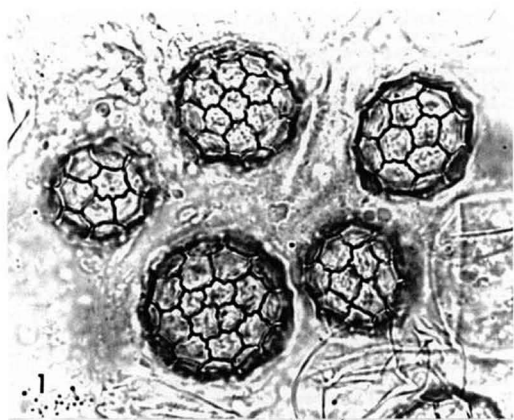
The first record of *C. auxiliaris* in Illinois is based

on the discovery of the fungus in cysts of *H. glycines* used in experiments to test several soilborne fungi for pathogenicity toward the nematode. *Catenaria auxiliaris* apparently was present in the nonsterile cyst-free field soil used in the experiment. Yellow (older, egg-producing) females of *H. glycines* were taken from greenhouse stock cultures maintained on soybeans (cv. Williams 82) in sterilized greenhouse soil mix (1:3 soil:sand). The females were placed in 7 cm-diam. clay pots in nonsterilized cyst-free field soil obtained from Kankakee Co., IL. After 1- and 2-week intervals the cysts were recovered from the soil by wet-sieving (Southey, 1970). Soil screenings were stored in tap water at 4 C for 10-11 days until cysts were mounted for microscopic observation.

Resting sporangia of *C. auxiliaris* were found in cysts examined after the 2-week interval in two replicates completed at different times. The resting sporangia were found in 4 of 154 cysts (2.6%) from the first replicate, and 1 of 132 cysts (0.7%) from the second replicate. A microscope slide mount of resting sporangia of the fungus has been deposited in ILLS. The resting sporangia (Figs. 1 and 2) were globose to subglobose, occasionally oblong, measuring 22-44 (-56) μm in diameter (\bar{x} = 30.6 μm). The resting spores, which develop inside the sporangia (Tribe, 1977), were yellow-brown and had a mesh-like, reticulate wall.

To determine whether *C. auxiliaris* was present in the sterilized greenhouse soil mix, 306 brown cysts taken directly from stock cultures were observed microscopically. In addition, 165 yellow females were taken from stock cultures, returned to the sterilized greenhouse soil mix, and recovered after two weeks. *Catenaria auxiliaris* was not observed in these cysts, suggesting that the fungus was not present in the sterilized greenhouse soil mix. The yellow females of *H. glycines* added to the field soil apparently served to bait *C. auxiliaris* from the soil. The fungus probably occurred on some other host or substrate, since no nematode cysts were found in the soil.

Figs. 1 and 2. *Catenaria auxiliaris* resting sporangia. 1. Surface view in focus. 2. In optical section. Both photographs, x1000.



The likely presence of this fungus on hosts other than cyst nematodes suggests that the host range is larger than previously believed (see also Doberski and Tribe, 1978). Knowledge of the host range of this cyst-inhabiting fungus may prove important in further investigations on *C. auxiliaris* as a potential biocontrol agent in the management of cyst nematodes.

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HALOPHYTOPHTHORA, GEN. NOV., A NEW MEMBER

OF THE FAMILY PYTHIACEAE

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ABSTRACT

As a result of a comparative study of all species of Phytophthora in culture at the American Type Culture Collection, (ATCC) Rockville, Maryland, most of the marine species are considered to be distinct enough to be assigned to a new genus Halophytophthora gen. nov. which is similar to Phytophthora de Bary in the production of zoospores within the sporangium proper but differs in the sporangial apical structure, the mode of zoospore emission and other morphological and cultural characters. The following species are transferred from Phytophthora to Halophytophthora: H. avicennae, H. bahamensis, H. batemanensis, H. epistomium, H. mycoparasitica, H. operculata, H. polymorphica, H. spinosa var. lobata, H. spinosa var. spinosa and H. vesicula.

Although Waterhouse (1973) included eight genera in the Family Pythiaceae of the Order Peronosporales, the most common of these genera undoubtedly are Pythium Pringsh and Phytophthora de Bary which are distinguished primarily by the fact that whereas differentiation of zoospores in Pythium takes place in a vesicle usually at the tip of a discharge tube, zoospore of Phytophthora are fully formed within the sporangium proper, and liberated at the apex with or without the formation of an evanescent vesicle (Alexopoulos & Mims, 1979). The genus Phytophthora is further characterized by the non-septate hyphae branching at right angle with slight constriction at the point of origin, the sympodially branched sporangiophore bearing ovoid to obpyriform, papillate to nonpapillate sporangia, the production of amphigynous and/or paragynous antheridia and their parasitism on terrestrial plants (Hickman, 1958). However, since 1969, nine species and two varieties of Phytophthora have been described from marine habitats and all except one which was mycoparasitic, were saprophytic on decaying leaves and roots in sea water

(Anastasio & Churchland, 1969; Fell & Master, 1975; Pegg & Alcorn, 1982; Gerrettson & Simpson, 1984). They were placed in the genus Phytophthora primarily based on the fashioning of zoospores within the sporangium proper. However, the sporangial apical structure and the methods of zoospore discharge are so unique that Waterhouse et al. (1983) excluded them from the genus Phytophthora.

As a result of a comparative study of all species of Phytophthora in culture at the American Type Culture Collection, Rockville, Maryland, we have arrived at a similar conclusion that these marine forms are distinct enough to be considered belonging to a new genus of the Pythiaceae based on the following reasons:

- (1) Whereas zoospores of Phytophthora are always released naked or in a quickly evanescent vesicle, the marine forms displayed different methods of zoospore emission. Thus P. vesicula releases zoospores in a semi-persistent vesicle which ruptures by the inversion of an internal plug. Zoospores of P. bahamensis, P. epistomium, P. mycoparasitica and P. spinosa are liberated upon the ejection of a plug within a dehiscence tube. Phytophthora operculata discharges the zoospores by means of an apical operculum but P. avicennae, P. batemanensis and P. polymorphica usually release them from a persistent vesicle.
- (2) The apex of sporangium of Phytophthora may be papillate, semi-papillate or non-papillate with a translucent, thick to very shallow apical thickening which eventually dissolves or becomes the evanescent vesicle. Although the sporangia of P. vesicula were described as papillate, the apex is occupied by a characteristic plug. The other marine species were described as nonpapillate, but unlike all other species of Phytophthora with nonpapillate sporangia, internal proliferation of sporangium was never observed and instead, the base of the empty sporangium was often conspicuously plugged.
- (3) While the sporangia of Phytophthora are smooth-walled and typically limoniform, obpyriform, ovoid to ellipsoidal, the sporangia of P. spinosa and P. mycoparasitica have spines on the surface and the sporangial shape of most marine species exhibit a wide variety of forms unknown for the genus.
- (4) With the exception of the rare occurrence of spherical oogonia with paragynous antheridia in the original description of P. vesicula, the sexual stage is unknown in all marine species. The amphigynous antheridium characteristics only of Phytophthora and the monotypic Trachysphaerella (Waterhouse, 1973) has never been found.

- (5) The great majority of Phytophthora species have hyphal diameters measuring 5-8 μm . Blackwell (1949) stated that the commonest diameter of young and vigorously growing hyphae was 5 to 8 μm while Waterhouse (1973) determined the average hyphal diameter for the genus as 6 μm . The marine forms shows a much wider range in hyphal diameters. The very narrow hyphae of P. bahamensis and P. epistomium (1-3 μm), and the broad hyphae of P. spinosa var. lobata and P. operculata (10 and 10-12 μm , respectively) are either well below or well above the norm for the genus Phytophthora. In most cases, hyphal branching was very irregular, unlike the free branching at wide angles characteristic of most Phytophthora spp.
- (6) Most marine species produce slow growing (1-5 μm per day at 20 °C) compact, appressed, finely rosette or petaloid colonies on clarified V8 juice agar medium, different from the floral colonies with larger sectors and various degree of fluffiness, produced by some fast growing Phytophthora spp.
- (7) Most Phytophthora species produce a characteristically firm rot in apple fruit (Ribeiro, 1978), but the marine forms produced a soft rot similar to that due to Pythium (Luo et al., 1987).
- (8) Nearly all species of Phytophthora are plant pathogens (Waterhouse, 1973). With the exception of P. mycoparasitica which is parasitic on other marine fungi, all marine forms are primarily saprophytic.

According to Waterhouse (1973), the Family Pythiaceae consists of eight valid genera: Pythium, Phytophthora, Trachysphaera Tabor et Bunting, Zoosphaera Sommerst, Diasporangium Höhnk, Sclerophthora Thirum. et al., Peronophythora Chen ex Ko et al., and Pythiogeton Winden. While Peronophythora has been reclassified in a family Peronophytoraceae (Ko, et al., 1978) Sclerophthora has been transferred to Peronosporaceae (Shaw, 1978). The descriptions of Diasporangium and Zoosphaera are incomplete and the inclusion of these genera in the Pythiaceae is only provisional. Trachysphaera and Pythiogeton are considered distinct from Phytophthora based on the spiny conidia forming no zoospores in the former and irregular, large sporangia with a long discharge tube in the latter. Undoubtedly, the marine species are at least as distinct, if not more distinct from Phytophthora as Trachysphaera and Pythiogeton and a new genus name is clearly warranted. We propose Halophytophthora to reflect its similarity with the genus Phytophthora in the production of zoospores within the sporangium and to highlight their significant differences.

Halophytophthora Ho et Jong, gen. nov.

Fungus marinus submergus, saprophyticus vel parasitus. Hyphae hyalinae, ramosae, teretes, demum raro septatae, 1-6 μm diam. Chlamydosporae ratae vel non exhibitae. Sporangio-phora intramatricalia aut extramatricalia. Sporangia haud decidua, plures formas habent, lageniformia, obpyriformia ad multilobata, auricula, bursiformia, globosa ad ovata, non papillata ad papillata. Zoosporae in sporangio effectae, ubi incystatae vel vesiculam aliquando migrantes. Vesicula absens vel praesens, persistans ad subpersistans, fistulan emissionis efficiens inversione obturamenti interioris. Tubus dehiscens prominens epistomio. Oogonia rata vel non exhibitata, trevia, globosa, hyalina, rubida in aetata. Antheridia paragyna. Oosporae unicae, fulvae in aetate, parietibus crasis, levia, globosa.

Mycelium saprophytic or mycoparasitic in sea water. Hyphae hyaline, smooth to irregular, 1-2 μm wide, with or without swellings, coenocytic. Sporangia non-deciduous, shapes highly variable, spherical, ovoid, obpyriform, auricular, bursiform, lageniform, obpyriform to multilobed, under 50 to over 100 μm long, non-papillate to papillate without translucent apical thickening, sporangial wall smooth or spiny. Zoospores are formed within the sporangium and released in a persistent vesicle or a semi-persistent vesicle ruptured by the inversion of an internal plug; by the ejection of a plug within a dehiscence tube or by the opening of an apical operculum. Chlamydospores rare or unknown.

Oogonia absent or rare, smooth, globose, hyaline, dark brown with age (32.1-) 46.3 (-59.7) μm with paragynous antheridia (15.0-) 20.5 (-25.0) μm x (7.5-) 9.0 (-12.5) μm and single smooth thick walled spherical oospore (29.7-) 42.2 (-49.4) μm , yellowish brown with age.

Type species. Halophytophthora vesicula (Anastasious et Churchland) Ho et Jong, comb. nov.

= Phytophthora vesicula Anastasiou et Churchland. Can J. Bot. 47: 251. 1979.

Additional species. --

Halophytophthora avicennae (Gerrettson-Cornell et Simpson) Ho et Jong, comb. nov.

= Phytophthora avicennae Gerrettson-Cornell et Simpson. Mycotaxon 19: 453. 1984.

- Halophytophthora bahamensis (Fell et Master) Ho et Jong,
comb. nov.
- = Phytophthora bahamensis Fell et Master. Can. J. Bot.
53: 2908. 1975.
- Halophytophthora batemanensis (Gerrettson-Cornell et
Simpson) Ho et Jong, comb. nov.
- = Phytophthora batemanensis Gerrettson-Cornell et
Simpson. Mycotaxon 19: 453. 1984.
- Halophytophthora epistomium (Fell et Master) Ho et Jong,
comb. nov.
- = Phytophthora epistomium Fell et Master. Can. J. Bot.
53: 2908. 1975.
- Halophytophthora mycoparasitica (Fell et Master) Ho et
Jong, comb. nov.
- = Phytophthora mycoparasitica Fell et Master. Can. J.
Bot. 53: 2908. 1975.
- Halophytophthora operculata (Pegg et Alcorn) Ho et Jong,
comb. nov.
- = Phytophthora operculata Pegg et Alcorn. Mycotaxon 16:
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Simpson) Ho et Jong, comb. nov.
- = Phytophthora polymorphica Gerrettson-Cornell et
Simpson. Mycotaxon 19: 453. 1984.
- Halophytophthora spinosa var. lobata (Fell et Master) Ho
et Jong comb. nov.
- = Phytophthora spinosa var. lobata Fell et Master. Can.
J. Bot. 53: 2908. 1975.
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Ho et Jong, comb. nov.
- = Phytophthora spinosa var. spinosa Fell et Master.
Can. J. Bot. 53: 2908. 1975.

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**A MONOGRAPH OF THE DISCOMYCETE GENUS
STROSSMAYERIA (LEOTIACEAE), WITH COMMENTS ON
ITS ANAMORPH, PSEUDOSPIROPES (DEMATIACEAE)¹**TERESITA ITURRIAGA² and RICHARD P. KORF³*Plant Pathology Herbarium, Cornell University, Ithaca, NY 14853, USA*

ABSTRACT

Sixteen species are recognized and characterized, of which 9 are new combinations (*Strossmayeria alba*, *S. alnicola*, *S. atriseda*, *S. bakeriana*, *S. confluens*, *S. immarginata*, *S. introspecta*, *S. jamaicensis*, *S. sordida*), and 5 are new species (*S. dickorfii*, *S. japonica*, *S. nigra*, *S. notabilis*, *S. ochrospora*). A dichotomous key to the included species is provided, as well as a map of the world distribution of the recognized species of the genus, which has also been called *Leptobelonium* and has regularly been confused with *Gorgoniceps*. A *Pseudospiropes* anamorph (in early publications referred to *Helminthosporium*) is associated with all but one species (*S. nigra*). All species occur on woody substrates (including some larger bamboos and woody parts of fruits) as saprophytes. The tiny apothecia (usually less than 1 mm diam) are easily overlooked, and their presence is often only detected by noting the anamorph forming extensive, black patches on the substrate. The genus is characterized by a rare phenomenon in Ascomycetes: ascospores (and some apothecial tissues as well) that turn blue in iodine mounts. The ascus pore is non-reactive in iodine.

KEYWORDS: *Strossmayeria*, *Leptobelonium*, *Gorgoniceps*, *Pseudospiropes*, *Helminthosporium*, Inoperculate Discomycetes, Leotiaceae, Dematiaceae

¹ Based primarily on the senior author's dissertation presented to the Graduate School of Cornell University, Ithaca, NY, in partial completion of the requirements for the Ph.D. degree conferred January, 1990.

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INTRODUCTION

The objective of this study is to monograph the genus *Strossmayeria* Schulzer (1881), for which no monograph has previously been published, by delimiting the genus and determining how many species belong in it. The genus is most unusual in possessing ascospores that blue in iodine mounts, a feature that occurs in very few other Ascomycetes and perhaps no other Discomycetes. Another feature of major interest is that it is the only Discomycete genus known to possess a dematiaceous anamorph belonging to *Helminthosporium* sensu lato. The anamorphs which connect to *Strossmayeria* are now more correctly referred to the genus *Pseudospiropes* Ellis (1971) (Iturriaga, 1984). An earlier study was made of the type specimens of species assigned to *Strossmayeria* (Iturriaga, 1984a). Of the seven species that had previously been assigned to the genus, three were excluded (Iturriaga, 1984).

Strossmayeria belongs to the order Helotiales, family Leotiaceae (Discomycetes). Its members are saprophytes on wood, frequently decorticated wood, and are almost always found in association with their anamorphs. This constant association was noted long ago, as pointed out by Iturriaga & Korf (1984). Whether the discomycete and the hyphomycete represented different morphs of a single species or one fungus parasitic on another was long a subject of speculation. Single-ascospore cultures of five collections referable to at least two species of *Strossmayeria* consistently yielded cultures belonging to *Pseudospiropes*, proving these to be teleomorphs and anamorphs, respectively, of the same holomorphs (Iturriaga & Korf, 1984). Production of apothecia of any species of the genus in axenic culture has yet to be achieved, despite repeated attempts on a variety of natural and artificial substrata and of environmental conditions.

For this monograph most of the available specimens of *Strossmayeria* from different parts of the world were studied. Since most of the type specimens of species that have been assigned to the genus *Strossmayeria* are from temperate areas, special effort was devoted to collecting in tropical and subtropical areas and to studying dried herbarium specimens from these areas. A major objective was to collect and/or obtain dried herbarium specimens collected in as many microecological niches and geographical environments as possible.

MATERIALS AND METHODS

This study was performed with dried herbarium specimens and with fresh specimens collected by other mycologists and by ourselves in tropical, sub-tropical, and temperate regions of Africa, Asia, Australasia, Europe, North America, and South America. Type specimens of species assigned to the genus *Strossmayeria* and to many other genera (*Belonidium*, *Belonium*, *Gorgoniceps*, *Leptobelonium*, etc.), which by the

description could possibly fall in this genus, were borrowed from many herbaria. Herbaria in the United States, Canada, and Europe were visited in order to search under different generic names for collections possibly assignable to *Strossmayeria* or *Pseudospiropes*. When possible, cultures were made from collected specimens. From some areas in which it was not possible to collect, specimens from herbaria in the area were borrowed.

Field collections, consisting of substrate with attached apothecia, were placed in small paper bags or glassine envelopes. Many specimens were later cultured. When isolations were done in the field, the specimens were prepared for deposit in the herbarium by being transferred to glassine envelopes and placed in a gas-heated or electric-heated portable field drier for approximately 10 hours. In other instances, specimens were returned to the laboratory, where the isolations were done, and specimens were then placed in a herbarium drier at 40 C for 1 day.

For obtaining cultures of *Strossmayeria*, 50 mm diam plastic Petri dishes with 2% water agar containing chloramphenicol and streptomycin⁴ were used. A small block of agar was removed from the center of the dish and attached to the inside of the lid, near the edge, with a sterile scalpel. An apothecium was placed upright on this agar cube, where it would adhere, and the lid was replaced so that the hymenium of the apothecium faced the agar. Every few hours the agar beneath the apothecium was examined for ascospores. For these observations, the surface of the agar in the Petri dish, sealed with Parafilm, was scanned under a dissecting microscope at a low ($\times 25$) magnification. If ascospores were present, the area was marked by scratching a circle on the exterior of the bottom of the dish, and the lid was rotated, so that newly discharged ascospores would not land among those previously discharged. This process was repeated until ascospores were discharged sufficiently at some distance from each other so they could easily be picked up individually.

Ascospores were then transferred with a fine needle, while focussing on them at $\times 40$ magnification. Each ascospore was placed in an individual Petri dish with Difco Bacto corn meal agar (CMA), and sealed with Parafilm. The fungus was permitted to grow under ambient light at room temperature.

Dried specimens were prepared for microscopy as follows. They were first rehydrated by placing a drop of 95% ethyl alcohol, followed by one or two drops of distilled water, on the specimen. The portion of the specimen selected consisted of a few representative apothecia, one to be sectioned and the others to be squashed, attached to their substrate. One apothecium with 1-2 mm² of substrate was removed and placed carefully inside a small slit made in a cube of water agar, to serve as support. This cube was then placed carefully on the freezing stage of a sliding microtome, in a position such that the point of attachment of the apothecium would be the first thing to be touched by the blade. The cube was covered by 50% aqueous commercial mucilage, frozen, and 15 μ m

⁴ 20 g agar, 1000 ml water, 300 mg chloramphenicol, autoclaved at 15 lb pressure for 20 min; when cooled to 40 C 7.5 mg streptomycin sulfate added.

vertical sections were made. Sections were removed from the blade with a small, wet brush and placed on a microscope slide, where they were left to air-dry. Median sections were chosen under the dissecting microscope, and after a drop of water was added, each of the sections was transferred with an insect pin to a slide to be mounted in soluble blue 706-lactic acid,⁵ 2% aqueous KOH followed by 1% aqueous phloxine, or Melzer's reagent⁶ without KOH pretreatment. For each specimen, squash mounts and sections were mounted in each of the three reagents and in water for observation of structures, tissues, and reactions.

Melzer's reagent was used to observe the amyloid reaction of the ascospores and ectal excipulum. This reaction is characteristic of the genus. It will be referred to as "J+" throughout the text, and indicates that the tissue or structure turns blue when exposed to the Melzer's reagent. This reagent was chosen after comparing the intensity of the J+ reaction in Lugol's solution,⁷ IKI,⁸ and Melzer's reagent, with tissues rehydrated in 2% KOH, 10% KOH, or water. Melzer's proved to be the reagent in which the amyloid reaction was seen most clearly.

Congo red was used as a stain for observing ascus walls. This technique was devised by Imshaug⁹ (pers. comm. to R. P. Korf) for demonstrating double walls in lichens.

KOH pretreatment tests were performed with 2% and 10% KOH, to see if rehydration of the tissue with either of these KOH concentrations caused variation in the presence or intensity of the J+ reaction of the tissues and structures, compared with rehydration with water. The variation in the reaction with and without KOH pretreatment has been recorded by different authors (Kohn & Korf, 1975; Nannfeldt, 1976; Baral, 1987). This comparison was done with several collections, but no differences associated with KOH concentration were observed. The same J+ reaction of the ascospores and ectal excipulum occurred with water and with 2% or 10% KOH pretreatment. Therefore subsequent rehydration was done with water. This had an additional advantage, because we had observed that when KOH rehydration was used, extreme swelling of the gel layer covering ascospores and conidia occurred.

Soluble Blue 706-lactic acid and KOH-phloxine were used to observe structures and tissues in sectioned and squashed material. Both, due to their properties as cytoplasmic stains, proved useful in ascertaining numbers of septa in the ascospores.

Whenever possible 30 measurements were recorded for each kind of structure for each specimen examined. All structures were measured in a

⁵ 0.05 g Soluble blue 706 (Hopkins & Williams, "Revector") [Poirrier's Blue], 30 ml lactic acid.

⁶ 100 g chloral hydrate, 5 g KI, 1.5 g Iodine, 100 ml water.

⁷ 2 g KI, 1 g Iodine, 300 ml water.

⁸ 1 g KI, 1 g Iodine, 100 ml water.

⁹ 1 g Congo red, 100 ml distilled water. Stain for a few minutes on slide, heat slightly by passing slide over flame 10 times, add one drop of 0.1% aqueous HNO₃, add cover slip and observe under microscope.

straight line between apex and basal point, or between the two widest points. Curves made by the structures were not taken into account. The thickness of the gel layer was measured at the side of the ascospore or conidium, not at the tip, where it is usually thicker. Only asci that contained mature ascospores were measured. Conidiophores were measured at their widest part, and at their base.

Structures were measured and drawn with a calibrated ocular micrometer in an Olympic standard research microscope equipped with a Wild drawing tube. Structures were measured in Melzer's reagent or Soluble Blue 706-lactic acid. Photomicrographs were made with a camera mounted on a Zeiss WL microscope. Colors of structures are given for rehydrated material, unless otherwise specified.

Terminology used follows Korf (1952, 1973). Abbreviations of herbarium names follow *Index Herbariorum* (Holmgren, et al., 1981). Specimens in the personal herbarium of Professor Richard Korf are marked "R.P.K." Abbreviated literature citations follow *Botanico-Periodicum-Huntianum*, *B-P-H* (Lawrence, et al., 1968) and *Taxonomic Literature* (Stafleu & Cowan, 1976-1988). Throughout this monograph, the *International Code of Botanical Nomenclature* (Greuter, et al., 1988) has been followed.

The sign (!!) indicates that holotype, neotype, or isotype material has been examined. The sign (!) indicates that syntype, paratype, or other authentic material has been examined.

A question mark before a species name means material has not yet been examined, though placement of the name in the synonymy is probable.

Species names placed inside square brackets have not been validly published.

Specimens examined are cited with the data exactly as they appear on the packet label, except that information that is enclosed in square brackets is either from the description or from the herbarium where the specimen is housed. Collections are separated in the listings by semicolons.

Other abbreviations used are HT for holotype, IT for isotype, PT for paratype, and NT for neotype.

MORPHOLOGY OF *STROSSMAYERIA*

Strossmayeria Schulzer is a genus of sub-sessile to sessile inoperculate discomycetes. The genus is assigned to the order Helotiales, family Leotiaceae. Its species are saprophytes on decorticated wood, or rarely on large grasses and bamboos, or woody parts of fruits.

1. APOTHECIA

The apothecia are usually turbinate (though in a few species the shape is discoid or discoid to turbinate), sub-stipitate to sessile, and connected to

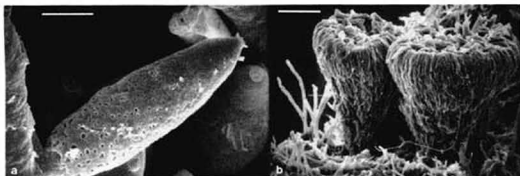


Figure 1. Scanning electron micrographs of conidia and apothecia of *Strossmayeria introspecta*, CUP 59716. a, Conidia of *Pseudospiropes* anamorph of *S. introspecta*, borne on conidiophore (left), scale bar = 5 μm . b, Apothecia, with conidiophores arising from basal mycelium, scale bar = 50 μm . Both SEM micrographs from unfixed, freeze-dried material.

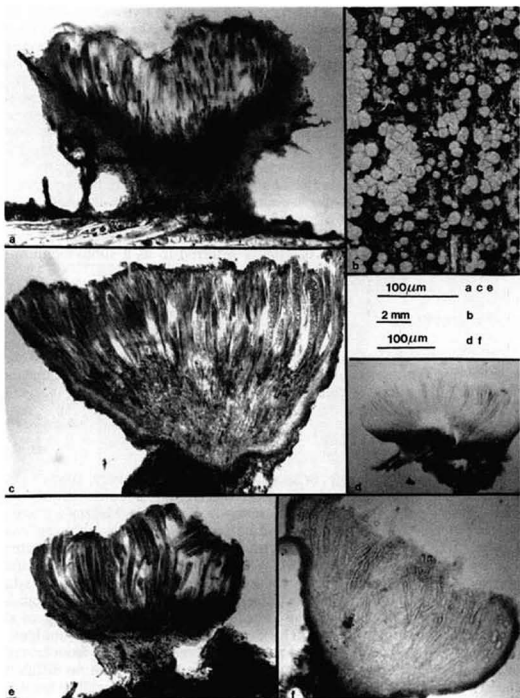
the substrate by a small point of attachment. They range usually from 0.2 to nearly 1 mm in diameter, but in *S. atriseda* the apothecia reach more than 1 mm in diameter (Fig. 1b). The apothecia can be solitary, gregarious, and very frequently confluent. When confluent, the apothecia lose their individuality, and two or many merge together (Fig. 2b). They are usually pale colored externally, lighter toward the apex and darker toward the base of the receptacle. The upper part of the receptacle is usually concolorous with the disc, or the disc may be slightly paler. The disc can be white, cream colored, yellow, beige, or grayish to pearl-colored. *S. ochrospora* has light brown apothecia. Two species, *S. atriseda* and *S. japonica*, have completely dark brown apothecia, and *S. nigra* has black apothecia. The disc of all species is smooth to slightly granulose or pruinose, but this character varies according to environmental conditions and the state of the specimen, and is not due to variation among species.

A ring left on the base of the apothecia when removed from substrate resembles the ring observed in the genus *Calycellina* Höhnel.

2. ECTAL EXCIPULUM

The ectal excipulum is composed of *textura oblita* in most cases (in *S. nigra* it is *textura oblita* to *porrecta*), formed by rectangularly shaped elongated cells, with a thin gel layer between them (Fig. 3a-c). This gel layer has a "glassy" appearance when seen under the microscope. A similar gel layer surrounds nearly all structures of this fungus. In a longitudinal section, it is frequently difficult to see the difference between

Figure 2. Apothecia: a, *Strossmayeria alba*, HT; b, f, *S. introspecta*, CUP 59713; c, *S. notabilis*, HT; d, *S. bakeriana*, *S. ostoyae* HT; e, *S. basitricha*, *G. pilatii* HT.



the inner ectal excipulum and the paraphyses in the hymenium, since they are very similar. The external ectal excipulum has the same colors as the apothecium, the upper part usually being white, cream, or beige, and the basal part being concolorous with the upper part or turning brown toward the base, one third of the way down the apothecium or just near the point of attachment. The inner ectal excipulum is hyaline. The ectal excipulum is J+, blueing throughout usually but in a few cases not blueing homogeneously. The intensity of the blue reaction varies but is not a character for distinguishing species. The surface of the apothecium is smooth, and this is well seen in section (Fig. 2), since the cells of the ectal excipulum are arranged in a palisade, with the axis of the cells parallel to the outer surface of the apothecium. The excipulum at the base of the apothecium is composed of round to irregular dematiaceous cells. The medullary excipulum is indistinguishable, and the small amount of tissue that can sometimes be seen is usually referred to as a subhymenium of *textura intricata*, also hyaline.

3. PARAPHYSES

Paraphyses are long and slender, simple or divided, septate or not, with swollen tips, hyaline, and the same height as the asci or a little longer. At times they may produce phialides bearing phialospores.

4. ASCI

Asci are usually clavate, or saccate in the case of several species (Fig. 3d-f, 8-11, 13, 15-19, 22-24). They are hyaline but have dextrinoid contents when young. The dextrinoid reaction is seen in Melzer's reagent. When the asci are immature, the dextrinoid reaction is light, and asci appear light brown. This color becomes darker when spores are forming and are young (with a few septa). When asci and ascospores are mature (the spores fully septate), the brown color is seen in some cases, but when the ascus lumen is completely occupied with the ascospores, this reaction disappears, or at least is hidden because of the strong blueing of the ascospores that fill the ascus. The dextrinoid reaction is not evident in mature asci that have discharged their ascospores. Asci arise from croziers or repeating croziers, which in most cases can be seen with no difficulty, and are unitunicate though they have a thick, very evident wall. Because of this thick wall, and because *Strossmayeria* connects with *Pseudosporopetes*, which has thick-walled dematiaceous conidia, we suspected that the ascus might be bitunicate. A technique devised by Prof. Henry Imshaug (obtained by pers. comm. to Dr. Richard P. Korf) using Congo red as a stain for demonstrating double walls in lichens was used. We saw no bitunicate asci, and concluded that *Strossmayeria* has unitunicate asci.

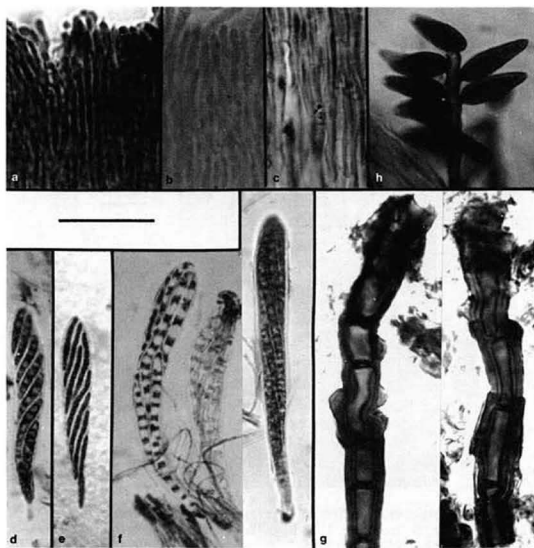


Figure 3. Ectal excipulum, asci, and conidiophores: a-c, ectal excipulum. a, *Strossmayeria bakeriana*, *S. ostoyae* HT; b, c, *S. notabilis*, b, CUP-VE 4336; c, IA 380550 (Martin 6067). d-f, asci. d, *S. atriseda*, HT; e, *S. confluens*, R.P.K. 2017 [ex HT]; f, *S. notabilis*, HT. g, h, conidiophores. g, *S. atriseda*, HT; h, *S. introspecta*, CUP 59716. Scale bar = 20 μ m for a, b, c, g, = 50 μ m for d, e, f, h.

5. ASCOSPORES

Ascospores are usually cylindrical-clavate, with the broad end toward the apex of the ascus (Fig. 4). In *S. atriseda*, the ascospores are subfusoid. Ascospores are hyaline, but in *S. ochrospora*, in which the lateral and septal walls are pale brown, the ascospore is pale ochraceous brown.

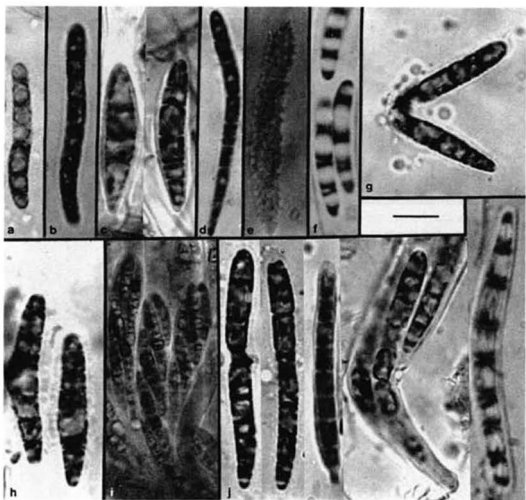


Figure 4. Ascospores of different species: a, *Strossmayeria alba*, HT; b, *S. alnicola*, HT; c, *S. atriseda*, HT. d, *S. bakeriana*, *S. longispora*, HT; e, *S. confluens*, R.P.K. 2017 [ex HT]; f, *S. introspecta*, CUP 59716; g, *S. sordida*, lectotype; h, i, *S. jamaicensis*, R.P.K. 3019 [ex HT], h, note enlarged refractocells, i, asci containing ascospores; j, *S. notabilis*, note disintegrating cells, first three spores and ascus containing spores IA 380550 (Martin 6067), right hand spore HT. Scale bar = 10 μ m, except i = 25 μ m.

Ascospores can be biseriata, but are most frequently multiseriata, arranged in a helix in the ascus. When mature, the ascospores are usually three-septate in *S. introspecta*, four-septate in *S. immarginata* and four- to five-septate in *S. atriseda*, three- to seven-septate in *S. dickorffii*, and mostly 7-septate in the remainder of the species. The cells in the ascospore are usually uniform, but in some of the tropical species certain cells have refractive contents different from the other cells of the same ascospore. These cells do not turn blue in Poirrier's Blue. The refraction is also evident in 2% KOH, and, less so, in Melzer's reagent. These cells are here termed "refractocells." They are present in *S. confluens*, *S. jamaicensis*,

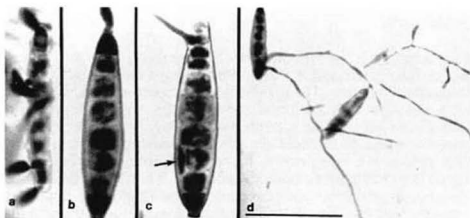


Figure 5. Germinating ascospore and conidia: a, *Strossmayeria basitricha*, germinating ascospore, CUP 61824; b-d, *S. bakeriana*, CUP 59717, germinating conidia. b, c, one day after discharge on agar (arrow shows internal germination hypha); d, three days after discharge on agar. Scale bar = 20 μm for a, b, c, = 50 μm for d.

and *S. sordida*. In *S. jamaicensis* the refractocell is enlarged. Some tropical species such as *S. confluens* also have cells that disintegrate. These cells, termed in this paper "disintegrating cells," are located in the ascospore and leave an empty space where the ascospore bends and later breaks, leaving short (2-, 3-, or 4-celled) ascospore segments (fig. 4g, j).

Ascospores in all species are surrounded by a gel layer. This layer in temperate species is usually smooth and always less than 1.5 μm thick. For tropical species the gel layer is thicker, usually verrucose, as in *S. confluens*, but smooth in *S. sordida*.

The amyloid (J+) reaction of the ascospores is characteristic of this genus and occurs in all the species. The blue reaction of the ascospores is generally lighter than that of the ectal excipulum. The length of time this reaction lasts is not clear. In some cases it shows immediately after the drop of Melzer's reagent is added, and then it disappears. Sometimes after disappearing, if more Melzer's reagent is added, the reaction is seen again. In other cases, the reaction is seen for hours and may or may not be recoverable by adding more reagent. Similar variability occurs in duration of the J+ reaction of the ectal excipulum, though the way ectal excipulum and ascospores react to the reagent is not always the same.

Germination of ascospores both inside the ascus and after discharge is quite frequent. This germination occurs by formation of a germ tube in all cases observed in European material. In North American species, in many instances ascospores germinate forming an apical phialide and phialospores, but occasionally basal and lateral phialides may also form (Fig. 5a). Germination by formation of germ tubes was also observed in North American species, but has rarely been observed in tropical material.

6. ANAMORPH

The anamorph of species of *Strossmayeria* is always a *Pseudospiropes* (Iturriaga & Korf, 1984). These morphs may or may not occur together in nature. The apothecia seem to occur at particular times of the year, and when they are found, the anamorph is almost always present. The condition of the anamorph varies, however. Very frequently conidiophores but no conidia are present, indicating that the time of conidial production was prior to the time of collection. Frequently the anamorph is found by itself with no apothecia.

Pseudospiropes is a dematiaceous, wood-inhabiting hyphomycete. The conidiophores (Fig. 3, g-h) are macronematous, mononematous, arising from a mass of rounded or elongated brown cells, simple, slightly flexuous or flexuous, thick-walled, and septate. All cells are dark brown except the conidiogenous cells, which are lighter and located toward and at the apex of the conidiophore. The conidiophore bears conspicuous cicatrized scars, that protrude grossly in *P. nodosus*, but are smaller and less protruding in *P. simplex* and other species. These scars turn darker and thicker as the conidiophore becomes older, due to more wall deposition. The conidiogenous cell is polyblastic, integrated, usually terminal, sympodial or percurrent, and also bears scars that are lighter than the conidiophore. The base of the conidiophore is swollen. The conidiophore is also surrounded by a gel layer that stains blue in Soluble Blue 706-lactic acid. Neither this gel nor any of the gel layers seen surrounding *Strossmayeria* ascospores or conidia of *Pseudospiropes* stain in Melzer's reagent. Conidia are usually fusiform, truncate at the base and tapering toward the apex, though they may be fusiform with one flat side in the anamorph of *S. dickorfi* and *S. jamaicensis*, and obclavate in *S. notabilis*. In some cases the basal cell of the conidium is a pedicel-like cell, as in *S. introspecta* (Iturriaga and Israel, 1985). There are characteristic dark cells in the conidia of some species. These may be basal, basal and apical, below the basal and/or apical cell, or central. In addition to or instead of dark cells, dark septa occur quite frequently in the conidia, usually as the basal and apical septa, or close to them. In one species, *S. josserandii*, a characteristic darker thickening around the septal pore in the conidia is found invariably, and this structure is referred to here as a "torus" (Fig. 6g, 21a-b). The conidial wall surface is always pitted (Fig. 1a) and markings on the surface show clearly in transmission electron microscopy (TEM) and scanning electron microscopy (SEM) photographs (Iturriaga & Israel, 1985). The wall of the conidium is up to 2 μm thick and multilayered. More than 8 wall layers were shown by them in TEM micrographs of one species of *Pseudospiropes*. Under the light microscope, the cell lumen is clearly seen, and it is very small compared to the conidial dimensions. Most of the conidium is occupied by the wall. Like the ascospores, conidia also are surrounded by a gel layer. Under some conditions this layer forms an apical thickening that is referred here to as a "bleb." This is best seen under SEM.

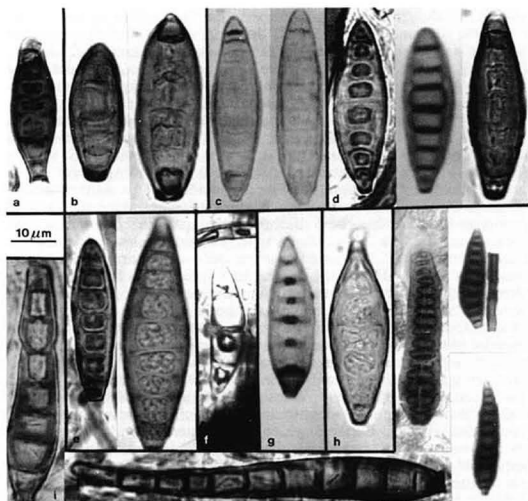


Figure 6. Conidia of different species: a, *Strossmayeria alnicola*, HT; b, *S. atriseda*, HT; c, *S. bakeriana*, left spore *S. longispora*, HT, right spore *S. ostoyae*, HT; d, *S. basitricha*, left spore HT, central spore Kew, Twycross 302, right spore *G. pilatii*, HT; e, *S. introspecta*, left spore R. P. K. 1709, right spore CUP 59716; f, *S. jamaicensis*, HT; g, *S. josserandii*, HT; h, *S. sordida*, Isolectotype; i, *S. notabilis*, left and bottom spore HT, three spores on right CUP-VEN 4336.

Septa in the conidia are eusepta or pseudosepta, and because the difference is very difficult to see, they will all be called septa here. The septal number varies among species and is thus a useful taxonomic character (Fig. 6). For example, the conidia of *S. japonica* have 3-6 septa, those of *S. jamaicensis* 5, those of *S. alnicola* 5-7, and those of other species 7-11.

Germination of conidia (Fig. 5b-d) begins frequently from the apical cell, as an enlargement of the "bleb", when this is present, or of the apical portion of the cell. Other cells of the conidium are also frequently seen germinating by a phenomenon called here "internal germination." This

consists of the growth of a germ tube inside the conidium, arising from one of the cells and growing toward the apex or base alongside the lumen of the adjacent cell or cells until it reaches a break in the conidial wall. It is frequently seen still inside the spore (Fig. 5c, arrow). The conidiophore has also been seen producing hyphae from one of the extremes of the conidiophore.

This monograph makes no attempt to delimit the form species that are the anamorphs of *Strossmayeria* species. The type species of *Pseudospiropes*, *P. nodosus* (Wallr.) Ellis, has as its teleomorph *S. atriseda* (Saut.) Iturriaga, characterized by grossly protruding scars on the conidiophore, and wide basal scars on the conidium. This is the first report of the teleomorph of that species. A similar species of *Pseudospiropes* occurs as the anamorph of *S. dickorffii* Iturriaga. We have termed such species as having a "*P. nodosus* type" of conidiophore. Species with conidiophores with less protruding scars and usually narrower basal scars on conidia are referable to the *P. simplex* (Kunze) Ellis complex, a group unresolved taxonomically as yet. We have referred to such species as having a "*P. simplex* type" of conidiophore. A major authority on the species in this genus, Dr. S. J. Hughes, has identified as *P. simplex* material in which we have found teleomorph specimens referable in some cases to *S. bakeriana* and in other cases to *S. basitricha*. We list a full synonymy of *P. simplex* only under *S. basitricha*, referring under *S. bakeriana* to that synonymy. The only other species of *Pseudospiropes* that we feel confident of identifying at this point is the anamorph of *S. josserandii* (Grelet) Bertault, which is characterized by the torus at the conidial septa mentioned above, *P. josserandii* (Bertault) Iturriaga. One species of *Pseudospiropes*, *P. longipilus* (Corda) Hol.-Jech., is said to be the anamorph of a pyrenomycete, *Moriola descensa* Norman (Eriksson, 1981) [= *Melanomma subdispersum* (Karst.) Nerl. & Vogl. (Ellis, 1976)]; we seriously doubt any close relationship of this *Pseudospiropes* to the species we have studied, and believe that *Pseudospiropes* needs redefinition to exclude such species. Many other species of *Pseudospiropes* have been described in recent literature, and a monographic study of this genus is clearly necessary to delimit species. The generic name should surely be held for those species which produce a *Strossmayeria* teleomorph.

TAXONOMY OF STROSSMAYERIA

1. GENERIC DIAGNOSIS OF STROSSMAYERIA (*Status Teleomorphosis*)

STROSSMAYERIA Schulzer von Müggenburg, *Oesterr. Bot. Z.* **31**: 313. 1881, emend. Iturriaga, *Mycotaxon* **20**: 172-173. 1984.

Holotype: *Peziza heterosperma* Schulzer, *Oesterr. Bot. Z.* **28**: 320. 1878, (\equiv *Strossmayeria rackii* Schulzer, *Oesterr. Bot. Z.* **31**: 313. 1881, a superfluous name based on the same type specimen).

= *Leptobelonium* Höhn., *Sitzungsber. Kaiserl. Akad. Wiss. Wien, Math.-Naturwiss. Kl., Abt. 1*, **132**: 112. 1923.

Holotype: *Peziza 'helminthicola* Bloxam in Höhn.' (= *Belonidium basitrichum* Sacc.).

Apothecia superficial, sessile or with a short point of attachment, generally smaller, but up to slightly more than 1 mm in diameter, turbinate or discoid, exuding a yellow substance in 2-10% aqueous KOH. Receptacle surface smooth, white, whitish, yellow, light brown, grayish, brown, or black, darker toward the base. Disc concolorous with, or paler than upper receptacle, disc smooth, pruinose or slightly granulose. Hymenium hyaline. Ectal excipulum of *textura oblita* with glassy walls, composed of thin parallel hyphae 1.5-3.0 μm wide, axes of cells parallel to outer surface, cells concolorous with receptacle in its outermost layers, and hyaline in its inner layers, usually all J+ (amyloid blue reaction to Melzer's reagent) with or without pretreatment in 2-10% aqueous KOH. Base of the excipulum composed of rounded to irregular or elongated dematiaceous cells. Medullary excipulum and subhymenium almost indistinguishable from ectal excipulum. Paraphyses long and slender, with swollen tips, hyaline, simple or divided, with or without septa. Asci 8-spored, occasionally 6-spored, clavate or saccate, hyaline when mature, but frequently with brownish to brown dextrinoid contents when young, thick-walled, unitunicate, arising from croziers. Ascospores cylindrical-clavate or subfusoid, from 3- to 7-septate, rarely more than that, cells uniform or enlarged, with or without refractocells and/or disintegrating cells, biseriate to usually multiseriate, J+, generally hyaline, rarely yellow-brown, surrounded by a gel layer which may be thin or thick, smooth or verrucose. Saprophytes on wood, woody portions of fruits, or rarely large grasses or bamboos. Anamorph generally present and always referable to the genus *Pseudospiropes* Ellis.

Etymology: Named for Bishop Strossmayer.

2. GENERIC DIAGNOSIS OF *PSEUDOSPIROPES* (*Status Anamorphosis*)

PSEUDOSPIROPES Ellis, *Dematiaceous Hyphomycetes*, p. 258. 1971.

Holotype: *Helminthosporium nodosum* Wallr.

Conidiophore macronematous, mononematous, arising from a mass of rounded or elongated brown cells, simple, slightly flexuous or flexuous, thick-walled, septate, brown, lighter toward the apex. Conidiophore base slightly swollen to swollen. Conidiogenous cells polyblastic, integrated, terminal or intercalary, sympodial, cylindrical, flexuous, bearing protruding, cicatrized scars, lighter than the rest of the conidiophore. Conidia solitary, dry, acropleurogenous, simple, fusiform, fusiform with one flat side, or obclavate, truncate at the base, tapering toward the apex, dematiaceous, 3-11-septate or pseudoseptate.

Etymology: From the Greek, *pseudo-*, false, plus the generic name *Spiropes* Cifferi.

3. KEY TO THE SPECIES OF *STROSSMAYERIA*

1. Apothecial receptacle pure white, cream-colored, yellowish, pale brown or light gray when rehydrated 2
- 1'. Apothecial receptacle brown to black when rehydrated 14
 2. Apothecia discoid at maturity; ascospores (32-) 35-55 × 3.5-5.1 (-6.6) μm, 6-7-septate, with smooth gel sheath 1.0-1.5 μm wide; conidia with a "torus" around each septal pore, basal cell dark and apical beak usually present 12. *S. josserandii*
 - 2'. Apothecia turbinate when mature; conidia without those characters 3
3. Asci predominantly clavate 4
- 3'. Asci predominantly saccate 12
 4. Septa and cell walls of mature ascospores yellow-brown. 15. *S. ochrospora*
 - 4'. Septa and cell walls of ascospores remaining hyaline 5
5. Ascospore gel sheath thick or thin, usually smooth; if verrucose, less than 1.5 μm thick 6
- 5'. Ascospore gel sheath always verrucose and over 1.5 μm thick 11
 6. Ascospores with a smooth gel, with refractocells when mature. 16. *S. sordida*
 - 6'. Ascospores with a thin, smooth or verrucose gel and without refractocells 7
7. Ascospores predominantly 3-4-septate 8
- 7'. Ascospores predominantly 5-7-septate 9
 8. Ascospores mostly 3-septate, with a thin, smooth to verrucose gel sheath; asci 99-135 × 11-15 μm; conidia 29-41 × 7.0-12 μm, basal scar 2.2 (-2.9) μm wide 9. *S. introspecta*
 - 8'. Ascospores mostly 4-septate, with a thin, verrucose gel sheath; asci 88-107 × 9.0-13 μm; conidia 23-37 × 7.0-10 μm, basal scar 1.0-2.2 μm wide 8. *S. immarginata*
9. Ascospores (30-) 37-49 (-64) μm long 4. *S. bakeriana*
- 9'. Ascospores 26-43 (-48) μm long 10
 10. Asci 82-114 × 11-19 μm; conidial width (10-) 11-15 (-17) μm; conidia 6-7 (-8)-septate 1. *S. alba*
 - 10'. Asci (82-) 101-137 (-140) × (9.3-) 11-16 (-19) μm; conidial width 7.0-15 μm; conidia 5-11-septate 5. *S. basitricha*

11. Ascospores cylindrical-clavate, with refractocells present or not, but when present not enlarged, disintegrating cells present or not; ascospores 2.9-4.4 (-5.8) μm wide 6. *S. confluens*
- 11'. Ascospores cylindrical, with enlarged refractocells present, disintegrating cells absent; ascospores 4.4-8.0 (-9.3) μm wide.
 10. *S. jamaicensis*
12. Ascospores long, (31-) 49-64 (-77) μm , frequently with disintegrating cells 14. *S. notabilis*
- 12'. Ascospores usually under 47 μm long 13
13. Asci (84-) 112-142 (-153) μm long; ascospores (29-) 34-40 (-60) \times (3.7-) 4.4-5.1 (-7.3) μm , 3-7-septate; conidia fusiform with one flat side, with hyaline apical cell; conidial basal scar broad, (3.7-) 4.4-6.0 (-6.6) μm wide; conidiophore with grossly protruding scars of the *Pseudospiropes nodosus* type 7. *S. dickorfi*
- 13'. Asci 86-108 μm long; ascospores (31-) 37-47 (-50) \times 3.7 (-4.4) μm , 6-7-septate; conidia fusiform, all cells brown; conidial basal scar narrow, (1.5-) 2.2-2.9 (-3.7) μm wide; conidiophore with scars that do not protrude grossly 2. *S. alnicola*
14. Apothecia discoid with an involute striate margin, receptacle black to dark brown; ectal excipulum of textura porrecta, ascospores (26-) 29-36 \times 3.7 (-4.4) μm , regularly 7-septate.
 13. *S. nigra*
- 14'. Apothecia turbinate, with a straight and smooth margin, receptacle brown; ectal excipulum of textura oblita 15
15. Ascospores subfusoid to slightly clavate, (26-) 29-37 \times (3.7-) 4.4-7.3 μm , usually 4-5-septate; conidiophore tortuous with grossly protruding scars of the *P. nodosus* type; conidia fusiform.
 3. *S. atriseda*
- 15'. Ascospores cylindrical-clavate, (34-) 37-45 \times 3.7-4.4 μm , 7-septate; conidiophore straight, with only slightly protruding scars of the *P. simplex* type; conidia obclavate to fusiform 11. *S. japonica*

4. DISTRIBUTION OF KNOWN SPECIES OF STROSSMAYERIA

Not much can be said about the distribution of species of *Strossmayeria* because they have seldom been collected due to their exceptionally small size and the lack of interest by pathologists in their being potential pathogens. They are thus typically overlooked by the general collector. A few workers have collected the rather obvious hyphomycetous anamorph, often without being aware that they had also collected the teleomorph. A map is provided (Fig. 7) of the known distributions, which clearly reflects the lack of collections from very large areas of the world. When such areas have been explored by mycologists

intent on finding such minute fungi, the distribution picture will doubtless be greatly different.

5. DESCRIPTION OF ACCEPTED SPECIES OF *STROSSMAYERIA*

1. *Strossmayeria alba* (Crouan & Crouan) Iturriaga & Korf, *comb. nov.* (Fig. 2a, 4a, 8).

- ≡ *Lecanidium album* Cr. & Cr., *Florule du Finistère*, p. 45. 1867. (!!)
≡ *Belonidium album* (Cr. & Cr.) Sacc., *Syll. Fung.* 8: 498. 1889.

Anamorph: *Pseudospiropes* sp.

Apothecium turbinate, sessile with a small point of attachment to the substrate, 0.2-1.0 mm in diameter, solitary or gregarious, but never confluent, the entire receptacle white or grayish-white, disc concolorous with receptacle. Ectal excipulum of *textura oblita*, 56 µm thick in median section, J+, cells pale in the outer ectal excipulum, and hyaline in the inner ectal excipulum, 2.9-3.7 µm wide. Subhymenium of *textura intricata*. Asci 8-spored, clavate, 82-114 × 11.2-18.7 µm. Ascospores cylindrical-clavate, hyaline, J+, with uniform cells, biseriate to triseriate, 29-43 × (2.9-) 3.7-6.6 µm, (1-) 5-7-septate, gel sheath usually smooth, only slightly verrucose in the holotype, 1.0-1.5 µm thick. Paraphyses long and filiform, simple, septate, with a clavate swelling at the apex, (0.7-) 1.5 (-2.2) µm at the middle, (1.5-) 2.2-2.9 (-3.7) µm at the apex. Conidiophore brown, lighter toward the apex, septate, flexuous, with evident protruding scars, (5.1-) 5.9-8.8 µm wide at the middle, base swollen to 7.3-15 µm wide, wall 0.7-1.5 (-2.2) µm thick. Conidia fusiform, brown, 30-39 × (10-) 11-15 (-17) µm, basal scar width (1.5-) 2.2-4.4 µm, septa 6-7 (-8), usually with the first two septa of each end darker than the rest.

Holotype: *Patellaria alba* Crouan mscr (*Lecanidium*). Sur un *Helminthosporium* sur un tronc du noisetier, couleur blanche à l'état vivant, le 25 Nvbre 1861, CO.

Type locality: Province of Finistère, France.

Habitat: On decorticated wood of *Corylus* and on rotting, decorticated and/or fallen logs of unknown hosts.

Distribution: Canada, France, U.S.A.

Exsiccatae specimens examined: None

Other specimens examined: CANADA: Tarzwell, Ontario (near Kirkland Lake) on fallen log, boreal forest beaver swamp, 6 Sept. 1979, George P. White 563, DAOM 173085a (as *Pseudospiropes simplex*); same data, 6 Sept. 1979, G. P. White 554, DAOM 173089 (as *P. simplex*).

UNITED STATES: Swain County: along Indian Creek, Great Smoky Mountains National Park, on decorticated log, August 14, 1968, C.T. Rogerson, NY, Fungi of North Carolina (as *S. basitricha*).

Illustrations: Fig. 2a, 4a, 8 in this paper.

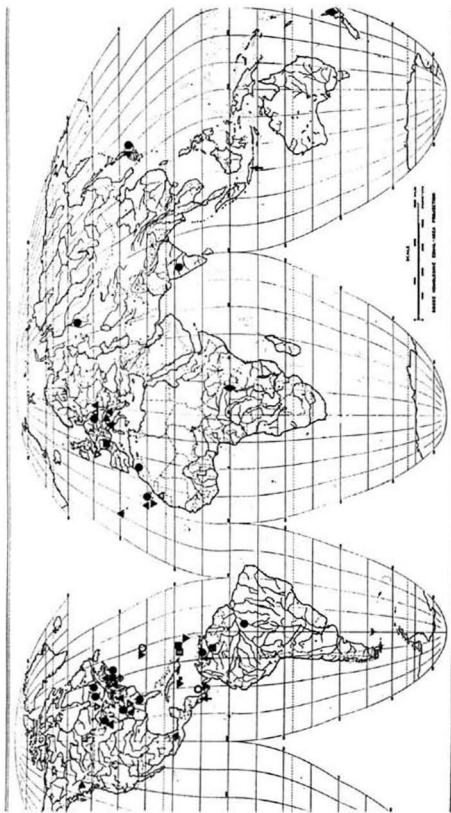


Figure 7. World distribution of species of *Strossmayeria*.

- | | | | | | |
|----------------------|-------------------------|-------------------------|-------------------------|-----------------------|-------------------------|
| ▽ <i>S. alba</i> | △ <i>S. alnicola</i> | ▶ <i>S. atriseda</i> | ● <i>S. bakeriana</i> | ▲ <i>S. basiricha</i> | ▼ <i>S. confluens</i> |
| □ <i>S. dickorfi</i> | ■ <i>S. inmarginata</i> | ✦ <i>S. introspecta</i> | ▪ <i>S. jamaicensis</i> | ◄ <i>S. japonica</i> | ■ <i>S. josserandii</i> |
| ⊙ <i>S. nigra</i> | | ↑ <i>S. notabilis</i> | ◆ <i>S. ochrospora</i> | | ○ <i>S. sordida</i> |

Etymology: The epithet *alba* comes from Latin, white.

Notes: Our observations of the holotype agree totally with the short description of it (*Lecanidium album*) by Crouan & Crouan (1867), except for the 6-septate ascospores they describe. We saw just one 6-septate spore on this HT, the ascospores being mostly 5 or 7-septate. Though there were no drawings accompanying the description, there is a drawing with the specimen of part of an ascus with ascospores, in which Crouan & Crouan drew two 6-septate and two 7-septate ascospores (Fig. 8c).

No details are given on the label of the type specimen, or in the publication, of the collecting locality. Because the specimens at CO may not be loaned, a visit was made by R. P. Korf in 1983 to Concarneau, Province of Finistère, France, to locate the holotype of *L. album*, but unfortunately he was unable to find the specimen amongst the uncatalogued and generally unarranged collection. Because of this, the senior author reported the holotype of *L. album* as lost (Iturriaga, 1984). In 1987 a second trip was made to Concarneau by F. Candoussau, R. P. Korf, T. Iturriaga, and W.-y. Zhuang to try to locate the specimen, and this time we were successful (Korf, et al., 1988). We discovered that in 1979 it had been located and annotated as *S. basitricha* by Steven E. Carpenter, but we do not agree with his taxonomic placement of this specimen, and accept both species as distinct. The Crouan brothers often collected around Brest, and there were (and still are) some small forests of hazelnut in the places where they often collected (information obtained from M. Yves Le Gal, subdirector of the Marine Biological Station at Concarneau). Four mycologists, F. Candoussau, R. P. Korf, T. Iturriaga, and W.-y. Zhuang, tried collecting duplicate material in September 1987 and were unsuccessful. They may have been to the wrong places, or they may have been too early in the season since the type was collected in November (Korf, et al., 1988). The original publication of the Crouans mentions "Aut. r.," meaning that the fungus was collected in the autumn, and is rare.

Morphologically, *S. alba* can be separated from its closest relative, *S. basitricha*, by the pure white apothecia, shorter and broader asci, broader ascospores, broader conidia, wider basal scar of the conidium, and fewer conidial septa. Saccardo (1889) correctly accepted them as different species.

2. *Strossmayeria alnicola* (Vel.) Iturriaga, *comb. nov.* (Fig. 4b, 6a, 9).
 ≡ *Belonium alnicola* Velenovský, *Monogr. Discomyc. Bohem.* 1:
 180. 1934. (!)

Anamorph: *Pseudospiropes* sp.

Apothecia 0.2 mm in diameter, solitary or gregarious, turbinate, arising from a mass of brown irregular cells that form the point of attachment from which the conidiophores also arise, upper receptacle cream colored, dark brown toward the base, disc concolorous with upper receptacle. Ectal

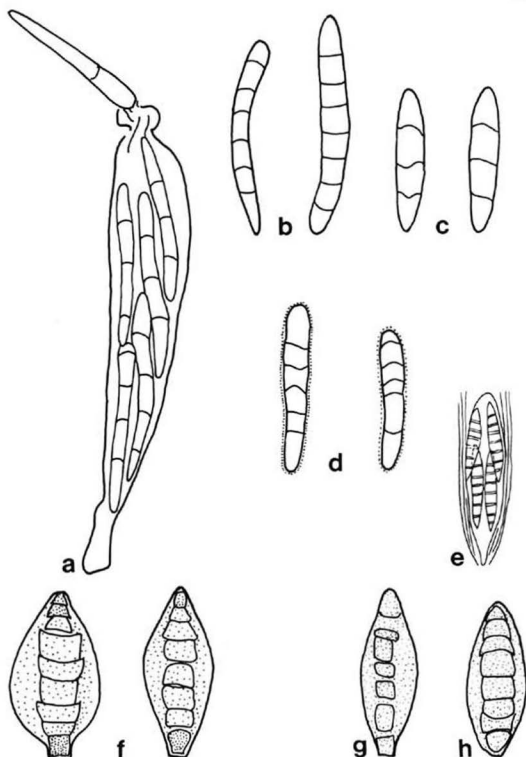


Figure 8. *Strossmayeria alba*. a, asci with ascospores; b, c, d, ascospores; e, asci with ascospores and paraphyses, inked copy from Crouan's drawing with HT, magnification unknown; f, g, h, conidia. a, h, DAOM 173085a; b, f, DAOM 173089; c, d, g, HT. All except e $\times 1000$.

excipulum of *textura oblita*, 19-21 μm wide in median section, J+, formed mostly by long rectangular cells, basal cells round and brown, elongated and rectangular in the middle, near the margin hyaline and longer, the apical terminal cells with a rounded apex, cells (6.6-) 10-18 \times (1.5-) 2.2-2.9 (-3.7) μm . Medullary excipulum and subhymenium not distinguishable. Asci 8-spored, saccate when mature, or at least without an elongated stipe and tapering down to a rounded base, with a short stipe when young, 86-108 \times (13-) 15-17 (-19) μm . Ascospores cylindrical-clavate, hyaline, giving a faint J+ reaction, with uniform cells, multiseriate, (31-) 37-47 (-50) \times 3.7 (-4.4) μm , (6-) 7-septate, gel sheath smooth and (0.7-) 1.5 μm thick. Paraphyses long and filiform, simple or divided, with a clavate apical swelling, (1.5-) 2.2 μm at the middle, 2.9-3.7 (-4.4) μm at the apex. Conidiophore brown, flexuous, with scars that do not protrude greatly, lighter toward the apex, 6.6-9.5 (-12) μm wide at the middle, base swollen, wall 0.7-1.5 (-2.2) μm wide. Conidia fusiform, brown, (28-) 30-37 (-40) \times (8.8-) 11-12 μm , basal scar width (1.5-) 2.2-2.9 (-3.7) μm , 5-8-septate.

Holotype: Flora Bohemica, No. 151014, = *Belonium alnicola* Vel. M.D. 180. 1934, [*Gorgoniceps alnicola* Vel. in herb. et lit.], Mnichovice, *Alnus*, VIII 1926, J. Velenovský, PRM. [Data from description: In trunco udo putrido alnea prope Mnichovice 1926, 8. Inclinat ad genus *Gorgoniceps*, conf. e. gr. *Gorg. sambuci*.]

Type locality: Mnichovice, Czechoslovakia.

Habitat: On rotted trunk of *Alnus*.

Distribution: Only known collection is the HT from Czechoslovakia.

Exsiccatae specimens examined: None.

Other specimens examined: None.

Illustrations: Velenovský, J., *Monogr. Discomyc. Bohem.* 2: Pl. 4, Fig. 4, 1934; Fig. 4b, 6a, 9 in this paper.

Etymology: The epithet *alnicola* is from Latin, meaning inhabiting *Alnus*.

Notes: Our measurements of ascus and ascospore length are smaller than the ones given by Velenovský (1934).

One distinctive feature of this species is its saccate asci. It can be distinguished from *S. alba* in that the ascospores are longer and thinner and the conidia are narrower, from *S. basitricha* in that ascospores are longer and in that the ascus shape is different and wider, and from *S. bakeriana* in ascus shape, width, and the wider conidial basal scar.

3. *Strossmayeria atriseda* (Saut.) Iturriaga, *comb. nov.* (Fig. 3d, 3g, 4c, 6b, 10).

≡ *Peziza atriseda* Saut., *Flora* 28: 133. 1845. (!!)

≡ *Tapesia atriseda* (Saut.) Poetsch and Schiedermayr, *Syst. Aufz. Krypt.* p. 158. 1872.

Anamorph: *Pseudospiropes nodosus* (Wallr.) Ellis, *Dematiaceous Hyphomycetes* p.258. 1971.

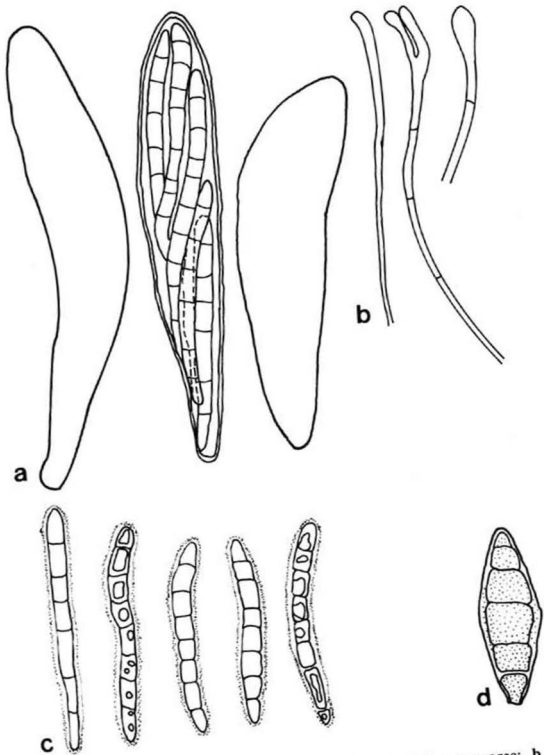


Figure 9. *Strossmayeria alnicola* (HT). a, asci, one with ascospores; b, paraphyses; c, ascospores; d, conidia. All $\times 1000$.

Apothecia turbinate, sessile, 0.5 to slightly more than 1 mm in diameter, solitary to gregarious, but growing individually, the entire receptacle brown and glossy, disc concolorous with receptacle, base of the apothecia composed of brown irregular cells, from which also arise conidiophores of *Pseudospiropes*. Ectal excipulum of textura oblita with very glassy walls, 12-16 μm wide in median section, J+ with a strong blue reaction, cells rectangular and elongate, 8.0-14 (-18) \times (1.5-) 2.2-2.9 μm , apical cells with rounded apices. Medullary excipulum and subhymenium not evident. Asci 8-spored, clavate with a long stipe tapering down to a fine base, with brown dextrinoid cytoplasmic contents when young, arising from croziers, (122-) 131-150 (-154) \times 13-19 μm , apical ascosporeogenous region (84-) 91-107 (-112) \times 13-17 (-19) μm . Ascospores subfusoid, slightly clavate, hyaline, J+, with uniform cells, generally biseriate but rarely triseriate, (26-) 30-37 \times (3.7-) 4.4-7.3 μm , (1-) 4-5 (-7)-septate, gel sheath smooth, 0.7 (-1.5) μm wide. Paraphyses long and filiform, simple or divided, septate, apex slightly swollen in a clavate or irregular shape, exceeding asci by 7.3 μm , 1.5 μm wide at the middle, (1.5-) 2.2 μm wide at the apex. Conidiophore brown, septate, with large scars and a zig-zag shape due to the scars left by the secession of the conidia during sympodial conidiogenesis, (7.3-) 9.5-15 (-18) μm , young conidiophores without scars, straight and thin, 7.3 μm wide, base slightly swollen. Conidiogenous cell terminal, lighter than the rest of the conidiophore, thin-walled with a round apex less than 0.7 μm wide, 21 \times 8.8-10 μm . Conidia fusiform, brown, (28-) 33-42 \times (10-) 11-13 (-18) μm , basal scar thickened at the edges, (3.7-) 4.4-5.9 (-6.6) μm , septa (3-) 7 (-8), frequently very light and difficult to see, apical and/or basal cells sometimes darker.

Holotype: *Peziza atriseda* Saut., Damberg 8/8, [Damberge bei Steyr, Ober-Osterr., 8 August 1842], Herb. Mus. Palat. Vindob., Acqu. 1917 Nr. 1295, W.

Type locality: Damberg Mt., near Steyr, "upper Austria."

Habitat: On old moist wood that it covers in a stellate fashion, and on decorticated wood of *Corylus avellana*.

Distribution: Canada, Germany.

Exsiccatae specimens examined: None.

Other specimens examined: CANADA: On *Corylus avellana*, Burnaby South, British Columbia, 13 August 1957, S. Hughes, DAOM 59658 (as *Helminthosporium nodosum* Wallr., det. S. J. Hughes).

Illustrations: Fig. 3d, 3g, 4c, 6b, 10 in this paper.

Etymology: The epithet *atriseda* is from Latin, meaning with a black subiculum.

Notes: Saccardo (1889), and Rehm in Rabenhorst (1887-96: 582), accepted the name *Tapesia atriseda*. Saccardo repeated Sauter's (1845) Latin diagnosis and gave a Latin translation of the collecting data, though he added the size of the apothecia "Cupulae 600 μ . ad 1 mm. latae" which presumably he transcribed from Sauter's description "die Becher 1/4-1/2'' breit." Rehm gave Sauter's and Saccardo's information in German. Both

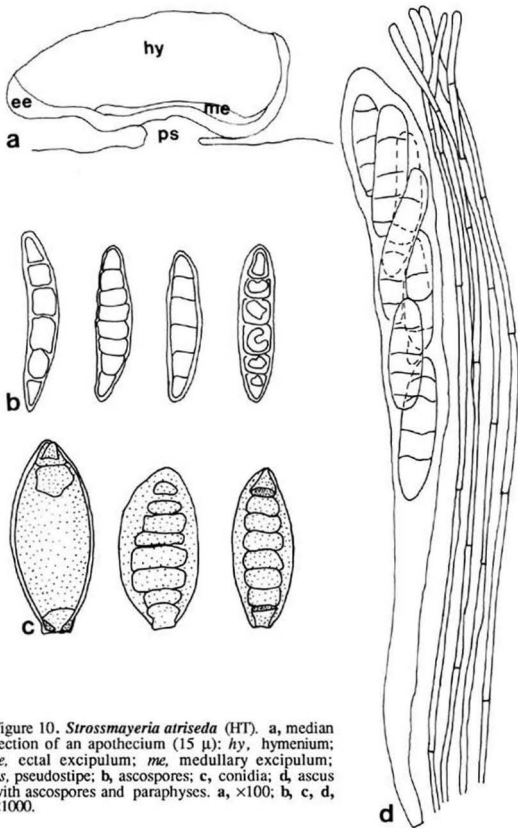


Figure 10. *Strossmayeria atriseda* (HT). a, median section of an apothecium ($15\ \mu$): *hy*, hymenium; *ee*, ectal excipulum; *me*, medullary excipulum; *ps*, pseudostipe; b, ascospores; c, conidia; d, ascus with ascospores and paraphyses. a, $\times 100$; b, c, d, $\times 1000$.

of them followed Poetsch and Schiedermayr (1872) in placing this species in the genus *Tapesia*, probably because of the presence of a subiculum that was described. Poetsch and Schiedermayr assumed the presence of a subiculum from Sauter's description of *P. atriseda* "auf feuchtem, altem Holze ges. das sie stellenweise überzieht" (covering the wood in a stellate manner). Sauter interpreted the conidiophores and mycelium of *Pseudospiropes* as a subiculum. It was Keissler (1917) who examined the type specimen, gave a full description, correctly interpreted the "subiculum" as being a hyphomycetous "*Helminthosporium*," and so treated the species again in *Peziza* as *P. atriseda*. He stated that this was a synonym of *P. helminthosporii* Blox. in herb. [for which he made a new combination under the genus *Belonium*, *B. helminthosporii* (Blox.) Keissl.]. In his annotation of the type specimen he noted as a synonym *Belonidium minutissimum* (Batsch) Sacc. For *Belonidium basitrichum* Sacc. he made another combination as *Belonium basitrichum* (Sacc.) Keissl. Though he was incorrect in stating that *P. atriseda* was conspecific with these specimens [he was misled by Saccardo's description of *Belonidium minutissimum* (Batsch) Phillips, *Syll. Fung.* 8: 504. 1889, which states that the ascospores of Batsch's species are 4-septate], he was the first to indicate the existence of a relationship among them, all of which are considered here as members of the genus *Strossmayeria*.

Keissler's description of *P. atriseda* agrees completely with ours.

The specimen DAOM 59658 differs in smaller ascus measurements and in smaller ascospore width than in the HT. The rest of the data match perfectly.

This appears to be the first report of the connection between *Pseudospiropes nodosus* (Wallr.) Ellis and its teleomorph. We agree with Hughes's identification of the anamorph in DAOM 59658, though he overlooked the presence of the teleomorph.

4. *Strossmayeria bakeriana* (P. Henn.) Iturriaga, *comb. nov.* (Fig. 2d, 3a, 4d, 5b-d, 6c, 11, 12).

- ≡ *Hyaloderma bakeriana* P. Henn., *Hedwigia* 48: 103. 1908. (!!)
- = *Gorgoniceps crataegi* Velenovsky, *Monogr. Discomycet. Bohem.* 1: 182. 1934. (!!)
- = *Gorgoniceps sambuci* Velenovsky, *Monogr. Discomycet. Bohem.* 1: 182. 1934. (!!)
- = *Strossmayeria longispora* Raitviir, *Biol. Zh. Armen.* 21(8): 9. 1968. (!!)
- = *Strossmayeria ostoyae* Bertault, *Rev. Mycol. (Paris)* 35: 140. 1970. (!!)

Anamorph:

- ? *Pseudospiropes simplex* (Kunze) Ellis and other synonyms listed below under *Strossmayeria basitricha*.
- ? = *Helminthosporium ostoyae* Bertault, *Rev. Mycol. (Paris)* 35: 140. 1970. (!!)

Apothecia turbinate, with a small point of attachment, 0.2-1.0 mm in diameter, receptacle light brown to grayish when dry, upper receptacle whitish to yellowish or beige when rehydrated, brown toward and at the base; disc concolorous with upper receptacle, rarely slightly darker, granulose; margin sometimes slightly involute, irregular; exuding yellow substance in 2% aqueous KOH; anamorph arising from the base of the apothecium. Ectal excipulum of textura oblita, 15-37 μm thick, J+, composed of septate parallel hyphae with gelatinized walls, cells of the outer layer brown, cells of the inner layer hyaline, cream colored or light brown, cells sometimes with angular inclusions, upper cells sometimes clavate and longer than the basal ones: (8.0-) 16-22 (-26) \times 2.2-3.7 μm , the cells more toward the base (6.6-) 15-19 \times 1.5-2.9 (-3.7) μm . Medullary excipulum and subhymenium indistinguishable one from the other, composed of a small amount of textura intricata. Asci clavate, arising from croziers and sometimes also from repeating croziers, (64-) 74-124 (-156) \times (9.3-) 10-15 (-20) μm . Ascospores cylindrical-clavate, hyaline, (29-) 37-49 (-64) \times (2.9-) 3.6-4.5 (-5.4) μm , (3-) 6-7 (-8)-septate; gel sheath faintly evident, often extremely thin, smooth, (0.7-) 1-2 μm thick. Paraphyses long and filiform, simple or divided, septate, not at all or up to 37 μm longer than the asci, swollen toward the tip, hyaline, 0.7-1.5 (-2.2) μm wide in the middle, (1.5-) 2.2-3.7 μm wide at the apex. Conidiophores macronematous, mononematous, arising from a mass of roundish, elongated, or irregular brown cells, simple, slightly flexuous to flexuous, thick walled, septate, cinnamon-brown, becoming yellowish brown toward the apex, (4.4-) 5.9-8.0 (-9.5) μm wide at the middle, base swollen to 7.3-11 (-15) μm wide. Conidiogenous cell polyblastic, integrated, terminal, or intercalary, sympodial or percurrent, cylindrical, flexuous, bearing protruding scars, lighter in color than the rest of the conidiophore. Conidia solitary, dry, acropleurogenous, simple, fusiform, truncate at the base, tapering toward the rounded apex, concolorous with the darker part of the conidiophore, (22-) 29-44 (-48) \times (7.2-) 8.8-16 μm , basal scar width (1.5-) 2.0-3.6 (-4.5) μm , septa (3-) 7-11 (-12), usually with the first septum nearest to the base darker than the remainder and also sometimes one or more of the apical septa darker.

Holotype: In vaginis *Bactridis majoris*. Pará, Hort. botan. Mus. Goeldi, 1. 1908, C. F. Baker, n. 202a [in societate *Cyphellae paraensis* in hyphis *Helminthospori*], S.

Type locality: Pará, Brazil.

Habitat: On dry culm of *Acacia macracantha*, *Acer*, *Bactris major*, *Castanea dentata*, *Castanea* sp., *Crataegus oxyacanthae*, *Fraxinus americana*, *Quercus*, *Rubus fruticosus*, *Sambucus racemosa*, *Zelkova*, conifer wood, fallen bamboo fence, decorticated, rotten or wet wood or stumps or branches or twigs of unknown hosts.

Distribution: Brazil, Czechoslovakia, Canada, Canary Islands, India, Japan, Morocco, U. S. S. R., U. S. A., Venezuela.

Exsiccatae specimens examined: CUP 60680, to be issued in Korf & Gruff, *Discomycetes Exsiccatae*.

Other specimens examined: CANADA: On wood, boreal forest beaver swamp, Tarzwell, Ontario (near Kirkland Lake), 7 Sept. 1979, DAOM 173358 (as *Pseudospiropes simplex* and *Strossmayeria*); Duchesnay, Quebec, Aug. 24, 1938, C. L. Shear 4182-a (as *Belonidium basitrichum*), BPI.

CANARY ISLANDS: Tenerife: On wet wood, West of Fuente de las Pulgas, Las Yedras, Monte de Las Mercedes, January 12, 1976, R. P. Korf, W. C. Denison, L. M. Kohn, M. A. Sherwood, CUP-MM 561; On wood, West of Fuente de las Pulgas, Las Yedras, Monte de Las Mercedes, January 12, 1976, R. P. Korf, W. C. Denison, L. M. Kohn, M. A. Sherwood, CUP-MM 562.

CZECHOSLOVAKIA: On *Sambucus racemosa*, Bohemia centralis: Jevany, IX. 1933, J. Velenovský, Flora Bohemica No. 812389, Akc. no. 29/1947 (as *Gorgoniceps sambuci*, Holotypus), PRM; On *Rubus fruticosus*, Mnichovice: Myrlín (Bohemia centralis), 2. XI. 1933, J. Velenovský, Flora Bohemica, No. 151008, Akc. no. 29/1947 (as *Gorgoniceps sambuci*, Paratypus), PRM; Stráncice (Bohemia centralis). In colle arido ad *Crataegum oxyacanthae*, 3. VIII. 1933, J. Velenovský, No. 151006 (as *Gorgoniceps crataegi*, Holotypus), PRM.

INDIA: On decaying *Quercus* log, Shergron (Arimachal Pradish), Sept. 8, 1981, R. Sharma, PAN 24028, CUP-IN 622.

JAPAN: On plywood, Asegata, Chuzenji-kohan, Okku-Nikko, Tochigi Pref., Honshu, 22. VIII. 1983, IMC₃ workshop people, CUP-JA 3621; On decorticated stump, along inlet creek south of Lake Karikomi, Okku-Nikko, Tochigi Pref., Honshu, 23. VIII. 1983, IMC₃ workshop people, CUP-JA 3648 (cultured by Kohn); On branch, Asegata, Chuzenji-kohan, Okku-Nikko, Tochigi Pref., Honshu, 25. VIII. 1983, IMC₃ workshop people, CUP-JA 3677; On fallen bamboo fence, Asegata, Chuzenji-kohan, Okku-Nikko, Tochigi Pref., Honshu, 25. VIII. 1983, IMC₃ workshop people, CUP-JA 3694; On wood, Kotoku-bokujo, Okku-Nikko, Tochigi Pref., Honshu, 26. VIII. 1983, IMC₃ workshop people, CUP-JA 3697; On a twig, Jujo Seichi Co. forest, Katashima-mura, Tone-gun, Gumma Pref., Honshu, 26. VIII. 1983, IMC₃ people, CUP-JA 3706.

MOROCCO: Sur bois mort d'*Acacia* sp., accompagné de *Helminthosporium ostoyae* Bertault, Parc Donabo, au Jbel Kbir, près Tanger, 5 Mars 1960, Bertault 11791 (ex 6031) (as *Strossmayeria ostoyae*, holotype, also holotype of *H. ostoyae*), MPU.

UNION OF SOVIET SOCIALIST REPUBLICS: On *Zelkova*, Azerbaidzhaniae, dist. Leriki, 20 Km., 13 Oct., 1962, A. Raitviir (as *Strossmayeria longispora*, holotype), TAA 43152.

UNITED STATES: Georgia: On wood, wild area, University of Georgia Botanical Garden, Athens, M. S. A. foray, August 25, 1978, J. H. Haines 3341 (as *Strossmayeria basitricha*), NYS. Massachusetts: On decorticated wood, and under bark, White Oaks Rd., near North Adams, 16. VIII. 1986, W.-y. Zhuang, CUP 61799; New York: On rotten wood, Yates, Sept. 1900, C. E. Fairman, CUP-D 1052 (73-72); On dead wood, Churchville, Sept. 21, 1901, E. J. D[urand], CUP-D 1275 (73-74); On

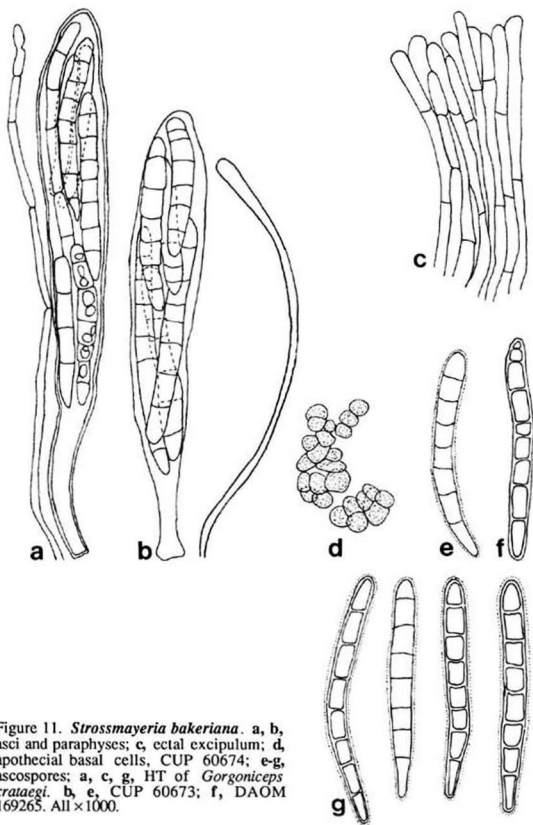
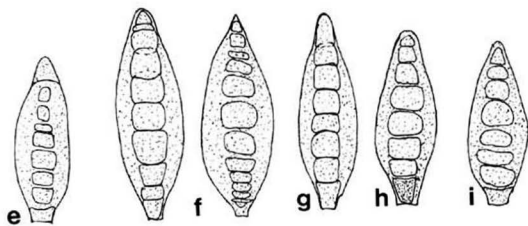
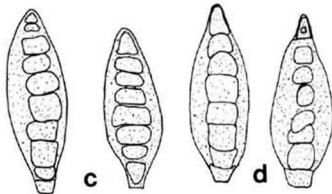
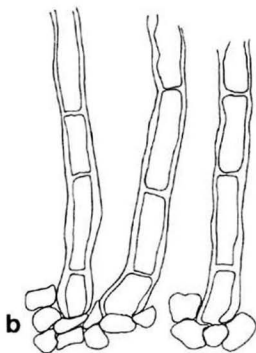
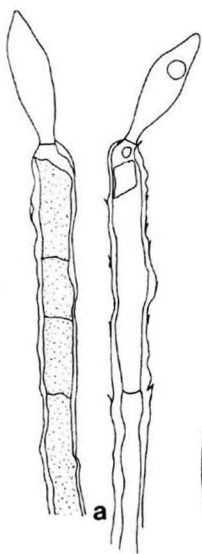


Figure 11. *Strossmayeria bakeriana*. a, b, asci and paraphyses; c, ectal excipulum; d, apothecial basal cells, CUP 60674; e-g, ascospores; a, c, g, HT of *Gorgoniceps crataegi*. b, e, CUP 60673; f, DAOM 169265. All $\times 1000$.

dead stick in damp woods, Churchville, Sept. 21, 1901, E. J. D[urand], CUP-D 1278 (73-73); White Plains, 7. VIII. 1915, F. J. Seaver and P. Wilson, R.P.K. 2025 ex NY (as *Gorgoniceps iowensis*); On *Castanea dentata*, Ringwood, Aug. 29, 1931, C. L. Shear (as *Belonidium basitrichum*), BPI; On *Castanea* sp., Ringwood, Aug. 29, 1931, C. L. Shear (as *Belonidium basitrichum*), BPI; On wood, Michigan Hollow, 4. IX. 52, S. J. Hughes, DAOM 29173 (as *Helminthosporium simplex* Kunze); On wood, Michigan Hollow, 4. IX. 52, S. J. Hughes, DAOM 29175 (as *Helminthosporium simplex* Kunze); On wood, Lloyd Cornell Preserve, McLean, 5. IX. 1952, S. J. Hughes, DAOM 29179 (as *Helminthosporium simplex* Kunze); On dead wood among a hyphomycete (*Pseudospiropes simplex*), near Bloomingdale, Essex Co., September 11, 1965, D. Malloch, DAOM 136546 (as *Strossmayeria basitricha*) (slide only); Among *Helminthosporium* on wood, 5 Burhans Pl., Delmar, July 11, 1975, J. H. Haines 2817 (as *Strossmayeria basitricha*), NYS; On log of *Quercus*, Peck foray, Cary Arboretum, Millbrook, Dutchess Co., Sept. 6, 1975, J. H. Haines 2882 (as *Strossmayeria basitricha*), NYS; On *Acer* wood, Peck foray, Cary Arboretum, Millbrook, Dutchess Co., Sept. 6, 1975, J. H. Haines 2883 (as *Strossmayeria basitricha*), NYS; Decorticated wood of *Acer* (ascospores producing phialides present), behind Ordway House, Huyck Preserve, Rensselaerville, Albany Co., Oct. 3, 1976, J. H. Haines 3184 (as *Strossmayeria basitricha*), NYS; On wood, Orange County, 1 mile north of circle on Route 6, vic. Raymond Torrey Monument, Harriman State Park, November 6, 1979, Steven E. Carpenter (as *Strossmayeria basitricha*), NY; Decayed wood of *Fraxinus americana*, Tibbits Recreational Area, on NY rt. 7 just West of the VT line, Rensselaer Co., Aug. 29, 1981, J. H. Haines 3524 (as *Strossmayeria basitricha*), NYS; On wood, Varna, Sept. 28, 1982, T. Iturriaga S-2, CUP 59717; On wood, woods along highway 1 mile west of the forest camp, Newcomb, Sept. 12, 1982, T. Iturriaga S-1, CUP 59718; On wood, near waterfall trail at the bridge at west end of Rensselaerville, Sept. 17, 1983, T. Iturriaga S-7, CUP 59894; On rotten wood in swampy area, St. Lawrence County, Cranberry Lake Campground, along trail S from campground around lake, 1500 ft., Sept. 22, 1983, W. R. Buck 9659, NY; Allegany State Park, Sept. 16, 1984, R. P. Korf, CUP 60673, 60674, 60675, 60676, 60677, 60678, 60679, 60680; On decorticated wood, Huntington Camps, Raquette Lake, 6. IX. 1986, W.-y. Zhuang, CUP 61805; On decorticated wood, Adirondacks, 5. IX. 1986, W.-y. Zhuang, CUP 61806; On decorticated wood, Raquette Lake, Adirondacks, 5. IX. 1986, W.-y. Zhuang, CUP 61807. **Pennsylvania:** On dead wood, Heart's Content, Alleghany Nat'l. Forest, 18. X. 1975, M. A. Sherwood 2120, CUP 54714. **Tennessee:** On bark of fallen branch, Bote Mt., Gt. Smoky

Figure 12. *Strossmayeria bakeriana*. a, conidiophores with conidia, break of the external wall where other conidia broke off; b, base of conidiophores; c-i, conidia. a, b, d, e, CUP 60677; c, HT of *G. crataegi*; f, DAOM 51651; g, PT of *Gorgoniceps crataegi*; h, CUP-IN 622; i, CUP 60676. All $\times 1000$.



Mountain National Park, Blount Co., Aug. 23, 1977, S. J. Hughes, DAOM 169265 (as *Pseudospiropes simplex*); On conifer wood, 1/2 mi. E. of Crib Gap, Blount Co., Great Smoky Mountains National Park, Hesler Symposium at The University of Tennessee, 11. VIII. 1968, J. H. Haines 1769 (as *Strossmayeria basitricha*), NYS. Wisconsin: Devil's L., near Madison, IX. 4. 53, D. P. Rogers (as *Strossmayeria* sp., = *Gorgoniceps confluens*), NY, R.P.K. 2777.

VENEZUELA: Sobre cara podada de rama de cují, *Acacia macracantha*, Charallave, Estado Miranda, Junio 1986, T. Iturriaga 680, CUP 61935.

Illustrations: Velenovský, J., *Monogr. Discomycet. Bohem.* 2: Taf. V, 40. 1934 (*Gorgoniceps crataegi*); Raitviir, A., *Biol. Zh. Armen.* 21(8): 5, Fig. 4. 1968 (*Strossmayeria longispora*); Bertault, R., *Rev. Mycol. (Paris)* 35: 139, Fig. 2. 1970; this paper, Fig. 2d, 3a, 4d, 5b-d, 6c, 11, 12.

Etymology: The epithet *bakeriana* is in honor of C. F. Baker, the collector.

Notes: *S. bakeriana* may be distinguished from *S. basitricha* in that it has longer ascospores and wider asci.

The original publication of *Hyaloderma bakeriana* was in Hedwigia, (Hennings, 1908), and was later reprinted (Hennings, 1909). It was misidentified as a pyrenomycete. The HT from S is in poor condition, and though identification was possible by use of the teleomorph, no conidia of the anamorph were seen. According to Rossman (1987), another part of the type collection at FH contained no ascocarps resembling a *Hyaloderma*.

The HT of *G. sambuci* did not have any conidia present of the anamorphic state, *Pseudospiropes*, and its paratype did not have any apothecia present, just the anamorph. The HT of *G. crataegi* has both states present in it. All our measurements of ascospore lengths and some of widths are smaller than Velenovský's measurements, but we agree with his data in the sense that he reported longer ascospores for *G. crataegi* and shorter for *G. sambuci*; though our values differ from his, the proportion between the two is the same.

Our measurements agree totally with Raitviir's (1968) measurements of *S. longispora* for all structures.

In some cases the ascospores were seen to be producing phialides: BPI-August 29, 1931, CUP-JA 3697, CUP-JA 3694, J.H.H. 2882, NYS, J.H.H. 2883, NYS (paraphyses also producing phialides).

Disintegrating cells are present in the ascospores of CUP-JA 3697, CUP-JA 3648, CUP-JA 3677, J.H.H. 3524, NYS.

5. *STROSSMAYERIA BASITRICHIA* (Sacc.) Dennis, *British Cup Fungi and their Allies*, p. 73. 1960. (Fig. 2e, 5a, 6d, 13, 14, 15).

≡ *Belonidium basitrichum* Sacc., *Atti Soc. Venet.-Trent. Sci. Nat. Padova* 4: 135. 1875. (!!)

≡ [*Belonidium helminthosporii* Sacc. in sched., Herb. PAD]

- ≡ *Arachnopeziza basitricha* (Sacc.) Boud., *Hist. classific. discomyc. Europe*, p. 126. 1907.
- ≡ *Belonioscypha basitricha* (Sacc.) v. Höhn., *Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. I*, **118**: 386. 1909.
- ≡ *Belonium basitrichum* (Sacc.) Keissl., *Ann. K. K. Naturhist. Hofmus.* **31**: 88. 1917.
- ≡ *Strossmayeria brevitricha* (Sacc.) Dennis ex Raitviir, *Biol. Zh. Armenii* **21**(8): 9. 1968 (lapsus calami).
- = *Peziza heterosperma* Schulzer, *Oest. Bot. Zeitsch.* **28**: 320. 1878. (!!)
- ≡ *Belonidium heterospermum* (Schulzer) Sacc. & Trott., *Syll. Fung.* **22**: 694. 1913.
- ≡ *Strossmayeria rackii* Schulzer, *Oest. Bot. Zeitsch.* **31**: 313-315. 1881 (superfluous epithet, based on the same type specimen).
- = *Belonidium marchalianum* Sacc., Bomm., & Rouss. in Bomm. & Rouss., *Bull. Soc. Roy. Bot. Belg.* **25**: 167. 1886 (!!)
- ≡ *Belonidium marchandianum* Sacc., Bomm., & Rouss., in v. Höhn., *Akad. Wiss. Wien, Math.-Naturwiss. Kl., Abt. I*, **132**: 112. 1923 ('*Marchandianum*') (lapsus calami).
- ?= *Belonidium fructigenum* P. Henn. in Warburg, *Monsunia* **1**: 31. 1900 (fide v. Höhnel, 1923).
- ?= *Belonidium albo-cereum* Penz. et Sacc., *Malpighia* **15**: 215. 1902 ('1901').
- = [*Peziza helminthosporii* Blox. in sched., Herb. K.] ('!!')
- ≡ [*Belonium helminthosporii* (Blox. in sched.) Keissl., *Ann. K. K. Naturhist. Hofmus.* **31**: 88. 1917.]
- ≡ [*Peziza helminthicola* Blox. in v. Höhn., *Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. I*, **118**: 884. 1909, lapsus calami].
- ≡ [*Belonioscypha helminthicola* (Blox. in v. Höhn.) v. Höhn. *Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. I*, **118**: 885. 1909.]
- ≡ [*Leptobelonium helminthicola* (Blox. in v. Höhn.) v. Höhn. *Akad. Wiss. Wien, Math.-Naturwiss. Kl., Abt. I*, **132**: 112. 1923.]
- = *Gorgoniceps iowensis* Rehm, *Ann. Mycol.* **4**: 338. 1906 ('*jowensis*') (!!)
- = *Gorgoniceps pilatii* Vel., *Monogr. Discomycet. Bohem.* **1**: 182. 1934 ('*Pilati*') (!!)

Misapplications:

Peziza minutissima Batsch, *Elenchus fungorum* **1**: 205, Fig. 143, Tab. 27 & p. 207 (fig. expl.), 1786, by Berk. & Br., *Ann. Mag. Nat. Hist.*, Ser. 3, **15**: 446. 1865 (fide v. Höhnel, 1909).

Belonidium minutissimum (Batsch) Phillips, by: Phillips, *British Discomycetes*, p. 149. 1887; by Saccardo, *Syll. Fung.* **8**: 504. 1889; by Schroeter in Cohn, *Krypt.-Fl. Schlesien* **3**(2): 110. 1893, (fide v. Höhn., *Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. I*, **118**: 385. 1909); by Rehm in Rabenhorst, *Krypt.-Fl. Deutschl.*, ed. 2, **1**(3): 1228.

1896, (fide Iturriaga); by Masee, *British Fungus Flora* 4: 224. 1895 (duplication of Phillips's description).

Anamorph: (For additional synonymy, see Hughes, 1958, Ellis 1971.)
Pseudospiropes simplex (Kunze) Ellis, *Dematiaceous Hyphomycetes* p. 260. 1971.

≡ *Helmisporium simplex* Kunze in Nees & Nees, *Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur.* 9: 241. 1818.

= *Helmisporium cylindricum* Wallr., *Fl. crypt. Germ.* 2: 164. 1833.

≡ *Pleurophragmium cylindricum* (Wallr.) Hughes, *Canad. J. Bot.* 36: 797. 1958.

= *Helminthosporium fusisporium* Berk. in Smith, J. E., *Engl. fl.* 5(2): 336. 1836.

?= *Helminthosporium apiculatum* Corda, *Icon. fung.* 1: 13. 1837.

= *Helminthosporium fusiforme* Corda, *Icon. fung.* 1: 13. 1837.

≡ *Arthrinium fusiforme* (Corda) Bon., *Handb. Mykol.* 84. 1851.

?= *Helminthosporium gongrotrichum* Corda, *Icon. fung.* 1: 13. 1837.

≡ *Helminthosporium gonyotrichum* Corda in Schulzer, *Oest. Bot. Zeitsch.* 28: 320. 1878 (lapsus calami).

= *Helminthosporium belonidium* Sacc., *Fung. ital.* pl. 113. 1877.

Apothecia turbinate, seldom discoid, sessile or pseudostipitate, 0.2-0.8 mm. in diameter, solitary, gregarious or confluent (losing their individuality), receptacle white, cream-colored, yellow, light brown or light gray when rehydrated, receptacle light brown toward the base and brown to dark brown at the base, beige to light brown or yellowish brown when dry; exuding a yellow substance in 2-10% aqueous KOH; disc concolorous with upper receptacle or lighter, white, pallid, light brown, brown, smooth to slightly granulose. Ectal excipulum of textura oblita, composed of rectangularly elongated cells, apical cells with rounded apices, J+, outer ectal excipulum with hyaline cells except in the area from the middle to the base that is composed of brown cells, cells 4.4-18 × 2.2-2.9 (-4.4) μm. Medullary excipulum and subhymenium indistinguishable. Pseudostipe when present composed of textura oblita as a continuation of the ectal excipulum but with broader cells and thicker glassy walls, with a very small amount of textura intricata in the middle. Asci clavate, arising from croziers, (82-) 101-137 (-140) × (9.3-) 11-16 (-19) μm, young asci frequently with dextrinoid contents. Ascospores cylindrical-clavate, sometimes with a not very even outline, hyaline, J+, with uniform cells, biseriate to triseriate, 26-40 (-48) × 2.9-5.1 (-5.9) μm, (3-) 6-7 (-8)-septate, gel sheath generally smooth, 1.0 (-1.5) μm wide, rarely verrucose but never over 1.5 μm wide, rarely not evident; germinating inside and outside the ascus. Paraphyses long and filiform, simple or divided, septate or aseptate, with a slight clavate swelling at the apex, approximately 6.0-10 μm longer than the asci, 0.7-2.2 μm wide at the middle, 2.2-3.7 μm wide at the apex. Conidiophores erect, macronematous, mononematous, arising from a mass of round and irregular brown cells, brown, septate, flexuous,

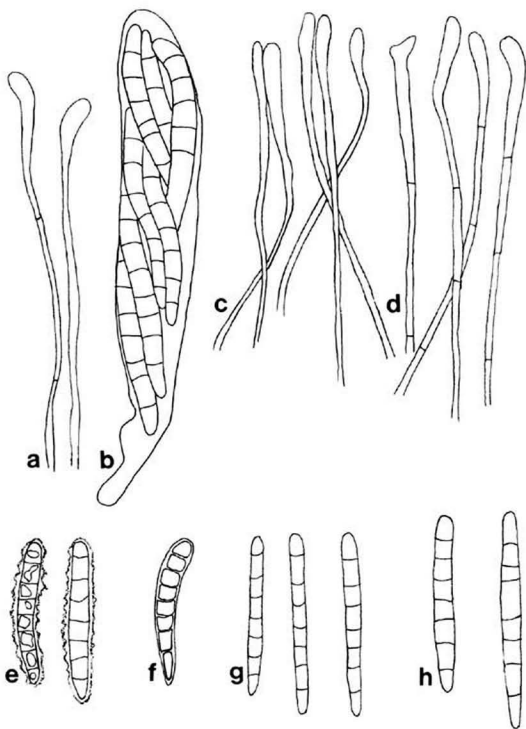


Figure 13. *Strossmayeria basitricha*. a, paraphyses; b, ascus with ascospores; c, d, paraphyses; e-h, ascospores. a, g, Durand 1011; b, c, h, NT of *Peziza heterosperma*; d, f, HT of *Gorgoniceps pilatii*; e, HT of *G. iowensis*. All $\times 1000$.

with evident protruding scars, lighter toward the apex, (3.7-) 5.1-9.3 (-10) μm wide at the middle, base swollen to 5.9-11 μm wide, wall 0.7-1.5 μm thick. Conidiogenous cell polyblastic, integrated, terminal, sympodial, and percurrent, cylindrical-flexuous, bearing protruding scars, lighter than the rest of the conidiophore, light brown, (19) 24-37 \times 5.6-7.5 μm . Conidia broadly fusiform, truncate at the base and tapering toward the apex which is rounded and sometimes has an apical bleb, outer wall punctate, dematiaceous, usually with a pedicel-like basal cell, frequently with basal and apical cells darker than the rest, 29-41 (-71) \times (6.6-) 7.3-15 μm , basal scar (1.5-) 2.2-3.7 μm wide, (3-) 5-11-septate or pseudoseptate, very commonly 7-septate. Basal and apical dark septa and/or cells sometimes present. Internal germination within the conidia seen.

Holotype: *Belonidium helminthosporii* Sacc., certe aff. *Peziza helminthosporii* Blox., in ligno quercino udo putrescente a Selva. Sept. 1874, PAD.

Type locality: Woods (at Selva) in Treviso, Italy.

Habitat: on old wood, on decorticated wood, branches or branchlets of *Acer*, *Carpinus*, *Castanea*, *Fagus*, *Fraxinus angustifolius*, *Platanus occidentalis*, *Quercus*, *Salix*, and unknown hosts.

Distribution: Azores Islands, Belgium, Canary Islands, Czechoslovakia, France, Italy, Mexico, United States, Yugoslavia.

Exsiccatae specimens examined: On branch of *Fraxinus*, in *Fraxinus* grove, young trees, Compartment 17a, adjacent to forest road between Compartment 16a & 17a., Mirkovci, near Vinkovci, 26 Sept. 1987, Korf, Iturriaga & Zhuang, CUP 61824 (NT of *Peziza heterosperma*) and Disc. Exs.; On decorticated log, Beaver Dam brook, Natchang State Forest, 12 miles E of Willimantic, Connecticut, August 26, 1979, R. P. Korf, CUP 58139 and Disc. Exs.

Other specimens examined: AZORES ISLANDS: **Terceira:** On rotted wood, Fontinhas above Aqualva, 8 April 1978, R. P. Korf, L. M. Kohn, N. Korf, A. Y. Rossman, CUP-MM 1907.

CANARY ISLANDS: **La Palma:** On old wood, Forest road south of Los Tilos, January 14, 1976, R. P. Korf, W. C. Denison, L. M. Kohn, M. A. Sherwood, CUP-MM 726; On *Castanea* sp. wood, Near mine entrance at km. mark 13, road between Buenavista and El Paso, January 18, 1976, R. P. Korf, W. C. Denison, L. M. Kohn, M. A. Sherwood, CUP-MM 904; **Tenerife:** On decorticated wood, Llano de los Viejos, Monte de las Mercedes, December 28, 1976, R. P. Korf, R. Fogel, G. L. Hennebert, L. M. Kohn, CUP-MM 1196.

EUROPE: BELGIUM: Sur l'*Helminthosporium apiculatum*, Groenendael, PAD (*Belonidium marchalianum* holotype).

CZECHOSLOVAKIA: Carpati Rossici [=Ucrania Transcarpatica], ad lignum frondosum (in silvis virgineis montanis), August 1929, J. Velenovský, Flora rossica, PRM 149988 (as *Gorgoniceps Pilati* (HT), also as an unpublished transfer to *Durella*).

FRANCE: On wood of *Carpinus* sp., Bois de Loubieng, Orthez, 9. VIII. 1983, J. Vivant, comm. F. Candoussau 4302, CUP 61800; On

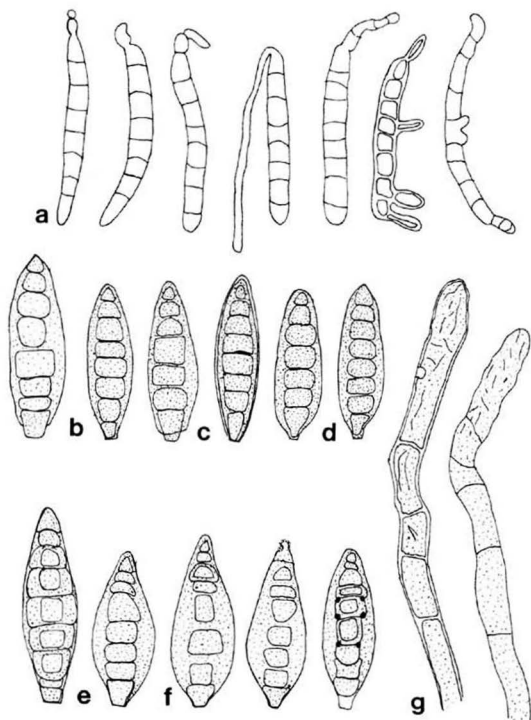


Figure 14. *Strossmayeria basitricha*. a, ascospores germinating in apothecia; b-f conidia; g, conidiophores. a, f, g, NT of *Peziza heterosperma*; b, HT of *Gorgoniceps iowensis*; c, CUP-D 1011; d, DAOM 37630; e, HT of *G. pilatii*. All $\times 1000$.

Corylus sp, abandoned hazelnut orchard, Kerlouguen, near Poullaouen, Finistère, France, 18. IX. 1987, F. Candoussau, T. Iturriaga, R. P. Korf & W.-y. Zhuang, CUP 61868; On wood of *Corylus* sp., l. c., CUP 61869 (as *Pseudospiropes*); On *Corylus* wood, l. c., CUP 61870, VEN; On wood, Forêt du la Saisine, west of Reffannes, about 10 km south of Parthenay, Dépt. Deux-Sèvres, 19. IX. 1987, F. Candoussau, T. Iturriaga, R. P. Korf & W.-y. Zhuang, CUP 61871, CUP 61872, VEN; On wood, l. c., CUP 61872, VEN; On rotted wood, l. c., CUP 61873, CUP 61874 and VEN, CUP 61875 and VEN.

YUGOSLAVIA: On branch of *Fraxinus*, in *Fraxinus* grove, young trees, compartment 17a, adjacent to forest road between compartment 16a & 17a, Mirkovci, near Vinkovci, 26 Sept. 1987, Korf, Iturriaga & Zhuang, CUP 61824 (NT of *Peziza heterosperma*), Disc. Exs., VEN; Same data, CUP 61825, Disc. Exs., VEN. On branchlet of *Fraxinus*, same data, CUP 61826 (material is too young); On decorticated branch of *Fraxinus*, same data, CUP 61828; On branchlet of *Fraxinus*, same data, CUP 61829 (Discomycete is too young, *Pseudospiropes* is good = *P. simplex*); On branchlet of *Fraxinus*, same data, CUP 61830; On twig of *Fraxinus*, same data, CUP 61831; On branch (decorticated) of *Fraxinus angustifolius* under large trees, woods S. of Vidor Creek, Compartment 16a, Mirkovci, near Vinkovci, 26 Sept. 1987, Iturriaga, Korf & Zhuang, CUP 61832, VEN [poor condition] and *Pseudospiropes simplex*; On decorticated *Fraxinus*, same data, CUP 61835; On decorticated wood, same data, CUP 61836 (too young) & *Pseudospiropes simplex*; On twig on branchlet of *Fraxinus*, same data, CUP 61837, VEN (too young) and *Pseudospiropes simplex*; On decorticated branch of *Fraxinus*, same data., CUP 61838 (as *Pseudospiropes simplex*, no *Strossmayeria* seen); On stump of *Fraxinus angustifolius*, woods S. W. of Vidor Creek, near Vinkovci, Yugoslavia, 25. IX. 1987, Iturriaga, Korf & Zhuang, CUP 61876 (as *Pseudospiropes* sp.); On the same stump of *Fraxinus angustifolius* as CUP 61876, same data, CUP 61877; On branch of *Fraxinus angustifolius*, Compartment #55, Beresinci Forest, 3 km E. of Privlaka, 12 km. S. of Vinkovci, Yugoslavia, forest stand ca. 25 years old, 25. IX. 1987, Iturriaga, Korf & Zhuang, CUP 61878, VEN; On branch of *Fraxinus angustifolius*, same data, CUP 61879; On cut end of branch of *Fraxinus angustifolius*, same data, CUP 61880 (as *Pseudospiropes* sp.); On wood chips of *Fraxinus angustifolius*, same data, CUP 61881 (as *Pseudospiropes* sp.); On cut ends of *Fraxinus angustifolius*, same data, CUP 61882; On decorticated branch of *Fraxinus angustifolius*, same data, CUP 61883; On decorticated wood of *Fraxinus angustifolius*, same data, CUP 61884; On rotted wood of *Fraxinus angustifolius*, same data, CUP 61885; On wood chip of *Fraxinus angustifolius*, same data, CUP 61886; CUP 61887; On decorticated wood, under large trees of *Fraxinus*, woods S. of Vidor Creek, Compartment 16a, Mirkovci, near Vinkovci, Yugoslavia, 26. IX. 1987, Iturriaga, Korf & Zhuang, CUP 61888; On decorticated wood, same data, CUP 61889, CUP 61890; On cut surface of trunk of *Fraxinus*, same data, CUP 61891; On branches of *Fraxinus*,

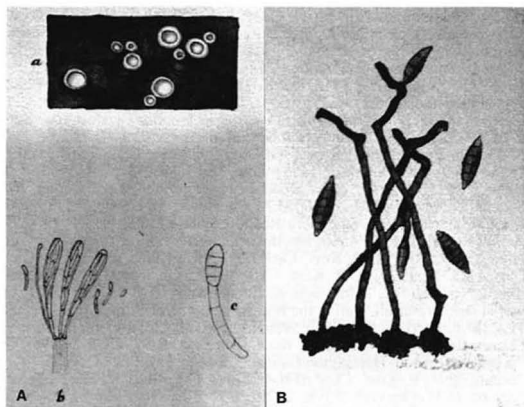


Figure 15. Photographs of Schulzer's drawings accompanying his notes: A: a, b, c. *Peziza heterosperma* (= *Strossmayeria basitricha*): a. Apothecia. b. Asci with ascospores. c. Ascospore with appendage. B. *Helminthosporium gongrotrichum* (= *Pseudospiropes* sp.) conidiophores and conidia. All enlarged. See text.

same data, CUP 61892; On cut surface of hard wood of *Fraxinus*, under large trees of *Fraxinus*, woods S. of Vidor Creek, Compartment 16a, Mirkovci, near Vinkovci, 26. Sept. 1987, Korf, Iturriaga & Zhuang, CUP 61839, CUP 61931.

MEXICO: On rotted log, between Km. 79-80, on road from Oaxaca to Valle National, Oaxaca, 10. VIII. 67, K. P. Dumont, CUP-ME 162.

UNITED STATES: Connecticut: On decorticated log, Beaver Dam Brook, Natchang State Forest, 12 miles E of Willimantic, 26.VIII. 1979, R. P. Korf, CUP 58139. Indiana: Decorticate trunk, Sayres' Wood, Union Co., 7-25-17, F[ink] & F[uson] 60, CUP-D 10594 (73-76). Iowa: On old wood, Mt. Pleasant, July 12, 1905, (Seaver), *Gorgoniceps iowensis* Rehm, [holotype], S; On wood of *Platanus occidentalis*, Mt. Pleasant, 22. II. 1906, Fred J. Seaver, R.P.K. 2024 ex NY (as *Gorgoniceps* ? *iowensis*). Maine: Kittery Pt., July 3, 1922, R. Thaxter (as *Strossmayeria basitricha*), FH. New York: Canandaigua, Sept. 1888, O. F. Cook, No. 1470 (as *Belonidium basitrichum*), BPI; On rotting stump (maple?), Lyndonville, 9. VIII. 1890, Dr. C. E. Fairman, R.P.K. 2015 ex

NY (as *Gorgoniceps iowensis*); On rotten oak wood, Jones's woods, Canandaigua, Sept. 11, 1900, E. J. Durand (as a new, unpublished species attributed to Rehm, of *Arachnopeziza*, with an epithet meaning sulfur-colored), and also as *Belonidium minutissimum* (Batsch) Phill.), CUP-D 1011 (73-37) ex CUP-A 5713, R.P.K. 1145, R.P.K. 1932 (ex Herb. Rehm, S); On hard moist chips in the woods, Lyndonville, Sept. 20, 1905, C. E. Fairman, CUP-D 448 (73-68); On chips in woods, Lyndonville, Sept. 1905, [Fairman], Det. Rehm (as *Belonidium marchalianum*), CUP-F 2122 (2-45); On chestnut log, Ringwood, Aug 29, 1931, C. L. Shear, R.P.K. 1558 ex NY; On *Acer*, Michigan Hollow, near Ithaca, Sept. 4, 1952, R. F. Cain, CUP 52833; On *Salix* wood in seepage area, Lodi Center Rd., Seneca County, 4. VIII. 1974, M.A. Sherwood 1847, CUP 54892; On wood of *Fagus*, along Sagamore Road, Raquette Lake, 11. IX. 1976, M. A. Sherwood, R.P.K. 4310; On decorticated wood, Hendershot Gulf, Alpine, 4.X.1977, R. P. Korf, CUP 56992; On rotted wood, Coy Glen, Ithaca, 25. X. 1979, R. P. Korf, CUP 58162; On wood, 6 Mile Creek, Ithaca, Nov. 24, '82, T. Iturriaga, A. Bujakiewicz, CUP 59720, 59721; On wood, near Waterfall Trail at the bridge, west end of Rensselaerville, Sept. 17, '83, T. Iturriaga S-8, CUP 59895; On wood, Lloyd-Cornell Preserve, Slaterville, 13. X. 83, R. P. Korf (Iturriaga S-9), CUP 59896; On decorticated wood, Huntington Camps, Raquette Lake, 6. IX. 1986, W.-y. Zhuang & R. P. Korf, CUP 61804. **North Carolina:** Ravenel's Forest, July 26, 1931, [Seaver], R.P.K. 2029 ex NY (as *Gorgoniceps iowensis*). **Tennessee:** Burbank, July-August 1887, R. Thaxter, FH. **Virginia:** On *Quercus* sp., Arlington Cemetery, July 7, 1929, C. L. Shear (as *Belonidium basitrichum*), BPI. **Wisconsin:** Devil's Lake State Park, near Madison, 4 Sept. 1953, R. P. Korf, R.P.K. 2775.

Illustrations: Saccardo, *Fung. ital.* pl. 113. 1877 (*Belonidium basitrichum* and *Helminthosporium belonidium*); Schulzer, *Oest. Bot. Zeitsch.* 31: 314. 1881; Schulzer's drawings in his manuscript, never published, kept in the National & University Library Kr. Sveuc Biblioteka at Zagreb University, are reproduced here (Fig. 15); Penzig & Saccardo, *Icones Fungorum Javanicorum*, Table 54, Fig. 1. 1904 (*Belonidium albo-cereum*); Velenovský, *Monogr. Discomycet. Bohem.* 2: Pl. 3, Fig. 20. 1934 (*Gorgoniceps Pilati*); this paper, Fig. 2e, 5a, 6d, 13, 14, 15.

Etymology: The epithet *basitricha* is from the Latin, referring to basal "hairs" (conidiophores).

Notes: *Peziza heterosperma* Schulzer (1878) [= *Strossmayeria rackii* Schulzer (1881)] is neotypified here with material collected on a special trip to the type locality at Vidor forest, close to Vinkovci, Yugoslavia, to search for topotypic material, since the holotype is lost. *S. rackii* Schulzer was described as occurring together with *Helminthosporium gongrotrichum* Corda. The epithet "*rackii*" is superfluous, since three years earlier Schulzer had described the fungus from the same specimen in almost exactly the same words as a new species, *P. heterosperma*. Schulzer's herbarium apparently no longer exists, and his specimens are difficult

if not impossible to locate (M. Torti , pers. comm.). Attempts to locate type material in any Yugoslavian herbarium met with failure. All these reasons made it desirable for a topotypic neotype to be designated. *Peziza heterosperma* is a later synonym and does not upset the currently accepted name, *Strossmayeria basitricha*. Topotypic material was found in abundance (Korf, et al., 1988). The number of germinating ascospores in the Yugoslavian collections of *S. basitricha*, including the neotype of *P. heterosperma* was surprising, because in every collection most of the ascospores inside and outside the asci were germinating when collected. Germination occurs at one or both ends of the ascospore and seldom from the central cells, 3-4 cells may germinate at the same time. Germ tubes frequently are thick and short, and resemble very much the "appendages" that Schulzer showed in his drawing of *S. rackii* (Fig. 15) and in Schulzer (1881). In general, European collections seem to have longer ascospores and a wider conical basal scar than specimens of *S. basitricha* from other localities.

The HT of *G. pilatii* Vel. and a specimen from FH (Thaxter, July-August 1887, Tennessee) have the peculiarity that the apothecia are clearly pseudostipitate, more evidently so than in any other specimens of *S. basitricha*.

There are other collections which vary slightly from *S. basitricha*, but clearly belong to this species. Collection CUP 52833 has ascospores whose cells disarticulate inside the ascus. Collection CUP-D 1011 has a yellow mold associated with it, which Durand considered as a yellow subiculum and annotated the packet as a new species of *Arachnopeziza*, a name apparently provided to him by Rehm, but never published. The HT of *G. iowensis* and of CUP 58162 usually have a verrucose gel sheath on the ascospores. CUP 58162 also has inflated apices of paraphyses, up to 5.9 μm wide. CUP 56992 has yellow apothecia. CUP 54892 has brown, discoid apothecia.

6. *Strossmayeria confluens* (Seaver & Waterston) Iturriaga & Korf, *comb. nov.* (Fig. 3e, 4e, 16).

≡ *Gorgoniceps confluens* Seaver & Waterston, *Mycologia* 32: 399. 1940. (!) (!)

Misapplication: *Gorgoniceps pumilionis* Rehm, by Seaver, *Mem. New York Bot. Gard.* 6: 506. 1916.

Anamorph: *Pseudospiropes* sp.

Apothecia turbinate, sessile with a small point of attachment, 0.2-0.5 mm in diameter, gregarious and often confluent, upper receptacle white or whitish when rehydrated, cream colored, beige or light brown when dry, darker toward the base, usually dark brown, margin and disc concolorous with upper receptacle, disc granulose. Ectal excipulum of *textura oblita*, J+ with a strong blue green (in the HT) to blue reaction, basal cells shorter

and those marginal or closer to the margin longer, 13-15 (-27) \times 2.2-3.7 μm . Asci clavate, (91-) 93-118 (-130) \times 13-19 (-22) μm . Ascospores cylindrical-clavate, hyaline, J+, with refractocell present or not, cells not enlarged, with or without disintegrating cells, biseriate or triseriate, 32-43 (-52) \times 2.9-4.4 (-5.8) μm , (6-) 7 (-8)-septate; gel sheath thick and markedly verrucose or papillate, 1.5-2.2 (-2.9) μm wide. Paraphyses long and filiform, simple, seldom divided, septate, broader at the clavate apex, 1.5-2.2 μm wide at the middle, 2.2-3.7 μm wide at the apex. Conidio-phores brown, septate, flexuous, with evident protruding scars, lighter toward the apex, (3.7-) 4.4-7.3 μm wide at the middle, wider and rounded at the base where they are (4.4-) 7.3-11 μm wide, wall 0.7-1.5 μm thick. Conidia fusiform, brown, scarce, 29-44 \times (8.1-) 9.5-12 μm , basal scar width 1.5-3.0 (-3.4) μm , septa 5-7 (-10); aberrant conidia present in the HT, cylindrical-fusiform, 71-127 \times 12-15 μm , basal scar 3.7 μm broad.

Holotype: On wood, Nov. 29-Dec. 14, 1912, S. Brown, N.L. Britton, F. Seaver, Explorations of Bermuda 1487, [on rotten wood and on palm stems], NY; isotype in R.P.K. 2017.

Paratype: On *Sabal bermudiana*, Paget Marsh, F. J. Seaver & J. M. Waterston, Dec. 2, 1938, Fungi of Bermuda 62, NY (as *Gorgoniceps confluens*).

Type locality: Bermuda.

Habitat: On decomposed wood, principally decorticated, on *Myrica*, on *Schinus terebinthefolium*, on spiny woody involucre of ?*Sloanea*, and on palm (*Sabal*) stems and petioles.

Distribution: Bermuda, Canary Islands, Dominica, Jamaica, Panama.

Exsiccatae specimens examined: None.

Other specimens examined: BERMUDA: On wood, Nov. 29-Dec. 14, 1912, S. Brown, N. L. Britton, F. J. Seaver, NY Explorations of Bermuda 1437, R.P.K. 2016, Authentic; On *Sabal bermudiana* Bailey, Paget Marsh, Bermuda, 1/8/22, H. H. Whetzel, CUP 35005 (as *G. confluens*); On *Sabal bermudiana* Bailey, Paget Marsh, Bermuda, 1/29/22, H. H. Whetzel, CUP 35006, R.P.K. 1187; Old petioles, *Sabal blackburnianum*, Paget Marsh, 8. I. 1922, Whetzel, R.P.K. 2022 ex NY (as *Gorgoniceps pumilionis*); On *Sabal*, Paget Marsh, "small spores," Dec. 6, 1940, F. J. Seaver & J. M. Waterston, Fungi of Bermuda 407, NY (as *G. confluens*); On *Sabal*, Paget Marsh, Dec. 6, 1940, F. J. Seaver & J. M. Waterston, Fungi of Bermuda 410, NY (as *G. confluens*); On *Sabal*, Paget Marsh, Dec. 6, 1940, F. J. Seaver & J. M. Waterston, Fungi of Bermuda 418, NY (as *G. confluens*); On *Myrica cerifera*, Paget Marsh, Sept. 13, 1941, F. J. Seaver & J. M. Waterston, Fungi of Bermuda 460a, NY (as *G. confluens*); On *Myrica cerifera*, Paget Marsh, Sept. 13, 1941, F. J. Seaver & J. M. Waterston, Fungi of Bermuda 461a, NY (as *G. confluens*); On rotten stick, Walsingham, Bermuda, 10/14/44, J. M. Waterston, CUP 35098 (as *G. confluens*) R.P.K. 1186; On branch, Smith's Parish, along Store Hill Road, January 17, 1980, R. P. Korf, leader, et al., CUP-BE 1; On fallen petiole of *Sabal bermudiana*, Paget Parish, Paget Marsh, January 19, 1980, R. P. Korf, leader, et al., CUP-BE 35; On *Schinus terebinthefolium*

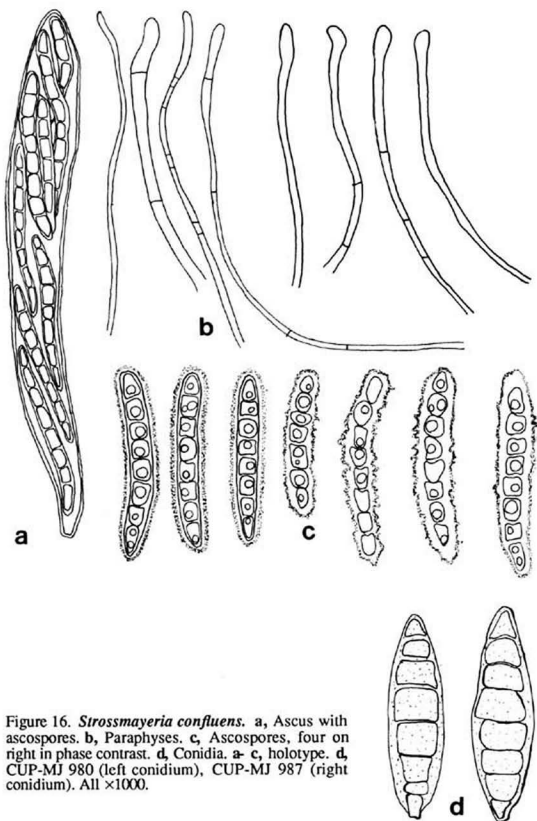


Figure 16. *Strossmayeria confluens*. a, Ascus with ascospores. b, Paraphyses. c, Ascospores, four on right in phase contrast. d, Conidia. a-c, holotype. d, CUP-MJ 980 (left conidium), CUP-MJ 987 (right conidium). All $\times 1000$.

[stems], Smith's Parish, North Nature Preserve, January 21, 1980, R. P. Korf, leader, et al., CUP-BE 97; On wood, Smith's Parish, Spittal Pond, January 21, 1980, R. P. Korf, leader, et al., CUP-BE 102 (part of this collection in herb. M. B. Bigelow); On carbonous pyrenomycete/hyphomycete, Hamilton Parish, North Nature Reserve near Mangrove Lake, January 21, 1980, R. P. Korf, leader, et al., NY, Rossman-BER-151 (as *Strossmayeria* sp.).

CANARY ISLANDS: La Palma: On wet wood, Forest road south of Los Tilos, January 14, 1976, R. P. Korf, W. C. Denison, L. M. Kohn, M. A. Sherwood, CUP-MM 713; On wood, Forest road south of Los Tilos, January 14, 1976, R. P. Korf, W. C. Denison, L. M. Kohn, M. A. Sherwood, CUP-MM 714.

DOMINICA: On face of line of dehiscence of spiny involucre of ?*Castanea* or ?*Sloanea*, woods and roadside near Bee House, Springfield Estate, 7 miles from Roseau, elev. 1200 ft., June 21, 1970, R. P. Korf, leader, et al., CUP-DO 81; On wood, Cochrane Estate, above Roseau, elev. approx. 1500 ft., June 28, 1970, R. P. Korf, leader, et al., CUP-DO 261.

JAMAICA: On very rotted twig, Dolphin Head, Hanover Parish, January 22, 1971, R. P. Korf, leader, et al., CUP-MJ 690, NY-K. P. D. 1965; On *Rubus ellipticus* J.E. Smith stems, creek below Pine Grove Villas, 0.9 mi. North of Guava Ridge, 3400 ft., St. Andrew Parish, Dec. 8, 1986, R. P. Korf, T. Iturriaga, W.-y. Zhuang, CUP-MJ 978, VEN 210435; On decorticated log, trail above Bath Fountain Hotel, Bath, St. Thomas Parish, elev. 650 ft., December 12, 1986, R. P. Korf, T. Iturriaga, W. Y. Zhuang, CUP-MJ 1111, VEN 210554.

PANAMA: Canal Zone: Barro Colorado Island, 18 July 1945, G. W. Martin 6067, ISC ex IA 380550 (as *Belonium sordidum*, "Part A: big piece of wood"); On fallen palm trunk, Canal Zone: Barro Colorado Island, 18 July 1945, G. W. Martin 6067, USDA, ex Mycological Collection of the Univ. of Iowa.

Illustrations: Seaver, F. J., *Mycologia* 38: 551. 1946; Seaver, F. J. 1951. *N. Amer. Cup-Fungi (Inoperc.)*. pl. 110; this paper, Fig. 3e, 4e, 16.

Etymology: The epithet *confluens* is from the Latin, meaning thickly clustered.

Notes: The distinctive characters of this species are presence of a thick, verrucose gel sheath on ascospores, refractocells present or not in the ascospore, but when present, not enlarged, and disintegrating cells present or not. This species can be distinguished from *S. jamaicensis* in that asci and ascospores are thinner and in the absence of enlarged refractocells in the ascospores. Anamorph characteristics were very noticeable in the collections studied. The absence or poor quality of the anamorph was evident in most of the collections studied. Aberrant conidia and/or different kinds of conidia present, not seen before, were observed: obclavate in CUP-MJ 1111 (4 seen), fusiform with one flat side in CUP-MJ 978 (1 seen) and CUP-MJ 987 (3 seen) but also one fusiform conidium seen. Aberrant obclavate multiseptate conidia, 10-14-septate, seen in

CUP-MJ 980 (8 seen), together with four fusiform 7-septate conidia. In the HT only four conidia were seen, 2 fusiform but in a poorly preserved state, and 2 aberrant. In CUP-MM 714 many conidia measured were obtained from multiple-ascospore cultures prepared in the field by Professor Korf.

Waterston (1947) published a list of examined specimens of *G. confluens* in his book, *The Fungi of Bermuda*. There Waterston indicates that the type specimen was "listed as *G. pumilionis* Rehm, by Seaver (1916: 506), but see also Seaver (1946: 551, 552)."

Seaver's (1916) paper on Bermuda Fungi cites no specimen number for *Gorgoniceps pumilionis* but mentions that it was the only *Gorgoniceps* collected (p. 501) during a "two weeks collecting trip (November 29-December 14, 1912)." It was in 1940 that Seaver and Waterston designated this specimen as the type of *G. confluens*. The 1916 identification is thus merely a misidentification.

Seaver and Waterston (1940) (repeated in Seaver, 1946, 1951) indicated that *G. confluens* is very similar to *G. iowensis* Rehm (treated here as a synonym of *S. basitricha*), which was described from material collected by Seaver in Iowa, but indicated that the "spores of the Bermuda specimens seem to be larger."

7. *Strossmayeria dickorfi* Iturriaga, *sp. nov.* (Fig. 17a-e).

Ab Strossmayeriae speciebus aliis ascis aliquando 6 sporas contentibus, conidiophoro typi Pseudospiropedis nodosi characteristici, et conidiis fusiformibus latere uno applanatis differt.

Anamorph: *Pseudospiropes* sp.

Apothecia turbinate when young, discoid, flatly appressed to the substrate when mature, sometimes with an evident whitish subiculum, receptacle cream colored, disc cream-ochraceous. Ectal excipulum textura oblita, 26-30 μm thick in median section, J+, cells 8.0-12 \times (1.5-) 2.2-2.9 μm . Asci 6-8-spored, saccate with a very short stipe, (84-)112-142 (-153) \times 13-19 (-21) μm . Ascospores cylindrical-clavate to sub-fusoid, hyaline, J+, cells uniform but sometimes disarticulating inside and outside the ascus, biseriate, (29-) 34-40 (-60) \times (3.7-) 4.4-5.1 (-7.3) μm , (3-) 7-septate, gel sheath 1.0-1.5 μm thick, verrucose. Paraphyses cylindrical, 2.2 μm wide at the tips. Conidiophore brown, septate, flexuous, with thick walls and evident, grossly protruding scars, (6.6-) 7.3-9.5 (-11) μm wide at the middle, base swollen to 10-11 μm wide. Conidia fusiform with one flat or flatter side, brown except apical cell which is hyaline, sometimes enlarged, and usually of an irregular shape, seeming to be a germinating cell but usually broken, 32-44 (-56) \times 12-15 μm , basal scar width (3.7-) 4.4-6.0 (-6.6) μm , septa (4-) 6-7 (-9), dark septa sometimes present.

Holotype: On a twig, trail from Km. 12.2 to falls of Rio de la Mina, El Yunque, elev. 650 m., June 8, 1970, R. P. Korf, leader et al., CUP-PR

3929.

Type locality: El Yunque, Puerto Rico.**Habitat:** On a twig of unknown host.**Distribution:** Puerto Rico.**Exsiccatae specimens examined:** None.**Other specimens examined:** None.**Illustrations:** Fig. 17a-e in this paper.**Etymology:** The epithet *dickorfi* is in honor of Professor Richard (Dick) Korf.

Notes: Diagnostic features for this species are the presence (sometimes) of a subiculum, occasionally 6-spored asci, saccate asci, frequently with disarticulating ascospore cells, *Pseudospiropes nodosus* type of conidiophore, fusiform conidia with one flat side, and 6-7-septate conidia. *S. dickorfi* differs from *S. atriseda* in the shape of the conidia, being fusiform with one flatter side for *S. dickorfi* and fusiform for *S. atriseda*; in ascus shape, being short and stout in *S. dickorfi* and long and clavate in *S. atriseda*; and in the position of the dark cells in the conidia, being penultimate in *S. dickorfi*, and sometimes apical and/or basal in *S. atriseda*.

8. *Strossmayeria immarginata* (Pat. & Gaill.) Iturriaga, *comb. nov.* (Fig. 17f-g).

≡ *Beloniella immarginata* Pat. & Gaill., *Bull. Soc. Mycol. France* 4: 100. 1888. (!!)

≡ *Belonidium immarginatum* (Pat. & Gaill.) Sacc., *Syll. Fung.* 8: 498. 1889.

Anamorph: *Pseudospiropes* sp.

Apothecia turbinate, sessile but with a small point of attachment to the substrate, 0.15-0.20 mm in diameter when dry, 0.2-0.3 mm in diameter when rehydrated, solitary (but this is not certain since the type specimen is poor), receptacle yellowish when dry, white when rehydrated, base brownish and composed of brown irregular cells, from which the conidiophores also arise, disc concolorous with upper receptacle. Ectal excipulum of *textura oblita*, 18 μ m thick in the middle, 9.0-11 μ m thick at the flanks, J+, composed of long rectangular cells with gelatinized walls, 7.3-11 (-12) \times (1.5-) 2.2-2.9 (-3.7) μ m, apical cells with rounded ends. Medullary excipulum and sub-hymenium of *textura intricata*, indistinguishable, intermixing with the irregular cells from the base of the apothecium. Asci clavate, 88-107 \times (9.3-) 11-13 μ m, base of the asci 3.7 (-5.6) μ m wide. Ascospores cylindrical-clavate, hyaline, J+, with uniform cells, 30-51 \times 2.9-3.7 μ m, (3-) 4-7-septate, frequently 4-septate, smaller ascospores with fewer septa and larger ones with more septa, gel sheath verrucose, 1.0 μ m thick. Paraphyses long and filiform, simple, septate, slightly swollen and rounded at the apex, 1.5 (-2.2) μ m wide in the middle,

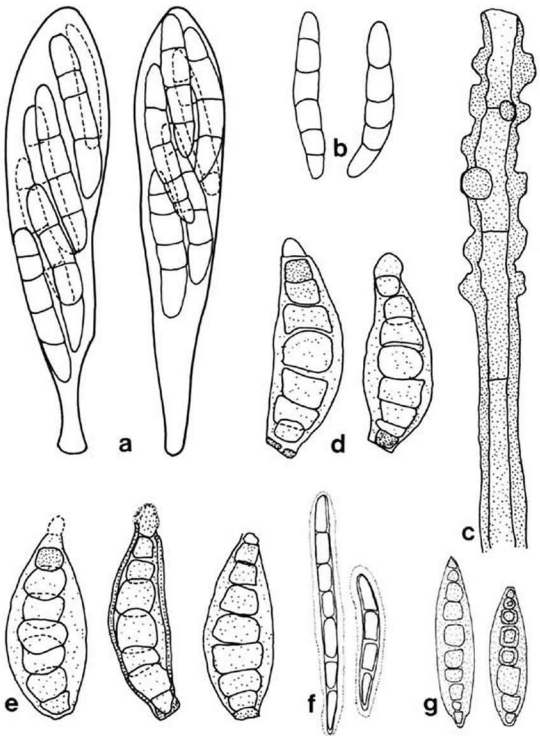


Figure 17. *Strossmayeria* spp. a-e, *S. dickorfi* (HT). a, asci with ascospores; b, ascospores; c, conidiophore; d, e, conidia. All $\times 1000$. f, g, *S. immarginata* (HT). f, ascospores; g, conidia. Both $\times 1000$.

2.2-2.9 (-3.7) μm wide at the apex. Conidiophores brown, straight, with protruding scars, 5.1-5.9 (-7.3) μm wide in the middle, base somewhat swollen, rounded, 7.3-11 μm wide, wall 0.7-1.5 μm thick. Conidiogenous cell lighter in color than the rest of the conidiophore, at least in its upper terminal part. Conidia fusiform with a short basal pedicel, brown, (23-) 32-35 (-37) \times 7.3-9.5 μm , basal scar narrow, width 1.0-2.2 μm , septa (3-) 7-9.

Holotype: Blanc laiteux opalin, Puerto Zamuro, 15 Juin 1887, Herb. N. Patouillard 56, Gaillard, FH. [Part of the HT (one slide) at NY as KPD 3167 ex FH Pat. Herb. 56].

Type locality: Puerto Zamuro, at the margin of the Orinoco River, Estado Bolívar, Venezuela.

Habitat: On dead wood of unknown host.

Distribution: Venezuela.

Exsiccatae specimens examined: None.

Other specimens examined: None.

Illustrations: Patouillard, N. & A. Gaillard, *Bull. Soc. Mycol. France* 4: Pl. XVIII, 3, 3a, 3b, 1888; this paper, Fig. 17f-g.

Etymology: The epithet *immarginata* is from the Latin meaning without a margin.

Notes: Saccardo's (1889) transfer to *Belonidium immarginatum* was accompanied by a Latin translation of the original French description. Our measurements agree with Patouillard and Gaillard's (1888) in everything but ascospore width, for which our values are lower than theirs, "40-43 \times 4-5 μ ." They report no reaction in iodine, but we found ectal excipulum and ascospores blueing in Melzer's Reagent. They reported only 4-septate ascospores.

The outstanding morphological features of *S. immarginata* are the frequency of 4-septate ascospores, the small size of the conidia, the small conidial basal scar, and the short ascus length. Ascospore size is similar to that in *S. bakeriana*.

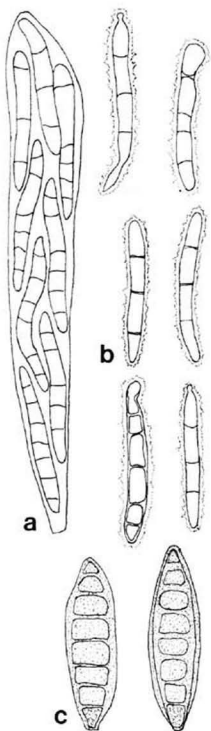
This fungus was cited by Pfister (1977), who indicated the basionym and the combination in *Belonidium*, but without comment on its taxonomic position. It was also cited by Dennis (1970) under omitted species. Dennis wrote: "Perhaps a lichen." The holotype is not in good condition; just one or two apothecia are left. The part of the HT at NY is just a slide with a squash mount of one apothecium and a few conidiophores and conidia, probably in glycerine.

9. *Strossmayeria introspecta* (Cooke) Iturriaga, *comb. nov.* (Fig. 1, 2b, 2f, 3h, 4f, 6e, 18).

≡ *Peziza introspecta* Cooke, *Hedwigia* 14: 84. 1875. (!!)

≡ *Belonidium introspectum* (Cooke) Sacc., *Syll. Fung.* 8: 498. 1889.

Anamorph: *Pseudospiropes* sp.



Apothecia turbinata, 0.2 to 1 mm diameter, usually confluent, sometimes gregarious, seldom scattered, sub-stipitate, upper flank of receptacle beige, turning white to cream colored when rehydrated, pure white to gray when fresh, darker toward the base, disc concolorous with upper receptacle. Base of the apothecium composed of brown to irregular brown cells, with its anamorph, *Pseudospiropes*. Ectal excipulum of textura oblita, 26-39 μm thick in median section, J+, composed of long rectangular cells, apical cells with rounded, slightly swollen tips, cells 8.8-15 (-20) \times (2.2-) 2.9 (-3.7) μm , basal cells brown and of textura angularis. Medullary excipulum and sub-hymenium mixed, both thin, of textura intricata embedded in a gel. Asci 8-spored, clavate, with brown dextrinoid cytoplasmic contents when young, arising from croziers, (93-) 99-135 \times (9.3-) 11-13 (-15) μm . Ascospores cylindrical-clavate, hyaline, J+, with uniform cells, biseriate to usually triseriate, (23-) 29-40 \times 2.9-4.4 (-5.1) μm , 3 (-7)-septate, germination frequently seen, inside and outside the ascus either by production of narrow germ tubes or by production of bleb-like structures which are probably phialides, gel sheath smooth to verrucose, 0.7-1.5 μm thick. Paraphyses long and filiform, simple or divided, septate, swollen at the apex, 1.5-2.2 μm wide in the middle, 2.9-3.7 μm wide at the apex, granulose contents in the cytoplasm seen in one specimen. Conidiophore brown, straight, with thick walls and scars present, 5.1-5.9 (-7.3) μm wide in the middle, base swollen. Conidia fusiform, with a prominent short basal pedicel-like cell,

Figure 18. *Strossmayeria introspecta*. a, ascus with ascospores; b, ascospores (some germinating); c, conidia. a., b, HT; c, R.P.K. 1566 [IT ex NY 762]. All \times 1000.

brown, basal and apical cells usually darker than the rest, (29-) 34-41 × (7.3-) 9.0-12 μm, basal scar width 2.2 (-2.9) μm, 5-7 (-10)-septate.

Holotype: On rotten wood, Newfield, N. J., July 14, Ellis 2160 K; isotypes in CUP-D 3773 (73-56), R.P.K. 1709, CUP-D 8715 (73-59), NY (Ellis 2160) [Note on packet mentions the presence of an *Helminthosporium* (prob. *H. septemseptatum* Pk.)], R.P.K. 1566.

Type Locality: Newfield, New Jersey, U. S. A.

Habitat: on rotten wood of unknown hosts, on decorticated wood, and on *Fraxinus*.

Distribution: All collections known are from U.S.A.

Exsiccatae specimens examined: Korf & Gruff, Discomycetes Exsiccatae, to be issued shortly, Coy Glen, Ithaca, New York, September 30, 1982, R.P. Korf, CUP 59716; On decorticated wood, Freese Road extension, Fall Creek, Varna, NY, 22. vii. 1960, W. C. Denison, R. T. Moore, R. P. Korf, et al., R.P.K. 2968.

Other specimens examined: UNITED STATES: Oct. 1878, with conidia, Cke. says very near *P. minutissimum* Blox. (as *Peziza introspecta*) Ellis 3171(762), NY [Poor specimen], R.P.K. 1565; Newfield, N.J., Oct. 1878, Ellis, CUP-D 8714 (73-58) (ex NY Ellis 3171) (as *Peziza introspecta*) [well-preserved specimen]; On *Fraxinus*, Waverly, October 1899, R. Thaxter (as *S. basitricha*, annotated by M. Sherwood), FH; Belmont, Massachusetts, October 1886, R. Thaxter (as *S. basitricha*, annotated by M. Sherwood), FH; On decorticated wood, Coy Glen, Ithaca, N.Y., Sept. 30, 1982, R. P.Korf, CUP 59716 [referred to as "S-3" in Iturriaga & Israel, (1985)].

Illustrations: Iturriaga & Korf, *Mycotaxon* 20: 182, Fig. 1-3, 1984; Iturriaga & Israel, *Canad. J. Bot.* 63: 196-199, Fig. 1-12, 1985; this paper, Fig. 1, 2b, 2f, 3h, 4f, 6e, 18.

Etymology: The epithet *introspecta* is from the Latin, meaning looked at internally.

Notes: This species may be distinguished from *S. basitricha* because of its very frequently 3-septate ascospores and by the conidial pedicel-like basal cell. The 3-septate ascospores frequently have been seen germinating indicating that they are mature. The anamorph is of the *Pseudospiropes simplex* type. There are granulose contents in the cytoplasm of paraphyses in CUP 59716.

10. *Strossmayeria jamaicensis* (Seaver) Iturriaga & Korf, *comb. nov.* (Fig. 4h-i, 6f, 19).

≡ *Gorgoniceps jamaicensis* Seaver, *Mycologia* 38: 552-553. 1946. (!!)

Anamorph: Probably *Pseudospiropes* sp.

Apothecia discoid, sessile with a small point of attachment, 0.2-0.5 mm. wide, gregarious but not losing their individuality, upper receptacle

cream colored when dry, white when rehydrated, brown toward the base, margin and disc concolorous with upper receptacle, disc granulose, whole apothecium turning lemon-yellow in 2% aqueous KOH and exuding a similarly colored substance into that medium. Ectal excipulum of textura oblita with long rectangular cells, J+, terminal cells with rounded apex, (9.5-) 12-15 (-17) × (2.2-) 2.9 (-3.7) μm . Asci clavate, 105-143 (-148) × (17-) 19-21 (-23) μm , base 3.7-5.6 μm wide, arising from repeating croziers. Ascospores cylindrical, hyaline, J+ reaction very strong in spore and gel layer, with usually one (seldom two) enlarged refractocells (best seen in Soluble Blue 706-lactic acid), (31-) 33-46 (-49) × 4.4-8.0 (-9.3) μm , (1-) 7-septate, gel layer thick and very evidently verrucose, 2.2-3.7 μm thick. Paraphyses long and filiform, simple, septate, swollen at the apex, (0.7-) 1.5 (-2.2) μm at the middle, (1.5-) 2.2 (-2.9) μm at the apex. Conidiophore brown, flexuous, with scars, lighter toward the apex, 5.9-8.0 (-9.5) μm wide at the middle, base rounded 6.6-8.0 (-10) μm wide, wall 0.7-1.5 μm wide, arising from a mass of brown roundish to irregular cells located at the base of the apothecia. Conidia fusiform with one flattened side, tapering toward the two ends, one end pointed and the other broader, frequently with an enlarged cell (as with ascospores), dematiaceous with two middle cells darker and two end cells lighter, (25-) 26-29 (-32) × (6.6-) 7.3-8.0 (-8.8) μm , basal scar (0.7-) 1.5 (-2.2) μm , 3 (-5)-septate.

Holotype: Very small, white, Chester Vale, 3000-4000 Ft., wet mountainous region, Jamaica, December 21-24, 1908, W.A. Murrill and Edna L. Murrill 311, Det. F. J. Seaver, [On bamboo, *Bambos vulgaris*], NY; isotype in R.P.K. 2019.

Type locality: Jamaica.

Habitat: On culms of *Bambusa vulgaris* and stems of *Rubus ellipticus*.

Distribution: Only collections known are from Jamaica.

Exsiccatae specimens examined: None.

Other specimens examined: JAMAICA: On *Rubus ellipticus* J. E. Smith stems, creek below Pine Grove Villas, 0.9 miles north of Guava Ridge, 3400', St. Andrew Parish, 8 XII, 1986, R. P. Korf, T. Iturriaga, W.-y. Zhuang, CUP-MJ 980.

Illustrations: This paper, Fig. 4h-i, 6f, 19. Fig. 19b, representing an ascus with ascospores and an ascospore outside, is a machine copy of Seaver's drawing which is a part of the holotype. Apparently this drawing was never published.

Etymology: The epithet *jamaicensis* is from the country name where the type was collected.

Notes: The main features of this species are the shape, width, and cell characteristics (enlarged refractocell) of the ascospores. Though measurements and characteristics are given for the dematiaceous mold found together with this species, we are not certain that this is the anamorph of *S. jamaicensis*, because many of the conidia encountered do not seem to be referable to *Pseudospiropes*. In just one case, one *Pseudospiropes*-type of conidium was seen (see drawing). Neither the

dematiaceous fungus nor the presence of the enlarged refractocells was described by Seaver. In CUP-MJ 980 a dematiaceous obclavate conidium $190 \times 15 \mu\text{m}$ was observed.

Our measurements agree with Seaver's (1946) in all structures but the ascospores. In this case his measurements, "9-10 \times 50-55 μ ," are larger than ours.

With the holotype specimen there is another dematiaceous mold with helicoid conidia, but that is located on a different part of the substrate than where the *Strossmayeria* apothecia are found.

The ascospores in Melzer's Reagent look like they are in flames, because of the refraction of the irregularly warted gel that surrounds them. No germination of any ascospore was seen.

11. *Strossmayeria japonica* Iturriaga, *sp. nov.* (Fig. 20).

Ab S. atriseda ascosporis cylindrico-clavatis, majoribus, conidiis obclavatis vel fusiformibus longioribus 4-6 septatis praeditis differt.

Anamorph: *Pseudospiropes* sp.

Apothecia turbinate, up to 1 mm diameter, confluent, receptacle light brown when rehydrated, dark brown when dry, disc concolorous. Ectal excipulum of textura oblita, light brown, J+, cells (6.3-) 9.8-11 \times 2.8-3.5 μm . Medullary excipulum and sub-hymenium thin. Asci clavate, 84-116 \times 11-13 μm . Ascospores cylindrical-clavate, hyaline, J+, with uniform cells, (34-) 37-45 \times 3.7-4.4 μm , 7-septate, gel sheath smooth, 1.0 μm thick. Paraphyses long and filiform, simple, septate, swollen at the apex, 1.5 μm wide in the middle, some over 2.9 μm wide in the apex. Conidiophore brown, straight, scars present, 7.3-9.5 μm wide in the middle, base swollen to 8.8-10 μm wide. Conidia obclavate to fusiform, brown, dark cells absent, dark septa present, (41-) 44-56 (-60) \times 10-15 μm , basal scar width (3.7-) 4.4-5.1 μm , (3-) 4-6-septate.

Holotype: On decorticated wood, grounds of Chuzenji Kanaya Hotel, Chuzenji-kohan, Okku-Nikko, Tochigi Pref., Honshu, 26.VIII.1983, IMC₃ workshop people, CUP-JA 3718.

Type locality: Japan (Honshu).

Habitat: On decorticated wood of unknown host.

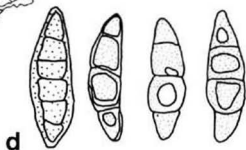
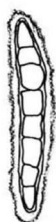
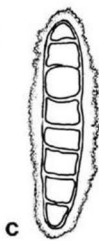
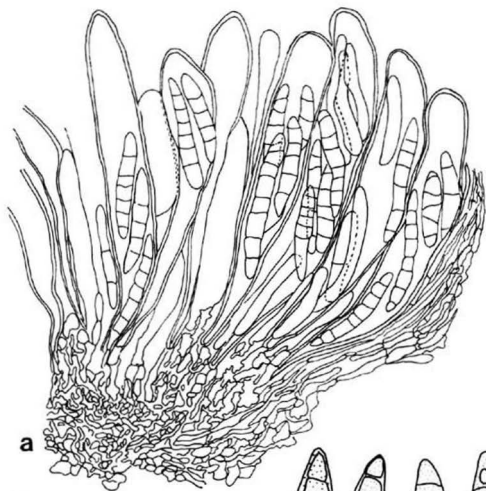
Distribution: The only collection known is from Japan.

Exsiccatae specimens examined: None.

Other specimens examined: None.

Illustration: This paper, Fig. 20.

Figure 19. *Strossmayeria jamaicensis*, (HT). **a**, median section through part of an apothecium, showing asci with ascospores, $\times 655$; **b**, ascus and ascospores redrawn from Seaver's drawing in HT packet, magnification not stated; **c**, ascospores, $\times 1000$; **d**, conidia, $\times 1000$.



Etymology: The epithet *japonica* is taken from the country name where the type specimen was collected.

Notes: *Belonidium japonicum* Hara (1954) [as *Belanidium*] (see doubtful species) is most probably not a *Strossmayeria* as judged from the description.

The main features of this species are the brown color of the apothecia and the large, wide obclavate to fusiform conidia. This species differs from *S. atriseda* in shape and size of ascospores and conidia, and in number of conidial septa.

12. *STROSSMAYERIA JOSSERANDII* (Grelet) Bertault, *Rev. Mycol. (Paris)* 35: 133. 1970. (Fig. 6g, 21).

≡ *Belonidium josserandii* Grelet, *Rev. Mycol. (Paris)* 15: 38. 1950 ('*Josserandi*'). (!!)

Anamorph: *Pseudospiropes josserandii* (Bertault) Iturriaga, *comb. nov.*

≡ *Helminthosporium josserandii* Bertault, *Rev. Mycol. (Paris)* 35: 136. 1970. (!!)

Apothecia discoid when mature, sometimes turbinate when young, sessile to sub-stipitate, 0.5-1.0 (mostly 0.8) mm diameter, frequently confluent, yellowish to yellow-greenish when rehydrated, sometimes whiter when young and turning beige as they mature, brown toward the base, basal tissue brown or brownish, exuding in 2% KOH a yellow substance which soon disappears, disc from white to pale to light brown, granulose, margin folding inwards when young and then opening. Point of attachment very short, brownish to brown, conidiophores seeming to arise from this point. Ectal excipulum of textura oblita, composed of more or less parallel long hyphae, 32-45 μm wide, light brown to yellowish, clear, J+ turning blue-green with Melzer's reagent, cells 8.8-13 \times 2.2 μm . Medullary hymenium and subhymenium not clearly differentiated. Asci clavate or saccate, arising from croziers, (97-) 103-131 (-140) \times 11-19 μm . Ascospores cylindrical-clavate, hyaline, J+, with uniform cells which disarticulate in one specimen, biseriate to multiseriate, (32-) 35-55 \times 3.5-5.1 (-6.6) μm , 6-7-septate, gel sheath smooth, 1.0-1.5 μm thick. Paraphyses long and filiform, simple or divided, septate, swollen at the apex, same length as, or a little longer than the asci, 1.5 μm wide in the middle, 2.2-2.9 μm wide at the apex. Conidiophores brown and lighter toward the apex, macronematous, mononematous, simple, slightly flexuous to flexuous, thick-walled, septate, 4.4-7.3 μm wide in the middle, base swollen to 7.3-8.8 (-14) μm wide. Conidiogenous cell polyblastic, integrated, terminal or intercalary, sympodial, cylindrical, slightly flexuous, bearing slightly protruding scars that are lighter in color than the rest of the conidiophore. Conidia brown, solitary, dry, acropleurogenous, simple, fusiform, sometimes constricted near the middle, tapering toward

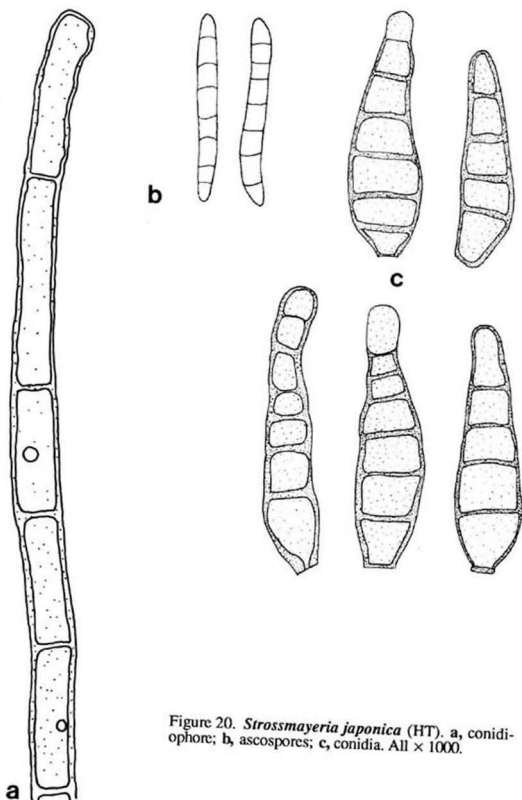


Figure 20. *Strossmayeria japonica* (HT). a, conidiophore; b, ascospores; c, conidia. All $\times 1000$.

the apex, sometimes with a distinct beak, that may be relatively long (see Fig. 21a, and Notes), truncate at the base, (5-) 7-9-septate, sometimes with dark septa, basal cell usually dark brown, and basal septum always very thick and dark brown, usually all of the conidial septa with a dark thickening (the torus) around the pore between cells, 29-59 (-73) \times (7.3-) 10-15 (-16) μm , basal scar width (2.2-) 2.9-3.7 (-4.4) μm .

Lectotype: s/*Carpinus betulus?*, Bois du Casino de Charbonnières, Cne de La Tour de Salvagny (Rhône), 7bre 1933, M. Josserand, PC, selected by Bertault (1970); isolectotype in CUP 61933. (Specimen is also holotype of *Helminthosporium josserandii*.)

Type locality: Rhône, France.

Habitat: On decorticated wood of *Carpinus betulus?* [in Grelet's publication (1950), he describes the host as on decorticated decomposed trunk of "*quercus, carpini vel fraxini?*"], *Ulmus americana*, on twig of undetermined host.

Distribution: France, U.S.A. (incl. Puerto Rico).

Exsiccatae specimens examined: None.

Other specimens examined: UNITED STATES: **New York:** On Dutch elm-killed *Ulmus americana* L., 5 Burhans Pl., Delmar, Town of Bethlehem, Albany Co., Oct. 18, 1977, John H. Haines, J.H.H. 3260, NYS (as *Strossmayeria basitricha* with *Pseudospiropes simplex*). **Puerto Rico:** Trail from km. 12.2 to Falls of Rio de La Mina, El Yunque, elev. 650 m., June 8, 1970, R.P. Korf, leader, et al., CUP-PR 3929.

Illustrations: Grelet, L. J., *Rev. Mycol. (Paris)* 15: 39, Fig. 31, 1950; Bertault, *Rev. Mycol. (Paris)* 35: 135, Fig. 1, 1970; this paper, Fig. 6g, 21.

Etymology: The epithet *josserandii* is in honor of the collector, Prof. M. Josserand.

Notes: This species can be distinguished from *S. basitricha* by conidial elements: shape and size, presence of the torus, dark basal cell, and apical beak. It can also be distinguished by the difference in sizes of the ascospores, the measurements of *S. basitricha* being considerably smaller. It can be distinguished from *S. bakeriana* in the same conidial characteristics and in the mature apothecial shape.

Bertault (1970) indicated that he studied two syntype collections made by Josserand, one collected on September 29, 1933, and the second collected on October 7, 1933, both from the same station, an undetermined trunk surrounded by *Quercus*, *Fraxinus*, and *Carpinus*. Bertault selected the first one collected as the lectotype. We have not studied the lectoparatype.

Collection CUP-PR 3929 bears two different *Strossmayeria* and *Pseudospiropes* species, *Strossmayeria dickorffii* and *Strossmayeria josserandii*, occurring mixed together on the same piece of wood. The part of this collection with *Strossmayeria josserandii* varies some from that of the other two collections of *S. josserandii* examined in having larger ascospores, ascospores which disarticulate, and larger, 9-septate conidia, with a basal scar 3.8 μm wide. In comparison the HT has a basal

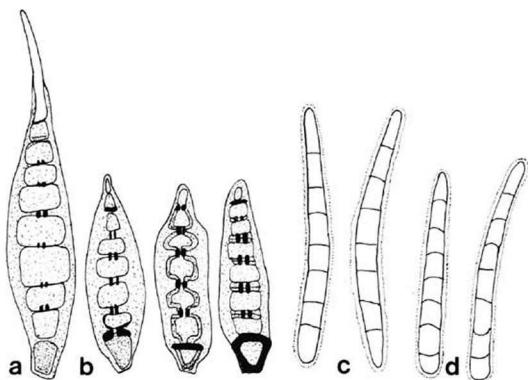


Figure 21. *Strossmayeria josserandii*. a, b, conidia; c, d, ascospores. a, d, CUP-PR 3929; b, c, HT. All $\times 1000$.

scar $2.9 \mu\text{m}$ wide and 5-7-septate conidia, while in J.H.H. 3260 the basal scar is $2.6 \mu\text{m}$ wide, and the conidia are 7-septate. Conidia of CUP-PR 3929 have a longer beak, which may be a germination tube. The beak was not included in conidial measurements. The reason for including CUP-PR 3929 in *Strossmayeria josserandii* is because of the presence of the torus in the conidia, and apothecial shape and color similarities. The torus is a unique character in the conidia of *Pseudospiropes josserandii*, and we believe that it deserves being considered as a diagnostic species character. The torus is not present in every conidium.

13. *Strossmayeria nigra* Iturriaga, *sp. nov.* (Fig. 22).

Ab Strossmayeriae speciebus aliis apotheciis valde atris discoideis margine involuto striato praeditis, ascis parvis $71-94 \times 13 \mu\text{m}$ differt.

Anamorph: Unknown, presumably *Pseudospiropes* sp.

Apothecia discoid with an involute margin that is slightly striate and

occasionally broken into slits, sub-stipitate, receptacle all black or dark brown, disc dark brown, reviving paler. Ectal excipulum of textura porrecta, 7.3-11 μm wide, dark brown, J+ reaction unobservable because of dark color of the excipulum, cells 8.8-14 (-16) \times 2.2-3.7 μm . Medullary excipulum indistinguishable. Subhymenium of mainly textura globulosa mixed with textura intricata. Asci clavate, small, (66-) 71-94 (-103) \times (11-) 13 (-15) μm , thick walled, walls 0.7-1.5 μm thick. Ascospores cylindrical-clavate, hyaline, J+, biseriate to triseriate, (26-) 29-36 \times 3.7 (-4.4) μm , always 7-septate, gel sheath smooth and thin, less than 0.7 μm thick. Paraphyses very thin and filiform, simple, septate, sometimes remaining cylindrical, other times widening at the apex in a clavate shape, 0.7-1.5 μm wide in the middle, 1.5-3.7 μm wide at the apex. No anamorph found.

Holotype: On beech, near River Chocorea, N. H., Sept. 1916 (as *Patellaria* sp., then annotated by M. A. Sherwood in 1979 as *Strossmayeria* sp.). [Probably R. Thaxter, leg.], F.

Type locality: New Hampshire, U. S. A.

Habitat: On decorticated wood of *Fagus*.

Distribution: Only known from the HT.

Exsiccatae specimens examined: None.

Other specimens examined: None.

Illustrations: Fig. 22 in this paper.

Etymology: The epithet *nigra* is from the Latin, meaning black.

Notes: The main features of this species are the black or almost black apothecia, the very small asci and ascospores, and the presence of two different kinds of paraphyses. There was no trace of an anamorph on the only known collection. The name of the collector does not appear on the specimen, but from the collecting date and locality it was probably collected by Thaxter. This species may be distinguished from *S. atriseda* by ampler asci and wider ascospores. It may be distinguished from the rest of the species mainly because of the color and shape of the apothecia and because of its small asci and ascospores.

14. *Strossmayeria notabilis* Iturriaga, sp. nov. (Fig. 2a, 3b-c, 3f, 4j, 6i, 23).

Ab Strossmayeriae speciebus aliis ascis longioribus latioribusque, 110-163 \times 15-21 μm , et ascosporis longioribus 49-64 μm longis differt.

Anamorph: *Pseudospiropes* sp.

Apothecia turbinate with a small point of attachment, 0.5-0.8 mm in diameter, usually gregarious to confluent, seldom scattered, upper flanks of receptacle white, pale, light brown or brown, lower flanks of receptacle and base brown, disc granulose, generally concolorous with upper receptacle, in one case lighter in color, base of the apothecia composed of

roundish to irregular cells. Ectal excipulum usually of textura oblita with long parallel cells, J+, (7.0-) 9.0-17 × (1.5-) 2.0-4.0 μm. Asci generally saccate or at least with a short pedicel and blunt base, in a few cases with a long stipe and then having a clavate shape, (99-) 110-163 (-178) × (11-) 15-21 (-24) μm arising from croziers. Ascospores cylindrical-clavate, hyaline, J+, frequently with disintegrating cells, sometimes with crystal-like contents in the guttules of certain cells, triseriate, (31-) 49-64 (-77) × 4.0-6.0 (-7.0) μm, 7 (-9)-septate, most spores with a smooth gel sheath, some spores with a verrucose gel sheath, 1.0-2.0 μm thick. Paraphyses long and filiform, simple or divided, widening at the top, 1.5-2.2 (-3.7) μm at the middle, 2.9-3.7 (-5.9) μm at the top. Conidiophores brown, straight, with marked percurrent growth of the conidiophore, generally smooth, base swollen, (4.4-) 5.1-9.5 μm at the middle, 7.3-15 μm at the base. Conidia brown, of different shapes: obclavate and widening at the base, or obclavate with a central constriction, fusiform to fusiform with one flat side, (42-) 51-58 (-90) × (7.3-) 13-15 (-21) μm, basal scar width (2.9-) 4.4 (-5.1) μm, (6-) 7-10-septate.

Holotype: On bamboo, Casita Alta, [Prov. Chiriquí], 21 August 1937, G. W. Martin 4338, ISC ex IA 380549, Fungi of Panama, (Det. E. K. Cash as *Belonium sordidum*); isotypes in BPI [on trail between Boquete and summit of El Volcán. Alt. 2000-2200 m.] and CUP 61865 [slide].

Paratypes: INDONESIA: On rotting stem of *Amomum coccineum*, Tjibodas, Java, 22. XII. 1961, M. A. Rifai & R. P. Korf, CUP-SA 393.

PANAMA: On fallen palm trunk, Barro Colorado Id., Canal Zone, July 18, 1945. G. W. Martin 6067, (Det. E. K. Cash as *Belonium sordidum*) BPI, ISC ex IA 380550.

VENEZUELA: On dead herbaceous stems, path leading to water source behind the hotel, Rancho Grande, Aragua, June 14, 1968, K. P. Dumont, CUP-VE 4336.

Type locality: Panama.

Habitat: On bamboo, on decorticated wood of unknown host, on fallen palm trunk, on dead herbaceous stem, on rotting stem of *Amomum coccineum*.

Distribution: Indonesia, Panama, Venezuela.

Exsiccatae specimens examined: None.

Other specimens examined: None.

Illustrations: This paper, Fig. 2a, 3b-c, 3f, 4j, 6i, 23.

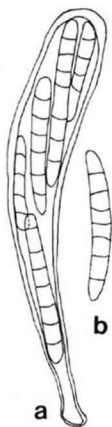


Figure 22. *Strossmayeria nigra* (HT). a, ascus with ascospores; b, ascospore. Both × 1000.

Etymology: The epithet *notabilis* is from the Latin, meaning remarkable.

Notes: The distinguishing characteristics of this species are the width of the asci, the width and length of ascospores, and the presence of refractocells in the ascospores. The ascospore gel sheath may be smooth or verrucose.

In the holotype the conidiophores are sparse and scattered but homogeneously distributed on the host, which is bamboo. This is a characteristic that we have observed for all species of *Strossmayeria* when they occur on bamboo.

In the Venezuelan collection the ectal excipular cells are narrower than any of the other collections of this species, 1.5-2.2 μm wide, and the apothecia arise from dark brown melanized round patches on the host.

In the Panama collection Martin 6067 the ectal excipulum is between *textura porrecta* and *textura oblita*, which is unusual, since this tissue in all other species of *Strossmayeria* is of *textura oblita*.

The collection from Iowa State University 380550 (ex Martin 6067) has two different *Strossmayeria* species: *S. confluens* (Seaver) Iturriaga & Korf (on the large piece of wood), and *S. panamaensis* (on the small piece of wood).

The Java collection differs from the other collections because it has saccate asci, verrucose ascospore gel sheath, and absence of refractocells or disintegrating cells in the ascospores.

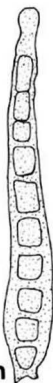
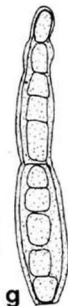
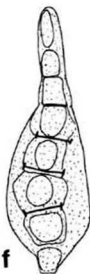
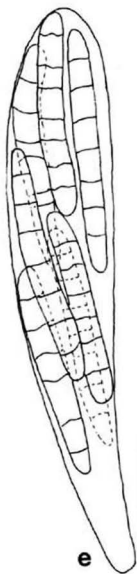
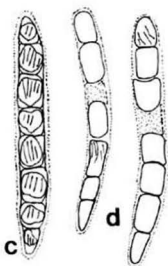
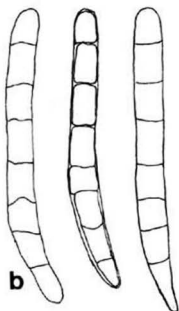
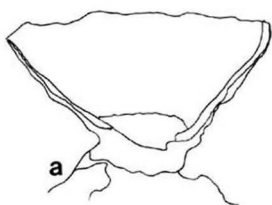
15. *Strossmayeria ochrospora* Iturriaga, *sp. nov.* (Fig. 24a-c).

Ab Strossmayeriae speciebus aliis ascosporis parietibus flavo-brunneis et septis flavo-brunneis praeditis differt.

Anamorph: *Pseudospiropes* sp.

Apothecia 0.8-1.0 mm in diameter, turbinate when young, shallow cupulate when mature, receptacle dark brown, lighter toward the edge, disc reviving pale to light brown, medium to dark brown when dry. Ectal excipulum of *textura oblita*, outer layers dark brown, inner layers light brown and J+, cells 7.0-10 \times 1.0-3.0 μm . Asci 8-spored, clavate, when young with an apical papilla, 150-178 (-185) \times (13-) 15-17 μm . Ascospores cylindrical clavate, outer walls and septa light yellow-brown in all or some of the cells, J+, disintegrating cells or refractocells sometimes present, triseriate, (33-) 44-56 \times 4.0-5.0 μm , (6-) 7 (-8) septate, septa distinctly light brown, gel sheath slightly verrucose. Paraphyses long and filiform, simple, septate, frequently swollen and rounded at the apex, 2.0

Figure 23. *Strossmayeria notabilis*. a, median section of apothecium; b-d, ascospores; e, ascus with ascospores; f-h, conidia. a, b, f, h, HT; c, g, Martin 4338, BPI; d, e, Martin 6067, BPI. a, \times 100; all others \times 1000.



μm wide at the middle, 3.0 μm wide at the apex. Conidiophore brown, lighter toward the apex, septate, flexuous, with scars that do not protrude grossly, 5.0-7.0 μm wide at the middle, 8.8 μm wide at the base. Conidia fusiform, brown, 7-septate, dark septa absent, sometimes with central and/or basal cells dark, 36-37 \times 11-12 μm , basal scar 2.0-3.0 μm wide.

Holotype: On dead stem of *Rhipogonium scandens* (= 'Supplejack'), Orongorongo Valley, near Wellington, New Zealand, November 1970, A. Bell, NY - Fungi of New Zealand, CUP 61932 ex NY.

Paratype: AFRICA: [Ruwenzori, 6600 ft.], Scott Elliot [no date], CUP-D 4166 (73-75) ex NY-Massee.

Type locality: Near Wellington, New Zealand.

Habitat: On dead stem of *Rhipogonium scandens*, and on old bark.

Distribution: New Zealand and Africa (Uganda).

Exsiccatae specimens examined: None.

Other specimens examined: None.

Illustrations: This paper, Fig. 24a-c.

Etymology: The epithet *ochrospora* is from the Latin, referring to the colored ascospores.

Notes: Diagnostic characters for this species are the light brown ascospores with brown lateral walls and septa and the brown receptacle.

16. *Strossmayeria sordida* (Cash) Iturriaga, *comb. nov.* (Fig. 4g, 6h, 24d-h).

\equiv *Belonium sordidum* Cash, *Iowa Studies Nat. Hist.* **17**: 215. 1937. (!)

\equiv *Pseudohelotium sordidum* (Cash) Dennis, *Kew Bull.* **1954**: 317. 1954.

Anamorph: *Pseudospiropes* sp.

Apothecia turbinate, up to 1 mm diameter, scattered or gregarious, usually confluent, upper receptacle usually light brown but sometimes white when rehydrated, generally brown toward the base, seldom remaining light in color, disc concolorous with upper receptacle or lighter in color. Ectal excipulum of textura oblita, formed by long rectangular cells with thickened gelatinized walls, cells (5.9-) 10-18 \times 2.2-2.9 μm . Medullary excipulum and subhymenium not distinguishable. Asci 8-spored, generally clavate, seldom saccate, and if so, clavate asci in the same apothecium, (99-) 114-140 (-155) \times (9.4-) 13-17 (-19). Ascospores cylindrical-clavate, rarely subfusoid, hyaline, J+, with uniform cells, with refractocells present and frequently guttules occurring in the refractocells with the refractive elements, multiseriate, (33-) 37-48 (-60) \times (3.7-) 4.4-5.8 μm , 6-7 (-8)-septate, gel sheath smooth, 1.0-1.5 μm thick. Paraphyses long and filiform, simple or divided, swollen at the apex in a clavate shape, 0.7-1.5 μm at the middle, 2.0-3.7 μm at the apex. Conidiophores brown, flexuous, sometimes scars not protruding so evidently, others protruding as

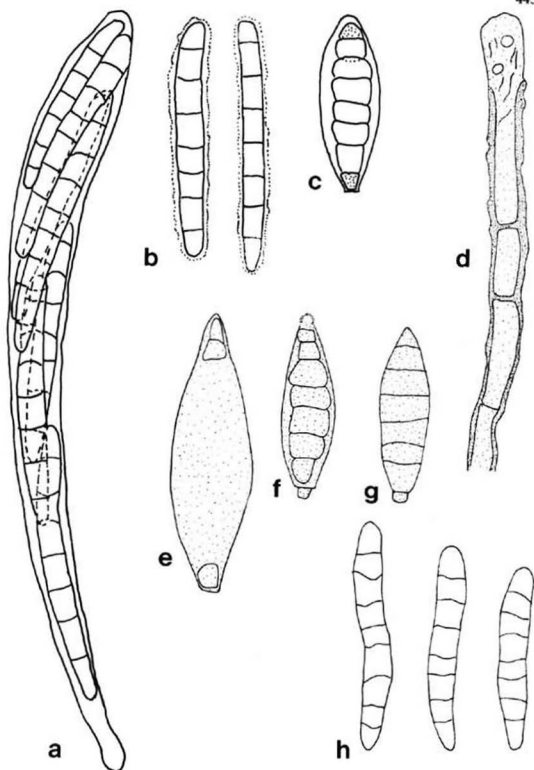


Figure 24. *Strossmayeria* spp. a-c, *S. ochrospora* (HT). a, ascus with ascospores; b, ascospores; c, conidium. All $\times 1000$. d-h, *S. sordida*. d, conidiophore; e-g, conidia; h, ascospores. d, f, Isolectotype, IA 380551; e, g, h, HT. All $\times 1000$.

much as 0.7 μm from the conidiophore, 6.6-10 μm wide at the middle, base swollen 9.5-13 μm wide. Conidia fusiform usually with a pedicel-like cell, dark cells absent, dark septa usually absent, but if present the basal and extreme septa are the darker ones, (26-) 31-44 (-50) \times (6.6) 8.1-12 (-13) μm , basal scar 2.2-3.7 μm , 6-7 (-8)-septate.

Lectotype: (Selected here.) Prov. Coclé: Valle Chiquita, about 7 k. south of El Valle de Antón. Alt. 500-600 m., July 25, 1935, G. W. Martin 3008, Fungi of Panama [on decorticated wood] (as *Belonium sordidum*), BPI (isoelectotypes in BPI ex MO 162188, ISC ex IA 380551, CUP 61867 [slide]).

Type locality: Prov. Coclé, Panama.

Habitat: on decorticated wood of unknown host, on *Sabal bermudiana*.

Distribution: Bermuda, Panama.

Exsiccatae specimens examined: None.

Other specimens examined: BERMUDA: On *Sabal bermudiana*, Paget Marsh, Jan. 29, 1922, H. H. Whetzel, CUP 35006, R.P.K. 1187.

Illustrations: Cash, E. K., *Univ. Iowa Stud. in Nat. Hist.* 17: Pl. 14, fig. 3, 1937; Dennis, R. W. G., *Kew Bull.* 1954: fig. 28, p. 318; this paper, Fig. 4g, 6h, 24d-h.

Etymology: The epithet *sordida* is from the Latin, meaning dirty.

Notes: There are three collections marked "Martin No. 3008", all of them labeled "Type" or "Part of Type." The number given in the original description is Martin 3008, but there is no mention of a particular portion as the holotype. Therefore, we selected a lectotype amongst the three portions of the collection, the other two becoming isoelectotypes.

In the original publication Cash (1937) says: "A complete set of these collections is in the herbarium of the State University of Iowa, Iowa City, and duplicates of most of them have also been deposited in the Mycological collections of the Bureau of Plant Industry, Washington" (now BPI). Apparently this meant that the holotype (HT) was the specimen deposited at Iowa, but indeed there should have been a clearer designation of which portion was the HT where collection No. 3008 was mentioned. This lack of clarity in the HT designation and the fact that the Iowa collection (No. 380551) no longer has any apothecia, made me choose as the LT one of the two portions that has both states, anamorph and teleomorph. We designate the BPI portion as the LT because in that packet a copy of the original published description was included, indicating that possibly Cash gave that packet a special importance over the others. The pieces of wood of the three portions that bear the number 3008 fit together like a puzzle, so one can be sure that they really are parts of the same collection.

Our measurements of the asci differ from those of Dennis (ours are larger), and agree with Cash's. We did not observe the moniliform cells at the apex of the paraphyses that Dennis (1954) described.

Dennis (1954) transferred *Belonium sordidum* to the genus *Pseudohelotium*, indicating that "in coloring, stature, habit and structure it agrees

well with *Peziza pineti* Batsch, the type species of *Pseudohelotium*." Dennis (1968) commented on the similarities between *Pseudohelotium pineti* and *Gorgoniceps aridula*: "It will be seen that there is little difference between this and *Pseudohelotium* apart from the number of septa in the ascospores" These comments and dispositions seem to indicate that Dennis's concepts of *Gorgoniceps*, *Pseudohelotium*, and *Strossmayeria* were not clear. Neither Cash nor Dennis described the presence of the anamorph on the specimen of *Belonium sordidum*. If Dennis had observed the anamorph he would surely have included it in the genus *Strossmayeria*, as he did with three other species, *S. phaeocarpa* (Dennis, 1960), *S. sphenospora* (Dennis, 1962), and *S. viridi-atra* (Dennis, 1962), included in that genus partly because hyphomycetes were present with them.

S. sordida may be distinguished from *S. jamaicensis* in that *S. sordida* has uniform, not enlarged refractocells, smooth usually thick gel sheath in the ascospores, conidial basal scar width of 2-4 μm , and usually larger conidia.

Cash (1937) described this species as *Belonium sordidum*. Her concept of the genus *Belonium* was clearly far wider than that adopted by modern taxonomists.

6. EXCLUDED SPECIES

Species correctly assigned to the genus *Strossmayeria* have been assigned by various authors to other genera because of sharing similar characters. At other times they have been assigned to such genera by mistake, due to lack of information or due to unclear or too broad generic delimitations. Some of the genera under which *Strossmayeria* species were found were *Belonidium*, *Belonium*, *Gorgoniceps*, *Hyaloderma*, *Lecanidion*, *Leptobelonium*, and *Peziza*. Descriptions of the species recorded under these genera were studied in order to decide which of them could be possible *Strossmayeriae*, and thus had to be studied.

Of the seven species that have been previously assigned to the genus *Strossmayeria*, three were previously excluded: *S. viridi-atra* (Sacc. & Fautr.) Dennis, *S. sphenospora* (Kirscht.) Dennis, and *S. phaeocarpa* Dennis (Iturriaga, 1984). None of these three is a member of the genus *Strossmayeria* as delimited here. One of the three species which Iturriaga (1984a) accepted in the genus, *S. longispora*, has been placed in synonymy with *S. bakeriana*, above.

7. SPECIES IMPERFECTLY KNOWN

1. *Belonidium albo-cereum* Penz. & Sacc., *Malpighia* 15: 215. 1902 ('1901').

Holotype: ad ligna putrida, Tjibodas (7 ex parte).

Illustration: Penzig, O. & P. A. Saccardo. 1904. *Icones Fungorum Javanicorum*, Tab. LIV, Fig. 1.

Notes: We asked for this specimen in different herbaria: F, BO, and PAD. Apparently it is not at F or BO. We were not able to get a response from PAD in regard to this specimen.

According to von Höhnelt (1923) this species is a synonym of *Leptobelonium helminthicola* (Blox.) Höhn. [i.e., of *Strossmayeria basitricha* (Sacc.) Dennis].

2. [*Belonium flocculum* Kirchstein in Schieferdecker, Z. Mus. Hildesheim, n. ser., 7: 87. 1954 (not validly published).]

'Holotype': April/May 1943, Hildesheim, Weidengebüsch bei der Drei-Bogen-Brücke, auf der Innenseite abblätternder Weidenrinde.

Illustration: l.c., Taf. 13, d.

Notes: The name *B. flocculum* Kirchstein is not validly published (no Latin diagnosis). We considered it to be worth studying, even though the description is very short, due to ascospore characters: cylindrical shape, 3-septate, eventually 4-septate, colorless. We wrote B (Dahlem) for the specimen, but it was not there, so we were unable to examine it.

3. *Belonidium fructigenum* P. Henn. & E. Nym. in Warburg, *Monsunia* 1: 31. 1900.

Holotype: Java, Hort. Bogor.: auf faulenden Früchten von *Cedrela serrulata*, 26 März 1898. (E. Nyman).

Notes: No illustration is provided with the original description. We tried to obtain this specimen from B (Dahlem) and BO (Indonesia). It is not in those herbaria. According to von Höhnelt (1923) this species is a later synonym of *Leptobelonium helminthicola* (Blox.) Höhn. [i.e., of *Strossmayeria basitricha* (Sacc.) Dennis].

4. *Belonidium glauco-fuligineum* Penz. et Sacc., *Malpighia* 15: 214. 1902 ('1901').

Holotype: in vaginis foliorum putrescentium Palmarum in horto Bogor, 22. XII. 1896 (75).

Illustration: Penzig, O. and P. A. Saccardo, *Icones Fung. Javanic.*, Tab. LIII, Fig. 4. 1904.

Notes: The specimen was asked for in several herbaria: BO, PAD and F. It is not housed in F. The two first herbaria did not answer.

5. *Belonidium guttula* Rick, *Brotéria* 5: 36. 1906.

Holotype: In mycelio fusco perisporiaceo, ramos bambusinos occupante. Rio Grande do Sul, Brasiliae.

Notes: We wrote PACA (Anchieta), but did not receive an answer or the specimen. Judging by the description this species may be a *Strossmayeria*.

Rick's original publication (1906) was followed (1932: 41, 42) by a publication in which he again described the same species, twice, due to a

mistake.

6. *Belonidium japonicum* Hara [as *Belanidium*, lapsus calami], *A list of Japanese Fungi hitherto known*, p. 399. 1954.

Holotype: In *Pinus pentaphyllus* var. *Himekomatsu*, in Japonica. Tokyo: in Komaba, K. Hara, Jan. 10. 1911.

Notes: This is a doubtful species. Nevertheless, since some characters of the description could match *Strossmayeria* characters, we wrote to Japan, but the specimen is apparently lost. The main characters of this species are: yellow apothecia and 3-septate ascospores, constricted at the septa, $22-25 \times 4.0-5.0 \mu\text{m}$.

7. [*Gorgoniceps kirschsteinii* Jaap, *Verh. Bot. Vereins Prov. Brandenburg* 64: 14. 1922. ('*Kirschsteinii*') nomen nudum (no description).]

'Holotype': Auf alten Harzgallen an *Pinus silvestris* mehrfach.

Notes: See *Gorgoniceps kirschsteniana*, below.

8. *Gorgoniceps kirschsteniana* Jaap ex Kirschst., *Ann. Mycol.* 36: 378. 1938.

Holotype: Triglitz, Ostprignitz. Auf einem dürren Ast von *Pinus silvestris* an Harzgallen und Apothecien von *Biatorina difformis*, Oktober 1912, O. Jaap.

Notes: The HT of *G. kirschsteniana* Jaap is apparently lost. The type specimen was requested as a loan from several herbaria, B, FH, and HBG. It was not found. This is probably a respelling of *G. kirschsteinii* Jaap.

9. *Belonidium pulvinatum* Boud., *Bull. Soc. Myc. France* 12: 14. 1896.

Holotype: Ad basim culmorum putridorum *Junci capitati* in paludosis sylvae, Montmorency, Martio 1895 (PC).

Notes: We were unable to study this species. Judging by the description it may be a *Gorgoniceps* or belong to a closely related genus. Boudier says it differs from *Gorgoniceps* in the shorter asci and non-filiform ascospores.

10. *Belonidium rathenowianum* P. Henn. & Ploettn., *Verh. Bot. Vereins Prov. Brandenburg* 41: 97. 1899.

Holotype: Rathenower Stadtforst auf Eichenholz vereinzelt mit *Ceratospaeria quercina*, 30 März 1899. (B-Dahlem)

Notes: We received no answer from this herbarium, so were unable to study the specimen.

11. *Belonium sulphureo-testaceum* v. Höhn., *Ann. Mycol.* 3: 553. 1905. (!!)

≡ *Leptobelonium sulphureo-testaceum* (v. Höhn.) v. Höhn., *Ber. Deutsch. Bot. Ges.* 37: 108. 1919.

Holotype: Allentsteig, 9. 1905, No. Waldviertel, v. Höhnel (F).

Notes: We were unable to find an apothecium that matched the description. The collection includes soil and sand, making it difficult to detect tiny apothecia. To judge by the description, this species seems similar to *Strossmayeria sphenospora* (Kirschst.) Dennis, which the senior author excluded from the genus (Iturriaga, 1984).

12. *Belonidium tabacinum* Penz. et Sacc., *Malpighia* 15: 214. 1902 ('1901').

Holotype: in ramis corticatis, emortuis, Goenoeng Pantjar, Raciborski.

Notes: We wrote PAD and also wrote to BO, but received no answer. The description suggests it could belong to *Strossmayeria*.

13. *Gorgoniceps taveliana* Rehm in Rabenh., *Krypt.-Flora* 1(3): 691. 1892. (!!)

Holotype: In den Spalten abgefellener Föhrenrinde auf der Coerhaide bei Münster i. W. (v. Tavel), S-Rehm.

Notes: This seems to be a species of the genus *Gorgoniceps*, but the part of the HT that we received was not sufficient for full determination. It could be a *Strossmayeria*.

14. *Gorgoniceps verniicola* (P. Henn.) Batista, *Atas Inst. Mic. Univ. Recife* 1: 244. 1960.

≡ *Erinella verniicola* P. Henn., *Hedwigia* 43: 272. 1904. (!!)

Holotype: Perú, Tarapoto: Auf Blättern von *Vernonia* spec., Dezember 1902, No. 3185, F.

Notes: We could not find any fungus on the portion of the HT that was sent to us.

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The senior author wants to thank her Professor, Richard P. Korf, for his invaluable help, guidance and encouragement. His motivation toward knowledge and exactness, his scientific approach and criticism toward any problem, and his humanity to others have been an example to her.

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She wants to express her thanks to her fellow students for sharing wonderful moments, especially to Wen-ying Zhuang, Nina Shishkoff, and Mimi Harrington.

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NOMENCLATURE AND SYNONYMY OF STEREUM SPADICEUM VAR. PLICATUM

by

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There is much confusion regarding the nomenclature and synonymy of Stereum spadiceum var. plicatum Peck.

Stevenson and Cash (1936) cited:

Stereum spadiceum var. plicatum Peck Rept. N.Y. State Mus.,
50 : 132, 1897

= Stereum plicatum (Peck) Lloyd Myc. Writings 7 : 1157, 1922

A check of the Peck (1898) publication shows that the name published there was Stereum spadiceum var. plicatum and not plicatum as has been mentioned by Stevenson and Cash in 1936. 8/

Lentz (1955) cited :

Stereum spadiceum var. plicatum Peck N.Y. State Mus. Ann. Rept.,
50 : 132, 1897.

= Stereum plicatum (Peck) Lloyd Mycol Notes [Writ.] 7, Mycol
Notes 67 : 1157, 1922, ut plicatum, lacking Pk. publication
data.

However, from the above two lists of synonymy and forgoing discussion one might conclude that :

Stereum spadiceum var. plicatum Peck Rept. N.Y. State Mus.,
50 : 132, 1897

= Stereum plicatum (Peck) Lloyd Mycol Notes [Writ.] 7, Mycol
Notes 67 : 1157, 1922

= Stereum plicatum (Peck) Lloyd Myc. Writings 7 : 1157, 1922

But both Stevenson and Cash (1936) and Lentz (1955) made some mistakes.

The authority of both Stereum plicatum (Lentz 1955 p. 52) and Stereum plicatum (Stevenson and Cash 1936) have been wrongly cited as '(Peck) Lloyd'. Authority of both of these taxa should be cited simply as 'Lloyd' (Lloyd 1918 p 807 and Lloyd 1922 p.1157 respectively).

Secondly, the reference to Stereum plicatum has been wrongly represented by Lentz (1955). The correct citation should be : 'Mycol. Writ. 5, (Mycol Notes 56) : 807, 1918' (Lloyd 1918 p. 807).

Thirdly, consideration of Stereum spadiceum var. plicatum [Stevenson and Cash [1936] cited 'var. plicatulum' by mistake] as synonymous with Stereum plicatum (Lentz 1955) and Stereum plicatulum (Stevenson and Cash 1936) is erroneous.

Stereum spadiceum var. plicatum was published by Peck (1898) based on a fungus collected from New York State, U.S.A.; Stereum plicatum was published by Lloyd (1918) as a new species based on a fungus collected from Sydney, Australia; Stereum plicatulum was published by Lloyd (1922) based on a fungus collected from Sendai, Japan.

A review of literature (Peck, 1898, Lloyd 1918, 1922) and the foregoing discussion reveals that Stereum spadiceum var. plicatum Peck, Stereum plicatum Lloyd and Stereum plicatulum Lloyd are three distinct taxa, as they have been validly published based on three different type materials, each of which differs from the other two in many important and distinctive features.

American mycologists have seemingly been unable to distinguish between Stereum spadiceum var. spadiceum and S. spadiceum var. plicatum and the latter name is now usually cited in synonymy under S. spadiceum. In contrast S. plicatulum as represented by the Japanese material sent to Lloyd by Prof. A. Yasuda and also by recent material collected in India appears to provide a name for an otherwise undescribed Asiatic Stereum.

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PHOMA PROBOSCIS SP. NOV. PATHOGENIC ON CONVULVULUS ARVENSIS

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ABSTRACT

Phoma proboscis Heiny pathogenic on field bindweed (*Convolvulus arvensis* L.) is described and illustrated. *P. proboscis* is typified by rostrate pycnidia, eguttulate, occasionally septate conidia averaging $10.5 \times 3.5 \mu\text{m}$, unicellular, spherical chlamydo-spores, and optimal growth at 20°C.

INTRODUCTION

Diseased field bindweed (*Convolvulus arvensis* L.) leaves and stems were collected in Phillips County, Colorado, in 1988 and transported to Arkansas under permit from the USDA Animal and Plant Health Inspection Service and the Arkansas State Plant Board. A species of *Phoma* was isolated from diseased plant tissue and reinoculated on field bindweed seedlings in a growth chamber. The fungus caused collapse of young petioles and shoots and development of small lesions on leaves. Severe infection below the cotyledonary node caused death of field bindweed seedlings.

Several species of *Phoma* have been described previously from *Convolvulus* spp. or the related genus *Calystegia* without regard to their pathogenicity.

Published with the approval of the Director of the Arkansas Agricultural Experiment Station.

Included among these are *Phoma convolvuli* Wehmeyer on *Convolvulus glomerata* Chois. collected in India (Wehmeyer, 1964); *Phoma sepium* Brun. on *Calystegia sepium* (L.) R. Br. (Saccardo, 1895); *Phoma minuta* Alcalde and *Phoma macrocollum* Alcalde on *Calystegia sepium* in Spain (Alcalde, 1952). Saccardo (1895) also listed *Phoma capsularum* (Schw.) Starb. in seed capsules of *Convolvulus purpureus* (syn. *Ipomoea purpurea* (L.) Roth.) (Bedevian, 1936). The Colorado field bindweed isolate, described here as a new species, combines characteristics that do not occur together in any previously described species of *Phoma* (Boerema, 1976; Boerema et al., 1965; Boerema et al., 1981; Dorenbosch, 1970; Morgan-Jones, 1988a; Morgan-Jones, 1988b; Morgan-Jones and White, 1983; Sutton, 1980; Wehmeyer, 1946; Wehmeyer, 1964).

MATERIALS AND METHODS

Colony characteristics and radial growth rates of mass transfer cultures were determined on each of four media incubated at 20, 25, or 30°C in darkness [Table 1]. Agar disks 5 mm in diameter were taken from 7-day-old potato dextrose agar (PDA) spread plate cultures and inverted in the center of each plate. All treatments were replicated four times. Measurements of radial growth were recorded after 4, 7, and 14 days. Dimensions of 10 pycnidia and 15 conidia were measured from each medium after 14 days of growth at 25°C, exposed to a 12-hr daily photoperiod 42 cm from the light source (Bright Stik, General Electric, Cleveland, Ohio 44112).

Agar blocks (2 cm square) of cultures from each medium were exposed to ammonia vapors or treated with 1 N NaOH for observation of pigment change or crystal formation diagnostic for some *Phoma* species (Dorenbosch, 1970).

Pycnidia from PDA were fixed in Karnovsky's fixative (1965), embedded in JB-4 resin (Polysciences, Inc., Warrington, PA 18976-2590), and sectioned 4 to 10 μ m thick with a glass knife on a Sorvall MT2-B Ultra-microtome. Sections were stained with Lugol's iodine (Tuite, 1969; Boerema et al., 1981) or 3% erythrosin in 10% ammonia (Sutton, 1980) for permanent resin mounting, or wet-mounted in lactophenol cotton blue containing 0.004% aniline blue (EM Diagnostic Systems, Inc., Gibbstown, New Jersey 08027).

DIAGNOSIS

Phoma proboscis sp. nov.

Laesiones circulares vel elongato-irregulares, usque ad 2 mm diametro, coalescentes et laesiones grandiores formantes, cinereae vel fulvae vel aurantiaco-brunneae, margine distincto, brunneo, deducentes caules juvenes et petiolos hospitis illuc ut hi collabentur et desiccescantur. Mycelium septatum, ramosum, pallide brunneum vel brunneum, hyphis 4.5-7 μm latis. Pycnidia solitaria vel confluentia, subglobosa vel ampulliformia, brunnea vel atrobrunnea, ex parte immersa vel superficialia, pro parte maxima glabra, pseudoparenchymata, ostiis solitariis vel plus (usque ad 9) praedita, colla elongata aliquando ramosa solitaria vel plus plerumque confingentia. Pycnidia 173-550 X 112-275 μm (383 X 256 μm), collo 1/3- 3-plo longiore quam pycnidii diametro. Cellulae conidiogenae phialidicae, hyalinae, simplices, parietibus laevibus praeditae, subglobosae vel late ampulliformes, 6.5-9.0 X 6.5-12.5 μm . Conidia salmonea (in congerie), enteroblastica, hyalina, simplicia, juventute eguttulata, ex culturis vetustioribus biguttulata, cylindrica vel anguste ellipsoidea, extremitate una saepe parum ampliora, pediformia vel interdum parum curvata, utraque extremitate obtusa, laevia, continua (vel ea maxima aliquando 1-septata), 5.5-15.0 (17) X 2.3-5.0 μm , medio numero 10.5 X 3.5 μm . Chlamydo sporae sphaericae, unicellulares, intercalares, ca. 14 μm diametro.

Lesions circular to elongate irregular, up to 2 mm in diameter, coalescing to form larger lesions, gray or tan to orange-brown, margin distinct, brown; causing young stems and petioles to collapse and desiccate. Mycelium septate, branched, pale brown to brown with hyphae 4.5-7 μm wide. Pycnidia solitary or confluent, subglobose to flask-shaped, brown to blackish brown, partly immersed or superficial, mostly glabrous, pseudoparenchymatous, with one or more ostioles (up to nine), usually developing one or more elongate necks, which sometimes branch. Pycnidia 173-550 X 112-275 μm (383 X 256 μm) with neck length from 1/3 to 3 times the diameter of the pycnidium. Conidiogenous cells phialidic, hyaline, simple, smooth-walled, subglobose to broadly flask-shaped, 6.5-9.0 X 6.5-12.5 μm . Conidia salmon color in mass,

enteroblastic, hyaline, simple, eguttulate when young, biguttulate from older cultures, cylindrical or narrowly ellipsoidal, often slightly larger at one end, foot-shaped or sometimes slightly curved, obtuse at each end, smooth, continuous or largest conidia occasionally one-septate, 5.5-15.0 (17) X 2.3-5.0 μm , averaging 10.5 X 3.5 μm . Chlamydospores spherical, unicellular, intercalary, approximately 14 μm in diameter.

P. proboscis differs from other species in having rostrate pycnidia, relatively large eguttulate conidia that are occasionally septate, unicellular, spherical chlamydospores, and an optimum growth rate at cooler temperatures (20°C).

Figure 1; Plates 1, 2, 3 and 4.

Pycnidia developed on dead tissue following incubation under lights in a moist chamber [Plate 1, A, B].

Growth rates varied with media and temperature [Table 1]. The highest rate of growth occurred on oatmeal agar at 20° C. At 25°C, rate of development was greater on oatmeal agar than on any other medium. No growth occurred in darkness at 30°C on any medium [Table 1].

Colonies on malt extract agar (MEA) were dark

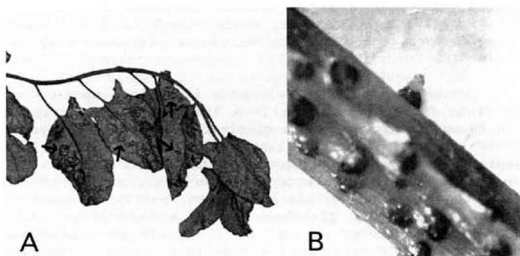


PLATE 1. A, Lesions on leaves and stems of *Convolvulus arvensis* caused by *Phoma proboscis* (selected lesions indicated by arrows). B, Pycnidia of *P. proboscis* developing on bindweed stem.

Table 1

Average growth diameter of *Phoma proboscis* plated on various media at three temperatures.^a

Days ^e	Potato Dextrose Agar ^b			Malt Extract Agar ^c			Oatmeal Agar ^c			Cellulose Agar ^d		
	20°C (mm)	25°C (mm)	30°C (mm)	20°C (mm)	25°C (mm)	30°C (mm)	20°C (mm)	25°C (mm)	30°C (mm)	20°C (mm)	25°C (mm)	30°C (mm)
4	15.0	7.0	5.0	11.5	7.5	5.0	15.0	12.0	5.0	13.0	6.5	5.0
7	29.0	7.0	5.0	24.0	7.5	5.0	34.0	12.5	5.0	21.0	7.0	5.0
14	57.0	7.0	5.0	46.0	8.0	5.0	70.0	17.5	5.0	43.0	7.0	5.0

^a A culture plug 5 mm in diameter was inverted on four replications of each of four media. Plates were incubated in darkness at the temperatures indicated.

^b Acidified (Difco Laboratories, Detroit, MI 48232).

^c Difco Laboratories, Detroit, MI 48232.

^d Eggins and Pugh (1962), substituting cellulose powder MN 300 by Macherey, Nagel & Co. (Brinkmann Instruments, Inc., Westbury, NY 11590) for ball-milled Whatman's cotton cellulose powder.

^e Number of days plates were incubated.

olivaceous with sparse aerial mycelium [Plate 2, A], with center darker and thinly floccose or slightly ropy in appearance, reverse dark olivaceous. On PDA colonies were lanose or somewhat floccose, yellow-brown to dark brown, pigment increasing with age, with a white margin 5 mm wide, colony darker towards the center, reverse brownish [Plate 2, B]. No pycnidia developed in darkness on MEA or PDA.

Colonies on cellulose agar in darkness had some aerial mycelium, becoming floccose with age, producing sparse pycnidia after 7 days at 20°C, fewer at 25°C. Mycelium was sparse and brown in agar [Plate 2, C]. On oatmeal agar, colonies were dark brown, consisting of a dense mat of pycnidia even in darkness, with a 6-mm-wide, light brown, lanose margin. Aerial mycelium was sparse, increasing with age, floccose to lanose, olive-brown or gray to white in color [Plate 2, D].

Mycelium was composed of septate, branched, pale brown to brown, short (9.0 X 7.0 μm) or long (20.5 X 4.5 μm) barrel-shaped or straight cells 13.5-36.5 X 4.5-5.5 μm [Plate 3, A, B]. Chlamydospores developed in hyphae on malt extract agar, less frequently on cellulose agar or PDA [Plate 3, C, D].

HOLOTYPE: On leaf petioles and blades, and on stems of *Convolvulus arvensis* L.; Phillips County, Colorado, U.S.A., May, 1988, D. K. Heiny, UARK.

PARATYPES: BPI, K.

LIVING CULTURES: ATCC.

Etymology of specific epithet: Refers to elongate necks of pycnidia that sometimes resemble an elephant's trunk.

ADDITIONAL NOTES

Ammonia vapor did not cause crystallization or changes in color of agar or hyphae. NaOH caused no change on MEA or PDA, but marginal hyphae on oatmeal agar turned light orange-brown, darkening beyond the yellowing of oatmeal agar alone treated with NaOH. No crystals were produced on any medium.

Exposure to light promoted pycnidia development on all media. Pycnidia developed elongate necks within 7 days on all media, especially on PDA [Plate 3, G-K; Plate

4, A-F]. Pycnidia sometimes produced branches that developed into an enlargement resembling a pycnidium [Plate 4, F]. Pycnidia were smallest on cellulose agar, 102-428 X 102-193 μm , averaging 246 X 134 μm . Otherwise, 173-550 X 112-275 μm , averaging 383 X 256 μm .

The pycnidial wall was composed of *textura angularis* [Plate 3, E], with two to five layers [Plate 3, F], 13-18 μm thick, frequently slightly thicker in the zone of transition between the neck and the main pycnidia body [Plate 4, A, D], with individual cells 7-16 μm in diameter. Cells darkened upon addition of Lugol's iodine,

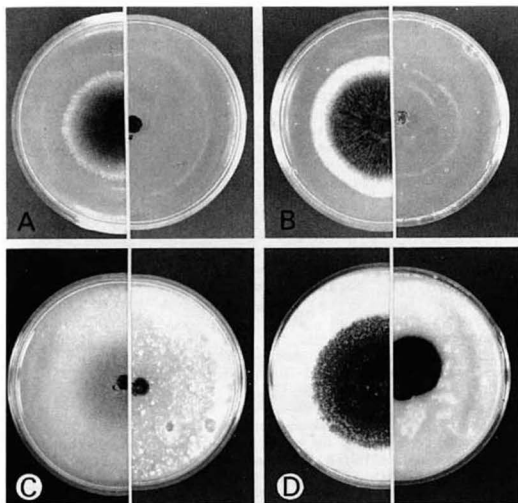


PLATE 2. Growth of *Phoma proboscis* on various media after 14 days in darkness at 20 C (left) and 25 C (right). A, malt extract agar; B, potato dextrose agar; C, cellulose agar; D, oatmeal agar.

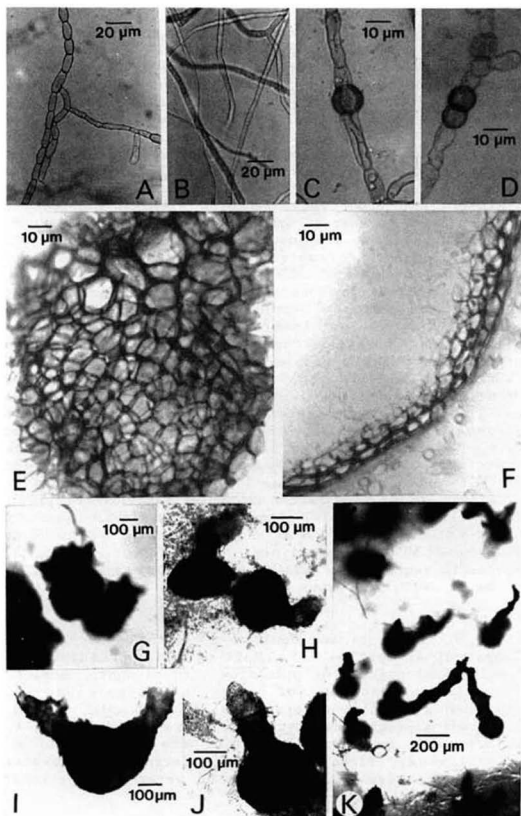
which is brown, but did not turn red as described by Boerema et al. (1981) for scleropectenchyma of some *Phoma* species in the section *Plenodomus*. Conidiogenous cells were borne on the innermost cells of the pycnidial wall up to the base of the neck region. Conidia were as described previously [Plate 4, G]. Concentrated spore suspensions appeared muddy brown. Conidia on water agar initially produced a single germ tube through one end or laterally near one end of the spore [Plate 4, H].

DISCUSSION

The isolate was compared to an isolate of *Phoma complanata* (Tode ex Fries) Desmazieres obtained from the American Type Culture Collection (ATCC #32158). Conidia of *P. complanata* had a size range similar to the range of *P. proboscis*, and some conidia had one septum. However, the majority of *P. complanata* conidia were found to be smaller (7.0 X 3.0 μm) than conidia of *Phoma proboscis*, pycnidia were much smaller (153 X 125 μm), and, other than temperature and light preferences, no similarities in other cultural or morphological characteristics were found. Other *Phoma* species that produce occasional septate conidia include *P. dennisii* Boerema (Boerema, 1976), *P. exigua* Desm. var. *exigua* (Morgan-Jones and Burch, 1988c), *P. lycopersici* Cooke (Morgan-Jones and Burch, 1988b), *P. macrostoma* Montagne (White and Morgan-Jones, 1984), *P. medicaginis* Malbr. & Roum. (Boerema, 1976; Morgan-Jones and Burch, 1987), and *P. pinodella* (L.K. Jones) Morgan-Jones & Burch (Boerema, 1976; Morgan-Jones and Burch, 1987; White and Morgan-Jones, 1987).

P. minuta and *P. macrocollum* on *Calystegia sepium* have conidia sizes of 2-3.4 X 0.9-1.2 μm and 2.8-4.2 X

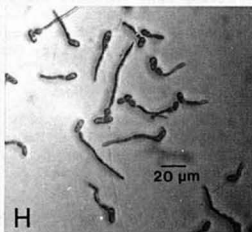
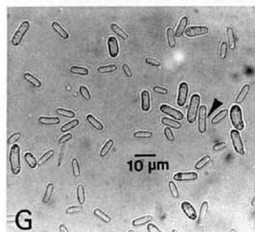
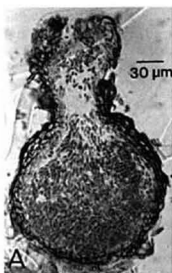
PLATE 3. Mycelium, chlamydospores, and pycnidia of *Phoma proboscis* developing on artificial media. A, hyphae with barrel-shaped cells; B, hyphae composed of straight cells; C, spherical, single-celled, intercalary chlamydospore; D, chlamydospores; E, pycnidial wall; F, cross-section of pycnidial wall; G, multiostiolate pycnidia from oatmeal agar; H, pycnidia from potato dextrose agar; I, pycnidium with two necks from potato dextrose agar; J, pycnidium from potato dextrose agar; K, pycnidia with elongate necks on potato dextrose agar.



1.5-2.0 μm , respectively (Alcalde, 1952). Both ranges are completely outside the range for *P. proboscis*. Spore sizes of *P. sepium* from *C. sepium* are 10-12 X 4 μm , but pycnidia are described without measurements as sparse and minute (Saccardo, 1895), which is not typical of *P. proboscis*. *P. convolvuli* from *Convolvulus glomerata* has fusoid conidia 6-7 X 1.5-2.0 μm (Wehmeyer, 1964), too small for *P. proboscis*. *P. capsularum* from *Ipomoea purpurea* (tall morningglory) has conidia approaching the appropriate size for *P. proboscis* (8-10 X 2.5-3.5 μm), but details on shape and guttulation of conidia are not available (Saccardo, 1883; Saccardo, 1895). Pycnidia of *P. capsularum* on average are smaller than expected for *P. proboscis* and lack a pronounced rostrum (Saccardo, 1883; Saccardo, 1895). *P. capsularum* is apparently restricted to the seed capsules of tall morningglory.

Like *Phoma proboscis*, the type species for the genus, *Phoma herbarum* Westend., is described as having salmon pink spores (Boerema, 1964). Among other differences, however, *Phoma herbarum* produces a red pigment that changes to violet-blue upon addition of NaOH (Dorenbosch, 1970). The shapes of pycnidia of *Phoma proboscis* are similar to the shapes of pycnidia of *Phoma multirostrata* (Mathur, Menon & Thirum.) Dorenbosch & Boerema (Dorenbosch & Boerema, 1973; Dorenbosch and Höweler, 1968). However, conidia of *P. multirostrata* measure 5-6.5 X 2-2.5 μm , and cultures grow rapidly at 30°C (Dorenbosch and Boerema, 1973), unlike cultures of *P. proboscis*, which grow better at cooler temperatures (20°C; Table 1). Colonies of *P. multirostrata* attain diameters of 76 mm, 80 mm, and 72 mm after 7 days on PDA at 20°C, 25°C, and 30°C, respectively (Morgan-Jones, 1988b); *P. proboscis* requires 14 days on PDA to reach a diameter of 57 mm at 20°C, and grows very slowly at 25°C and 30°C on

PLATE 4. Pycnidia and conidia of *Phoma proboscis*. A, longitudinal-section of short-necked pycnidium; B, longitudinal-section of pycnidium with elongate neck; C, longitudinal-section of neck of pycnidium; D, longitudinal-section of pycnidium with elongate neck; E, longitudinal-section of pycnidium with branching neck; F, enlargements on pycnidia bearing one neck (left) or several necks (right); G, conidia (arrowhead indicates septum); H, germinating conidia on water agar, stained with lactophenol cotton blue.



all media tested [Table 1; Plate 2]. The structures of the pycnidial walls of *P. proboscis* and *P. multirostrata* also differ. The outer cells of pycnidial walls of *P. proboscis* are distinctly isodiametric. In *P. multirostrata* they are ellipsoid or oblong to cylindrical (Morgan-Jones, 1988b). Pycnidia of *P. proboscis* are not covered by a loose network of hyphae, a characteristic that distinguishes this species from *P. multirostrata* (Morgan-Jones, 1988b), *P. herbarum* (Morgan-Jones, 1988a), and *P. americana* Morgan-Jones & White (Morgan-Jones and White, 1983). The unicellular chlamydospores of *P. proboscis* are more spherical than chlamydospores of *P. multirostrata*, which are doliiform, oblong, or flat-sided (Morgan-Jones, 1988b). Only three additional genera with unicellular chlamydospores have been described: *P. pinodella* (Boerema, 1976; White and Morgan-Jones, 1987), *P. eupyrena* Sacc. (Morgan-Jones and Burch, 1988a), and *P. medicaginis* (Morgan-Jones and Burch, 1987).

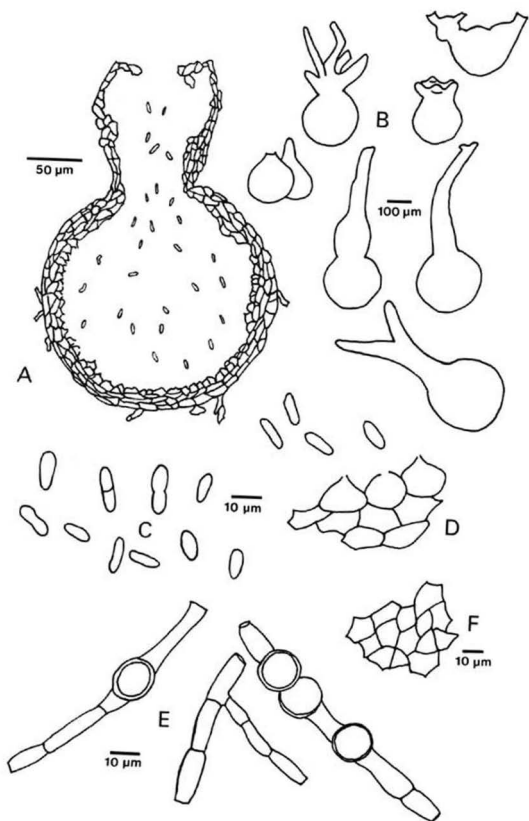
Species belonging to *Phoma* section *Plenodomus* (Preuss) Boerema, van Kesteren & Loerakker (1981) have rostrate pycnidia. *P. proboscis* is not included in section *Plenodomus* because it does not produce a thick or scleroplectenchymatous pycnidial wall like other members of the section.

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FIGURE 1. *Phoma proboscis*. A, longitudinal-section of pycnidium; B, various forms of pycnidia; C, conidia; D, conidiogenous cells; E, hyphae and chlamydospores; F, portion of pycnidial wall.



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TAXONOMICAL STUDIES ON USTILAGINALES. V.*

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ABSTRACT

NEW SPECIES proposed: Entyloma zacantha Vánky (type on Crepis zacantha). – Melanotaenium antirrhini Viennot-Bourgin ex Vánky (type on Antirrhinum latifolium). – Ustilago dumosa Vánky & Oberwinkler (type on Rumex dumosus).

The following names are considered SYNONYMS: Entyloma crepidis Kaw.-Starm. (type on Crepis praemorsa = misidentified Hieracium sp.) is E. hieracii H. & P. Sydow ex Cif., s. str. – Melanotaenium lamii Beer (type on Lamium album), and M. koschurnikoveanum Lavrov (type on Galeopsis tetrahit) are synonyms of M. jaapii P. Magnus (type on Teucrium montanum). – Neovossia iowensis Hume & Hodson, and N. danubialis T. Savul. (both having types on Phragmites australis) are considered synonyms of Neovossia molinae (Thümen) Körn. (type on Molinia coerules). – Uredo digitariae Rabenh. (type on Digitaria sp. = misidentified Cynodon dactylon) is Ustilago cynodontis (P. Henn.) P. Henn. – Ustilago cariciphila Speg. (type on Carex bonariensis) is Farysia thuenenii (Fischer v. Waldh.) Nannf.

EXCLUDED SPECIES: Entyloma aristolochiae Saccardo (type on Aristolochia elegans) represents immature ascocarps of a pyrenomycete. – Entyloma debonianum Saccardo (type on Oenanthe globulosa), and Entyloma hydrophilum Saccardo & Paoletti (type on Sium cicutaefolium) are probably Protomycetales. – Entyloma erodiamum Saccardo (type on Erodium moschatum) is not a fungus but granules of an unidentified substance. – Entyloma glyceriae Fragoso (type on Puccinellia festuciformis subsp. tenuifolia) is Physoderma gerhardtii (Chytridiales). – The type of Entyloma xanthii Massalongo (on Xanthium strumarium) contains only necrotic host cells. – Melanotaenium byzovae Schwarzman (type on Galium tenuissimum) is a myxomycete.

LECTOTYPE is selected for Tilletia wilcoxiana Griff. (= T. hyalospora Masee).

In this paper, further results of my taxonomical and nomenclatorial investigations on smut fungi are presented.

Entyloma species on Crepis s. lat. (Compositae).

The following Entyloma species were described from different Crepis species:

1) E. crepidicola Trotter, 1908:21, type on Crepis bulbosa (L.) Tausch (= Aetheorhiza bulbosa (L.) Cass.), Italy, Avellino, S. Agata di Sopra, 14.V.1907, A. Trotter (Urophlyctis crepidicola Trotter, 1907:27; nomen nudum). Sori as globose outgrowths on the roots, 4–5 mm in diameter. Spores in groups, first

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intracellularly, globose, ellipsoidal, sometimes slightly angular, mostly 13–15 μm in diameter, when young yellowish, when mature chestnut brown. Spore wall often irregular, 1.5–2.5 μm thick, smooth. Known only from the type locality. (Material not seen, description taken from the original.)

2) *E. crepidis-rubrae* (Jaap) Liro, 1938:139, type on *Crepis rubra* L., Yugoslavia, Dalmatia, Monte Marian near Spalato, 22.V.1914, O. Jaap (BPI 175176!). Sori as discoidal or convexo-concave, callous spots on the leaves, 1–3 mm in diameter, grayish or yellowish-brown. Spores (Fig. 1) usually adhering in irregular groups, globose, broadly ellipsoidal or polyhedral, 9–15 x 12–18(–20) μm , orange-yellow or light brownish-yellow. Spore wall smooth, two-layered, uneven, 1.5–3.5 μm , sometimes with a short, pedicel-like thickening at the angle. It was reported on different *Crepis* species from Europe and Asia.

3) *Entyloma crepidis* Kawecka-Starmachowa, 1939:173, type on "*Crepis praemorsa*", USSR, Ukraine, Kolomyia (formerly Poland, Kolomya, Bania Berezowska, Mt. Rokieta), VI.1913, A. Wróblewski (as *Entyloma calendulae*; KRAM 2521!). Kochman & Majewski (1973:178) considered *E. crepidis* as a synonym of *E. picridis*, together with *E. arnosericis*, *E. leontodontis* and *E. hieracii*. The restudy of the type specimen, a leaf from KRAM, showed that the host plant actually does not belong to *Crepis praemorsa* (L.) Tausch but it is a *Hieracium* sp. (from the group *murorum*; checked also by Professor W. Sauer), and the smut is identical to *E. hieracii* H. & P. Sydow ex Ciferri, s. str.

4) A further *Entyloma* species on various *Crepis* species is not identical to either *E. crepidicola* or *E. crepidis-rubrae*. Its formal description is the following:

***Entyloma zacantha* Vánky, sp. nov.**

Typus in matrice *Crepis zacantha* (L.) Babcock (= *Lapsana zacantha* L. = *Zacantha verrucosa* Gaertner), Graecia, ins. Rhodos, inter pagg. Agaia Isodoros et Laerma, alt. ca. 200 m.s.m., 27.IV.1978, K. Vánky. Holotypus in herbario HUV (7174!); isotypus in BPI.

Sori in foliis maculas rotundas, amphigenas, dispersas vel gregarias, 0.5–2 mm diam., primum albidas deinde flavas et postremam pallide brunneas formantes. Sporae singulares vel in gregibus parvis congregatae, globosae, ovoideae vel plusminusve irregulares, 10–15 x 13–19 μm diam., subhyalinae vel flavido-brunneae, pariete bistrato, strato interno cca. 0.5 μm crasso, strato externo saepe inaequaliter incrassato, 1.5–4(–5) μm crasso, levi. Anamorphia ignota.

Sori (Fig. 7) in leaves as round, thin, amphigenous, scattered or gregarious spots, 0.5–2 mm in diameter, first whitish, then yellow and finally light brown. Spores (Fig. 2) solitary or in small groups, globose, ovoid or more or less irregular, 10–15 x 13–19 μm in diameter, subhyaline to pale yellowish-brown; wall two-layered, the inner layer c. 0.5 μm thick, the outer layer often unevenly thickened, 1.5–4(–5) μm wide, smooth. Anamorph not seen.

Key to the *Entyloma* species on *Crepis* s. lat.

1. Sori as globose outgrowths on the roots *E. crepidicola*
- Sori as leaf-spots 2
2. Sori callous. Spores in groups. Spore wall up to 3.5 μm thick *E. crepidis-rubrae*
- Sori not callous. Spores solitary or in small groups. Spore wall up to 5 μm thick *E. zacanthae*

***Melanotaenium* species on Scrophulariaceae.**

Viennot-Bourgin (1956:38) described (invalidly; ICBN Art. 35.1 & 36.1) *Melanotaenium antirrhini* on *Antirrhinum*, collected in France. The study of the type specimen, compared with the two other *Melanotaenium* species, known on Scrophulariaceae, *M. cingens* (G. Beck) P. Magnus, and *M. hypogaeum* (L.-R. & C. Tulane) Schellenberg, showed that *M. antirrhini* is a distinct species. Its description is the following:

Melanotaenium antirrhini Viennot-Bourgin ex Vánky, sp. nov.

Typus in matrice Antirrhinum latifolium Miller, Gallia, Distr. Alpes Maritimes, Andon, pr. Grasse, VI.1954, leg. Bouscary (PC!).

Sori in parte basali caulium pustulas molybdeas usque nigrescentes, saepe confluentes et magnas partes caulium nonnunquam ascendentes usque ad inflorescentiam surculis basalibus foliisque non exceptis obtegentes, primum epidermide tectas serius epidermide rupto, massam nigram agglutinatum sporarum ostendentes formantes. Sporae globosae, subglobosae, ellipsoideae, nonnunquam parum compressae, nunquam angulares, 12–18 x 14–20 μm , atrorubrunneae, granulis plenae, pariete levi, 2-stratoso, plusminusve aequaliter incrassato, 1,5–2,5 μm crasso, sine maculis refractivis.

Sori on basal part of stems as lead-coloured to blackish pustules, often confluent and covering large parts of the stems ascending sometimes to the inflorescence, and comprising basal shoots and leaves, first covered by the epidermis which later ruptures disclosing the black, agglutinated spore mass. Spores (Fig. 4) globose, subglobose, ellipsoidal, sometimes slightly flattened, never angular, 12–18 x 14–20 μm , dark reddish-brown, with granular contents; wall smooth, two-layered, more or less evenly thickened, 1.5–2.5 μm wide, no light-refractive spots.

The main differences between the three species of Melanotaenium on Scrophulariaceae are presented in form of a key.

1. Sori as large galls on the hypocotyls. On Kickxia M. hypogaeum
– Sori as pustules on the stems and leaves 2
2. Spores usually irregular, often angular, 16–24 μm long; wall uneven, 1–4 μm wide, light-refractive spots often present. On Linaria M. cingens
– Spores more or less regular, 14–20 μm long; wall even, 1.5–2.5 μm wide, light refractive spots absent. On Antirrhinum M. antirrhini

Discussion. For the spore measurements of Melanotaenium cingens, Viennot-Bourgin (1956:170) gives almost the same values (12–17 x 14–21 μm) as for his M. antirrhini (12–18.5 x 15–20 μm). For spore measurements of the type of M. cingens (on Linaria genistifolia, Austria, Mt. Leopoldsberg near Wien, VI.1880, G. Beck; HUV 1403; Fig. 3), I obtained 13–21 x 16–24 μm . Unfortunately, Viennot-Bourgin did not describe the spore wall, and he did not specify which sample he studied. If the host plant was correctly identified (as Linaria) it could mean that Linaria species may be parasited by both M. cingens and M. antirrhini. Actually, Viennot-Bourgin's figure (Pl. 42, fig. 1) of M. cingens represents a host plant with a tumour on the stem, which is not typical for M. cingens.

Melanotaenium species on Labiatae.

Three species of Melanotaenium were described on different Labiatae. Common to these species is, i.a., that the sori appear on the basal part of the stems or on the hypocotyl as swellings or tuberous bodies. M. jaapii and M. koschurnikoveanum are known only from the type collections while M. lamii was collected in a few localities in England and Germany. The comparison of the spores of these three species revealed no essential morphological differences. Consequently, I consider them as conspecific as follows:

Melanotaenium jaapii P. Magnus, 1911:456, type on Teucrium montanum L., Germany, Thuringia, near Jena, mt. Hausberg, 14.VII.1911, O. Jaap (PC!). – M. lamii Beer, 1920:337 (September), type on Lamium album L., Great Britain, England, Gloucestershire, Stroud, Chalfont, early summer 1918, W.F. Drew (K). – M. lamii H. & P. Sydow, 1920:156 (April 15, 1921; later homonym), type on L. album, Thuringia, Gross Furra near Sondershausen, 17.V.1918, G. Müller (JE). – M. koschurnikoveanum Lavrov, 1934:87, type on Galeopsis tetrahit L., USSR, W. Siberia, prov. Tomsk, near Baturino, 28.VII.1926, M.N. Koschurnikova (LE!).

Sori on underground stems and hypocotyl as swellings or tuberous bodies, from a few mm to several cm long, dark coloured, containing agglutinated, black spore masses. Spores subglobose, ovoid, usually irregular, subpolyhedral or flattened, sometimes with protuberances and also with light-refractive areas, 12–18 x 16–23 μm in diameter, dark reddish-brown; wall smooth, often two-layered and irregularly thickened, 1–2(–3.5) μm wide.

Neovossia molinia, N. iowensis and N. danubialis = one species.

Neovossia molinia (Thümen) Körnicke (1879:217), the type of the genus, is characterised by sori in scattered ovaries of Molinia caerulea (L.) Moench, and by ovoid to irregularly elongated, sometimes subglobose or lemon-shaped, finely and densely foveolate, dark reddish-brown spores, 12–20 x 17.5–32(–36) μm in diameter, provided with a long, hyaline appendage derived from the sporogenous hypha. Spore germination usually results in short basidia bearing a large number of terminal fusiform or slightly curved basidiospores which, without copulation, give rise to mycelia or short, falciform ballistospores (secondary sporidia).

Neovossia iowensis Hume & Hodson, in Hodson (1900:274) and N. danubialis T. Săvulescu (1955:71) were described from scattered ovaries of Phragmites communis Trin. (= P. australis (Cav.) Trin. ex Steudel). Although spores of N. danubialis were described as being larger than N. iowensis, I found that differences in the spore measurements fall within the normal variability of a species (Vánky 1985:95). I consider N. danubialis a synonym of N. iowensis.

While N. molinia and N. iowensis are distinct from all other known Neovossia species, they are indistinguishable from one another, even in SEM pictures of the spores and germination studies. Consequently, I consider them as one species under the oldest name N. molinia.

The types of Tilletia wilcoxiana Griff.

In the protologue of T. wilcoxiana, Griffiths (1904:88) mentioned two collections, both on "Stipa eminens Andersonii Vasey" (= S. lepida Hitchc. var. andersonii (Vasey) Hitchc.), from USA, California, Santa Monica, collected by H.E. Hasse. One of the samples was collected in "Spring 1901", the other in "April 1902". The second date, however, was probably a slip of the pen and should have been April 5, 1895. The original samples are preserved in Beltsville. The first one (BPI 173930!), is represented by scanty, more or less immature sori. The second one is richer (BPI 173929! & 173924!), labelled as "n. sp.", collected on "April 5, 1895". There is no collection from April 1902. I select as lectotype for Tilletia wilcoxiana Griff. that on Stipa lepida Hitchc. var. andersonii (Vasey) Hitchc., USA, Ca., Santa Monica, S.IV.1895 (BPI 173930!), and as syntype that of spring 1901 (BPI 173930!). T. wilcoxiana is a synonym of T. hyalospora Massee (1899:148).

Ustilago cariciphila Speg. = Farysia thuemennii.

Spegazzini (1925:152) described U. cariciphila with some hesitation, under the genus Ustilago (type on Carex bonariensis Desf., Argentina, Prov. Buenos Aires; no special collection designated). Spegazzini characterised this species, i.a., by the following: sori in ovaries, spore mass olivaceous, powdery. Spores subglobose, 6–10 μm long, olivaceous; wall thin (1–1.5 μm), when young smooth, when mature finely papillate. Ciferri (1931:58), without seeing any material, transferred it into the genus Cintractia.

The study of a specimen, collected by C. Spegazzini in Argentina, Prov. Buenos Aires, Navarro, 13.V.1917 (LPS 3117!) revealed that it is Farysia thuemennii (Fischer v. Waldheim) Nannfeldt (F. olivacea (DC.) H. & P. Sydow). The sori start to develop from the floral pedicel, within the utricle, beneath the young nutlet (similar to F. thuemennii on Carex riparia – G. Deml, pers. comm.).

Spores very variable in shape and size, globose, subglobose (4–7 μm), irregular, pyriform or elongate (5–12 μm long), pale olivaceous-brown, densely verruculose. Hyphal fascicles ("elaters"), typical for *Farysia* are also present.

What is *Ustilago digitariae* auctt.?

Kunze (in Holl 1830:369) described *Uredo* (*Ustilago*) *digitariae* Kunze as follows: "maculis obsoletis pallidis, acervis germinum effusis, sporangiolis magnis, sporidiis globosis, minutissimis, atris. Auf *Digitaria setigera* Rth.", collected by F. Holl, Island of Madeira. From this short and incomplete description the fungus can not be identified with certainty. Regarding the host plant, Professor Scholz's opinion (in litt.) is: "Apparently the name *Digitaria setigera* Roth given by Kunze is a misidentification. Only one species of *Digitaria* is reported from Madeira: *D. ciliaris* (Retz.) Koeler".

Rabenhorst published in his *exsiccata* (Rbh., Herb. viv. myc. ed. 2, No. 1199, 1847) "*Uredo Digitariae* Rabenh. Mspt. Ab *Ured. Panicorum* W. sat diversa! *Digitariae* germina infestat, pr. Triest, Rabenh." This fungus, at least the HUV copy (no. 3622), is typical *Ustilago cynodontis* (P. Henn.) P. Henn. on misidentified *Cynodon dactylon* (L.) Pers.

Winter (in Rabenhorst 1881:88), based on Kunze's name, *Uredo digitariae* Kunze, but using Rabenhorst's material (= *Ustilago cynodontis*), gave a more detailed description of what he considered to be "*Ustilago digitariae* (Kunze) Winter".

Consequently, it is not known what the name *Uredo* (*Ustilago*) *digitariae* Kunze (1830) represents. On the other hand, *Uredo digitariae* Rabenh. (1847) is *Ustilago cynodontis* (P. Henn.) P. Henn. (1893) /syn. *Ustilago segetum* (Bulliard) Ditmar var. *cynodontis* P. Hennings (1892). That means, that for the well-known and wide-spread smut of *Cynodon dactylon* there is an older name than *Ustilago cynodontis* (P. Henn.) P. Henn., namely *Uredo digitariae* Rabenh. Fortunately, Kunze's fungus *Ustilago digitariae* (Kunze) Winter (1881) preoccupies the name *Ustilago digitariae* and it is not necessary to propose the Henningean name for conservation, at least until the identity of Kunze's fungus can be clarified by the study of the type specimen.

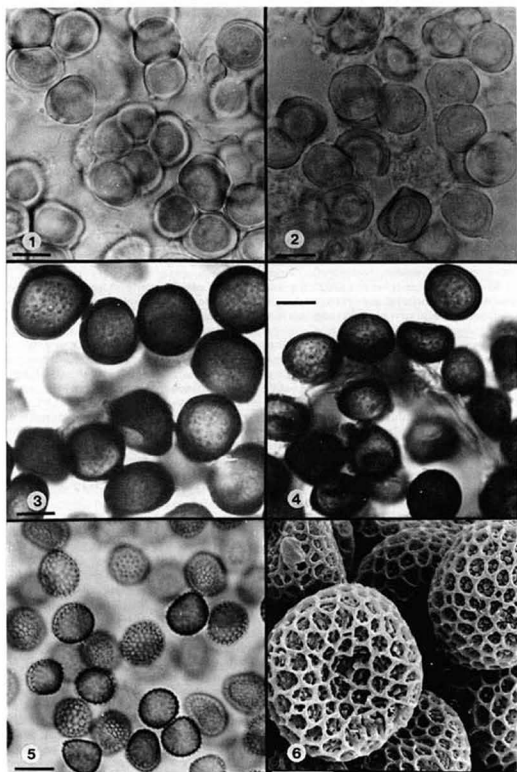
Ustilago dumosa Vánky & Oberwinkler, sp. nov.

Typus in matrice *Rumex dumosus* A. Cunn. ex Meisn., Australia, New South Wales, Moree, 30.X.1961, F.W. Cutting. Holotypus in HUV 6663!, isotypi in BRIP 11845! et in DAR 8533 (sub *Ustilago kuehneana*).

Sori caules ramulosque parum tumefacientes, massa sporarum purpureo-brunnea, semiagglutinata. Sporae globosae, ovoideae, ellipsoideae vel parum irregulares, 9,5–12 x 11–15 μm , pariete flavido-brunneo simul violaceo tincto, sub microscopio normali reticulato, punctato-reticulato vel reticuliformiter punctato cum 6–9 reticulis in diametro sporarum, muris reticuli 0,5–0,8 μm altis, in sectione mediana sicut projectiones obtusiusculae apparentibus, in SEM reticulato, verrucis ad muros et in campis inter muros visibilibus.

Sori (Fig. 8) in slightly swollen stems and branches filled by a purplish-brown, semiagglutinated spore mass. Spores (Figs 5, 6) globose, ovoid, ellipsoidal or slightly irregular, 9.5–12 x 11–15 μm , violet tinted yellowish-brown; wall in LM reticulate, punctate-reticulate or only punctate in a reticulate pattern, 6–9 meshes per spore diameter, muri 0.5–0.8 μm high, in median view appearing as blunt projections, in SEM reticulate with tubercles in the interspaces and on muri.

U. dumosa differs from *U. parlatorei*, i.a., by the different type of reticulate surface ornamentation and by the low muri, in median view appearing as blunt projections; from *U. kuehneana* by the smaller spores and the low, blunt muri.





- Fig. 1. Spores of *Entyloma crepidis-rubrae* (Jaap) Liro. Type.
 Fig. 2. Spores of *Entyloma zacintha* Vánky. Type.
 Fig. 3. Spores of *Melanotaenium cingens* (G. Beck) P. Magnus. Type.
 Fig. 4. Spores of *Melanotaenium antirrhini* Viennot-Bourgin ex Vánky. Type.
 Figs 5–6. Spores of *Ustilago dumosa* Vánky & Oberwinkler in LM and SEM. Type.
 Fig. 7. Sori of *Entyloma zacintha* on *Crepis zacintha*. Type.
 Fig. 8. Sori of *Ustilago dumosa* on *Rumex dumosus*. Type.

Bars = 10 μ m, except for Fig. 6, where it represents 4 μ m.

EXCLUDED SPECIES

E. aristolochiae Saccardo, 1915:32, type on Aristolochia elegans (cult.), Island Malta, San Antonio, 19.XII.1913, G. Borg (417; PAD!).

According to the original description: Sori on withering leaves, decoloring the epidermis, up to 1 mm in diam., surrounded by a black halo. Spores crowded, globose, 12–15 μm in diam., yellowish to dark brown, wall 1–2 μm thick, nearly smooth, with pale plasm, often divided in different ways.

Black sori, dark brown spores with divided protoplasm are not characteristics of an Entyloma. The study of the type specimen showed that the agglomerated fungal cells, yellowish-brown at the periphery, otherwise hyaline, rounded to irregular in shape and size, sometimes elongated and divided, represent immature ascocarps (perithecia) of a pyrenomycete.

Entyloma debonianum Saccardo, 1914:115, type on Oenanthe globulosa L., Island Malta, Ghain Mula, IV.1913, A. Caruano-Gatto (PAD!).

Saccardo described this species as follows: Sori on stems as blackish pustules, 0.5–0.6 μm in diameter. Spores produced in subglobose, intercellular masses 300 μm in diameter. Spores ellipsoidal-globose, 16–17 μm in diameter, with 1–3 hyaline nuclei, wall smooth, about 1 μm thick, yellowish-brown.

The study of the type specimen showed that this is not an Entyloma. The "spores" measure 16–24 μm in diameter. It may be in the Protomyceales, but it is not Protomyces macrosporus Unger, which has much larger ascogenous cells (37–74 μm).

Entyloma erodiamum Saccardo, 1915:33, type on Erodium moschatum (L.) Hér., Island Malta, Addolorata, 9.III.1914, A. Caruano-Gatto (388; PAD!). According to the original description, this species is characterised by sori forming light brown, indefinite, amphigenous spots. Spores not crowded but densely and widely situated in the leaf parenchyma, globose or slightly angular-globose, 14–15 μm in diameter, epispore 1.5 μm thick, light yellowish-brown, plasma sometimes divided into 2–4. In withered leaves of Erodium moschatum. Hardly visible. Spores sometimes only 9 μm in diameter.

This description is consistent with the characters of an Entyloma, except the statement that "the plasma is sometimes divided into 2–4". However, the study of the type specimen revealed that the "spores" are, in fact, compact bodies of non-fungus origin. Their form varies from globose to rectangular, measuring 6–20 μm in diameter, composed of numerous concentric layers. Rarely may be composed of 2–4 pieces. These bodies somewhat resemble starch granules but are iodine negative.

Additional Entyloma species, reported from Geraniaceae, are E. atlantica Massenot, in Guyot, Malençon & Massenot, 1958:187, and E. geranii Kuznetsova & Schwarzman, in Schwarzman, 1960:276.

Entyloma glyceriae Fragoso, 1924:441, type on Glyceria tenuifolia Boiss. & Reuter (= Puccinellia festuciformis (Host) Parl. subsp. tenuifolia (Boiss. & Reuter) W.E. Hughes), Spain, near Barcinona, Castelldefels, VII.1910, F. Sennen (MA 7133!). It was described as having globose to ellipsoidal spores 17–28 μm in diameter. The study of the type revealed that it is Physoderma gerhardtii Schröter (Chytridiales).

Entyloma hydrophilum Saccardo & Paoletti, in Saccardo, 1889:85, type on Sium cicutae-folium Schrank, USSR, Siberia, near Minusinsk, coll. N. Martianoff (LEI, PAD!).

This fungus was described as producing blackish, amphigenous, pustulous sori that never open on the leaves in yellowish, indefinite patches. Spores in the host cells, crowded, subglobose to angular, 24 μm in diameter, epispore thick, brown, nucleus globose, subhyaline, 15 μm in diameter.

Liro (1938:119), without seeing material, suggested that "this species may

possibly be identical to Entyloma flavum Ciferri, although the spores are said to measure up to 24 μm ".

The study of the type specimen revealed that this fungus is not an Entyloma, either. For the "spore" measurements I obtained 12–24 x 16–26(–30) μm values. The colour of the sori, the morphology of the spores, including the great size, are not typical for Entyloma. It looks like a Protomycetales, but it could not be identified with any of the known members of this order, mentioned by Reddy and Kramer (1975). All three species, Protomyces macrosporus Unger, Burenia cicuta (Lindroth) Reddy & Kramer, and B. inundata (Dangeard) Reddy & Kramer, have much larger ascogenous cells.

Entyloma xanthii was described by Massalongo, in Saccardo 1913:568, on Xanthium strumarium L., from Italy, Verona, Tregnago, "Calavena", summer 1913, coll. C. Massalongo (PAD!). According to the original description "The sori appear on the upper surface of the leaves as abundant, small, circular or angular spots, 2–3 mm in diameter, slightly bullate, no discoloration at the margins, whitish, almost calceolate, on the under side of the leaves the sori have a light olivaceous-yellow colour; spores in the mesophyll, globose to subglobose, in loose groups, fumose, 10–14 μm in diameter; epispore thin, minutely punctate-rough; conidia not seen. A species recognizable rather by the peculiar spots and host plant".

The study of the type specimen of Entyloma xanthii revealed no spores of Entyloma type, only necrotic leaf tissues covered by a white exudate which disappears in boiling water.

Schwarzman (1960:301) described Melanotaenium byzovae, from Galium tenuissimum M.B., USSR, Kazakhstan, Dzhambulskaja obl., Chu-Ilijskii Mts, 10 km from railway station Khantau, 26.V.1958, coll. Z.M. Byzova (AA!). Sori on the stem and leaves, rounded or elongated, bullate, lead-coloured, first "covered by the epidermis", later bursting. Spore mass brownish-violet. Spores globose, rarely ovoid, 9.5–11(–13) x 9.5–13 μm ; epispore 1–1.5 μm thick, smooth or obscurely verruculose, pale violet. The study of the type specimen showed that it is a myxomycete.

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ABBREVIATIONS

The abbreviations for herbaria follow Index Herbariorum (Stafleu 1981).
 HUV = Herb. Ustilag. Vánky, the author's private herbarium.

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BOOK REVIEWS

by

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THE AGARICALES IN MODERN TAXONOMY, by R. SINGER, 4th. ed., viii + 981 pp., 88 pl., 16 x 24 cm, cloth hardcover, 1986. Koeltz Scientific Books, D-6240 Koenigstein, Fed. Rep. Germany. ISBN 3-87429-254-1. DM 320.-

This is the fourth and, as the author says, "probably last edition" of *Agaricales in modern Taxonomy*, a full treatise of the Agaricales, introduced by an updated critical review of all concepts necessary to the observation and comprehension of that major group of fungi.

The first part, *Critical survey of the characters of the Agaricales as the base of their taxonomy*, is the most enriched part of this edition. It includes many of the recent advances in the taxonomy of the Agaricales, up to 1985. That part should be considered as the necessary guide to any taxonomical study by beginner. In 24 chapters, it deals with most aspects of descriptive taxonomy, from the most technical, like fungus culture or staining, to the most conceptual ones, like taxon definition and phylogeny.

The taxonomical part covers 230 genera, with 1 new genus described in the text, and slightly over 5000 species. The synonymy has been updated, leaving out 87 cases of *genera excludenda et incertae sedis*.

The main changes in the classification are the subdivision of the Agaricales into three suborders, the Agaricinae (11 families including Agaricaceae and Polyporaceae), the Boletineae and the Russulineae (with Bondarzewiaceae and Russulaceae), the creation of new tribes or subtribes in the Tricholomataceae, the major family of the Agaricales, (e.g. the tribe Termitomycetaceae for *Termitomyces* and *Podabrella*, the subtribes Laccariinae (*Laccaria*), Clitocybinae (*Clitocybe*, a.o.), Omphalinae (*Armillariella*, a.o.) and Tricholomatinae (*Tricholoma*) under the tribe Tricholomataceae), the transfer of the genera *Omphalotus* and *Lampteromyces* from the Tricholomataceae to the Paxillaceae.

This really monumental monograph is the work of a mycologist with a world-wide knowledge of the fungi, an extended and up-to-date acquaintance with literature and a deep minded criticism based on acute observation. The book shall remain a milestone in the systematics of higher fungi, to which any current or future mycologist will refer.

But progress towards modern taxonomy shall continue. One shall have to remember Singer's guarding words against the belief that multiplication, reorganization or upgrading of taxa necessarily make taxonomy modern. "Approximation towards a natural classification", he says, "requires patient comparative studies on the whole spectrum of characters available now or newly made available, on the largest possible number of taxa of the world mycoflora. The resulting conclusions, sometimes fortified by numerical methods, will produce a natural classification, and that approach is, I believe, the main characteristic of modern taxonomy."

THE BIOLOGY OF MARINE FUNGI, edited by S.T. MOSS, 382 pp., ill., 17 x 25 cm, cloth hardcover, 1986. Cambridge University Press, Shaftesbury Road, Cambridge CB2 2RU, UK. ISBN 0-521-30899-2. £27.50.

If there are a large number of fungi restricted to marine substrates or marine environment, which justifies studies of the marine mycoflora, *marine mycology* is not a field apart from mycology. This is once more demonstrated through the reading of the set of 30 papers presented by 42 contributors at the Fourth International Marine Mycology Symposium held at Portsmouth Polytechnic, U.K., in August 1985.

In regard to taxonomy, two major lines are the Labyrinthulales and the Mastigomycota with 3 papers on one side, and the Ascomycota with 8 papers (5, 6, 18-23) on the other. Modern taxonomical methods are used, such as G+C% values and enzymatic profiles. A more heterogeneous cluster of paper deals with physiology of the marine fungi (including yeasts and Deuteromycetes also) in relation to their environment and its salinity, their biomass production, their competitive substrate colonization, referring to salt, glycerol and polyol concentration, fatty acid, ergosterol, enzyme profiles and secondary metabolite production. Four papers (13-15 and 17) deal with pathogenic fungi causing mycoses of marine organisms, while one considers the mutualistic symbiosis between *Mycosphaerella ascophylli* and the brown alga *Pelvetia canaliculata*. Geographical distribution of the marine fungi is analysed in four papers, with interesting results by cluster analysis. As mycology has always had some practical aspects of biotechnological interest, four papers approach such features as hydrocarbon degradation by fungi, mycelial adhesion to surfaces, patterns of timber decay and wood preservation.

The title of the book might suggest a comprehensive treatment of the biology of the marine fungi in their specificity but is too promising. From the contributions it is not clear what makes marine fungi different from others. However, they are of real interest at the levels of general documentation and specific research progress.

FILAMENTOUS MICROORGANISMS: BIOMEDICAL ASPECTS, edited by Tadashi ARAI, xvi + 460 p., ill., 16 x 23 cm, cloth hardcover, 1985. Japan Scientific Societies Press, Tokyo. Distributed: Business Center for Academic Societies Japan, Koshin Bldg., 6-16-3 Hongo, Bunkyo-ku, Tokyo 113. ISBN 4-7622-8432-7. US\$50.00.

This book contains the 34 papers presented at the International Symposium on Chemiobiodynamics devoted to taxonomy, toxicogenicity and infections by filamentous organisms, held at Chiba University on 5-6 September 1983. In his overview of the subject, C.V. Subramanian emphasizes the benefits medical mycology takes from advances in descriptive mycology. In regard to the peculiar and difficult problems in the identification of medically important fungi, the contributions of Hughes, Yokoyama, Malloch, Onions, McGinnis, Udagawa, Samson and Cole offer a critical synthesis of the current descriptive research, taxonomy and nomenclature of the major groups of fungi in relation to health. This comprises the ontogenesis of chlamydo-spores, morphogenesis of *Coccidioides immitis*, and reviews of the Coelomycetes, the Trichocomaceae and their anamorphs *Penicillium*, *Aspergillus* and others, the pathogenic dematiaceae hyphomycetes, the thermophilic and thermo-tolerant fungi, as well as the food moulds.

The mechanisms of fungal infections, their biochemical agents, such as fungal toxins, the defensive reactions of the organism, and the effects of food mycotoxins on the organism are considered in special sections. Also basic and clinical aspects of antifungal chemotherapy is the subject of the last section of the book.

DEVELOPMENTAL BIOLOGY OF HIGHER FUNGI, by MOORE, D., L.A. CASSELTON, D.A. WOOD and J.C. FRANKLAND, British Mycological Society Symposium vol. 10, 615 pp., ill., 15 x 23 cm, cloth hardcover, 1985. Cambridge

University Press, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 2RU, U.K. ISBN 0-521-30161-0. £70.- US\$99.50

These transactions of the 1984 annual British Mycological Society Symposium held at Manchester are actually the joint publication of two different symposia, the first on "Resource Relationship of Agarics" (the first six chapters of the book) and the other on "Developmental Biology of the Agarics" (the other twenty-one chapters).

The first part of the book reviews concepts and cases of the fungus-host or fungus-substrate relationship in the Agaricales, characterized as saprotrophy, necrotrophy, mycorrhizal or pathogenic biotrophy. Particular attention is given to the dynamics of vegetative development and fruiting, in cases like the agaric community in tropical forest, *Crinipellis pernicioso* on cocoa trees, and *Armillaria* in temperate forests.

The second part of the book is a progressive series of papers going from the fundamentals in cellular biology to the practical management of mushroom production. Each of the 24 papers of that part is of real interest, such as the role of the dolipore, dikaryon formation, the mechanism of anastomosis. Then the morphogenesis of vegetative organs such as the stipe leads to that of fruitbodies, with an important paper by Roy Watling on the developmental characters in the Agaricales. After the biochemistry of morphogenesis and particularly that of fructification, the genetics of development is reviewed. The series ends with some new ideas for mushroom breeding strategies and mushroom cultivation techniques. Most of the papers presented are reviews of results published elsewhere. But all together they provide both fundamentally and practically oriented mycologists with a detailed and well-documented account of the today's knowledge in the field.

PLANT PATHOGENIC FUNGI, by von ARX, J.A., Beihefte zur Nova Hedwigia, 87, 288 pp., 105 fig., 17 x 24 cm, paperback, 1987. J. Cramer in der Gebrüder Borntraeger Verlag, D-1000 Berlin, Germany. ISBN 3-443-51009-4.

This book, the last one that late Dr von Arx published, is aimed to introduce mycologists to plant pathogens and plant pathologists to mycological classification. It is framed according to the systematic scheme of the fungi that von Arx published in *Pilzkunde* (1976) and *Fungi sporulating in pure culture* (1981) but with some changes, a few of these from *Mykologie* by Müller and Loeffler (1983). In that scheme of 6 phyla (=divisions), the major subdivisions up to the orders are described. A selection of briefly described genera, based on their importance or relation to plant disease or post-harvest decay, are commented upon with added lists of some relevant species. The book is well illustrated and contains numerous keys but references to the literature are limited to genera and to higher taxa only and are not numerous.

The major changes in the taxonomical scheme are the recognition of Endogonaceae as Endogonales, the recognition of the Endomycetes as a class of the Ascomycota, with the exclusion of the basidial orders, the change of Pseudo-sphaeriales into Dothideales, the recognition of the Meliolales, the surprising aggregation of the Helotiales (inoperculates Discomycetes) into the Phacidiales, the recognition of the classes Uromycetes and Urediniomycetes in the Basidiomycota, but with the Tilletiales in the class Basidiomycetes (=Hymenomycetes) near the Exobasidiales, and the division of the Agaricales into 4 orders, Polyporales, Agaricales, Russulales and Boletales. That scheme differs largely from the now classic one in *The Fungi* IVA-B by Ainsworth, Sparrow and Sussman (1973).

The most interesting feature of the book is the presentation of the Deuteromycetes (although the old divisions Sphaeropsidales, Melanconiales and Moniliales are still given) into 4 groups of anamorphs related to taxonomical ascomycetous orders, as anamorphs of Dothideales, of Sphaeriales, of Phacidiales and of others. This presentation may remind one that the biological unit is the holomorph and that the fungal pathogen should bear the name of it. If that, as I believe, was the opinion of the author, I cannot explain why he was reluctant to recognize *Botryotinia* as distinct from

Sclerotinia on the basis of such diagnostic holomorphic characters as sclerotia and conidiomata provide.

Von Arx has provided us with an interesting way of teaching plant pathogenic fungi.

ENTOLOMA (AGARICALES) IN EUROPE. *Synopsis and keys to all species and a monograph of the subgenera Trichopilus, Inocephalus, Alboleptonia, Leptonia, Paraleptonia and Omphaliopsis.* by M. E. NOORDELOOS, Beihefte zur Nova Hedwigia vol. 91, vi + 419 p., 128 fig., 17 x 21 cm, paperback, 1987. J. Cramer, Gebrüder Borntraeger, D 1000 Berlin, D 7000 Stuttgart. ISBN 3-443-51013-2.

This is an additional piece of work that the author adds to his already published partial monographs of the genus *Entoloma*, especially of subgenera *Pouzarella*, *Nolanea*, *Allochybe* and *Entoloma* in *Persoonia*, 1979, 1980 and 1981. The present book contains the monograph of five other subgenera, *Trichopilus* (6 species), *Inocephalus* (8 spp.), *Alboleptonia* (4 spp.), *Paraleptonia* (4 spp.), *Omphaliopsis* (3 spp.) and *Leptonia*, with 3 sections *Leptonia* (16 spp.), *Griseorubida* (7 spp.) and *Cyanula* (49 spp.). All species have been collected from Europe, in many different habitats. They are fully described, with much care and precision and illustrated by an half or full page of line drawings.

In another part of the book, the author has compiled and disposed in taxonomic order all the 226 species of the genus *Entoloma* in Europe, including those redescribed or described as new in this monograph. Species names that are not monographed in this book are entered with indications of typification, synonymy, misapplications, references to literature and illustrations and notes. A very elaborate dichotomous key, covering 17 pages but subdivided into 11 limited keys, allows the identification of all 226 species. The book is completed by a documented list of 177 insufficiently known or excluded taxa, accompanied with comments on type analysis, short description, taxonomic remarks and their taxonomical position in *Entoloma* when dubious or in other taxa when excluded.

This work results from 10 years of field and desk research. It is an important contribution to that very large genus, known by its many species from other parts of the world.

INTRODUCTION TO FOOD-BORNE FUNGI, edited by SAMSON, R.A., E.S. HOEKSTRA and C.A.N. VAN OORSCHOT, 2d edition, 248 pp., ill., 21 x 30 cm, paperback, 1984. Centraalbureau voor Schimmelcultures, P.O. Box 273, 3740 AG Baarn, The Netherlands. ISBN 90-70351-03.

More than the title might suggest, this book is a comprehensive guide to the whole problem of fungal contamination of food. The major part (205 p.) is of course devoted to the identification of almost one hundred food-borne fungi amongst the Zygomycetes, Ascomycetes, Deuteromycetes and the yeasts. Two facing pages are given to every described species, one for the description and outline drawings, the other for excellent black and white photographs of cultures and microscopic features. There follow four other chapters (31p.) by different authors on isolation and quantification of fungi in food, mycotoxin production, mycotoxin sampling, detection and identification, heat resistance of fungal spores and yeast cells and food preservatives. A last chapter, for a good balance of the contents, reminds the reader that moulds are not all noxious, but some are harmless and used in production of fermented foods. Each chapter is completed with a long literature list, the book itself by a glossary and a species index.

This guide has proven very useful to many microbiologists and the first edition was rapidly out of print. This second slightly revised edition is most welcome.

TROPICAL MUSHROOMS, Biological Nature and Cultivation Methods, by CHANG, S.T. and T.H. QUIMIO, xxi + 493 pp., 16 x 24 cm, ill., cloth hardcover, 1982. The Chinese University Press, Chinese University of Hong Kong, Shatin, N.T. Hong Kong, China. ISBN 962-201-264-7.

This is a concise, in-depth treatment of the knowledge on mushroom science for tropical countries. It is divided in five parts. Part 1 is for general aspects of mushroom cultivation, such as genetics and breeding, spawn production, substrates for mushroom production, preservation, chemical analysis. Part 2 deals with morphology, physiology, enzymatic activities, ecology of *Volvariella volvacea*, its cultivation in Southeast Asia, Philippines and India and its nutritive value. Part 3 details the biology, physiology, environment and cultivation techniques of *Pleurotus* species, and their nutritive value, with a special case of using cotton waste as a substrate. In Part 4 *Auricularia politracha* and other species, often called the Chinese mushrooms, show a broad taxonomic and population diversity. Their growth and fruiting physiology has been investigated. Their cultivation on composted sawdust in the Philippines and on logs in China is commented upon. In Part 5 the cultivation of *Termitomyces* species by termites in natural habitats is described, while no cultivation by man has been successful. The book is an excellent state of the art, in the tropical countries, and is invaluable for anyone interested in mushroom production. But from its reading it becomes also clear that mushroom taxonomy, physiology, genetics and culture, as well mushroom quality as food, urgently need extensive scientific investigations, and that should concern mycologists in the field.

HANDBOOK OF INDIGENOUS FERMENTED FOODS, edited by STEINKRAUS, K.H., Microbiology Series vol. 9, ix + 671 pp., fig., ill., 18 x 26 cm, cloth hardcover, 1983. Marcel Dekker, Inc. 270 Madison Ave, New York, NY 10018, U.S.A. 0-8247-1848-8.

This book is based upon papers submitted to the Symposium on Indigenous Fermented Foods (SIFF) held in Bangkok, Thailand, in November 1977. Let us recall that, while *Saccharomyces cerevisiae* was recognized and cultured as beer yeast in Mesopotamia by 6000 B.C., many other fungi are actually or potentially involved in food fermentation and that, today, at the least one-tenth of the world's population consume less food than their bodies need. We know that food fermentation, a practical end of mycology, cannot be forgotten. The book deals mainly with tropical food fermentations, including tropical mushroom cultivation, but is of general application. *Absidia*, *Actinomucor*, *Chlamydomucor*, *Mucor*, *Rhizopus*, *Aspergillus*, *Penicillium*, *Fusarium*, *Geotrichum*, *Monascus*, *Chrysonilia*, and *Neurospora* are the main filamentous fungus genera involved. *Brettanomyces*, *Candida*, *Debaryomyces*, *Endomycopsis*, *Hansenula*, *Kluyveromyces*, *Rhodotorula*, *Saccharomyces*, *Schizosaccharomyces* and *Zygosaccharomyces* are the yeast genera concerned. The book is divided in 6 sections: protein-rich foods, acid fermentations, alcoholic foods, amino acid/peptide sauces, mushroom production, developments and problems in fermented foods. The book is profusely documented with references.

ZUR OKOLOGIE DER PORLINGE, II, by Ingo NUSS, Bibliotheca Mycologica vol. 105, 300 pp., 182 pl., 38 tab. + 57 diagr., 14 x 22 cm, paperback, 1986. J. Cramer in der Gebrüder Borntraeger Verlag, D-1000 Berlin, Germany. ISBN 3-443-59006-3.

This heavy document consists of 187 pages of dense text, 100 pages for 187 outstanding drawings and black and white photographs of carpophores and 140 pages of diagrams and tables, with the addition of 16 diagrams on 3 to 4 folded pages, and an index. More than 100 specimens of 31 perennial species of polypores (*Fomitiporia*, *Fuscoporia*, *Inocutis*, *Ochroporus*, *Phellinidium*, *Porodaedalea*, *Bondarzewia*, *Fomes*, *Ganoderma*, *Gloeophyllum*, *Skeletocutis* and *Trametes*) have been surveyed weekly

over two years and investigated for the growth of the hymenium (tubes), spore liberation, odor and guttation, in relation to external climatic factors.

The author distinguishes three groups of hymenial development. In a first group (*Trametes gibbosa*) the hymenium does not increase after the first year but continue to sporulate. In the second group, the hymenium increases in size during successive years, forming successive prolongation of the one-year tubes, so that the tubes remain open, are continuous from year to year and keep sporulating (*Fomitiporia hartigii*, *Ganoderma adpersum*). In this group annual hymenial layers are less conspicuous than in the third group. The third group has new annual hymenial growth but after closure by tramal hyphae of the pre-existing tubes (*Fomitiporia robusta*, *Ganoderma applanatum*). Those features should contribute to the taxonomy and the identification of polypores. *Fuscoporia (Phellinus) ferruginosa* is suggested to be divided in two species, for it shows the two type of successive hymenial growth. Those features are remarkably illustrated.

Sporulation periods depend on both the type of perennial polypores, and the species itself. It can be either continuous all through the year or discontinuous, with one or two spore liberation periods. The author gives a full detailed account on the spore release periodicity.

The book contains much more information that surely all those interested in the biology and ecology of the polypores will want to read.

Notice: an index and a 4 pages corrigendum of *Zur Ökologie der Porlinge I* is added as a loose leaflet.

AD POLYPORACEAS IV, by CORNER, E.J.H., Beihefte zur Nova Hedwigia vol. 86, 265 pp. + 35 fig. and 11 pl., 17 x 25 cm, cloth hardcover, 1987. J. Cramer in der Gebrüder Borntraeger Verlag, D-1000 Berlin, Germany. ISBN 3-443-51008-6.

The subtitle of the book indicates its contents: "the genera *Daedalea*, *Flabellophora*, *Flavodon*, *Gloeophyllum*, *Heteroporus*, *Irpex*, *Lenzites*, *Microporellus*, *Nigrofomes*, *Nigroporus*, *Oxyporus*, *Paratrachaptum*, *Rigidoporus*, *Scenidium*, *Trichaptum*, *Vanderbylia* and *Steccherinum*." The study of species in those genera is based on Dr. Corner's collections from Southeast Asia, the Solomon Islands and Brazil. Corner follows the Ryvardeen's taxonomy of temperate species. Therefore, it is not surprising that he describes 56 new species and one new genus, *Paratrachaptum*, from that little explored tropical mycoflora. The species are illustrated by 8 color plates and three photographs. But this fourth volume like the previous three is not a description of tropical species only. Each generic concept is analysed and discussed in regard to others for its developmental morphology. That should meet the interest of many mycologists.

BEITRAGE ZUR KENNTNIS DER PILZE MITTELEUROPAS, II, 240 pp., ill., 6 coul. pl., 17 x 24 cm, paperback, 1986. Einhorn Verlag, Eduard Dietenberger GmbH, Schwäbisch Gmund, Germany.

This is the second issue of the Arbeitsgemeinschaft Mycologie Ostwürttemberg (AMO) der Deutschen Gesellschaft für Mycologie, in honor of three German mycologists, W. Stein, J. Krok and the late H. Seemann. Twelve contributions concern more than 56 species of Basidiomycetes in the genera *Amanita*, *Conocybe*, *Entoloma*, *Flammulaster*, *Hebeloma*, *Hypholoma*, *Inocybe*, *Lentinellus*, *Lepista*, *Macrolepiota*, *Mycena*, *Naucoria*, *Omphalina*, *Paneolus*, *Phaeotella*, *Pholiotina*, *Picoa*, *Psathyrella*, *Psilocybe*, *Pterula*, *Riparites*, *Russula*, *Stephanospora*, *Tyromyces* and *Volvariella* and include special analyses of the genera *Callistosporium*, *Tricholomopsis* and *Psilocybe*, an interesting detailed key to the *Agaricus* species by M. Meusers (p.27-56) and an illustration of the microscopical features useful in the identification of *Russula*. Four papers concern the Ascomycetes, two on the genera *Melastiza* and

Heyderia, the two others on the discomycetes on *Filipendula ulmaria* and on 16 interesting Pyrenomycetes of the Bavarian Alps.

FUNGAL DIFFERENTIATION, A Contemporary Synthesis, edited by SMITH, J.E., Mycology Series vol. 4, xii + 624 pp., ill., 16 x 23 cm, cloth hardcover, 1983. Marcel Dekker, Inc. 270 Madison Ave, New York, NY 10016, U.S.A. ISBN 0-8247-1734-1.

This *Mycology Series* is the place for publication of works dealing with all aspects of mycology, particularly in its progress and in its relation to man. For instance biodeterioration, toxicity, pathogenicity or environmental adaptation. How morphogenesis and variations of the form can be achieved at a biochemical and cellular level in a large range of fungi is the subject of this book. That the matter is treated by 33 contributors in 19 chapters indicates also the diversity of aspects. After an attempt to define differentiation and the recognition of the cell polarity as a major factor of it in the introductory chapter, some chapters study the biochemical mechanisms of the morphogenesis in the slime molds and of cell polysaccharide synthesis (chitin synthesis) in *Blastocladiella*. Two chapters deal with yeasts, one on cell division, the other on ascospore formation. The next one details the so far known inhibition mechanisms of macromolecule synthesis and other factors that lead to fungal dimorphism yeast/hypha. Then a series of chapters reviews morphogenesis at the cell chemistry level in connection to genetic commands and external factors, of different developmental phases of the filamentous fungi: spore dormancy release, spore activation and spore germination, hyphal tip growth, colony patterns, sclerotial formation, conidiogenesis, sexual response from pheromones, and fruitbody development. A final chapter deals with genetic recombinations after fungal protoplast fusion in fungi and possible manipulations. The reading of the text requires some special acquaintance with cell molecular biology and chemistry, but the content being reviewed from a very large literature is an extremely rich source of information for the initiated.

MICROBIAL DEGRADATION OF ORGANIC COMPOUNDS, edited by GIBSON, D.T., Microbiology series vol. 13, x + 535 pp., ill., 16 x 23 cm, cloth hardcover, 1984. Marcel Dekker, Inc. 270 Madison Ave, New York, NY 10016, U.S.A. ISBN 0-8247-7102-8. \$ 107.50.-

Biodegradation of organic compounds is the fact for fungi as for other partners of the microbial world. Pasteur demonstrated it for the first time. This book's broad scope reviews some known processes of biochemical degradation with the help of 26 specialists. Biodegradation of C1 compounds, of alicyclic compounds, of aromatic hydrocarbons, of furans and lignin, and of pesticides such as halophenes, halogenated aromatic compounds, polychlorinated biphenyls or phthalates, is reviewed on the basis of an extended literature. In processes of degradation of monocarbon and alicyclic compounds (chapters 3 and 4), fungi and particularly yeasts are known to be involved. Lignin degradation is the characteristic of basidiomycetes and the chapter by T.K. Kirk is most interesting. In most processes, bacteria are the agents. But undoubtedly, fungi have still unexplored properties that this book may stimulate approaching. Also, fungal secondary metabolites produced by fungi, like the furans from *Aspergillus* and *Penicillium* species, are in turn biodegraded by other organisms, and that is another aspect of interest of this book. The increasing importance of fungal biodegradation today justifies recommending the book to fungus physiologists and biochemists, as well as to plant pathologists.

BRITISH FUNGUS FLORA, 5. Strophariaceae & Coprinaceae p.p., by WATLING, R. and N.M. GREGORY, 119 p., ill., 15 x 24 cm, paperback, 1987. Royal Botanic Garden, Inverleith Row, Edinburgh EH3 5LR, UK. ISBN 0-9504270-7-1. £8.-

This part of the fungi of the British Islands contains the characters of the family of Strophariaceae with four genera, *Hypholoma* (15 species), *Melanotus* (6 species), *Psilocybe* (25 species) and *Stropharia* (11 species). Two genera, *Panaeolus* (14 species) and *Lacrymaria* (3 species) are complementary to the already revised family Coprinaceae (Part 2). Keys to genera and species are provided. Amongst the indexes, a list of 23 misidentifications and of 54 rejected names and a list of the species disposed according their ecological niches are noteworthy. The genus *Nematoloma* is rejected for *Hypholoma*. *Psilocybe* is not as large as *Psilocybe* sensu Kühner (including *Stropharia* and *Hypholoma*) but includes species of *Deconica* and some species only of *Stropharia*. *Psilocybe*, as opposed to *Stropharia*, does not have chrysocystidia. *Panaeolina foenicisecii* is returned to *Panaeolus*. *Pholiota* (*Kuehneromyces*, *Galerina*) *mutabilis* is not considered. This part is of special interest in the identification of hallucinogenic fungi.

FLORA CRIPTOGAMICA DE TIERRA DEL FUEGO, Orden Helotiales, Orden Cyttariales, by GUARRERA, S.A., I. GAMUNDI DE AMOS and D. RABINOVICH DE HALPERIN, Flora Criptogámica de Tierra del Fuego vol. X(4), 266 p., 31 pl., 16 x 24 cm, paperback, 1986 (published July 1987). Consejo Nacional de Investigaciones Científicas y Técnicas Rivadavia 1917, Buenos Aires, Republica Argentina.

This part of the fungus flora of the Tierra des Fuego includes the family Cyttariaceae (Order Cyttariales), with the genus *Cyttaria* and 4 species, and in the Helotiales the family Geoglossaceae (8 species) with genera *Sarcoleotia*, *Trichoglossum*, *Thuemenidium*, *Scleromitrla*, *Pseudomitrla* and *Heyderia*, and the family Dermateaceae (30 species), with *Calycellina*, *Haglundia*, *Tapesia*, *Mollisiopsis*, *Mollisia*, *Niptera*, *Dermateopsis*, *Ocellaria*, *Propolomyces*, *Pseudopeziza*, *Hysteropezizella*, *Merostictis*, *Pirotaea* and *Trochila*. *Calycellina hygrophila*, *Tapesia fusca* var. *microspora*, *Mollisia cinerella* var. *citrinoreflecta*, *M. glutinosa*, *M. crocata* and *Merostictis aciculispota* are new described taxa. *Tapesia brachycarpa* is a new combination. All species are very carefully drawn on 31 full pages.

PRELIMINARY LIST OF VIETNAMESE APHYLLOPHORALES AND POLYPORACEAE s. str., by PARMASO, E., 88 pp., 14 x 20 cm, paperback, 1986. Academy of Sciences of the Estonian SSR, Institute of Zoology and Botany, 21 Vanemuise St., 202400 Tartu, U.S.S.R.

This is a compilation of all the 227 species of Aphyllophorales and Polyporaceae known in Vietnam, together with 83 doubtful ones. The list is taxonomical. The names are commented upon with reference to published data and to locality and habitat of collection. No identity checking has been made on herbarium material. The aim of the paper is to make a first step towards further exploration of the Vietnam mycoflora. (In both Russian and English)

PROBLEMS OF SPECIES AND GENUS IN FUNGI, edited by PARMASO, E., 194 pp., 14 x 20 cm, paperback, 1986. Academy of the Estonian SSR, Institute of Zoology and Botany, 21 Vanemuise St., 202400 Tartu, U.S.S.R.

What is the species, is a debatable question. The author dared to raise it to 19 mycologists specialized in the different groups of fungi. The answers make the chapters (in Russian, but with English summaries) of this interesting document. A distinction must be made between the *species concept* (morphological, biological), the *species definition* (based on the characters corresponding to the species concept) and the *species standard* (or set of criteria delimiting the species). For a number of the 19 authors, the only species problem is how to elaborate the species standard and build keys from it. If for some the species concept is strictly a morphological one, for others it is the concept of a biological species that prevails. Yet there are some divergences. How to qualify the uniparental species (the "asexual" species in Deuteromycetes)?

Heterokaryosis and parasexuality have not been investigated far enough to qualify uniparental species as biological species and some prefer to call them *pseudospecies*. Also, what are the intersterile groups of morphologically indistinguishable individuals in tetrapolar or multipolar Hymenomyces? Would they or should they be called *ultraspecies*? One knows sibling species and microspecies. But they are not accepted by everybody and often grouped in *collective species*, *species aggregates*, *supraspecies* or *macrospecies*. But these categories are supraspecific and should not be confused with species.

The debate is open. The matter is not discussed as a pure abstraction or a pure terminological problem, but practically through a full range of examples from all the groups of fungi.

BIODETERIORATION 6, edited by Sheila BARRY, D.R. HOUGHTON, G.C. LLEWELLYN and C.E. O'REAR, xv + 691 p., ill., 19 x 26 cm, cloth hardcover, 1986. The Biodeterioration Society and CAB International Mycological Institute, Farnham House, Farnham Royal, Slough SL2 3BN, U.K. ISBN 0-85198-555-6.

This is the proceedings of the Sixth International Biodeterioration Symposium held in Washington in 1984. The topics of the Symposium cover a very wide range of field due to the diversity of biological agents and of biodegradable substrates. The fungi have therein an importance place. The 129 papers are grouped into 14 sessions. The session topics are general aspects of biodeterioration and biodegradation, corrosion of metals, biodeterioration of museum objects, library and archive materials, biodegradation of effluents, fuels, polymers, lignocellulose, paints and plastics, marine biodeterioration, rapid detection methods of biodeterioration, deterioration by insects, control of biodeterioration, mycotoxin production. About one fifth of the papers are related to fungi. They deal with deterioration of different substrates, like wood, textiles, paints, natural and artificial stones and metal plates or pipes, with the control of the fungi by natural substances or by chemicals, the resistance testing of materials to fungi, the production of mycotoxins and their degradation, the biodegradation of those toxins. 108 species of fungi are cited in the text. An organism index and a subject index complete the very neatly edited book.

MUCL LIST OF CULTURES 1989. FUNGI-YEASTS. by HENNEBERT G.L. and Coll., xxii + 360 p., 21 x 29 cm, paperback, 1989. Mycothèque de l'Université Catholique de Louvain, B-1348 Louvain-la-Neuve, Science Policy Office of Belgium, 8, Rue de la Science, 1040 Bruxelles. FB600.-

This is the first edition of a catalogue of the fungi and yeasts kept in pure culture at MUCL collection. It includes almost 5000 strains, most of Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes. The data includes a nomenclator, the strain origin, status, history, optimal growth conditions, state of preservation and some properties like enzyme production, industrial applications, assays, etc. The living collection consists of 15000 strains derived from half the 30000 specimens kept in MUCL mycological herbarium.

MUCL, together with IHEM collection of fungi related to man (6000 strains, Brussels) and LMG collection of bacteria (8000 strains, Ghent), make up the Belgian Coordinated Culture Collections (BCCM), a consortium coordinated by the Sciences Policy Office of Belgium. The three catalogues are available on request, free of charge to those answering a survey on the use of microbial strains. All data in the collections are in databases according the general dataformat agreed upon by the Microbial Information Network Europe (MINE).

NOTICE

FOURTH INTERNATIONAL MYCOLOGICAL
CONGRESS: SECOND CIRCULAR

The Second Circular for IMC₄, to be held in Regensburg, Germany, from August 28th through September 3rd, 1990, has been mailed to those expressing interest. Sixty symposia are arranged in six parallel sessions in seven Sections, the organizers given here in parentheses: Systematics and Evolution (F. Oberwinkler), Morphology and Ultrastructure (R. Agerer), Ecology (J. Webster), Genetics and Physiology (U. Stahl), Biotechnology and Applied Mycology (P. Präge), Pathology (H. J. Schwinn), and Special Topics (B. Hock). There will also be an Honorary Lecture by K. Esser entitled *Molecular aspects in aging — facts and perspectives*, a series of General Lectures, Poster Sessions, Workshops, Exhibitions, Films, and pre- and post-Congress Excursions.

Those who have not received this circular may obtain one by writing:

IMC 4 / Prof. Dr. A. Bresinsky
Botanisches Institut der Universität
D-8400 Regensburg
Federal Republic of Germany

NOTICE

XI CONGRESS OF THE INTERNATIONAL SOCIETY FOR HUMAN AND ANIMAL MYCOLOGY

The Canadian Society for Medical Mycology has issued a First Announcement for the Congress to be held in Montréal, Québec, Canada, from June 24th-28th, 1991. The Congress is sponsored by them in collaboration with the International Society for Human and Animal Mycology (ISHAM) and the Université de Montréal.

To obtain a copy of the Announcement, which includes a card to be completed in order to receive the Second Announcement, write:

XI Congress of the International Society for Human and
Animal Mycology
c/o JPdL Multi Management Inc.
1410 Stanley, Suite 609
Montréal, Québec H3A 1P8
Canada

NOTICE

SUBSCRIPTION PRICE INCREASE

We regret having to inform subscribers that a price increase for subscriptions to MYCOTAXON is necessary in order to meet the increasing costs of production.

This is the journal's first price increase since volume 14. Few other journals have been able to maintain their subscription prices for such a long period without increases.

The new rates, effective with volume 37 and with *all* orders received after 1 February 1990, is:

Regular (Multi-user) Rate:	\$55.00 per volume
Personal (Individual) Rate	\$25.00 per volume

Subscribers qualify for the Personal Rate by agreeing not to give, sell, or deposit their copies in any library other than their personal one within three years after receipt.

All back volumes are still available. As in the past, orders for *complete runs* (vol. 1—last complete volume) and for runs that *complete* a subscriber's set are available at a 20% discount, reflecting postal savings involved in multi-volume shipments. Prices for the Cumulative Index to Volumes I-XX, for copies of the Thiers *Festschrift* number, and for Chupp's book on *Cercospora* remain unchanged.

NOTICE

IMPORTANT CHANGE IN EDITORIAL POLICY REQUIRING SUBMISSION OF REVIEWERS' COMMENTS

Effective immediately, authors are required to enclose the full pre-submission reviews (or copies thereof) of their paper at the time they send in their camera-ready copy. If the reviews were based on a manuscript substantially modified after review, a copy of the manuscript as submitted for review must also accompany the camera-ready copy.

Many authors already use this procedure. The previous requirement, to provide merely the names and addresses of reviewers, is thus no longer sufficient for acceptance of manuscript for publication.

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Page 284	line 16	for arbitrarily	read arbitrary
	34	for possibility	read possibility
287	9	for death 1915.	read death in 1915.
	32	for typification	read typifications
288	10	for doubts	read doubt
	29	for and contradictory:	read and is contradictory:
	38	for synonymized,	read synonymized,
289	6	for supposed	read suppose
	38	for single of	read single one of
290	14	for of of	read of
	21	for iodine-positive	read iodine positive
291	2,23,26	for fruting	read fruiting
	16	for species	read species,
292	20	for fruting	read fruiting
293	3	for synonymized	read synonymized
295	36	for already	read already
296	11	for iodine-positive	read iodine-positive
	12	for adequate to do not	read not adequate to
	31	for posthumous	read posthumously
	38	for arbitrarily,	read arbitrary,
297	6	for akward	read awkward
	9	for transfered	read transferred
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