
Further new smut fungi (Ustilaginomycetes) from Australia

Kálmán Vánky^{1*} and Roger G. Shivas²

¹Herbarium Ustilaginales Vánky (HUV), Gabriel-Biel-Str. 5, D-72076 Tübingen, Germany

²Plant Pathology Herbarium (BRIP), Department of Primary Industries, 80 Meiers Road, Indooroopilly, Queensland 4068, Australia; e-mail: roger.shivas@dpi.qld.gov.au

Vánky, K. and Shivas, R.G. (2003). Further new smut fungi (Ustilaginomycetes) from Australia. *Fungal Diversity* 14: 243-264.

Nine new species of smut fungi, belonging to eight genera, are described from Australia: *Dermatosorus schoenoplecti* Vánky & R.G. Shivas, on *Schoenoplectus mucronatus*, *Entyloma grampiansis* Vánky & R.G. Shivas, on *Hydrocotyle laxiflora*, *Macalpinomyces brachiariae* Vánky, C. Vánky & R.G. Shivas, on *Brachiaria holosericea*, *M. digitariae* Vánky & R.G. Shivas, on *Digitaria gibbosa*, *Restiosporium baloskionis* Vánky & R.G. Shivas, on *Baloskion tetraphyllum*, *Thecaphora maireanae* R.G. Shivas & Vánky, on *Maireana pentagona*, *Tilletia cape-yorkensis* Vánky & R.G. Shivas, on *Whiteochloa airoides*, *Urocystis chorizandrae* J. Cunningham, R.G. Shivas & Vánky, on *Chorizandra enodis*, and *Ustanciosporium tenellum* R.G. Shivas & Vánky, on *Cyperus tenellus*. New combinations are: *Macalpinomyces ordensis* (R.G. Shivas & Vánky) Vánky & R.G. Shivas (based on *Sporisorium ordense*, type on *Brachiaria pubigera*, Australia), and *Sporisorium setariae* (McAlpine) Vánky & R.G. Shivas (based on *Sorosporium setariae*, type on *Setaria glauca*, Australia).

Key words: taxonomy, new species, new combinations

Introduction

Recent studies of the smut fungi (Ustilaginomycetes) of Australia have resulted in the description of some new genera, numerous new species, and several new combinations (Shivas and Vánky, 1997, 2001, 2002, 2003, Vánky, 1997, 2001, 2002, Vánky and Shivas, 2001a, 2001b, Vánky and Websdane, 1995, 1996, Walker and Shivas, 1998). Examination of recent collections and herbarium material has revealed nine new species of smut fungi belonging to eight genera, and has also necessitated two new combinations which are reported here.

*Corresponding author: email: VANKY.K@cityinfonetz.de

A new *Dermatosorus* species on *Schoenoplectus* (Cyperaceae)

The genus *Dermatosorus* Sawada ex Ling is characterised by sori in the seeds of *Cyperaceae*. The sori are swollen, first covered by a peridium which ruptures disclosing the spore balls and a more or less evident columella. The spore balls are composed of a cortex of empty sterile cells and a central mass of spores with very finely, deeply reticulate wall. Five species of *Dermatosorus* are recognised (Vánky, 1987, 1995), each on a different genus of host plant: 1. *D. bulbostylidis* (Thirum. & Pavgi) Vánky, on *Bulbostylis*, 2. *D. cyperi* Vánky, on *Cyperus*, 3. *D. eleocharidis* Sawada ex L. Ling, on *Eleocharis*, 4. *D. fimbristylidis* (Thirum. & Naras.) Langdon, on *Fimbristylis*, and 5. *D. thirumalachari* (Pavgi & B.K. Giri) Vánky, on *Scirpus*. A further species was collected recently on *Schoenoplectus*:

Dermatosorus schoenoplecti Vánky & R.G. Shivas, **sp. nov.** (Figs 1, 3-4)

Typus in matrice *Schoenoplectus mucronatus* (L.) Palla ex Kerner (det. M. Marshall, BRI), Australia, Queensland, *cca.* 60 km SSW urbe Cairns, inter Gordonvale et Yungaburra, 5 km turn off to "Cathedral Fig Tree", 17°11'32" S, 145°39'53" E, alt. *cca.* 730 m.s.m., 28.IX.2001, M.D.E. Shivas et K. Vánky. **Holotypus** in BRIP 28979!, **isotypus** in Herbario Ustil. Vánky, HUV 19750!

Sori in seminibus, nonnulla eorum inflorescentiae eiusdem inficientes, tumefacti, 1,5-2,5 × 3-4 mm, glomerulis sporarum impleti, glumis partim obtecti et peridio delicato cinerescenti cooperti. *Glomeruli sporarum* forma et magnitudine varii, irregulares, elongati usque subfusiformes, 30-100 × 40-200(-250) µm, atrobrunnei, opaci, e sporis multis compositi, cortice cellularum steriliarum, reticulatarum, magnitudine cum sporis fere aequalium circumdati. *Sporae* subglobosae, ovoideae, ellipsoidales, 8-10,5 × 9-12 µm, pallide flavidobrunneae; pariete aequali, leniter reticulato, *cca.* 1 µm crasso, reticulo incluso.

Sori (Fig. 1) in some of the seeds of an inflorescence, swollen, 1.5-2.5 × 3-4 mm, filled by spore balls, partly hidden by the glumes and covered by a delicate greyish peridium. *Spore balls* (Figs 3, 4) variable in shape and size, irregular, elongated, subfusiform, 30-100 × 40-200(-250) µm, dark brown, opaque, composed of numerous spores surrounded by a cortex of dark, reticulate, sterile cells about the size of the spores. *Spores* (Figs 3, 4) subglobose, ovoid, ellipsoidal, 8-10.5 × 9-12 µm, light yellowish-brown; wall even, finely reticulate, *ca.* 1 µm thick including reticulum.

On *Cyperaceae*: *Schoenoplectus mucronatus*; Australia. Known only from the type collection.

Dermatosorus thirumalachari which occurs on *Scirpus supinus* L. (*Schoenoplectus supinus* (L.) Palla), has a thicker peridium, larger spore balls and slightly smaller spores than *D. schoenoplecti*. Vánky (1995) gives a key to five species of *Dermatosorus*.

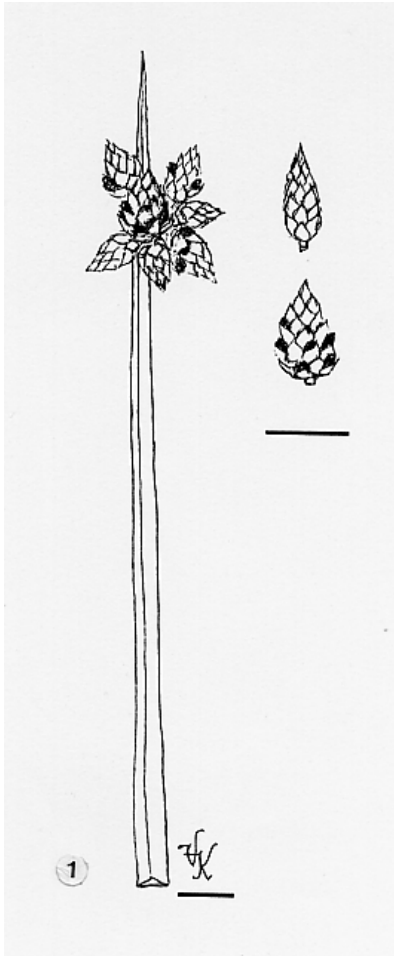


Fig. 1. *Dermatosorus schoenoplecti* (holotype). Sori in some of the seeds of *Schoenoplectus mucronatus*. Habit (left) and a healthy and an infected spike (right). Bars = 1 cm.

A new *Entyloma* species on *Hydrocotyle* (Umbelliferae)

The genus *Entyloma* de Bary is characterised by sori in vegetative parts of dicotyledonous host plants, the spores are single or grouped, colourless, permanently embedded in the host tissue. About 180 species of *Entyloma* are known on plants belonging to 25 families. On *Hydrocotyle* three species of *Entyloma* are known: **1.** *E. hydrocotylis* Speg., type on *H. cryptocarpa* Speg., Argentina, **2.** *E. fimbriatum* G.W. Fischer, type on *H. ranunculoides* L., USA, and **3.** *E. novae-zelandiae* McKenzie & Vánky, types on *H. novae-zelandiae* DC., and *H. heteromeria* A. Rich., New Zealand. A different species was recently collected in Australia.

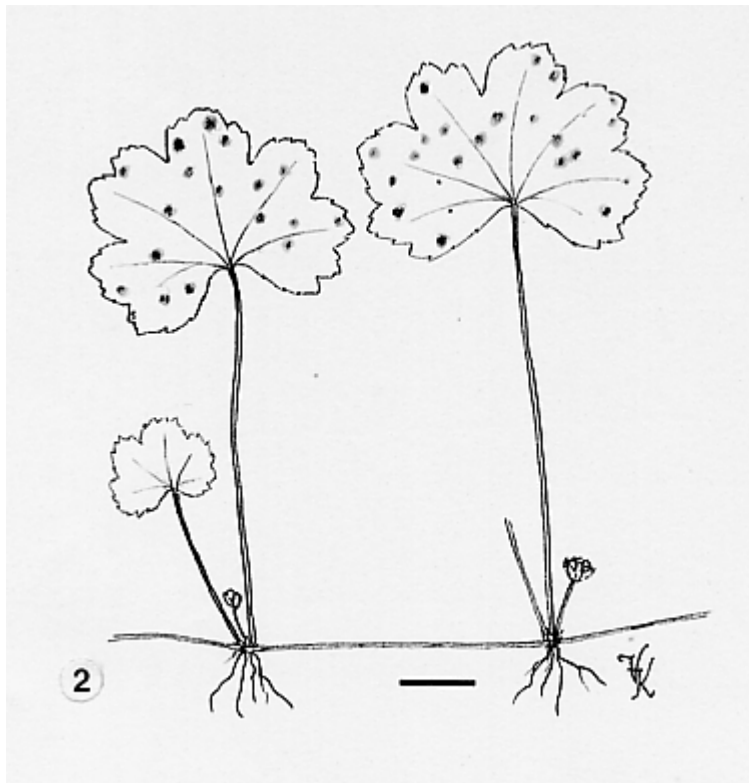


Fig. 2. *Entyloma grampiansis* (holotype). Sori as leaf spots on *Hydrocotyle laxiflora*. Bar = 1 cm.

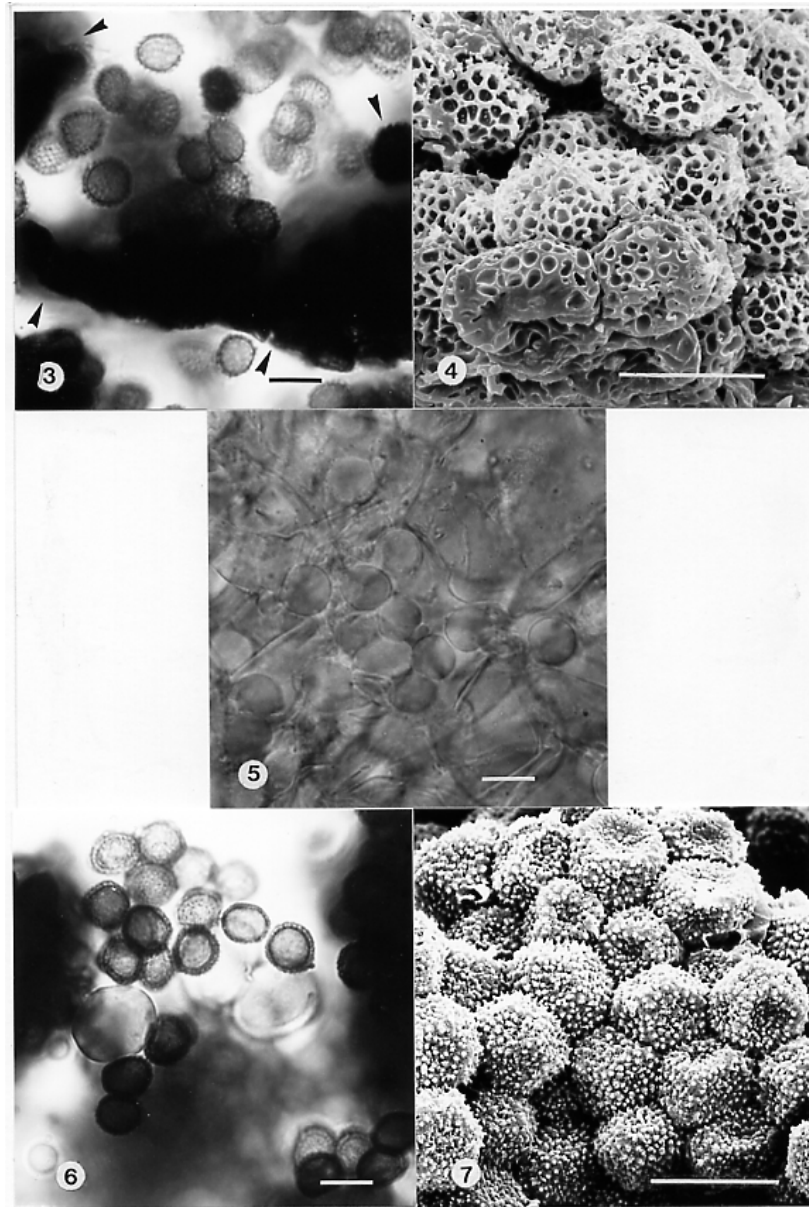
***Entyloma grampiansis* Vánky & R.G. Shivas, sp. nov.** (Figs 2, 5)

Typus in matrice *Hydrocotyle laxiflora* DC. (det. I.R. Thompson, MEL), Australia, Victoria, 9 km SW urbe Halls Gap, Grampians National Park, pr. Silverband Falls, 37°11'56" S, 142°31'45" E, alt. cca. 335 m.s.m., 9.X.2001, R.G. Shivas et K. Vánky. **Holotypus** in BRIP 28402!, **isotypi** in HUV 19749! et in BPI!

Sori sicut maculae sparsae, amphigenae, subcirculares, flavae usque pallide flavidobrunneae foliorum, diametro 0,5-3 mm, in latere abaxiali magis conspicuae. *Sporae* in telis hostilibus innatae, solitariae, globosae, subglobosae usque late ellipsoidales, 7-12 × 7,5-13 μm, subhyalinae; pariete aequali, tenui, usque ad 0,5 μm, levi; contentu homogeneo. *Conidia* nulla observata.

Sori (Fig. 2) in leaves as scattered, amphigenous, subcircular, yellow to pale yellowish-brown spots, 0.5-3 mm in diam., more evident on the abaxial side. *Spores* (Fig. 5) embedded in the host tissue, solitary, globose, subglobose to broadly ellipsoidal, 7-12 × 7.5-13 μm, subhyaline; wall even, thin, up to 0.5 μm, smooth, content homogenous. No conidia observed.

On *Umbelliferae*: *Hydrocotyle laxiflora*; Australia. Known only from the type collection.



Figs 3, 4. *Dermatosorus schoenoplecti* (holotype). Spore balls and spores on *Schoenoplectus mucronatus* in LM and in SEM. The LM picture shows a squashed spore ball with dark, mostly agglutinated cortical cells (arrow heads), and paler, more or less separated spores. Bars = 10 μm . **Fig. 5.** *Entyloma grampiansis* (holotype). Spores on *Hydrocotyle laxiflora* in LM. Bar = 10 μm . **Figs 6, 7.** *Macalpinomyces brachiariae* (holotype). Spores and sterile cells on *Brachiaria holosericea* in LM and in SEM. Bars = 10 μm .

Entyloma grampiansis resembles *E. novae-zelandiae*, from which it differs especially by its regular, paler, somewhat smaller, thin-walled spores.

Key to the *Entyloma* species of *Hydrocotyle*

1. Spore wall two-layered, 1.5-2.5 μm thick, content granular *E. hydrocotylis*
1. Spore wall one-layered, thinner (up to 1 μm), content homogenous2

2. Spores 12-24 μm long *E. fimbriatum*
2. Spores smaller, up to 14.5 μm long3

3. Spores often irregular, wall 0.5-1 μm thick. Sori up to 1.5 mm diam. *E. novae-zelandiae*
3. Spores regular, wall up to 0.5 μm thick. Sori up to 3 mm diam. *E. grampiansis*

Two new species of *Macalpinomyces*

The genus *Macalpinomyces* Langdon & Full. is characterised by sori in different organs (ovaries, flowers, culms) of *Gramineae*, covered by host tissue permeated by hyphae. Sori filled with pigmented, tightly packed, usually subpolyangular spores intermixed with hyaline or pale coloured sterile cells. Columella is lacking. In addition to the 26 known *Macalpinomyces*, two further species are described from Australia, one on *Brachiaria holosericea*, another on *Digitaria gibbosa*.

Macalpinomyces brachiariae Vánky, C. Vánky & R.G. Shivas, **sp. nov.**

(Figs 6-8)

Typus in matrice *Brachiaria holosericea* (R. Br.) Hughes subsp. *holosericea* (det. B.K. Simon, BRI), Australia, Northern Territory, Litchfield National Park, prope oppid. Bachelor, Rum Jungle, 13°01'49" S, 130°59'07" E, alt. *cca.* 140 m.s.m., 13.III.2000, R.G. Shivas, I.T. Riley, C. et K. Vánky. **Holotypus** in BRIP 26915!, **isotypus** in HUV 19188!

Sori in ovariis nonnullis inflorescentiae ejusdem, ovoidei, *cca.* 0,7 \times 1 mm, involucris floralibus occulti, peridio atrobrunneo cooperti, quo irregulariter rupto massam nigrescenti-brunneam, agglutinatum usque granulosam irregularium catervarum sporarum cellulis sterilibus intermixtum ostendentes. Columella nulla. *Sporae* subglobosae, late ellipsoideales usque parum irregulares, rotundate-subpolyedricae, magnitudine variae, 7-9,5 \times 7-11 μm , rubrobrunneae; pariete aequaliter crasso (0,5-1 μm), dense, humiliter verrucoso-echinulato; imago obliqua sporarum fere levis usque leniter undulata. *Cellulae steriles* singulae vel in catervis parvis, solutis, cellulae singulae subglobosae, ovoideae vel parum irregulares, sporis majores, 11-20 \times 13-22 μm , flavido- usque pallide rubrobrunneae; pariete 1-1,5 μm crasso, levi.

Sori (Fig. 8) in some ovaries of an inflorescence, ovoid, *ca.* 0.7 \times 1 mm, hidden by the floral envelopes, covered by a dark brown peridium which ruptures irregularly disclosing the blackish-brown, agglutinated to granular

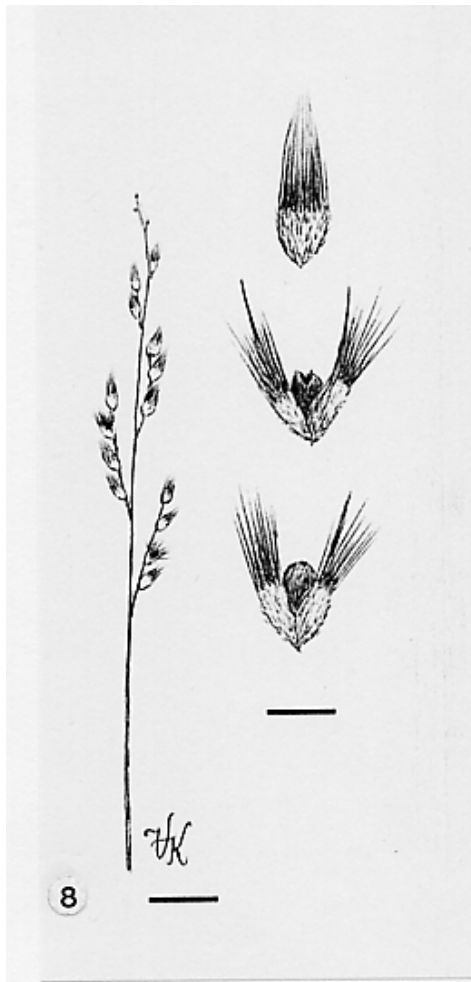


Fig. 8. *Macalpinomyces brachiariae* (holotype). Sori in some ovaries of *Brachiaria holosericea*. Habit (left) and a healthy and two infected spikelets with sori (right). Bars = 1 cm for habit, and 2 mm for the enlargement.

mass of irregular groups of spores intermixed with sterile cells. No columella. *Spores* (Figs 6, 7) subglobose, broadly ellipsoidal or slightly irregular, rounded subpolyhedral, variable in size, $7-9.5 \times 7-11 \mu\text{m}$, reddish-brown; wall evenly thick ($0.5-1 \mu\text{m}$), densely low verruculose-echinulate, spore profile nearly smooth to finely wavy. *Sterile cells* (Fig. 6) single or in small, loose groups, single cells subglobose, ovoid or slightly irregular, larger than the spores, $11-20 \times 13-22 \mu\text{m}$, yellowish- to light reddish-brown; wall $1-1.5 \mu\text{m}$ thick, smooth.

On *Gramineae*: *Brachiaria holosericea* subsp. *holosericea*; Australia. Known from the type collection only.

***Macalpinomyces digitariae* Vánky & R.G. Shivas, sp. nov.** (Figs 9, 11–12)

Typus in matrice *Digitaria gibbosa* (R. Br.) P. Beauv. (det. B.K. Simon, BRI), Australia, Northern Territory, 190 km E urbe Darwin, Kakadu National Park, 12°44'24" S, 132°19'14" E, alt. cca. 50 m.s.m., 18.III.2000, R.G. Shivas, I.T. Riley, C. et K. Vánky.

Holotypus in BRIP 26903!, **isotypus** in HUV 19291!

Sori in ovariis nonnullis inflorescentiae eiusdem, inconspicui, ovoidei, apice breve, acuto, 0,5-0,7 × 1-1,5 mm, integumentis floralibus plus-minus obtecti, primum peridio tenui, pallide brunneo cooperti, quo irregulariter rupto massam atrobrunneam, semiagglutinatum usque granuloso-pulveream sporarum, cellulis sterilibus intermixtam ostendentes. Columella nulla. *Spores* in catervis irregularibus vel singulae, subglobose, ovoideae, ellipsoideae usque plerumque subpolyedrice parum irregulares, 7-9,5 × 7,5-12 μm, flavidobrunneae; pariete aequali, 0,5-0,8 μm crasso, leniter, satis dense echinato; imago obliqua sporarum fere levis usque leniter serrulata. *Cellulae steriles* in catervis irregularibus vel singulae, ovoideae, ellipsoideae usque subpolyedrice irregulares, magnitudine sporis aequales vel majores, 7-13 × 8-14 μm, pallide flavidobrunneae; pariete 1-1,5(-2) μm crasso, levi.

Sori (Fig. 9) in some ovaries of an inflorescence, inconspicuous, ovoid, with a short, acute tip, 0.5-0.7 × 1-1.5 mm, more or less hidden by the floral envelopes, first covered by a thin, pale brown peridium which ruptures irregularly disclosing the dark brown, semiagglutinated to granular-powdery mass of spores intermixed with sterile cells. No columella. *Spores* (Figs 11, 12) in irregular groups or single, subglobose, ovoid, ellipsoidal to usually subpolyhedrally slightly irregular, 7-9.5 × 7.5-12 μm, yellowish-brown; wall even, 0.5–0.8 μm thick, finely, rather densely echinulate; spore profile nearly smooth to finely serrulate. *Sterile cells* (Figs 11, 12) in irregular groups or single, ovoid, ellipsoidal to subpolyhedrally irregular, the same size or larger than the spores, measuring 7-13 × 8-14 μm, pale yellowish-brown; wall 1-1.5(-2) μm thick, smooth.

On *Gramineae*: *Digitaria gibbosa*. Known only from the type collection.

Macalpinomyces digitariae differs from *Sporisorium gibbosum* Vánky, C. Vánky & R.G. Shivas, also on *Digitaria gibbosa* in Australia, in soral and spore characters. In *S. gibbosum* all spikelets of an inflorescence have sori (denoting a systemic infection), and a columella is present in the sori. The spores of *S. gibbosum* are larger and measure 9-13 × 9.5-13.5 μm.

A new species of *Restiosporium* on *Baloskion* (Restionaceae)

The genus *Restiosporium* Vánky is characterised by sori in the capsules of plants in the *Restionaceae*, replacing the seeds by a black, granular-powdery mass of spore balls. Peridium, columella and sterile cells are lacking. Currently, six species of *Restiosporium* are known, five from Australia and one from New Zealand: 1. *R. dapsilanthi* Vánky, type on *Dapsilanthus elatior* (R. Br.) B.G. Briggs & L.A.S. Johnson, 2. *R. dissimile* Vánky & McKenzie, type on *Apodasmia similis* (Edgar) B.G. Briggs & L.A.S. Johnson,



Fig. 9. *Macalpinomyces digitariae* (holotype). Sori in some ovaries of *Digitaria gibbosa*. Habit and enlarged a sorus and two healthy spikelets. Bars = 1 cm for habit, and 2 mm for the enlargement.

3. *R. lepidoboli* (McAlp.) Vánky, type on *Lepidobolus drapetocoleus* F. Muell.,
4. *R. leptocarpi* (Berk.) Vánky, type on *Leptocarpus tenax* R. Br.,
5. *R. meneyae* Vánky, type on *Lyginia barbata* (Labill.) R. Br., and
6. *R. restionum* (Nees) Vánky, type on *Restio nitens* Nees. A further species is:

***Restiosporium baloskionis* Vánky & R.G. Shivas, sp. nov.** (Figs 10, 13-14)

Typus in matrice *Baloskion tetraphyllum* (Labill.) B.G. Briggs & L.A.S. Johnson (conf. I.R. Thompson, MEL), Australia, Victoria, cca. 20 km NW urbe Halls Gap, Grampians National Park, Lake Wartook, 37°05'30" S, 142°25'57" E, alt. ca. 470 m.s.m., 9.X.2001, R.G. Shivas et K. Vánky. **Holotypus** in BRIP 28397!, **isotypi** in HUV 19748!, et in Vánky, Ust. exs. no. 1141. **Paratypus** cca. 30 km WSW urbe Halls Gap, Glenelg River crossing Syphon Road, 37°12'35" S, 142°20'25" E, alt. cca. 230 m.s.m., 9.X.2001, R.G. Shivas et K. Vánky, BRIP 28981!, HUV 19753!

Sori in capsulis, eas massa atrobrunnea, semiagglutinata usque pulverea glomerulorum sporarum implentens. *Glomeruli sporarum* forma et magnitudine varii, subglobosi, ovoidei, ellipsoidales, elongati vel irregulares, 35-100 × 45-150 μm, olivaceobrunnei usque subopaci, e

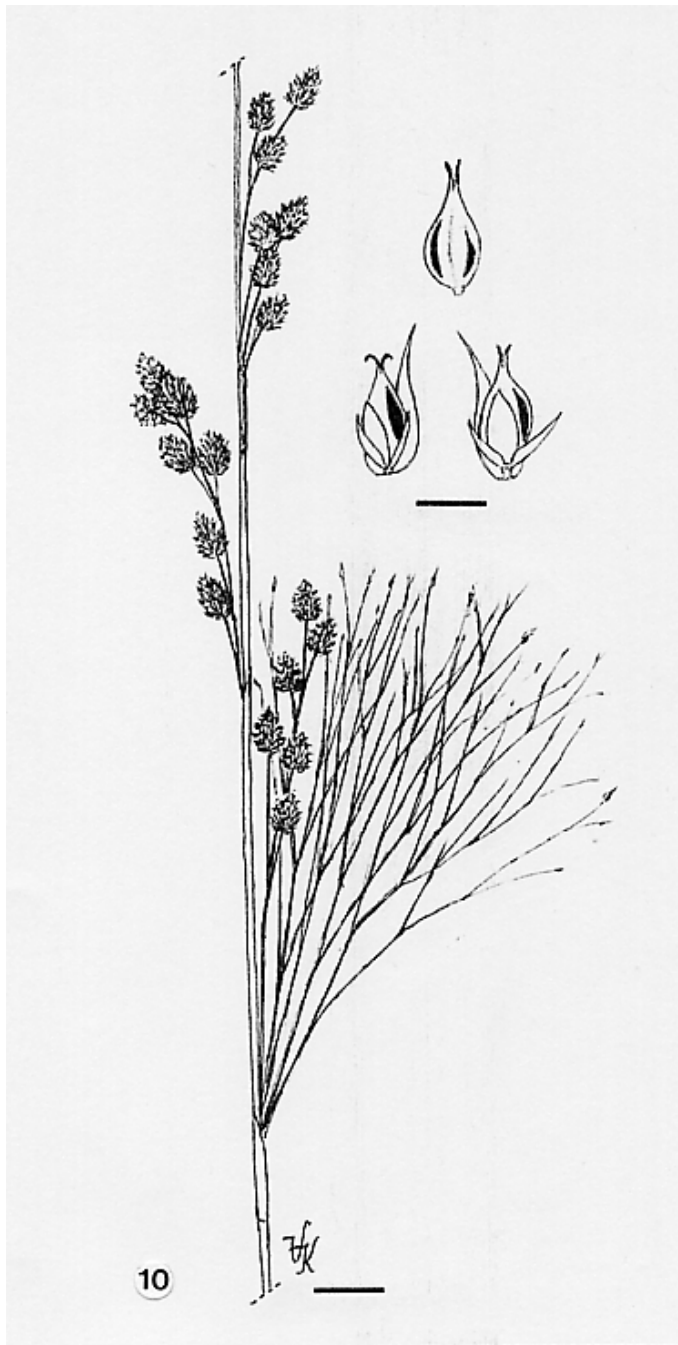
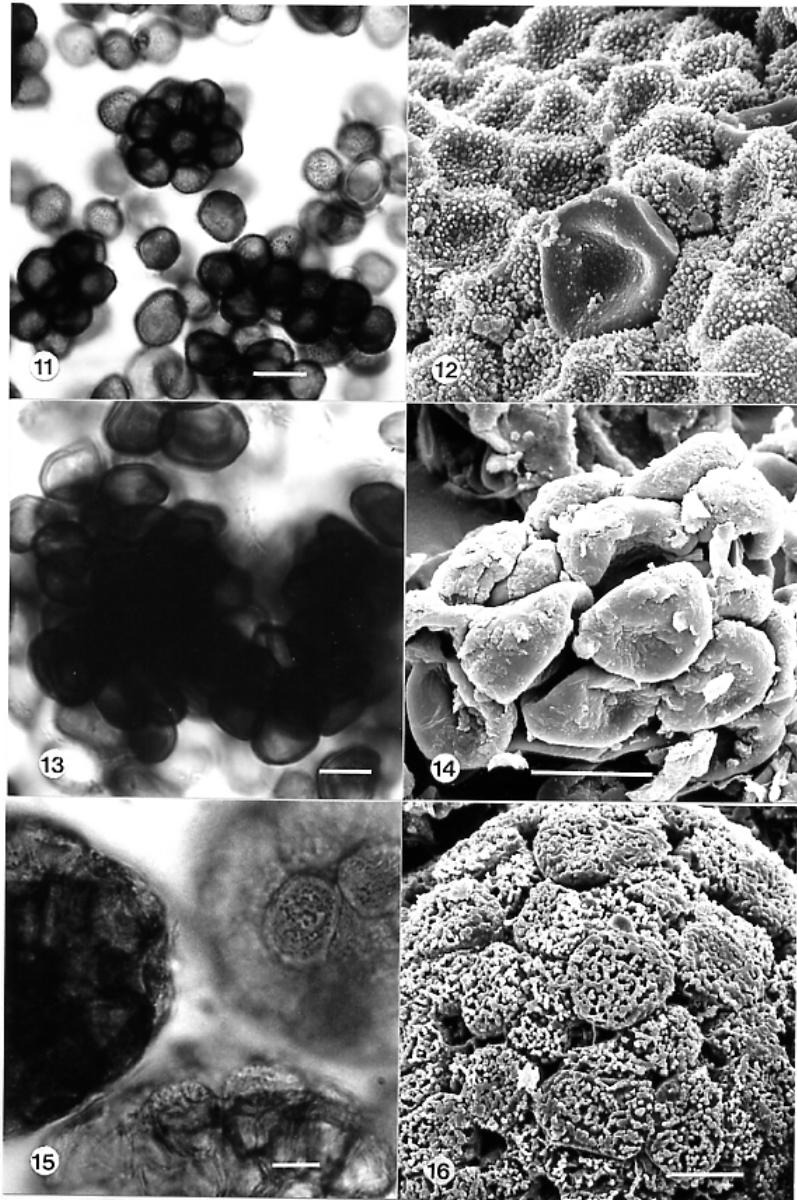


Fig. 10. *Restiosporium baloskionis* (holotype). Sori in the capsules of *Baloskion tetraphyllum*. Part of an inflorescence, habit and enlarged three infected, burst capsules filled with spore balls. Bars = 1 cm for habit, and 2 mm for the enlargements.



Figs 11, 12. *Macalpinomyces digitariae* (holotype). Spores and sterile cells on *Digitaria gibbosa* in LM and in SEM. Bars = 10 μ m. **Figs 13, 14.** *Restiosporium baloskionis* (holotype). Spore balls and spores on *Baloskion tetraphyllum* in LM and in SEM. Bars = 10 μ m. **Figs 15, 16.** *Thecaphora maireanae* (holotype). Spore balls and spores on *Maireana pentagona* in LM and in SEM. Bars = 10 μ m.

multitudine sporarum leviter separabilium compositi. *Sporae* forma et magnitudine variae, globoideae, ovoideae, ellipsoidales, elongatae vel subpolyedrice irregulares, 8-13,5 × 9-17(-20) µm, pallide olivaceobrunneae; pariete aequali, tenui (cca. 0,5 µm), levi.

Sori (Fig. 10) in the capsules filling them with a dark brown, semiagglutinated to powdery mass of spore balls. *Spore balls* (Figs 13, 14) variable in shape and size, subglobose, ovoid, ellipsoidal, elongated or irregular, 35-100 × 45-150 µm, olivaceous-brown to subopaque, composed of many easily separating spores. *Spores* (Figs 13, 14) variable in shape and size, globoid, ovoid, ellipsoidal, elongated or subpolyhedrally irregular, 8-13.5 × 9-17(-20) µm, light olivaceous-brown; wall even, thin (ca. 0.5 µm), smooth.

On *Restionaceae*: *Baloskion tetraphyllum* (*Restio tetraphyllum* Labill.); Australia. Known from the type collections only.

A new species of *Thecaphora* on *Maireana* (Chenopodiaceae)

The genus *Thecaphora* Fingerh. (including *Sorosporium*) is characterised by sori in various parts of dicotyledonous plants, filled with masses of yellowish- to dark reddish-brown, more or less permanent spore balls. No sterile cells, peridium or columella are present. Fifty species of *Thecaphora* are known on host plants belonging to 14 families. Study of herbarium specimens revealed that a smut fungus forming spore balls in the seeds of *Maireana pentagona* is a new species:

Thecaphora maireanae R.G. Shivas & Vánky, **sp. nov.** (Figs 15-17)

Typus in matrice *Maireana pentagona* (R. Anderson) Paul G. Wilson, Australia, Victoria, Wyperfeld National Park, 11 km S of NE corner of "The Hump", 35°26' S, 142°04' E, 11.XI.1968, A.C. Beaglehole 29464A. **Holotypus** in MEL 1055017!, **isotypi** in BRIP 27803! et in HUV 19619!

Sori seminum vices implentes, fructus massa glomerulorum sporarum pallide brunnea, granuloso-pulverea implentes, globoidei usque ovoidei, diametro 1,5-2,5 mm, involucris floralibus plus-minus obtecti. Infectio systemica, fructus omnes eiusdem plantae robiginosi. *Glomeruli sporarum* forma et magnitudine varii, globosi, ellipsoidales, ovoidei, elongati vel irregulares, 50-100 × 60-150(-190) µm, flavi usque pallide flavidobrunnei, e sporis pluries decem, firme unitis compositi. *Sporae* subcuneiformes, subpolyedrice irregulares, raro ellipsoidales, in aspectu surficiali 8-13,5 × 9-20 µm, in aspectu opticali mediano radialiter 11-21 µm longae, flavae usque pallide flavidobrunneae; pariete inaequali, in superficie libera 1,5-4 µm crasso, verrucis cca. 0,5 µm altis, saepe in ordinatione irregulari coalitis inclusis; pariete in lateribus contactis tenuiore, cca. 0,5 µm, conspicue levi.

Sori (Fig. 17) replacing the seeds, filling the fruits with a pale brown, granular-powdery mass of spore balls, globoid to ovoid, 1.5-2.5 mm in diameter, more or less hidden by the floral envelopes. Infection systemic, all fruits of a plant being smutted. *Spore balls* (Figs 15, 16) variable in shape and size, globose, ellipsoidal, ovoid, elongated or irregular, 50-100 × 60-150(-190)

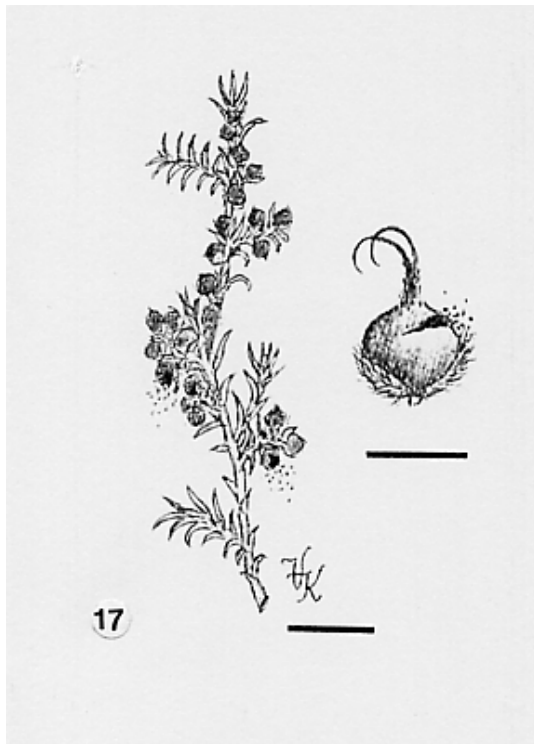


Fig. 17. *Thecaphora maireanae* (holotype). Sori in swollen fruits of *Maireana pentagona*. Habit (left) and enlarged an infected fruit (right). Bars = 1 cm for habit, and 2 mm for the enlargement.

μm , yellow to pale yellowish-brown, composed of tens of firmly united spores. *Spores* (Figs 15, 16) subcuneiform, subpolyhedrally irregular, rarely ellipsoidal, in surface view $8\text{-}13.5 \times 9\text{-}20 \mu\text{m}$, in optical median view radially $11\text{-}21 \mu\text{m}$ long, yellow to pale yellowish-brown; wall uneven, on the free surface $1.5\text{-}4 \mu\text{m}$ thick, including the *ca.* $0.5 \mu\text{m}$ high warts which often are fused into an irregular pattern; wall of the contact sides thinner, *ca.* $0.5 \mu\text{m}$, apparently smooth.

On *Chenopodiaceae*: *Maireana pentagona* (*Kochia pentagona* R. Anderson); Australia. Known only from the type collection.

A new species of *Tilletia* on *Whiteochloa* (*Gramineae*)

The genus *Tilletia* Tul. & C. Tul. is characterised by sori on host plants in *Gramineae*, most commonly in the ovaries, forming semiagglutinated to powdery spore masses composed of pigmented, single spores intermixed with colourless sterile cells. No peridium, no columella. About 140 species of *Tilletia* are known.

On *Whiteochloa* C.E. Hubbard, with 5 known species in Australia, two smut fungi are known: *Sporisorium whiteochloae* Vánky & McKenzie, and *Tilletia whiteochloae* R.G. Shivas & Vánky. A different *Tilletia* species was recently collected in the Cape York Peninsula.

***Tilletia cape-yorkensis* Vánky & R.G. Shivas, sp. nov.** (Figs 18, 20-21)

Typus in matrice *Whiteochloa airoides* (R. Br.) Lazarides (det. B.K. Simon, BRI), Australia, Queensland, Cape York Peninsula, 10 km NNE oppid. Bamaga, 10°49'15" S, 142°27'55" E, alt. cca. 50 m.s.m., 7.III.2000, R.G. Shivas, P.J.L. Whittle, C. et K. Vánky. **Holotypus** in BRIP 27011!, **isotypi** in BPI!, IMI! et in HUV 19293!

Tilletia cape-yorkensis a *T. whiteochloae* R.G. Shivas & Vánky (in Vánky & Shivas, Fungal Diversity 7: 164, 2001; type on *Whiteochloa cymbiformis* (Hughes) B.K. Simon, Australia) diversa imprimis sporis majoribus, pallidioribus, asperius ornatis. Sporae *Tilletiae cape-yorkensis* (20-)23-28(-32) × 24-32(-40) µm, mediocriter flavido- usque mediocriter rubrobrunneae, nunquam opacae; pariete 3,5-4,5 µm crasso, cum "projecturis scalariformibus", 3-4 µm altis, conicis vel cylindraceis, apice deplanatis, obtusis vel subacutis inclusis. Haec ornamenta parietis in visu superficiali delineationem irregularem, leniter usque satis dure reticulatam, cum areis per diametrum sporae 8-13, atris, irregulariter polyangularibus formantes.

Sori (Fig. 18) in some ovaries of an inflorescence, forming swollen, broadly fusiform or obovoid, brown bodies, with a narrow basal part and a short apiculate tip, more rarely lemon-shaped, 1-2 × 3-8 mm, covered by the thick pericarp which ruptures longitudinally at maturity disclosing the black, semiagglutinated to powdery mass of spores intermixed with sterile cells. *Spores* (Figs 20, 21) globose, subglobose to usually broadly ellipsoidal or ovoid, (20-)23-28(-32) × 24-32(-40) µm, medium yellowish- to medium reddish-brown, never opaque; wall even, 3.5-4.5 µm thick, including the 3-4 µm high, conical or cylindrical "scale-like projections" with flattened, blunt or subacute tips, in surface view the ornaments give an irregularly, finely to rather coarsely reticulate pattern, with 8-13 dark, irregularly polyangular areas per spore diameter. *Sterile cells* (Figs 20, 21) variable in shape, size and wall thickness, subglobose, ovoid, ellipsoidal to slightly irregular, 16-28 µm long, pale yellowish-brown; wall (1-)2-4(-5) µm thick, smooth, but also punctate or verrucose (= "immature spores"), rarely with a small appendage.

On *Gramineae*: *Whiteochloa airoides*; Australia. Known only from the type collection.

Tilletia cape-yorkensis differs from *T. whiteochloae* R.G. Shivas & Vánky (type on *Whiteochloa cymbiformis* (Hughes) B.K. Simon), in spore colour, size and surface ornamentation. The spores in *T. whiteochloae* are yellowish- to dark reddish-brown, measuring 18-24(-26) × 20-28 µm, the spore wall is 2.5-3.5 µm thick, including the 2-3 µm high verrucae which, in surface view, appear as 10-16, smaller, more regular, dark polyangular areas per spore diameter.

Fig. 18. *Tilletia cape-yorkensis* (holotype). Sori in some swollen seeds of *Whiteochloa airoides*. Habit (left) and enlarged two infected spikelets (right). Bars = 1 cm for habit, and 3 mm for the enlargement.

Tilletia cape-yorkensis differs also from *T. chionachnes* Vánky, C. Vánky & R.G. Shivas, described from the same area on *Chionachne cyathopoda* (F. Muell.) F. Muell. ex Benth (subtribe Chionachninae, tribe Andropogoneae). The size of the spores of these two *Tilletia* species is about the same, but in *T. chionachnes* they are darker, yellowish-brown to chocolate-brown or

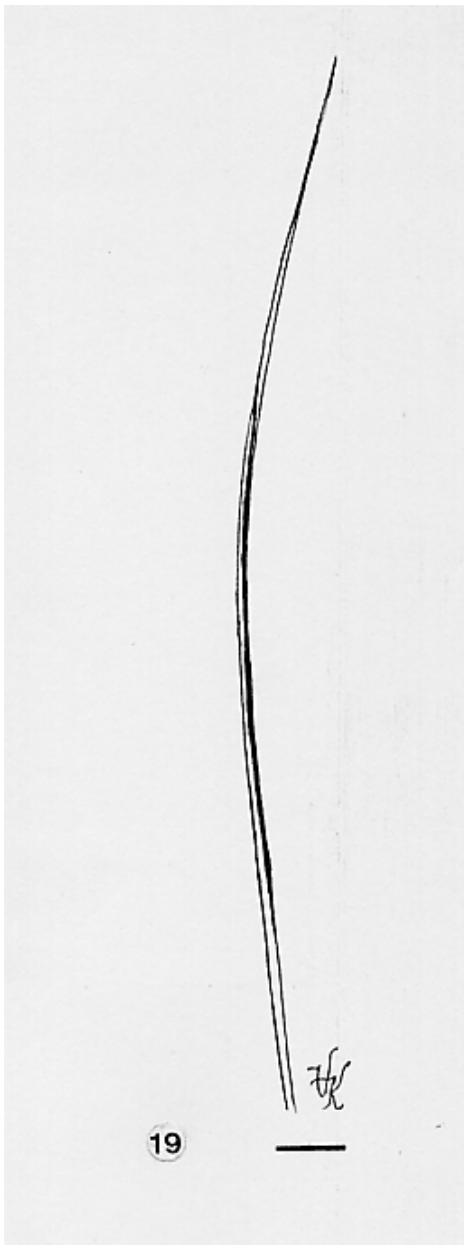
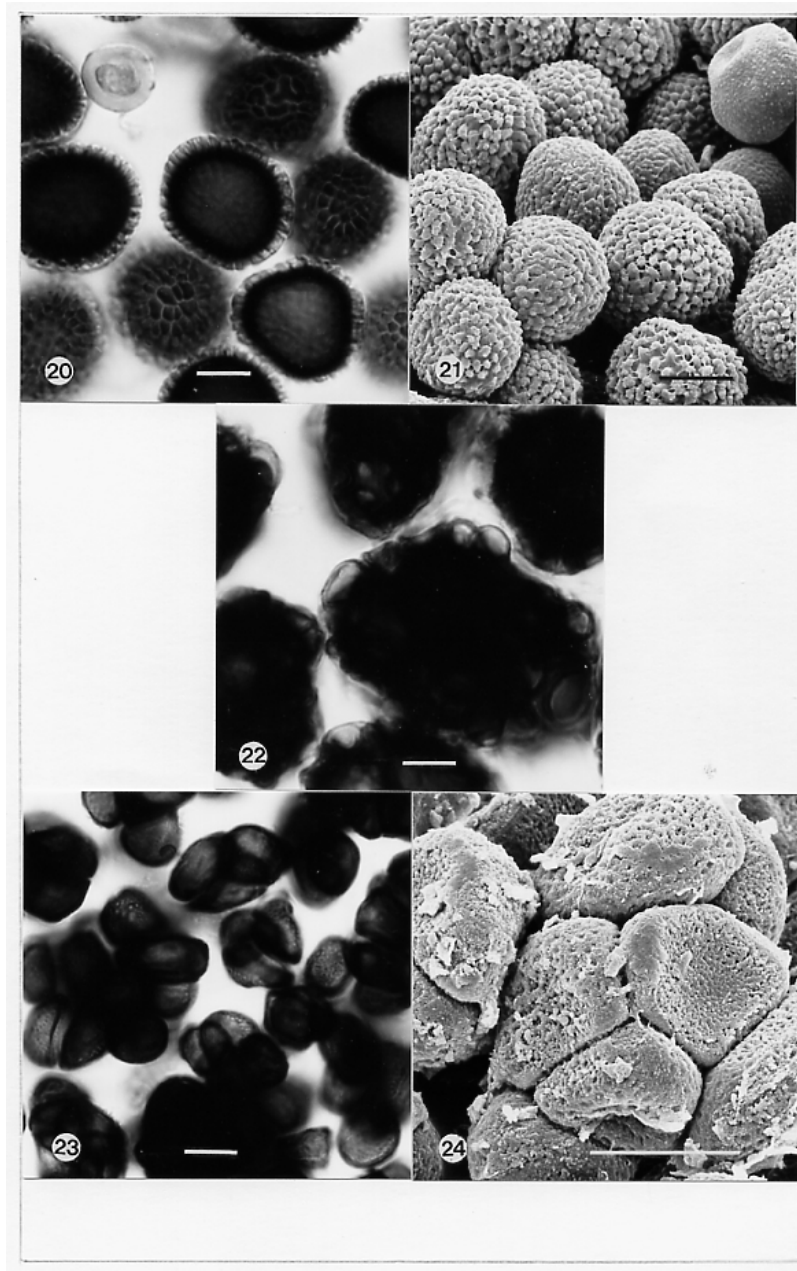


Fig. 19. *Urocystis chorizandrae* (holotype). Sori in a leaf of *Chorizandra enodis*. Bar = 1 cm.

opaque, the spore wall is thicker, 4.5-6 μm , including the 2.5-4 μm high and *ca.* 1 μm wide "projections", which in surface view appear as 8-16 dark, irregularly polyangular areas per spore diameter.



Figs 20, 21. *Tilletia cape-yorkensis* (holotype). Spores and sterile cells on *Whiteochloa airoides* in LM and in SEM. Bars = 10 μ m. **Fig. 22.** *Urocystis chorizandrae* (holotype). Spore balls on *Chorizandra enodis* with sterile cells surrounding the dark spores, in LM. Bar = 10 μ m. **Figs 23, 24.** *Ustanciosporium tenellum* (holotype). Spore balls and spores on *Cyperus tenellus* in LM and in SEM. Bars = 10 μ m.

Tilletia cape-yorkensis differs also from *T. biharica* Thirum. & Pavgi, *T. narayanaraoana* Mundkur & Thirum., *T. pulcherrima* Ellis & Galloway ex G.P. Clinton, and *T. verrucosa* Cooke & Masee, all on *Panicum* species, with spores provided with truncate or pointed, conical or cylindrical warts or scales.

A new species of *Urocystis* on *Chorizandra* (Cyperaceae)

The genus *Urocystis* Rabenh. ex Fuckel is characterised by sori mostly in leaves and stems, sometimes in flowers or seeds, less often in roots, as brown or blackish-brown streaks, spots, swellings or galls, containing a mass of spore balls, usually powdery. Infection usually systemic. Spore balls persistent, composed of one to several brown, fertile spores, surrounded by paler and smaller sterile cells. Spore germination of *Tilletia*-type.

The ca. 145 known *Urocystis* species are parasitising plants in 22 families, both mono- and dicotyledonous ones.

Scrutinising herbarium specimens in VPRI, J. Cunnington discovered a *Urocystis* species on a *Cyperaceae* (*Chorizandra enodis* Nees). On *Cyperaceae* two *Urocystis* species are known, both on *Carex*: *U. fischeri* Körnicke ex Winter (type on *Carex acuta* L., Germany) and *U. littoralis* (Lagerh.) Zundel (type on *Carex incurva* Lightf., Norway). Further studies showed that the smut on *Chorizandra* represents a new species.

***Urocystis chorizandrae* J. Cunnington, R.G. Shivas & Vánky, sp. nov.**

(Figs 19, 22)

Typus in matrice *Chorizandra enodis* Nees, Australia, Victoria, Stawell, Black Range, 37°03' S, 142°46' E, alt. cca. 210 m.s.m., 9.VIII.1924, J. Hill. **Holotypus** in VPRI 2999!, **isotypi** in BRIP 29104!, HUV 20092! et in VPRI 2993–2996! **Paratypus** idem, 7.VIII.1924, VPRI 2995!

Sori in interioris foliorum et culmorum steriliu, nonnulli cm longi, massa nigra glomerulorum sporarum completi, maturitate eorum longitudinaliter fissi et massa glomerulorum sporarum dispersa. *Glomeruli sporarum* subglobosi, ovoidei usque parum irregulares, 25-50 × 30-70 µm, atro-rufobrunneo, e sporis 1-6(-8), strato cellularum steriliu perfecte circumdatis compositi. *Sporae* subglobosae, late ellipsoidales, elongatae vel irregulares, latere 1 vel lateribus 2 depressae, 12-20 × 18-30 µm, rufobrunneae, leves. *Cellulae steriles* forma et magnitudine variae, globoideae, elongatae usque irregulares, 5,5-12 × 6,5-19 µm, flavidobrunneae; pariete 0,5-1(-1,5) µm crasso, levi.

Sori (Fig. 19) in the interior of leaves and sterile culms, several cm long, filled with a black mass of spore balls. At maturity, the sori split longitudinally and the granular-powdery mass of spore balls is scattered. *Spore balls* (Fig. 22) subglobose, ovoid to slightly irregular, 25-50 × 30-70 µm, dark reddish-brown, composed of 1-6(-8) spores completely surrounded by a layer of sterile cells. Frequency of spores per spore ball (calculated on 400 measured spore balls):

I = 12.5%, II = 26.75%, III = 29%, IV = 18%, V = 10%, VI = 2.5%, VII = 1%, VIII = 0.25%. *Spores* (Fig. 22) subglobose, broadly ellipsoidal, elongated or irregular, with one or two flattened sides, 12-20 × 18-30 µm, reddish-brown, smooth. *Sterile cells* (Fig. 22) variable in shape and size, globoid, elongated to irregular, 5.5-12 × 6.5-19 µm, yellowish-brown; wall 0.5-1(-1.5) µm thick, smooth.

On *Cyperaceae*: *Chorizandra enodis*; Australia. Known only from the type collection.

A new species of *Ustanciosporium* on *Cyperus* (*Cyperaceae*)

The genus *Ustanciosporium* Vánky, emend. M. Piepenbr. is characterised by sori in the spikelets of *Cyperaceae* forming black, semiagglutinated masses of spores or spore balls on the surface of inner parts of aborted flowers, more or less hidden by the glumes. Twenty-three species of *Ustanciosporium* are known on six genera of *Cyperaceae*. A further species is:

Ustanciosporium tenellum R.G. Shivas & Vánky, **sp. nov.** (Figs 23-25)

Typus in matrice *Cyperus tenellus* L. fil. (det. I.R. Thompson, MEL), Australia, South Australia, cca. 50 km NE Adelaide, 7 km SE Williamstown, 34°42'55" S, 138°56'11" E, alt. cca. 460 m.s.m., 13.X.2001, R.G. Shivas et K. Vánky. **Holotypus** in BRIP 28980!, **isotypus** in HUV 19770!

Sori in spiculis tumefactis, glumis obtecti, globoidei usque ellipsoidales, parum deplanati, cca. 0,5 × 0,5-1 mm. Infectio systemica, spiculi omnes eiusdem plantae infectae. *Glomeruli sporarum* irregulares, 12-35 × 15-55 µm, rubrobrunnei usque subopaci, e sporis 2-20(-25), pressu separabilibus compositi, vel sporae singulae. *Sporae* forma et magnitudine variae, globoideae, plerumque angulares vel subangulariter irregulares, saepe elongatae, unilateriter vel ad latera nonnulla compressae, 8-11(-13,5) × (10-)12-16(-19) µm, flavidobrunneae; pariete inaequali, 0,5-1,5 µm crasso, crassissimo ad angulos, dense, minute foveolato-reticulato.

Sori (Fig. 25) in the swollen spikelets, hidden by the glumes, globoid to ellipsoidal, slightly flattened, ca. 0.5 × 0.5-1 mm. Infection systemic; all spikelets of a plant are affected. *Spore balls* (Figs 23, 24) irregular, 12-35 × 15-55 µm, reddish-brown to subopaque, composed of 2-20(-25) spores which separate by pressure, or spores single. *Spores* (Figs 23, 24) variable in shape and size, globoid, usually angularly or subangularly irregular, often elongated, with one or several flattened sides, 8-11(-13.5) × (10-)12-16(-19) µm, yellowish-brown; wall uneven, 0.5-1.5 µm thick, thickest at the angles, densely, minutely foveolate-reticulate.

On *Cyperaceae*: *Cyperus tenellus*; Australia. Known only from the type collection.

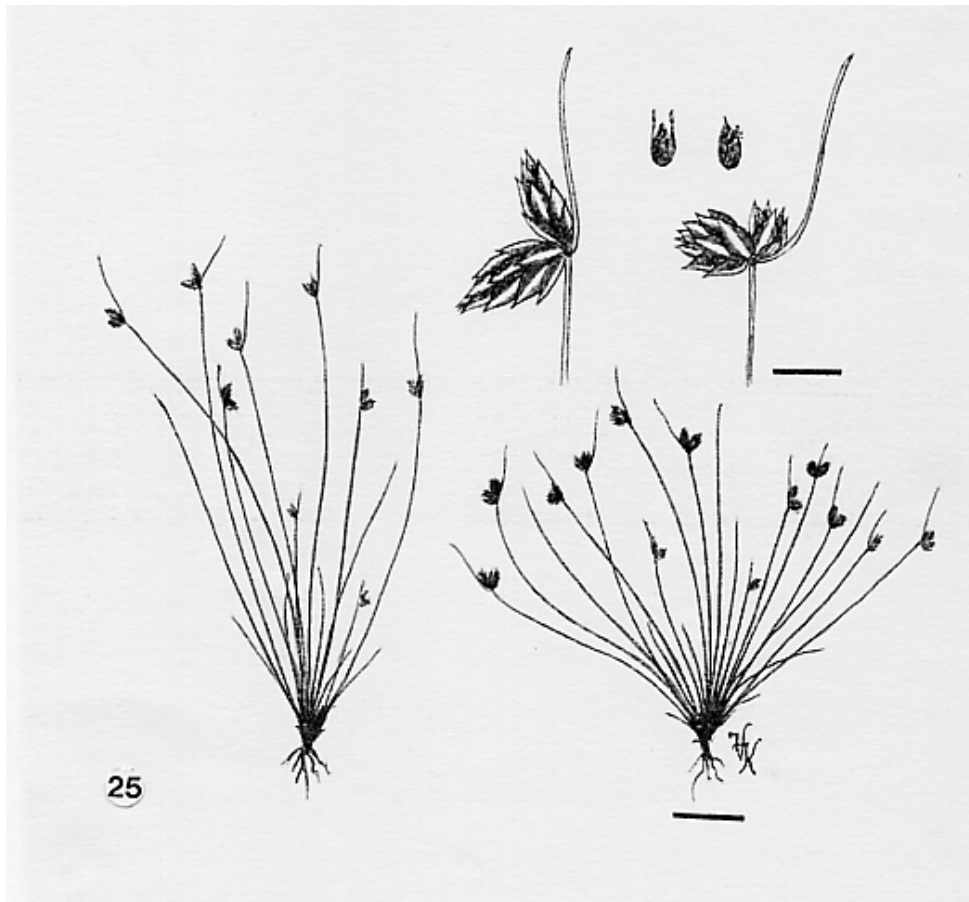


Fig. 25. *Ustanciosporium tenellum* (holotype). Sori in swollen spikelets of *Cyperus tenellus*. Healthy plant (left), infected plant (right); enlargement shows a healthy (left) and an infected inflorescence and two infected ovaries filled with spores (right). Bars = 1 cm for habit, and 2 mm for the enlargements.

Two additional *Ustanciosporium* on *Cyperus* are: *U. cyperi* (G.P. Clinton) M. Piepenbr. from North America, and *U. kuwanoanum* (Togashi & Y. Maki) Vánky from East and South Asia and South Africa. In *U. cyperi* the spores are paler and more finely ornamented, while in *U. kuwanoanum* the wall of the spores is thicker than that in *U. tenellum*, and the spores are more prominently ornamented.

Key to the *Ustanciosporium* species of *Cyperus*

1. Spore wall 0.8-2.5(-3) μm thick, prominently ornamented *U. kuwanoanaum*
1. Spore wall 0.5-1.5 μm thick, finely ornamented2
2. Spores (11-)14-21(-26) μm long; wall even, *ca.* 1 μm thick, very finely verruculose-foveolate *U. cyperi*
2. Spores (10-)12-16(-19) μm long; wall uneven, 0.5-1.5 μm thick, densely, minutely foveolate-reticulate *U. tenellum*

New combinations***Macalpinomyces ordensis* (R.G. Shivas & Vánky) Vánky & R.G. Shivas, comb. nov.**

Basionym: *Sporisorium ordense* R.G. Shivas & Vánky, Mycol. Res. 101: 835, 1997. - Type on *Brachiaria pubigera* (Roem. & Schult.) S.T. Blake, Australia, Western Australia, Kimberley region, Lake Kununurra, alt. *ca.* 50 m, 28 February 1995, R.G. Shivas, PERTH 3802140!, **isotype** HUV 17437!

For its description and illustrations see Shivas & Vánky, 1997: 835.

On *Gramineae*: *Brachiaria pubigera*; Australia (Northern Territory and Western Australia).

***Sporisorium setariae* (McAlpine) Vánky & R.G. Shivas, comb. nov.**

Basionym: *Sorosporium setariae* McAlpine, The smuts of Australia, etc., p. 183, 1910. - Type on *Setaria glauca* (L.) Beauv., Australia, Queensland, 20 miles S of Cloncurry, 10 May 1909, G.H. Robinson 203/9, VPRI 2980a; **isotypes** in BRIP 26796, VPRI 2981a, and HUV 20121!

Sori destroying some or all spikelets in the inflorescence, ovoid to short cylindrical, 1-2 \times 2-5 mm, partly hidden by the floral envelopes, first covered by a pale brown peridium which ruptures from its apex disclosing the black, granular-powdery mass of spore balls and sterile cells surrounding several, rather stout, irregular columellae of the length of the sorus, often with short apical branches. *Spore balls* variable in shape and size, subglobose, ellipsoidal, elongated or irregular, 25-70(-110) \times 40-100(-170) μm , dark reddish-brown, composed of tens to hundreds of spores which separate by pressure. *Spores* variable in shape and size, subglobose, ellipsoidal to usually subpolyhedrally irregular, dimorphic, (6.5-)7-12 \times (7.5-)8-13(-14.5) μm ; outer spores dark yellowish-brown, wall slightly uneven, 0.5-1 μm thick, free surface densely, finely verrucose-echinulate, spore profile wavy to finely serrulate; inner spores pale yellowish-brown, wall *ca.* 0.5 μm thick, apparently smooth to finely, densely punctate. *Sterile cells* few, single, globose to ovoid, 6-10 μm long, hyaline; wall 1-2 μm thick, smooth.

On *Gramineae*: *Setaria apiculata* (Scribner & Merr.) Vickery, *S. pumila* (Poiret) Roem. & Schult. subsp. *pumila* (*S. glauca*), *S. surgens* Stapf; Australia (Northern Territory, Queensland, Western Australia).

Acknowledgements

We wish to thank S. Tóth (Gödöllő, Hungary) for providing the Latin descriptions, B.K. Simon and N. Marshall (Brisbane, Australia) and I.R. Thompson (Melbourne, Australia) for identifying host plants, and I.T. Riley (Adelaide, Australia), P.J.L. Whittle (Cairns, Australia) and C. Vánky (Tübingen, Germany) for their help in collecting smut fungi. We are very grateful for financial support from the Australian Biological Resources Study to conduct surveys in southern Australia in 2001 as well as from the Australian Quarantine and Inspection Service to conduct surveys in northern Australia in 2000.

References

- Shivas, R.G. and Vánky, K. (1997). New smuts (Ustilaginales) on grasses from Western Australia. *Mycological Research* 101: 835-840.
- Shivas, R.G. and Vánky, K. (2001). The smut fungi on *Cynodon*, including *Sporisorium normanensis*, a new species from Australia. *Fungal Diversity* 8: 149-154.
- Shivas, R.G. and Vánky, K. (2002). A new smut fungus, *Sporisorium centrale* sp. nov., on *Themeda* from Australia. *Fungal Diversity* 11: 141-144.
- Shivas, R.G. and Vánky, K. (2003). First record of a smut fungus on *Byblidaceae*: *Yelsemia lowrieana*, a new species from Australia. *Fungal Diversity* 13: 131-135.
- Vánky, K. (1987). The genus *Dermatosorus* (Ustilaginales). *Transactions of the British Mycological Society* 89: 61-65.
- Vánky, K. (1995). Taxonomical studies on Ustilaginales. XII. *Mycotaxon* 54: 215-238.
- Vánky, K. (1997). New Ustilaginales from Australia. *Mycotaxon* 62: 151-174.
- Vánky, K. (2001). *Lundquistia*, a new genus of Ustilaginomycetes. *Mycotaxon* 77: 371-374.
- Vánky, K. (2002). *Illustrated Genera of Smut Fungi*. 2nd Ed. APS Press, 245 pp.
- Vánky, K. and Shivas, R.G. (2001a). New smut fungi (Ustilaginomycetes) from Australia. *Fungal Diversity* 7: 145-174.
- Vánky, K. and Shivas, R.G. (2001b). Smut fungi (Ustilaginomycetes) of *Sorghum* (Gramineae) with special regard to Australasia. *Mycotaxon* 80: 339-353.
- Vánky, K. and Websdane, K. (1995). Ustilaginales of *Schoenus* (Cyperaceae). *Mycotaxon* 56: 217-229.
- Vánky, K. and Websdane, K. (1996). New Ustilaginales on Cyperaceae from Australia. *Mycotaxon* 58: 167-183.
- Walker, J. and Shivas, R.G. (1998). Two species of *Sporisorium* on *Chionachne* in tropical Australia, the first Australian record of *Ustilago brunckii* and its transfer to *Jamesdicksonia*. *Mycological Research* 102: 1203-1214.

(Received 4 December 2002; accepted 10 June 2003)