New smut fungi (*Ustilaginomycetes*) from Mexico, and the genus *Lundquistia*

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The genus *Lundquistia* is emended and widened. Twelve new species of smut fungi are described from Mexico: *Lundquistia mexicana* on *Andropogon gerardii* and *Schizachyrium mexicanum*, *Entyloma aldamae* on *Aldama dentata*, *E. siegesbeckiae* on *Siegesbeckia orientalis*, *Jamesdicksonia festucae* on *Festuca tolucensis*, *Macalpinomyces tuberculatus* on *Bouteloua curtipendula*, *Sporisorium dacryoideum* on *Aristida adscensionis*, *S. ustilaginiforme* on *Muhlenbergia pulcherrima*, *Tilletia brefeldii* on *Muhlenbergia filiculmis*, *T. gigacellularis* on *Bouteloua filiformis*, *T. microtuberculata* on *Muhlenbergia pulcherrima*, *Ustilago circumdata* on *Muhlenbergia montana*, and *U. panici-virgati* on *Panicum virgatum*. New combinations proposed: *Lundquistia dieteliana*, *L. duranii* and *L. panici-leucophaei*, with its three new synonyms, *Ustilago bonariensis*, *Sorosporium lindmanii* and *L. fascicularis*.

Key words: *Lundquistia*, new combinations, new species, synonyms, taxonomy.

Introduction

The smut fungi of Mexico are relatively well-known, especially due to over 30 years of investigation by Prof. Ruben Durán (Washington State University, Pullman, USA). Numerous papers have been published by Durán, alone or in collaboration, in which many new species, a new genus and also the nuclear behaviour of the basidia and basidiospores of many North American smut fungi have been described (Durán and Fischer, 1961; Durán and Safeeulla, 1965, 1968; Durán, 1968, 1969, 1970, 1971, 1972, 1979, 1980, 1982, 1983; Durán and Cromarty, 1974, 1977; Cordas and Durán, 1976[1977]). Durán's work culminated in the publication of the profusely illustrated book Ustilaginales of Mexico (1987), containing 128 taxa of which 14 were new species. In his book, Durán applied a conservative nomenclature and classification of the smut fungi and 'most synonyms were accepted in good faith' (comp. Durán, 1987:VIII). In contrast, the recently published book by M. Piepenbring (2003), Smut fungi of the Neotropics, which includes also a

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large part of Mexico (that south of the tropic of Capricorn), the smut fungi are treated according to the most recent classification and nomenclature, although few taxa additional to those presented by Durán are given.

Mexico, with a territory of nearly 2 million km², is a country of major biodiversity – it is home to between 10% and 12% of all living organisms of the planet (Gómez-Pompa *et al*., 1994). Mexico has a great diversity of vegetation types. There are an estimated 19,500 vascular plant species (Dirzo and Gómez, 1996), with an estimated 52% endemic (Rzedowski, 1993). After the Compositae and Leguminosae, the Gramineae is the best represented family, with 950 species in 170 genera. The grasses are common hosts for smut fungi and this fact directed my attention towards the smut fungi of Mexico, in my efforts to prepare a world monograph.

Over 50 different smut fungi were collected during a nearly one month long trip to Mexico. Thirteen proved to be new species and twelve are described below. No description is given for the thirteenth species as it has not yet been possible to identify the host.

Taxonomy

Three smut fungi from Mexico, and another from South America, possess character combinations that do not allow them to be included in any known genus (comp. Vánky, 2002b). However, their characters fit rather well with the monospecific genus *Lundquistia*, with the exception of sterile cells, which may or may not be present between the permanent or ephemeral spore balls. Study of newly collected specimens, and of many old collections, resulted in a re-evaluation of the genus ***Lundquistia*** Vánky (2001a: 371; type *L. fascicularis* Vánky on *Digitaria brownii* (Roem. & Schult.) Hughes, Australia). Its emended description is: *Sori* in distal leaves, stems or inflorescence of host plants belonging to the Gramineae, with *spore balls* (which may be ephemeral) embedded in and destroying the parenchymatic tissues. No true peridium, no true columella. *Spores* pigmented brown (not orange-yellow). Spore balls differentiate within the mass of sporogeneous hyphae, without concentric hyphae around them. *Sterile cells* between the spores present or absent. *Parasitic hyphae* intracellular. *Spore germination* by phragmobasidium.

I consider the presence or absence of sterile cells between spores, and either permanent or ephemeral spore balls, two characters that are not strong enough to differentiate two genera. There are, for example, many species of *Sporisorium* in which sterile cells and spore balls are present and many species in which these are absent. With the emendation of the circumscription of *Lundquistia*, the four American smut fungi can be accommodated in this genus.

Lundquistia mexicana Vánky, **sp. nov.** (Figs. 1-2, 4-5)

Typus in matrice *Andropogon gerardii* Vitman (det. H. Scholz, B), Mexico, Durango State, 57 km WSW urbe Durango, via no. 48, 23°54'38" N, 105°01'27" W, alt. 2538 m.s.m., 19.XI.2003, leg. T. & K. Vánky. **Holotypus** in Herbario Ustil. Vánky, HUV 20498; isotypi in Vánky, Ust. exs. no. 1202. Paratypus in matrice *Schizachyrium mexicanum* (Hitchc.) A. Camus (det. H. Scholz, B), Mexico, Mexico State, 18.5 km W urbe Toluca, via no. 1, 19°19'30.2" N, 99°51'16.1" W, alt. 2812 m.s.m., 6.XII.2003, leg. C. & K. Vánky, HUV 20526; isoparatypi in BPI et IMI.

Sori in apice surculorum sterilium corpora atra, longa, tenua, arcuata, ex fasciculis numerosis vasorum et inter eos massis sporarum et cellularum sterilium, telas parenchymaticas destruentium compositi. Peridium nullum, nulla columella vera. Tempore maturitatis telae hospitis disintegratae et massa atrobrunnea, semiagglutinata usque pulverea sporarum et cellularum sterilium successive liberata, fasciculum 2-5 mm latum, 15-40 cm longum, convolutum et crispatum fascium vasorum numerosorum, filiformium relinquens. *Sporae* globosae usque subglobosae, 8-10,5 × 8-11 µm, mediocriter atro-flavidobrunneae, verrucis 1,5 µm altis, anastomosantibus ordinationem irregularem, labyrinthiformem vel incomplete et irregulariter reticulatam formantibus. Verrucae in visu opticali mediano acutae. *Cellulae steriles* singulae, in catenis brevibus vel in catervis parvis irregularibus. Cellulae singulae subglobosae vel ellipsoidales, lateribus contactis deplanatis, 7-13 µm longae, subhyalinae usque pallide flavidobrunneae; pariete aequali, cca. 0,5 µm crasso, levi. *Germinatio sporarum* per basidium 4-cellularem (saepe in ordine 3+1), 2-2,5 × 15-25 µm, quo lateraliter et terminaliter cum sterigmatis basidiosporae ovoideae, 1,5-2,5 × 4-5,5 µm magnae productae. Basidiosporae sicut cellulae gemmiferae pullulantes, colonias fermentorum errigentes.

Sori (Fig. 1) on the top of sterile shoots as dark, long, slender, bent bodies composed of numerous vascular bundles and between them spore masses and sterile cells destroying the parenchymatous tissues. No peridium, no true columella. At maturity the host tissues disintegrate and the dark brown, semiagglutinated to powdery mass of spores and sterile cells is successively liberated leaving behind a 2-5 mm wide, 15-40 cm long, twisted and curled fascicle of numerous, filiform vascular bundles. *Spores* (Figs. 4, 5) globose to subglobose, 8-10.5 × 8-11 µm, medium dark yellowish-brown, provided with 1.5 µm high, anastomosing warts forming an irregular, labyrinthiform or incompletely and irregularly reticulate pattern. Warts in optical median view acute. *Sterile cells* (Figs. 4, 5) single, in short chains or in small, irregular groups. Single cells subglobose or ellipsoidal with flattened contact sides, 7-13 µm long, subhyaline to pale yellowish-brown; wall even, *ca*. 0.5 µm thick, smooth. *Spore germination* (Fig. 2; on water-agar, at room temp., in one day) results in 4-celled basidia (often in 3+1 arrangement), measuring 2-2.5 × 15-25 µm, on which laterally and terminally, on sterigmata, ovoid basidiospores are produced measuring 1.5-2.5 × 4-5.5 µm. The basidiospores bud like yeast cells giving rise to yeast colonies.

Host: Gramineae: *Andropogon gerardii* Vitman, *Schizachyrium mexicanum* (Hitchc.) A. Camus.

Fig. 1. A sorus of *Lundquistia mexicana* on the top of a sterile shoot of *Andropogon gerardii* (from holotype). To the left a healthy inflorescence. Bar = 1 cm.

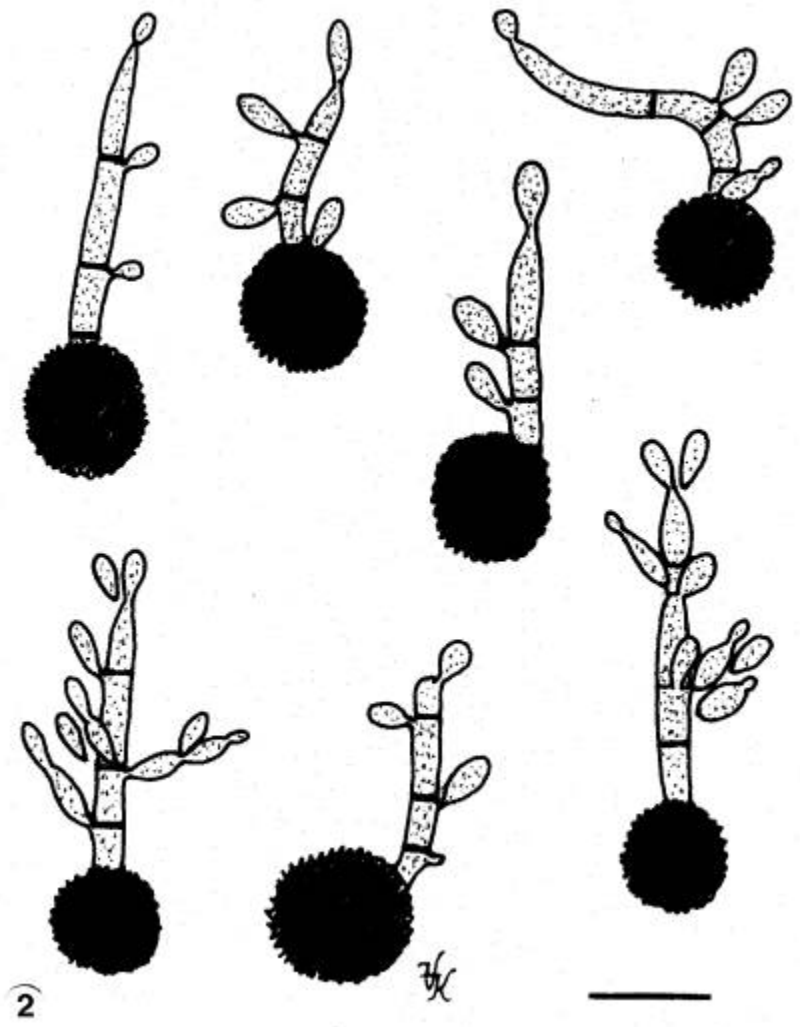


Fig. 2. Germinating spores of *Lundquistia mexicana* (from holotype; on water-agar, at room temperature, in one day). Bar = 10 µm.

Known distribution: N. America (Mexico). It is known from only the type collections.

Lundquistia dieteliana (Hennings) Vánky, **comb. nov.** (Figs. 3, 6-7)

Basionym: *Ustilago dieteliana* Hennings, Hedwigia 37: 268, 1898. — Type on *Tripsacum dactyloides* (L.) L., Mexico, near Mexico City, X.1896, E.W.D. Holway; isotypes in Sydow, Ust. no. 152, HUV 3621!

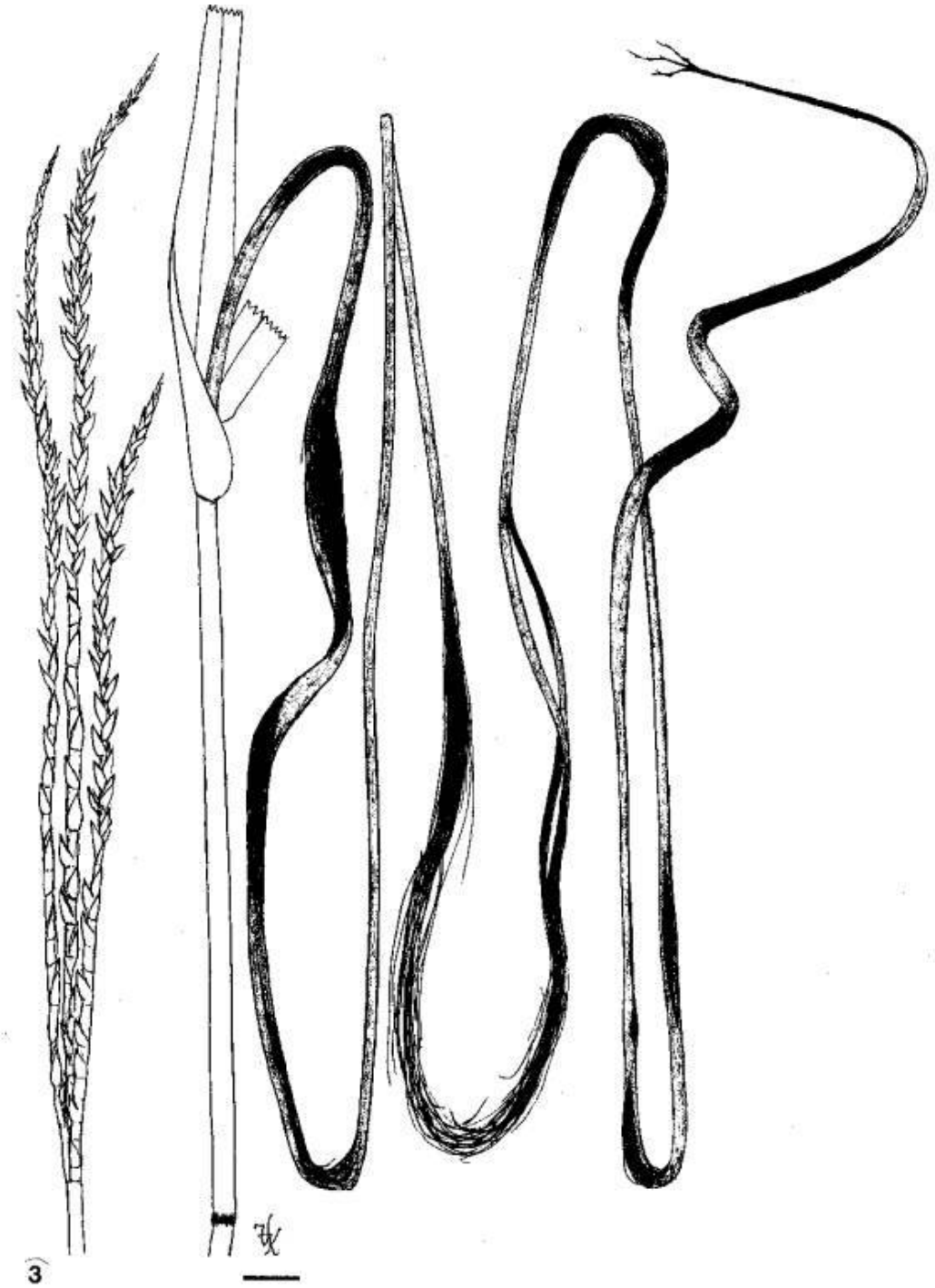


Fig. 3. A sorus of *Lundquistia dieteliana* on the top of a sterile shoot of *Tripsacum dactyloides* (Vánky, Ust. exs. no. 1201). On the top of the sorus remnants of raceme axes can be seen. To the left a healthy inflorescence. Bar = 1 cm.

Sori (Fig. 3) on the top of sterile shoot as long, twisted tubes or bands, 2-5 mm × 40-140 cm, partly enclosed by leaf sheaths, infecting inner leaves and the peduncle of the inflorescence (sometimes remnants of raceme branches are present on the top of the sori). The spores develop in the parenchymatic tissues between the veins. At maturity, the host tissues rupture longitudinally and the dark brown, semiagglutinated to powdery spore mass and sterile cells are scattered leaving behind fascicles of long filaments of vascular tissues. *Spores* (Figs. 6, 7) globose, subglobose, broadly ellipsoidal, rarely ovoid, 8-11(-12) × 9-13 µm, yellowish-brown; wall even, *ca*. 1 µm thick, conspicuously verrucose, spore profile wavy. *Sterile cells* (Fig. 7) in small groups, single cells variable in shape and size, from subglobose to irregular, with 1-2 flattened sides, 6-13.5 × 6-17 µm, hyaline; wall even, *ca*. 0.5 µm thick, smooth.

Host: Gramineae: *Tripsacum dactyloides* (L.) L., *T. latifolium* Hitchc., *T. laxum* Scribn. & Merr.

Known distribution: N. America (Mexico), C. America (El Salvador, Guatemala), West Indies (Cuba).

Presence of sterile cells between the spores was overlooked by earlier students.

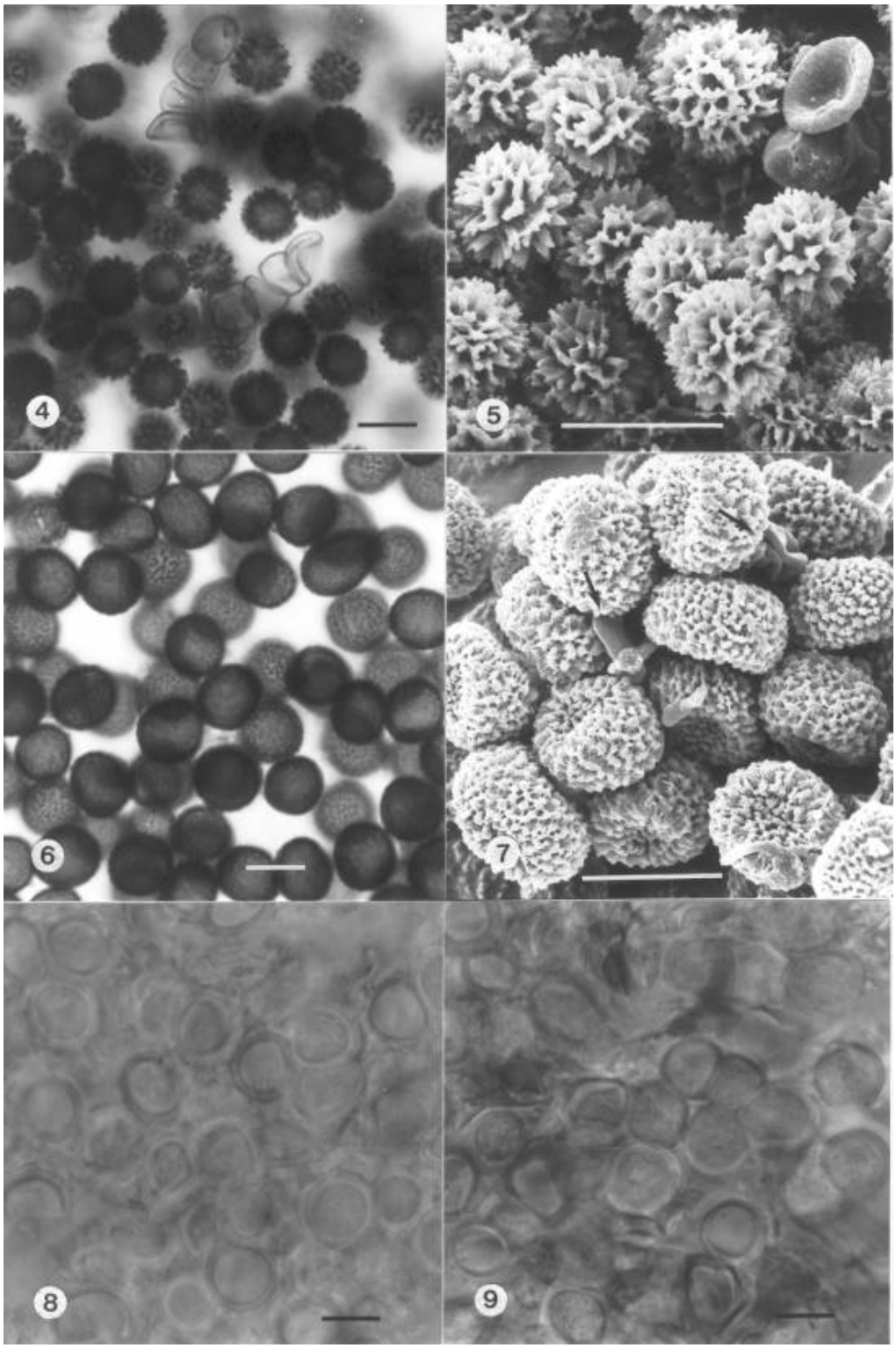
Lundquistia duranii (Vánky) Vánky, **comb. nov.**

Basionym: *Ustilago duranii* Vánky, Mycotaxon 89: 77, 2004. — Type on *Andropogon semiberbis* (Nees) Kunth, Mexico, Chihuahua State, Creel, Monte Gallegos (Padre Gallegos), above Urique, 12.X.1969, R. Durán, WSP 58571!

Sori in the uppermost 1-2 leaves of sterile shoots, destroying and replacing the parenchymatous tissues between the leaf-veins with a black, semiagglutinated to powdery mass of loose spore balls and spores. Sori protruding from the last healthy leaf-sheath, 2-3 mm wide, 6-8 cm long, first covered by the epidermis which ruptures, liberating the spore masses which are scattered, leaving behind fascicles of vascular tissues as long, often curled filaments. Only the 1-2 cm long tip of infected leaves remains intact. *Spores* when mature single, globose, subglobose, ovoid, ellipsoidal, 10.5-13.5 × 11-15(-16) µm, medium dark yellowish-brown; wall even or slightly uneven, 1-2.5 µm thick, provided with densely situated, rather high, confluent warts forming irregular rows and a fine, incomplete or complete reticulum; spore profile roughly wavy to denticulate.

Host: Gramineae: *Andropogon semiberbis* (Nees) Kunth.

Known distribution: N. America (Mexico). Known only from the type collection.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Lundquistia panici-leucophaei (Brefeld) Vánky, **comb. nov.**

Basionym: *Ustilago panici-leucophaei* Brefeld, Unters. Gesammtgeb. Mykol. 12, p. 114, 1895. — *Sphacelotheca panici-leucophaei* (Bref.) G.P. Clinton, 1906: 28. — *Sporisorium panici-leucophaei* (Bref.) M. Piepenbring, 1999: 465. — Type on *Panicum leucophaeum* H.B.K. (= *Digitaria insularis* (L.) Fedde), Brazil, Rio de Janeiro, coll. E. Ule, HBG.

Ustilago insularis Hennings, 1896: 51. — Type on *Tricholaena insularis* (L.) Griseb. (= *Digitaria insularis* (L.) Fedde), Brazil, Campo Bello, II.1894, E. Ule 2102, HBG; isotypes K, HUV 15443! (syn. by Clinton, 1902: 129, confirmed).

Ustilago bonariensis Spegazzini, 1909: 287. — *Sphacelotheca bonariensis* (Speg.) Ciferri, 1931: 56. — *Sorosporium bonariense* (Speg.) Zundel, 1953: 54 (as '*bonariensis*'). — *Sporisorium bonariense* (Speg.) Vánky, nom. herb. — Lectotype (design. by Zundel, 1953: 54) on *Panicum spectabile* Nees (= *Echinochloa polystachya* (H.B.K.) Hitchc.; no healthy host plant to check host identity), Argentina, near Buenos Aires, I.1904, C. Spegazzini, LPS 3018! (**syn. nov.**).

Sphacelotheca viegasiana Zundel, 1939: 588. — Type on *Trichachne sacchariflora* (Raddi) Nees (= *Digitaria insularis* (L.) Fedde), Brazil, Est. São Paulo, Campinas, Terreno baldio, 5.X.1935, A.P. Viégas 2554, BPI 195095!; isotype BPI 195097! (syn. suggested by Vánky, 2000: 208, confirmed by Piepenbring, 2003: 121).

Sorosporium lindmanii Zundel, 1943: 173. — Type on *Oplismenopsis najada* (Hack. & Arechav.) Parodi, Paraguay, in the forests on the banks of the river Riacho Mbopi, 11.IX.1893, C.A.M. Lindman B 331 (not 'Nov. 19, 1893'), S; isotype HUV 1714! (**syn. nov.**).

Ustilago garcesii Zundel, 1945b: 372 (as '*Garcesi*'). — Type on *Paspalum saccharoides* Nees ex Trin., Colombia, Valle, Palmira, Estacion Experimental, 13.XII.1940, C. Garces O. (= C.G. Orejuela), Fungi of Colombia 1281, BPI 160488! (syn. by Piepenbring, 2002: 110, but host identification doubtful, confirmed).

Lundquistia fascicularis Vánky, 2001a: 373. — Type on *Digitaria brownii* (Roem. & Schult.) Hughes, Australia, New South Wales, NW of Hermidale, between Cobar and Nyngan, 1.III.1971, D.A. Campbell, DAR 58832; isotype HUV 19444! (**syn. nov.**).

Sori comprise the uppermost leaves of sterile shoots, also the floral stem and often also a more or less developed inflorescence or only part of it, long cylindrical, often twisted and tapering towards the apex, 0.2-0.8 × 4-15 cm, usually partly enclosed by healthy leaf sheaths. In the sori, the parenchymatous tissues between the veins are replaced by the dark brown, semiagglutunated or granular-powdery mass of spore balls and spores disclosed by the rupture of the covering epidermis, leaving behind the typical fascicles of vascular bundles. *Spore balls* globose, subglobose, ellipsoidal, oblong to slightly irregular, 20-70 × 25-90 µm, yellowish- to dark brown, composed of many spores, when young rather permanent, later separating. *Spores* globose, subglobose, broadly ellipsoidal to slightly subpolyhedrally irregular, 5.5-8 × 6-9.5 µm, yellowish-brown; wall evenly thick (*ca*. 0.5 µm), finely, moderately

Figs. 4, 5. Spores and sterile cells of *Lundquistia mexicana* on *Andropogon gerardii*, in LM and in SEM (from holotype). **Figs. 6, 7.** Spores and sterile cells (arrows) of *Lundquistia dieteliana* on *Tripsacum dactyloides*, in LM and in SEM (from isotype). **Fig. 8.** Spores of *Entyloma aldamae* on *Aldama dentata*, in LM (from holotype). **Fig. 9.** Spores of *Entyloma siegesbeckiae* on *Siegesbeckia orientalis*, in LM (from holotype). Bars = 10 µm.

densely punctate-verruculose, spore profile smooth to just finely wavy; in SEM finely verrucose-echinulate. *Sterile cells* absent.

Host: Gramineae: *Digitaria brownii* (Roem. & Schult.) Hughes, *D. horizontalis* Willd., *D. insularis* (L.) Fedde (*Trichachne insularis* (L.) Nees; *Panicum lanatum* Rottb.; *P. leucophaeum* H.B.K.; *T. sacchariflora* (Raddi) Nees), ?*Echinochloa polystachya* (H.B.K.) Hitchc. (*Panicum spectabile* Nees), *Oplismenopsis najada* (Hack. & Arechav.) Parodi (*Panicum najadum* Hack. & Arechav.), *Panicum elephantipes* Nees, *Trichachne californica* (Benth.) Chase (*Panicum californicum* Benth.; *Digitaria californica* (Benth.) Henr.; *Trichachne saccharata* (Buckl.) Nash).

Known distribution: Australia, N. America (Mexico, USA), West Indian Antilles (Cuba, Dominican Rep., Haiti, Jamaica, Martinique, Puerto Rico, Virgin Islands), C. America (Guatemala), S. America (Argentina, Brazil, Colombia, Paraguay).

In the original description of *Ustilago bonariensis*, Spegazzini (1909: 287) listed three host plants: *Pennisetum tristachyon* (Kunth) Spreng., *Panicum elephantipes* Nees, and *Panicum spectabile*. Zundel, 1953: 54, considered *Pennisetum tristachyon* to be a misdetermination, which is certainly the case.

Study of the types of *Ustilago bonariensis*, *Sorosporium lindmanii* and *Lundquistia fascicularis* revealed that they are identical with, and synonyms of *Lundquistia panici-leucophaei*.

Ling (1951: 103) considered *Sphacelotheca viegasiana* (= *Lundquistia panici-leucophaei*) to be a synonym of *S. cordobensis* (Speg.) H.S. Jacks. Based on spore measurements, Zundel (1953: 86 and 104) showed that *S. cordobensis* and *S. panici-leucophaei* are different species. I demonstrated (Vánky, 2003: 33) that *Ustilago cordobensis* Speg. is identical with, and a synonym of *U. syntherismae* (Schwein.) Peck, which has 10-15 µm long, minutely echinulate spores.

Entyloma aldamae Vánky, **sp. nov.** (Figs. 8, 10)

Typus in matrice *Aldama dentata* Llave and Lex. (det. B. Nordenstam, S), Mexico, Michoacan State, cca. 8 km SW urbe Zitacuaro, via no. 51, 19°22'40.8" N, 100°20'40.9" W, alt. 1701 m.s.m., 4.XII.2003, leg. C. & K. Vánky. **Holotypus** in HUV 20563.

Sori in foliis, maculas rotundas, indefinitas, flavidas, diametro 1-10 mm formantes. *Sporae* in telis hospitis immersae, globosae, subglobosae, ellipsoidales usque parum irregulares, 9-15 × 9-17 µm, pallide flavae; pariete 2-stratoso: strato interno aequali, cca. 0,5 µm crasso, strato externo inaequali 1-1,5 µm crasso, levi. *Anamorpha* non observata.

Sori (Fig. 10) on the leaves forming rounded, indefinite, yellowish spots, 1-10 mm in diameter. *Spores* (Fig. 8) embedded in the host tissue, globose, subglobose, ellipsoidal to slightly irregular, 9-15 × 9-17 µm, pale yellow; wall

Fig. 10. Sori of *Entyloma aldamae* on the leaves of *Aldama dentata* (from holotype). Bar = 1 cm.

two-layered: inner layer even, *ca*. 0.5 µm thick, outer layer slightly uneven, 1-1.5 µm thick, smooth. *Anamorph* not seen.

Host: Compositae (subfam. Asteroideae): *Aldama dentata* Llave and Lex. (*Sclerocarpus dentatus* Benth. and Hook.).

Known distribution: N. America (Mexico). It is known from only the type collection.

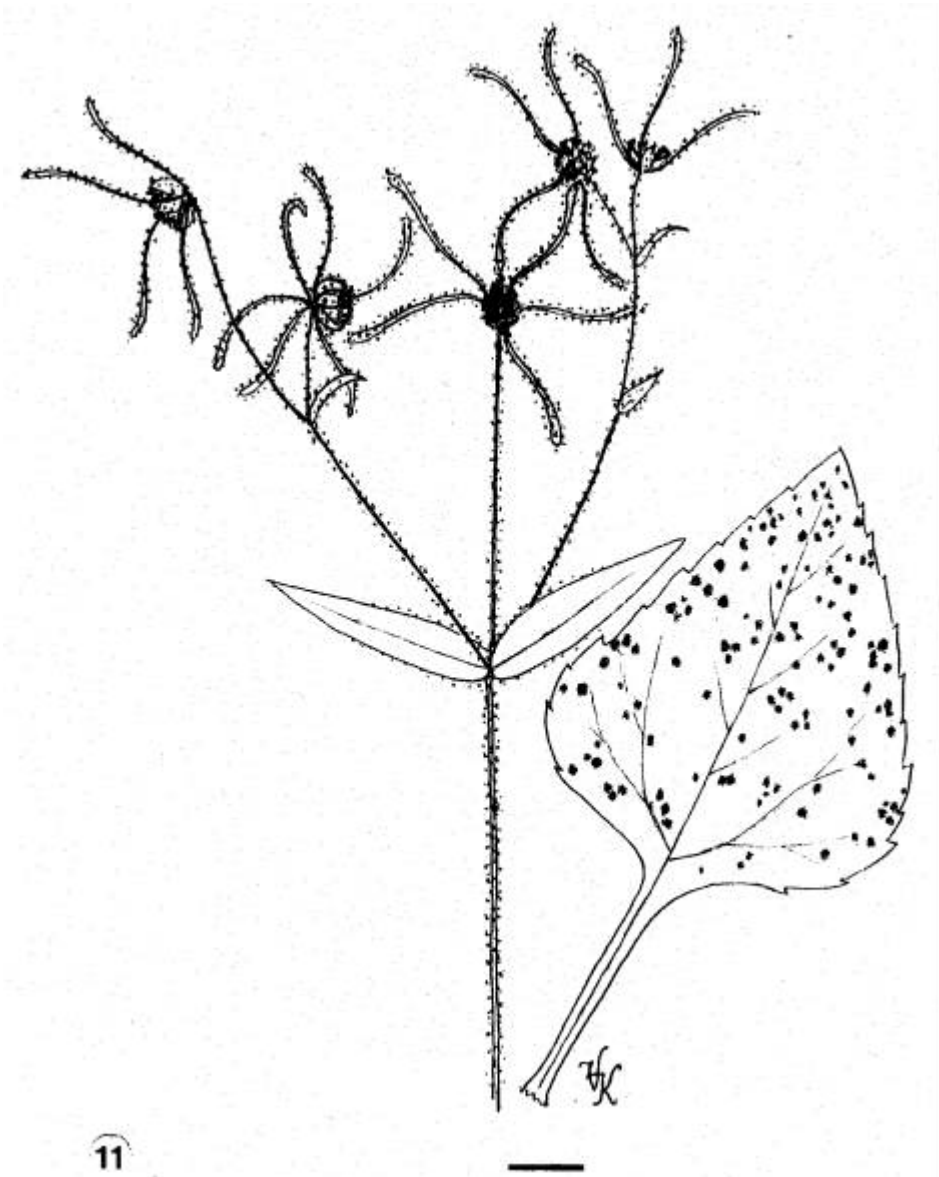

Fig. 11. Sori of *Entyloma siegesbeckiae* on a leaf of *Siegesbeckia orientalis* (from holotype). Bar = 1 cm.

Entyloma siegesbeckiae Vánky, **sp. nov.** (Figs. 9, 11)

Typus in matrice *Siegesbeckia orientalis* L. (det. B. Nordenstam, S), Mexico, Michoacan State, cca. 40 km N urbe Zitacuaro, Sierra Chincua, 19°40'48.1" N, 100°18'31.7" W, alt. 3150 m.s.m., 3.XII.2003, leg. C. & K. Vánky. **Holotypus** in HUV 20559; isotypi in Vánky, Ust. exs. no. 1205.

Sori in foliis, maculas parvas, polyangulares, diametro 1-1,5 mm, primo albescentes, serius brunneas cum margine flavidoalbescenti formantes. Sori seniores brunnei et fortasse perforati. *Sporae* in telis formatae, globosae, subglobosae, ellipsoidales vel irregulares, lateribus 1-2 deplanatis, 8-13,5 × 9-16 µm, subhyalinae usque pallide flavae; pariete aequali, 0,5-1(-1,5) µm crasso, levi. *Anamorpha* non observata.

Sori (Fig. 11) on the leaves forming small, polyangular spots, 1-1.5 mm in diameter, first whitish later brown with a yellowish-white margin. Old sori are brown and may be perforated. *Spores* (Fig. 9) embedded in the host tissue, globose, subglobose, ellipsoidal or irregular with one or two flattened sides, 8-13.5 × 9-16 µm, subhyaline to pale yellow; wall even, 0.5-1(-1.5) µm thick, smooth. *Anamorph* not seen.

Host: Compositae (subfam. Asteroideae): *Siegesbeckia orientalis* L.

Known distribution: N. America (Mexico). It is known from only the type collection.

Jamesdicksonia festucae Vánky, **sp. nov.** (Figs. 12, 14-15)

Typus in matrice *Festuca tolucensis* Kunth (det. H. Scholz, B), Mexico, Chihuahua State, 124 km SW urbe Hidalgo del Parral, 2.5 km NE pag. El Vergel, via no. 24, 26°29'52" N, 106°21'52" W, alt. 2769 m.s.m., 15.XI.2003, leg. T. & K. Vánky. **Holotypus** in HUV 20488; isotypi in Vánky, Ust. exs. no. 1207.

Sori in foliis sicut tumores plumbei, fusiformes, 0,5-1,5 × 1-10 mm, saepe nonnulli eorum in folio eodem. Sori maturi longitudinaliter fissi et massa nigra, agglutinata sporarum emergens. Massa haec in partes dissecta et dispersa, epidermidem folii et catervam continuam vasorum fascicularium relicta. *Sporae* forma et magnitudine nimie variae, raro subglobosae, plerumque irregulariter rotundae, saepe elongatae, latere uno vel lateribus nonnullis parum deplanatis, nonnunquam apiculatae, 8-17 × 9-25 µm, olivaceobrunneae; pariete 2-stratoso: strato interno aequali, cca. 0,5 µm crasso, strato externo inaequali, 1-7 µm crasso, ad angulos crassissimo, homogeneo vel leniter multistratoso.

Sori (Fig. 12) in the leaves as lead-coloured, fusiform swellings, 0.5-1.5 × 1-10 mm, often several on the same leaf. At maturity the sori split longitudinally and the black, agglutinated mass of spores becomes evident. This mass breaks into pieces and is dispersed leaving behind the leaf epidermis and a fascicle of continuous vascular bundles. *Spores* (Figs. 14, 15) extremely variable in shape and size, rarely subglobose, usually rounded irregular, often elongated, with one or several slightly flattened sides, sometimes apiculate, 8-17 × 9-25 µm, olivaceous-brown; wall two-layered: inner layer even, *ca*. 0.5 µm thick, outer layer uneven, 1-7 µm thick, thickest at the angles, homogeneous or finely multilayered.

Host: Gramineae: *Festuca tolucensis* Kunth.

Known distribution: N. America (Mexico). It is known from only the type collection.

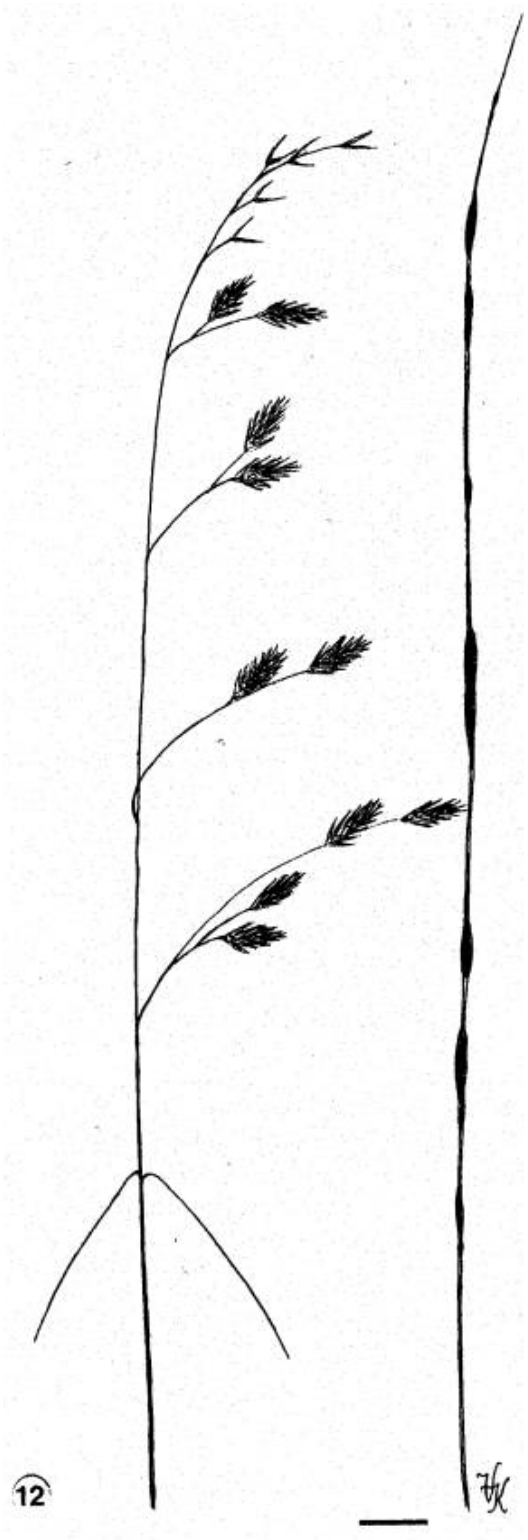

Fig. 12. Sori of *Jamesdicksonia festucae* in a leaf of *Festuca tolucensis* forming lead-coloured, fusiform swellings which split longitudinally (from holotype). To the left part of a healthy inflorescence. Bar = 1 cm.

Generic position of this species is somewhat uncertain. Spore germination or molecular data may show that it belongs to another genus of the order *Georgefischeriales*.

Macalpinomyces tuberculatus Vánky, **sp. nov.** (Figs. 13, 16-17)

Typus in matrice *Bouteloua curtipendula* (Michx.) Torr., Mexico, Michoacan State, 23 km SW urbe Zitacuaro, via no. 51, ad pag. Benito Juarez, 19°19'22" N, 100°25'36" W, alt. 1219 m.s.m., 23.XI.2003, leg. T. & K. Vánky. **Holotypus** in HUV 20565; isotypi in Vánky, Ust. exs. no. 1209.

Sori in nonnullis ovariis inflorescentiae eiusdem, globoidei usque ovoidei, 1-2 × 1,5-3 mm, inter involucra floralia distantia apparentes, atrocinerei, primo pericarpio tenui cooperti, quo irregulariter rupto massam nigram, semiagglutinatam usque pulveream sporarum cum catervis cellularum sterilium intermixtam ostendentes. *Sporae* globosae, subglobosae, ovoideae, ellipsoidales usque parum irregulares, magnitudine variae, 6,5-10,5 × 7-12 µm, atro-flavidobrunneae; pariete aequali, cca. 1 µm crasso, cum tuberculis parvis, sparse distributis inclusis; imago obliqua sporarum undulata, in SEM raro echinulato, spinis humilibus latis, inter spinas valde leniter, dense verruculoso. *Cellulae steriles* globosae, subglobosae, ellipsoidales, raro parum irregulares, cum lateribus 1-2 deplanatis, 5-9 × 5,5-10,5 µm, hyalinae; pariete aequali, tenui (cca. 0,5 µm), levi.

Sori (Fig. 13) in some ovaries of an inflorescence, globoid to ovoid, 1-2 × 1.5-3 mm, showing between the spreading floral envelopes, blackish-grey, first covered by the thin pericarp which ruptures irregularly disclosing the black, semiagglutinated to powdery mass of spores intermixed with groups of sterile cells. *Spores* (Figs. 16, 17) globose, subglobose, ovoid, ellipsoidal to slightly irregular, variable in size, 6.5-10.5 × 7-12 µm, dark yellowish-brown; wall even, *ca*. 1 µm thick including the sparsely situated small tubercles, spore profile wavy, in SEM sparsely echinulate, spines low, wide, between the spines very finely, densely verruculose. *Sterile cells* (Figs. 16, 17) globose, subglobose, ellipsoidal, rarely slightly irregular, with 1-2 flattened sides, 5-9 × 5.5-10.5 µm, hyaline; wall even, thin (*ca*. 0.5 µm), smooth.

Host: Gramineae: *Bouteloua curtipendula* (Michx.) Torr.

Known distribution: N. America (Mexico). It is known from only the type collection.

Sporisorium dacryoideum Vánky, **sp. nov.** (Figs. 18-20)

Typus in matrice *Aristida adscensionis* L., Mexico, Durango State, 236 km N urbe Durango, via no. 45 libre, 25°44'06" N, 104°40'40" W, alt. 1900 m.s.m., 17.XI.2003, leg. T. & K. Vánky. **Holotypus** in HUV 20533; isotypi in Vánky, Ust. exs. no. 1215. Paratypus: Durango State, 40 km S urbe Hidalgo del Parral, via no. 45, 26°33'00" N, 105°32'44" W, alt. 1788 m.s.m., 16.XI.2003, leg. T. & K. Vánky, HUV 20534; isoparatypus in BPI.

Sori in culmis ad internodia, lacrymiformes vel cylindricales cum apice acuto, residua involucrorum floralium, inflorescentiam abortivam vel sane inflorescentiam sustinentes, 1,5-4 × 5-12 mm, peridio crasso pallide brunneo cooperti, quo mature irregulariter rupto massam atrobrunneam, agglutinatam usque granulosopulveream glomerulorum sporarum intermixtam

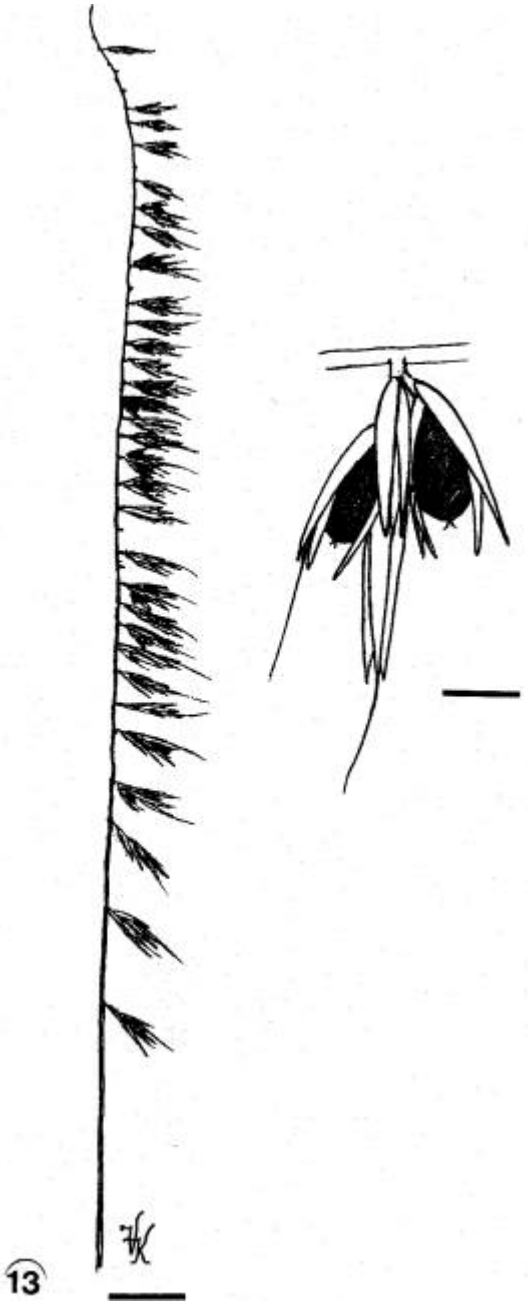

Fig. 13. Sori of *Macalpinomyces tuberculatus* in some ovaries of *Bouteloua curtipendula* (from holotype). Enlarged a spikelet with two sori. Bars = 1 cm for habit, 2 mm for detail drawings.

Figs. 14, 15. Spores of *Jamesdicksonia festucae* on *Festuca tolucensis*, in LM and in SEM (from holotype). **Figs. 16, 17.** Spores and sterile cells of *Macalpinomyces tuberculatus* on *Bouteloua curtipendula*, in LM and in SEM (from holotype). **Figs. 18, 19.** Spore balls, spores and groups of sterile cells of *Sporisorium dacryoideum* on *Aristida adscensionis*, in LM and in SEM (from holotype). Bars = 10 µm.

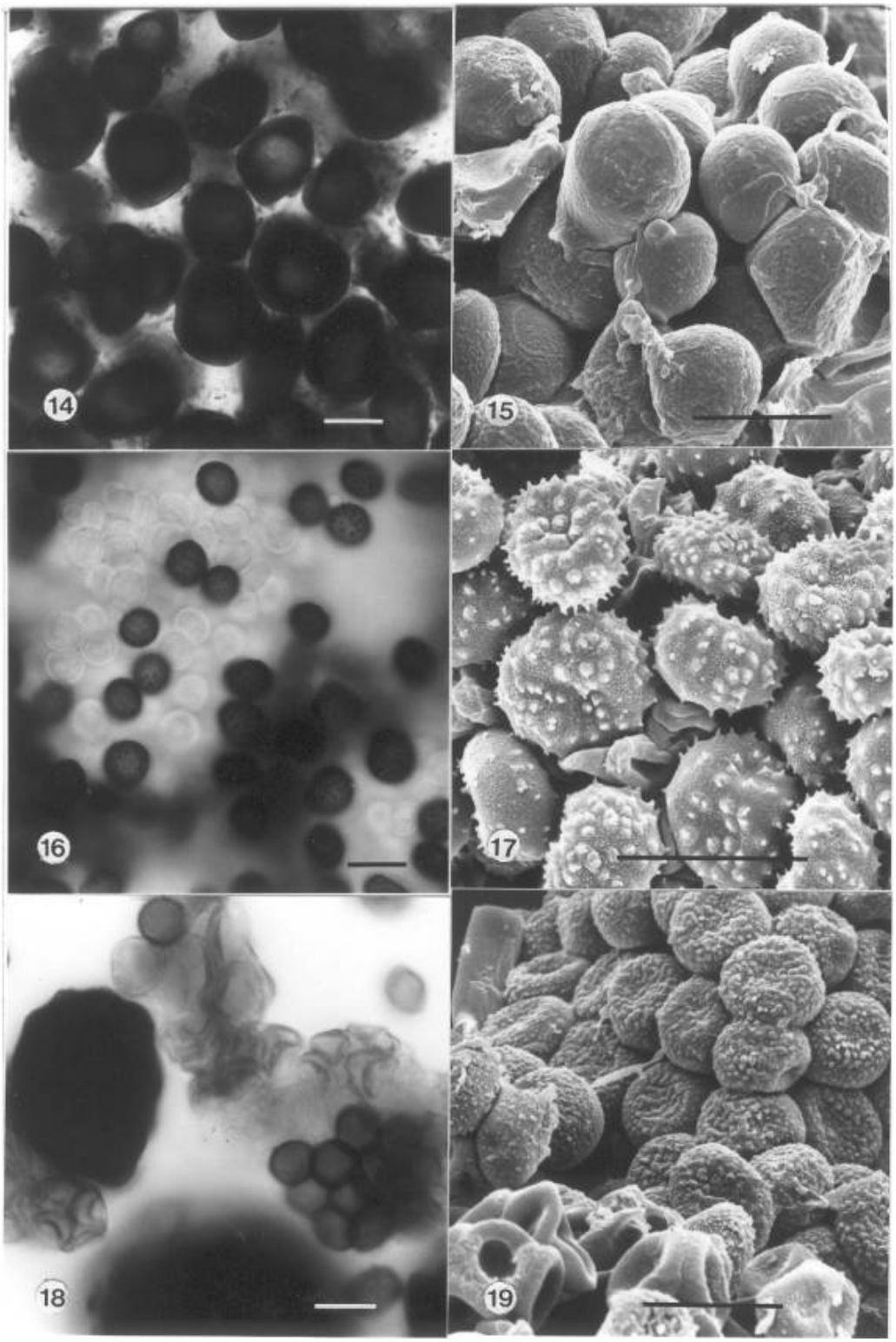
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Fig. 20. Sori of *Sporisorium dacryoideum* on the stems of *Aristida adscensionis* (from holotype). Bar = 1 cm.

cum cellulis sterilibus columellas nonnullas filiformes circumdatas ostendentes. *Glomeruli sporarum* forma et magnitudine varii, globosi, subglobosi, ovoidei, ellipsoidales, elongati vel subpolyedrice irregulares, 30-70 × 30-100 µm, atro-rubrobrunnei, e pluries decem vel pluries centum sporis pressu separabilibus compositi. *Sporae* subglobosae, ovoideae, ellipsoidales usque subpolyedrice irregulares, 6,5-9,5 × 8-10,5 µm, flavidobrunneae; pariete inaequali, 0,5-1,5 µm crasso, maxime incrassato in superficie libera sporarum maxime externarum verrucis 0,5-1,5 µm altis productarum; sporae internae parum pallidiores, conspicue leves. *Cellulae steriles* in catervis irregularibus, cellulae singulae forma et magnitudine variae, subglobosae, ellipsoidales usque plerumque irregulares, cum lateribus 1-2 deplanatis, 6,5-14 × 7-16 µm, pallide flavidobrunneae; pariete aequali, cca. 0,5 µm crasso, levi.

Sori (Fig. 20) on the stems at the internodes, lacrymiform or cylindrical with acute tip, bearing remnants of floral envelopes, aborted inflorescence or even an inflorescence on their tip, 1.5-4 × 5-12 mm, covered by a thick, pale brown peridium which ruptures irregularly at maturity disclosing the blackish-brown, agglutinated to granular-powdery mass of spore balls intermixed with sterile cells surrounding several filiform columellae. *Spore balls* (Figs. 18, 19) variable in shape and size, globose, subglobose, ovoid, ellipsoidal, elongated or subpolyhedrally irregular, 30-70 × 30-100 µm, dark reddish-brown, composed of tens or hundreds of spores which separate by pressure. *Spores* (Figs. 18, 19) subglobose, ovoid, ellipsoidal to subpolyhedrally irregular, 6.5-9.5 × 8-10.5 µm, yellowish-brown; wall uneven, 0.5-1.5 µm thick, thickest on the free surface of the outermost spores which are provided with 0.5-1.5 µm high warts; inner spores somewhat lighter, apparently smooth. *Sterile cells* (Figs. 18, 19) in irregular groups, single cells variable in shape and size, subglobose, ellipsoidal to usually irregular with 1-2 flattened sides, 6.5-14 × 7-16 µm, pale yellowish-brown; wall even, *ca*. 0.5 µm thick, smooth.

Host: Gramineae: *Aristida adscensionis* L.

Known distribution: N. America (Mexico). It is known only from the type collections.

Etymology: from the Latin *dacryoideus*, *-a*, *-um* = dacryoid, tear-shaped, referring to the form of the sori.

Of the 13 recognised smut fungi on *Aristida* (comp. Vánky, 2001b: 302-312; 2002a: 382-385) only *Sporisorium aristidae* (S. Ahmad) Vánky (type on *A. cyanantha* (Nees) Steudel, Pakistan) has sori on the stems. However, in *S. aristidae* the spore balls and the spores are larger (50-140 µm and 9.5-13(-15) µm long, respectively) and sterile cells are lacking.

Sporisorium ustilaginiforme Vánky, **sp. nov.** (Figs. 21, 25-26)

Typus in matrice *Muhlenbergia pulcherrima* Scribner, Mexico, Morelos State, 27 km N urbe Cuernavaca, 8.4 km N pag. Tres Marias, via no. 95 libre, 19°06'32" N, 99°11'51" W, alt. 2559 m.s.m., 11.XI.2003, leg. T. & K. Vánky. **Holotypus** in HUV 20529; isotypi in Vánky, Ust. exs. no. 1217.

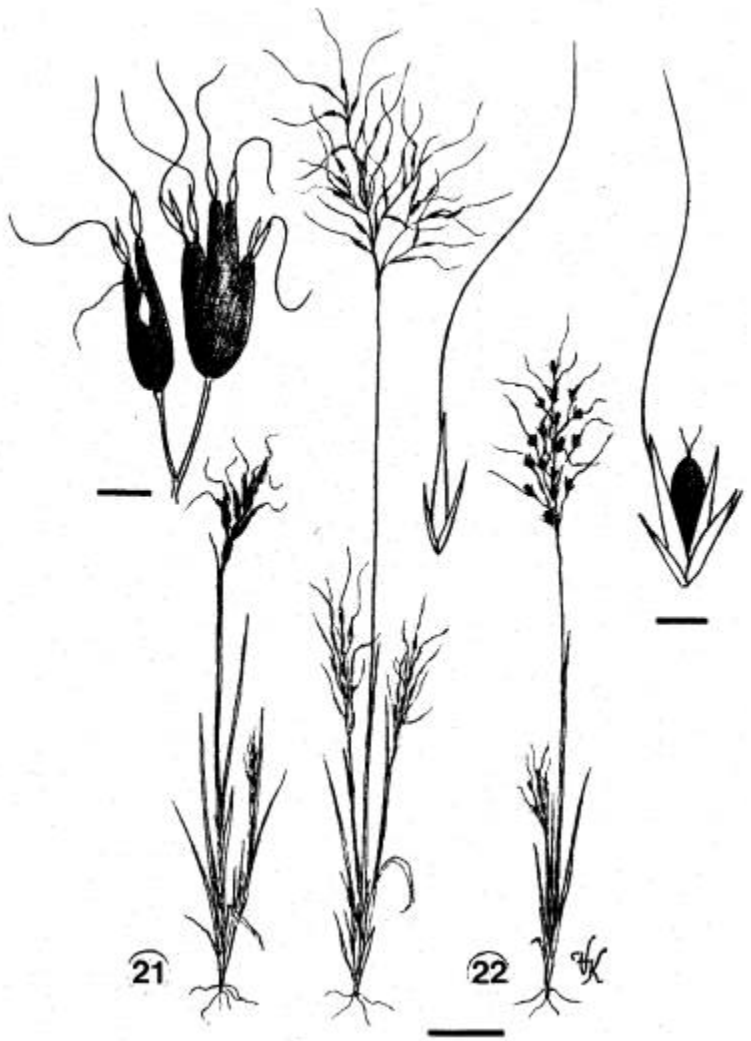


Fig. 21. Sori of *Sporisorium ustilaginiforme* in groups of spikelets of *Muhlenbergia pulcherrima* (from holotype). Enlarged two sori with remnants of sterile flowers on their tip. **Fig. 22.** Sori of *Tilletia microtuberculata* in the ovaries of *Muhlenbergia pulcherrima* (from holotype). Enlarged a sorus. In the middle a healthy host plant with a spikelet enlarged. Bars = 1 cm for habit, 1 mm for detail drawings.

Sori spiculas vel catervas spicularum destruentes, ovoidei, obovoidei, cylindrici vel breviter ramosi, in apice eorum residua florarum sterilium gerentes, 0,5-1,5 × 1-5 mm, plumbei, primo epidermide cooperti, quo irregulariter rupto massam nigrescentibrunneam, pulveream sporarum cum cellulis sterilibus, post dispersionem earum columellam irregularem, centralem relinquentibus, intermixtam ostendentes. *Sporae* maturae singulae, globosae, subglobosae usque ellipsoidales, lateraliter parum compressae (8-9 µm late), 9,5-13 × 11-14,5(-15) µm, flavidobrunneae; pariete inaequali, 0,5-0,8 µm crasso, in lateribus deplanatis

tenuiori, moderate dense verrucoso-echinulato; imago obliqua undulata usque leniter serrulata. *Cellulae steriles* in catervis parvis vel in seriebus brevibus, cellulae singulae globosae, subglobosae usque ellipsoidales, lateribus contactis parum deplanatis, 4-7 × 5-8 µm, hyalinae; pariete aequali, tenui, cca. 0,5 µm, levi.

Sori (Fig. 21) destroying the spikelets or groups of spikelets, ovoid, obovoid, cylindrical or shortly ramified, bearing remnants of sterile flowers on their tip, 0.5-1.5 × 1-5 mm, lead-coloured, first covered by the epidermis which ruptures irregularly disclosing the blackish-brown, powdery mass of spores intermixed with sterile cells which are scattered leaving behind an irregular central columella. *Spores* (Figs. 25, 26) when mature single, globose, subglobose to ellipsoidal, laterally slightly compressed (8-9 µm wide), 9.5-13 × 11-14.5(-15) µm, yellowish-brown; wall uneven, 0.5-0.8 µm thick, thinner on the flattened sides, moderately densely verrucose-echinulate; spore profile wavy to finely serrulate. *Sterile cells* (Figs. 25, 26) in small groups or short rows, single cells globose, subglobose to ellipsoidal, with slightly flattened contact sides, 4-7 × 5-8 µm, hyaline; wall even, thin, *ca*. 0.5 µm, smooth.

Host: Gramineae: *Muhlenbergia pulcherrima* Scribner.

Known distribution: N. America (Mexico). It is known from only the type collection.

Tilletia brefeldii Vánky, **sp. nov.** (Figs. 23, 27-28)

Etymology: named after one of the pioneers and giants of mycology of the 19th century, the German, Oscar Brefeld (1839-1926).

Typus in matrice *Muhlenbergia filiculmis* Vasey, Mexico, Federal District, cca. 38 km S urbe Mexico City, ad km 28 versus San Miguel Ajusco, 19°11'59.3" N, 99°16'00.2" W, alt. 3429 m.s.m., 7.XII.2003, leg. C. & K. Vánky. **Holotypus** in HUV 20501; isotypi in Vánky, Ust. exs. no. 1219.

Sori in ovariis omnibus inflorescentiae eiusdem, ovoidei-fusiformes, in parte basali dilatati et apice acuto residua pistillorum gerentes, cca. 1 × 3 mm, involucris floralibus distantibus occulti, pericarpio primo viridi serius flavidobrunneo cooperti, quo maturo longitudinaliter rupto massam foetidam, rubrobrunneam, pulveream sporarum et cellularum sterilium ostendentes. *Sporae* globosae, subglobosae usque late ellipsoidales, 19-23 × 20-24 µm, flavidobrunneae, reticulatae, 3-5 maculae per diametrum sporae, muri 1,5-2,5 µm alti, obtusi, interspatia a conspicue levi usque ad leniter punctato-verruculosum, vagina nulla. *Cellulae steriles* subglobosae, ovoideae usque irregulariter rotundae, 10-26 × 16-28 µm, hyalinae; pariete 1-4 µm crasso, homogeneo, contentu granuloso, in SEM superficie leniter granulosa-verruculosa. Formae intermediatae ('sporae immaturae') paucae praesentes.

Sori (Fig. 23) in all ovaries of an inflorescence, ovoid-fusiform, with widened basal part and an acute tip bearing remnants of the pistils, *ca*. 1 × 3 mm, hidden by the slightly spreading floral envelopes, covered by the first green, later yellowish-brown pericarp which ruptures longitudinally at maturity disclosing the reddish-brown, powdery, foetid mass of spores and sterile cells. *Spores* (Figs. 27, 28) globose, subglobose to broadly ellipsoidal, 19-23 × 20-24 µm, yellowish-brown, reticulate, 3-5 meshes per spore diameter, muri 1.5-2.5

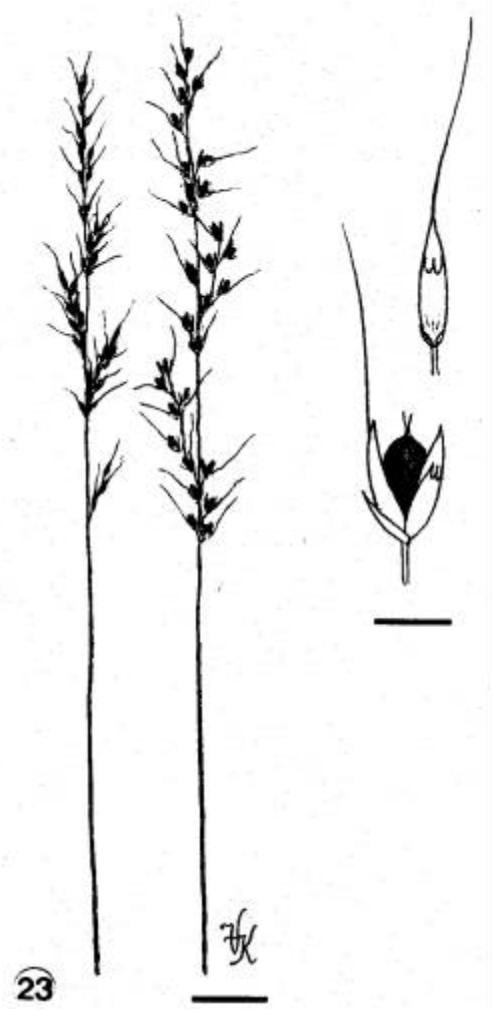


Fig. 23. Sori of *Tilletia brefeldii* in the ovaries of *Muhlenbergia filiculmis* (from holotype). Enlarged a sorus and a healthy spikelet. To the left a healthy inflorescence. Bars = 1 cm for habit, 2 mm for detail drawings.

µm high, blunt, interspaces from apparently smooth to finely punctate-verruculose, sheath lacking. *Sterile cells* (Figs. 27, 28) subglobose, ovoid to rounded irregular, 10-26 × 16-28 µm, hyaline; wall 1-4 µm thick, homogenous, content granular, in SEM surface finely granular-verruculose. Few intermediate forms ('immature spores') are present.

Host: Gramineae: *Muhlenbergia filiculmis* Vasey.

Known distribution: N. America (Mexico). It is known from only the type collection.

Tilletia brefeldii is close to *T. zonata* Bref., on *Muhlenbergia ligularis* (Hack.) Hitchc. from Ecuador. However, in the latter species the spores have a 2-3 µm thick hyaline sheath and measure (without sheath) 15-18 µm.

Tilletia gigacellularis Vánky, **sp. nov.** (Figs. 24, 29-30)

Etymology: *gigacellularis* refers to the giant sterile cells.

Typus in matrice *Bouteloua filiformis* (Fourn.) Griffiths, Mexico, Guerrero State, 29 km W pag. Iguala, via no. 51, 18°24'40" N, 99°41'38" W, alt. 1231 m.s.m., 23.XI.2003, leg. T. & K. Vánky. **Holotypus** in HUV 20555, isotypus in BPI.

Sori in nonnullis ovariis inflorescentiae eiusdem, ellipsoidales vel late fusiformes, 1-1,5 × 3-5 mm, inter involucra floralia distantia apparentes, pericarpio primo viridi, serius brunneo cooperti, quo maturo longitudinaliter rupto massam nigram, pulveream, nonfoetidam sporarum et cellularum sterilium ostendentes. *Sporae* globosae, subglobosae usque late ellipsoidales, 20-28(-32) × 22,5-32 µm, atro-chocolatebrunneae usque subopacae, verrucis 2,5-5 µm altis, cylindricis, apice deplanatis, in visu superficiali sicut areis atris, dense distributis, polyangularibus apparentibus, 6-11 per diametrum sporae. *Cellulae steriles* globosae, subglobosae, late ellipsoidales usque parum irregulares, (23-)28.5-44 × (25-)28-51 µm, pallide flavidobrunneae; pariete 3-8 µm crasso, levi, punctato vel verrucoso, contentu granuloso.

Sori (Fig. 24) in some ovaries of an inflorescence, ellipsoidal or broadly fusiform, 1-1.5 × 3-5 mm, showing between the spreading floral envelopes, covered by the first green, later brown pericarp which ruptures longitudinally at maturity disclosing the black, powdery, non-foetid mass of spores and sterile cells. *Spores* (Figs. 29, 30) globose, subglobose to broadly ellipsoidal, 20-28(-32) × 22.5-32 µm, dark chocolate-brown to subopaque, provided with 2.5-5 µm high, cylindrical warts with flattened tip, in surface view appearing as darker, densely situated, polyangular areas, 6-11 per spore diameter. *Sterile cells* (Figs. 29, 30) globose, subglobose, broadly ellipsoidal to slightly irregular, (23-)28.5-44 × (25-)28-51 µm, pale yellowish-brown; wall 3-8 µm thick, smooth, punctate or verrucose, content granular.

Host: Gramineae: *Bouteloua filiformis* (Fourn.) Griffiths.

Known distribution: N. America (Mexico). It is known only from the type collection.

Tilletia microtuberculata Vánky, **sp. nov.** (Figs. 22, 33-34)

Typus in matrice *Muhlenbergia pulcherrima* Scribner, Mexico, Morelos State, 27 km N urbe Cuernavaca, 8.4 km N pag. Tres Marias, hwy no. 95 libre, 19°06'32" N, 99°11'51" W, alt. 2559 m.s.m., 11.XI.2003, leg. T. & K. Vánky. **Holotypus** in HUV 20527; isotypi in Vánky, Ust. exs. no. 1220. Paratypus: Mexico State, 12 km NE oppid. Cuatepec, versus Volcan Ajusco, 19°10'11.9" N, 99°22'57.4" W, alt. 3034 m.s.m., 7.XII.2003, leg. C. & K. Vánky, HUV 20528.

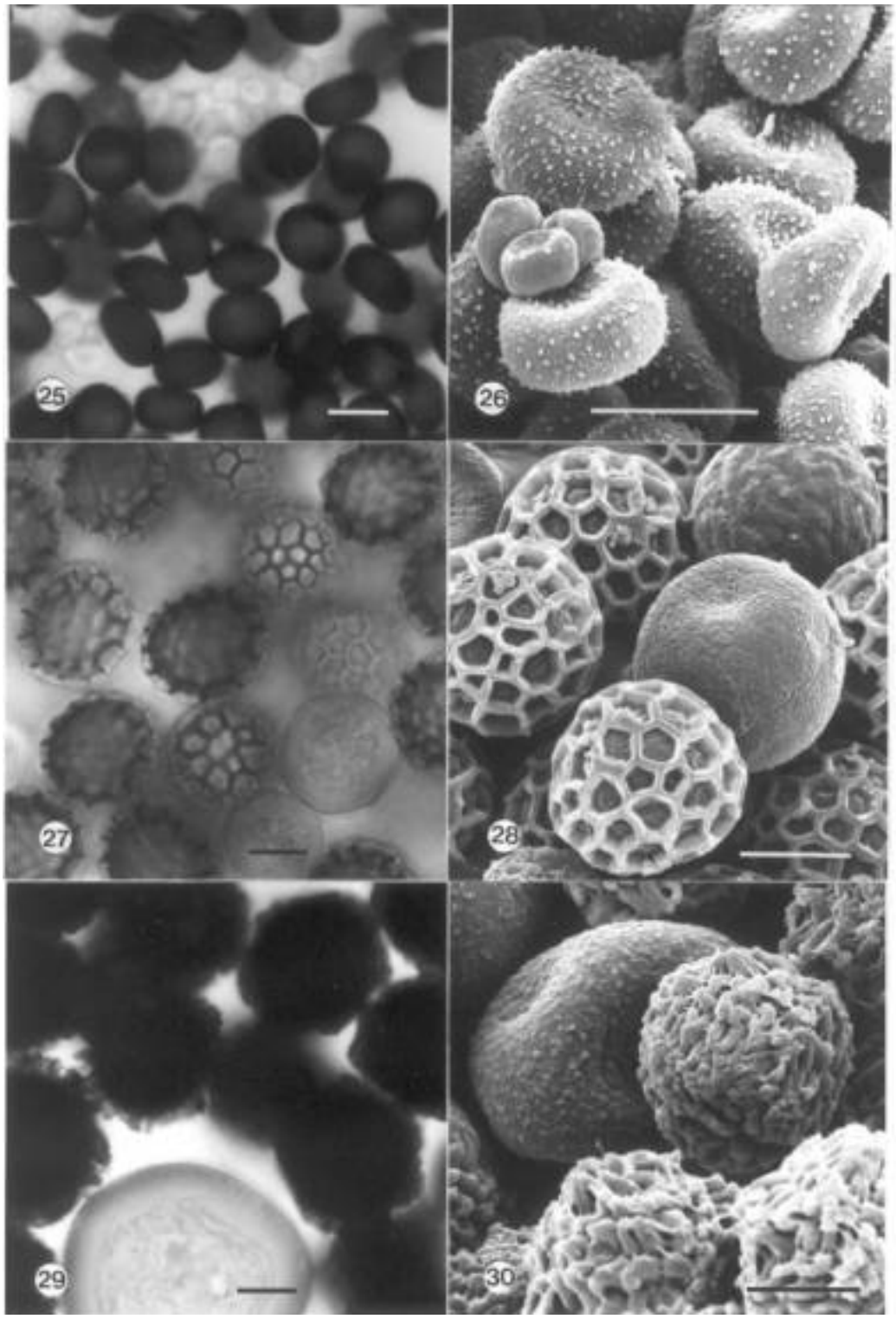
Sori in ovariis omnibus inflorescentiae eiusdem, ellipsoidales, apice acuto, brevi residua pistillorum gerenti, 0,5-0,7 × 1,2-1,8 mm, involucris floralibus parum distantibus plus-minus occulti, pericarpio atrobrunneo cooperti. Massa sporarum atrobrunnea, pulverea, inodora. *Sporae* globosae, subglobosae usque late ellipsoidales, 18,5-22 × 18,5-26,5 µm, flavido- usque rubrobrunneae, verrucis 1,5-2,5 µm altis, irregulariter polyangularibus, apice deplanatis, 6-8

Fig. 24. Sori of *Tilletia gigacellularis* in some ovaries of *Bouteloua filiformis* (from holotype). Bar = 1 cm.

per diametrum sporae instructae. Verrucae 2 vel 3 fortuito coalescentes. *Cellulae steriles* subglobosae, ellipsoidales, ovoideae usque subpolyedrice irregulares, 10,5-18,5 × 12-23 µm, subhyalinae; pariete aequali, 1-2 µm crasso, contentu granuloso. Formae intermediatae ('sporae immaturae') paucae praesentes.

Sori (Fig. 22) in all ovaries of an inflorescence, ellipsoidal, with a short acute tip bearing remnants of the pistils, 0.5-0.7 × 1.2-1.8 mm, more or less hidden by the slightly spreading floral envelopes, covered by the dark brown

Figs. 25, 26. Spores and sterile cells of *Sporisorium ustilaginiforme* on *Muhlenbergia pulcherrima*, in LM and in SEM (from holotype). **Figs. 27, 28.** Spores and sterile cells of *Tilletia brefeldii* on *Muhlenbergia filiculmis*, in LM and in SEM (from holotype). The sterile cell in the right upper corner, with abnormal ornamentation is an 'immature spore' or 'intermediate form'. **Figs. 29, 30.** Spores and sterile cells of *Tilletia gigacellularis* on *Muhlenbergia filiformis*, in LM and in SEM (from holotype). Bars = 10 µm.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pericarp. Spore mass dark brown, powdery, odourless. *Spores* (Figs. 33, 34) globose, subglobose to broadly ellipsoidal, 18.5-22 × 18.5-26.5 µm, yellowish- to reddish-brown, provided with 1.5-2.5 µm high, irregularly polyangular warts with flattened tip, 6-8 per spore diameter. Two or three warts may coalesce. *Sterile cells* (Figs. 33, 34) subglobose, ellipsoidal, ovoid to subpolyhedrally irregular, 10.5-18.5 × 12-23 µm, subhyaline; wall even, 1-2 µm thick, content granular. Few intermediate forms ('immature spores') are present.

Host: Gramineae: *Muhlenbergia pulcherrima* Scribner.

Known distribution: N. America (Mexico). It is known from only the type collections.

Tilletia microtuberculata differs from both *T. tuberculata* Durán (type on *Muhlenbergia depapuperata* Scribner) and *T. macrotuberculata* Durán (type on *M. pulcherrima* Scribner, and on *M. wolfii* (Vasey) Rydb.). In *T. tuberculata* the spores are 15-21(-23) µm long, the tubercles rounded, 1-2.5 µm high, (3-)4-6(-8) per spore diameter. In *T. macrotuberculata* the spores are 21-24(-28) µm long, the tubercles polyangular, 2.5-4 µm high, (4-)5-7(-8) per spore diameter.

Ustilago circumdata Vánky, **sp. nov.** (Figs. 31, 35-36)

Etymology: from the Latin *circumdatus*, *-a*, *-um* = surrounding, encircling, girdling, referring to the dark band of the spores.

Typus in matrice *Muhlenbergia montana* (Nutt.) Hitchc., Mexico, Mexico State, 22 km NE oppid. Coatepec, versus Volcan Ajusco, 19°11'06.3" N, 99°19'01.8" W, alt. 3509 m.s.m., 7.XII.2003, leg. C. & K. Vánky. **Holotypus** in HUV 20500; isotypi in Vánky, Ust. exs. no. 1225. Paratypus: Federal Distr., 38 km S urbe Mexico City, km. 28 versus San Miguel Ajusco, 19°11'59.3" N, 99°16'00.2" W, alt. 3429 m.s.m., 7.XII.2003, leg. C. & K. Vánky. HUV 20562.

Sori in spiculis omnibus inflorescentiae eiusdem, tumefacti, cum involucris floralibus nonnullis, atypicis. Sori organa floralia intima destruentes, involucris maxime externis obtecti, 0,5-0,7 × 2-2,5 mm, primo telis plantae nutrientis cooperti, qua matura rupta massam atrobrunneam, primo agglutinatam serius pulveream sporarum ostendentes. *Sporae* globosae, subglobosae, ellipsoideae, raro ovoideae vel elongatae, 5-6,5 × 5,5-7(-8) µm, flavidobrunneae, cum taenia 1-1,5 µm lata, obscuriori, ubi paries sporae crassior (cca. 0,8 µm) e contrario paries sporae extra taeniam 0,5 µm crassus; superficies sporae leniter, dense verrucosa, imaginem obliquam sporae non, vel vix tandem afficienter.

Sori (Fig. 31) in all spikelets of an inflorescence, swollen, with several atypical floral envelopes. The sori destroy the innermost floral organs and the basal part of the inner floral envelopes, hidden by the outermost floral envelopes, 0.5-0.7 × 2-2.5 mm, first covered by host tissue which ruptures at maturity disclosing the dark brown, first agglutinated later powdery mass of spores. *Spores* (Figs. 35, 36) globose, subglobose, ellipsoidal, rarely ovoid or elongated, 5-6.5 × 5.5-7(-8) µm, yellowish-brown with a 1-1.5 µm wide darker band where the spore wall is thicker (*ca*. 0.8 µm) in contrast to the 0.5 µm

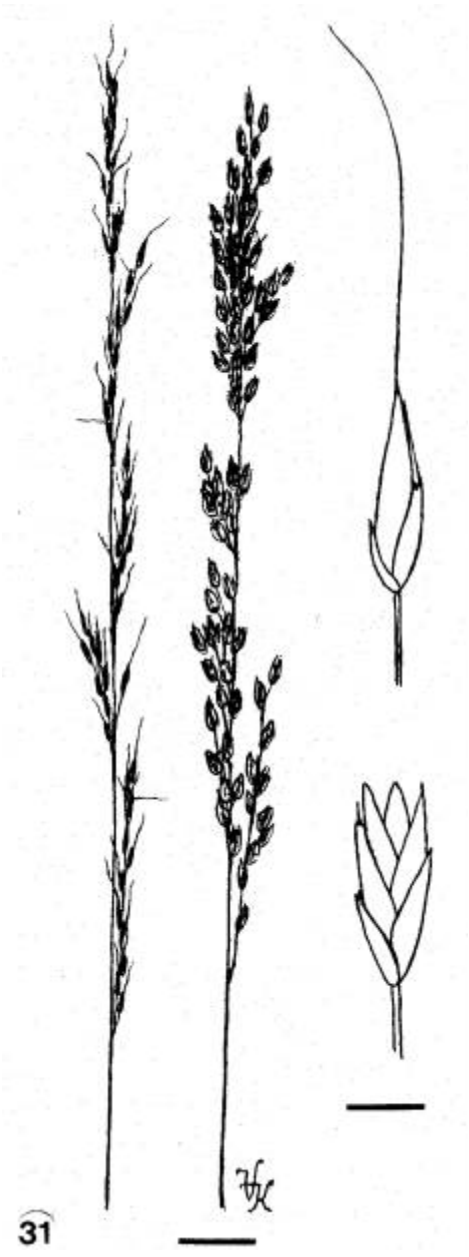


Fig. 31. Sori of *Ustilago circumdata* in the spikelets of *Muhlenbergia montana* (from holotype). To the left a healthy inflorescence. Bars = 1 cm for habit, 2 mm for detail drawings.

thick spore wall outside the band; spore surface finely, densely verrucose, which does not or only just affect the spore profile.

Host: Gramineae: *Muhlenbergia montana* (Nutt.) Hitchc.

Known distribution: N. America (Mexico). It is known from only the type collections.

Ustilago panici-virgati Vánky, **sp. nov.** (Figs. 32, 37-38)

Typus in matrice *Panicum virgatum* L. (det. H. Scholz, B), Mexico, Mexico State, 18 km N urbe Atlacomulco, via no. 55, 19°54'25" N, 99°51'01" W, alt. 2522 m.s.m., 13.XI.2003, leg. T. & K. Vánky. **Holotypus** in HUV 20530; isotypi in Vánky, Ust. exs. no. 1228.

Sori in apice surculorum sterilium et ad internodia suprema in foliis hypertrophicis, prolificantibus, 1-4 mm lati, 5-15 cm longi, apparentes sicut striae longae, coalescentes foliorum, vel partem distalem foliorum vel praesertim folia suprema ex toto occupantes, primo epidermide tecti, qou mature rupto massa atrobrunnea, semiagglutinata usque pulverea sporarum dispersa et folia dissolutae et tortuosae. Sori raro in inflorescentia apparentes, quo organa floralia in folia angusta, elongata, sporis farcta transformata. *Sporae* globosae, subglobosae, ellipsoidales usque parum irregulares, 10,5-13(-13,5) × 11-14(-15) µm, lateraliter parum compressae (6,5-9 µm late), flavidobrunneae; pariete aequali, cca. 1 µm crasso, mediocriter dense echinulatae, spinis 0,5-0,8 µm altis; imago obliqua sporarum serrulata. *Cellulae steriles* absentes.

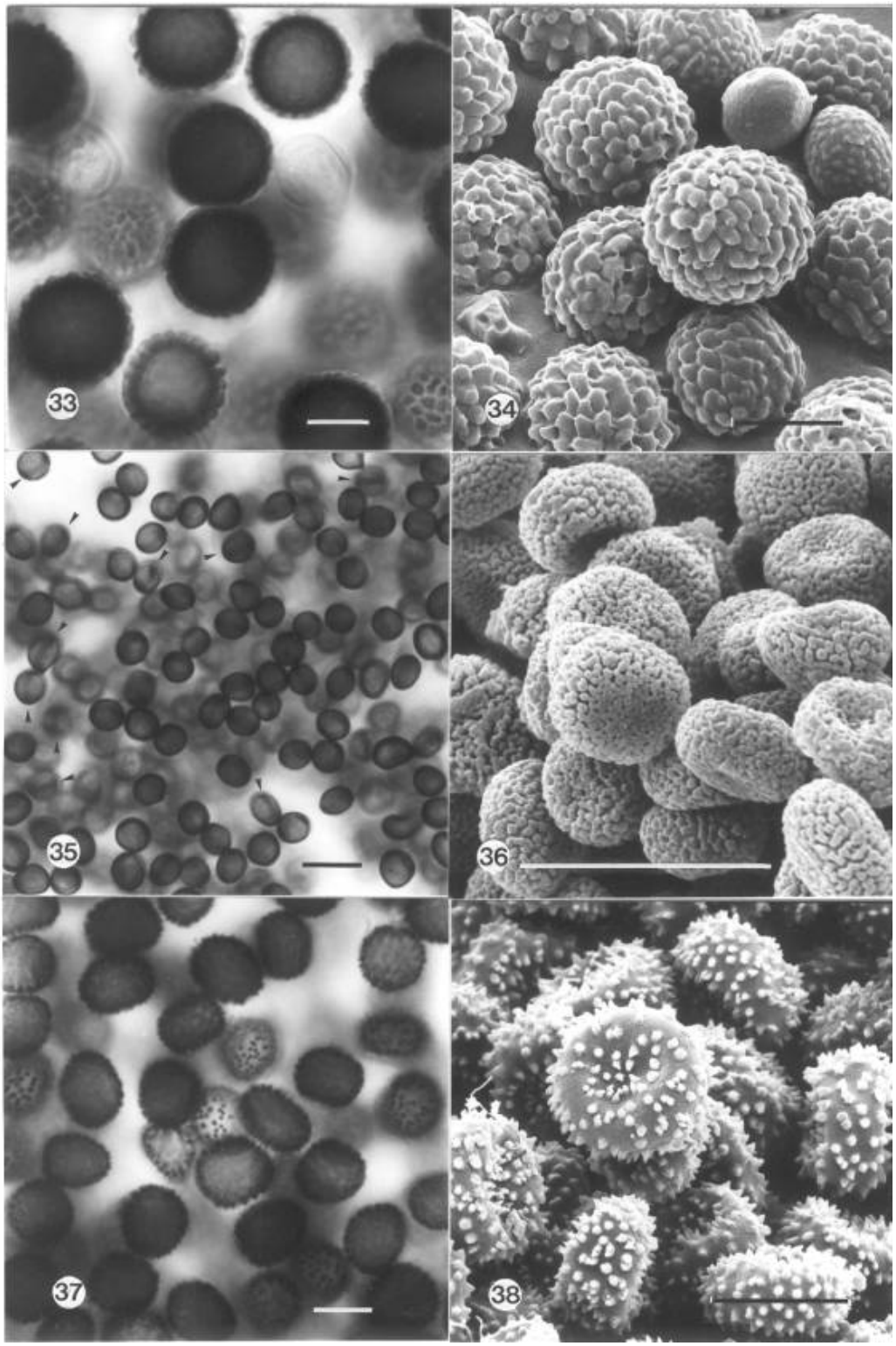
Sori (Fig. 32) on the top of sterile shoots and at the uppermost internodes in hypertrophied, proliferating leaves, 1-4 mm wide, 5-15 cm long, appearing as long, coalescent striae on the leaves or comprising the distal part of the leaves or the whole, especially uppermost leaves, first covered by the epidermis which ruptures at maturity, the dark brown, semiagglutinated to powdery mass of spores is dispersed and the leaves become shredded and twisted. Rarely, the sori may appear in the inflorescence where the floral organs are transformed into narrow, elongated leaves filled with spores. *Spores* (Figs. 37, 38) globose, subglobose, ellipsoidal to slightly irregular, 10.5-13(-13.5) × 11-14(-15) µm, laterally slightly compressed (6.5-9 µm wide), yellowish-brown; wall even, *ca*. 1 µm thick, moderately densely echinulate, spines 0.5-0.8 µm high; spore profile serrate. *Sterile cells* absent.

Host: Gramineae: *Panicum virgatum* L.

Known distribution: N. America (Mexico). It is known only from the type collection.

Ustilago panici-virgati differs from all 40, or so, recognised smut fungi on *Panicum* (Vánky, in press), including *U. panici-proliferi* Henn. (type on *P. proliferum* Lam., Mexico), in which the spores are smaller (6.5-9 × 7-10.5 µm), apparently smooth to very finely and densely punctate-verruculose.

Fig. 32. Sori of *Ustilago panici-virgati* in the leaves and inflorescence of *Panicum virgatum* (from holotype). Bar = 1 cm.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Figs. 33, 34. Spores and sterile cells of *Tilletia microtuberculata* on *Muhlenbergia pulcherrima*, in LM and in SEM (from holotype). **Figs. 35, 36.** Spores of *Ustilago circumdata* on *Muhlenbergia montana*, in LM and in SEM (from holotype). Note the dark band on the spores (arrowheads). **Figs. 37, 38.** Spores of *Ustilago panici-virgati* on *Panicum virgatum*, in LM and in SEM (from holotype). Bars = 10 µm.

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