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The taxonomy of *Echinochaete* and *Polyporus s. str.* in southern South America[1]

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Abstract—Taxonomic characters of the genera *Echinochaete* and *Polyporus s. str.* from southern South America are summarized based on examination of 350 collections, including 88 holotypes from different herbaria. The research revealed one species of *Echinochaete* and nineteen species and one variety of *Polyporus s. str.* representing four established subgenera (*Polyporus, Melanopus, Polyporellus, Favolus*). and the new subgenus, *Austropolyporus*, proposed here to accommodate *P. gayanus*. *Pseudofavolus* is considered a synonym of *Polyporus s. str. Polyporus arcularioides* is accepted as a separate taxon. *Polyporus brumalis* was not found in the area studied. *Polyporus saltensis*, considered an autonomous taxon, differs from *P. tenuiculus* in lacking clamp connections. *Polyporus tucumanensis* is recognized as a separate species distinct from *P. ciliatus*. *Polyporus maculatissimus*, usually considered within *Polyporus s. str.*, belongs in *Neolentiporus*.

Key words— Basidiomycota, *Polyporaceae*, morphology

Introduction

Polyporus s. str. and related genera have been given scant attention in South America. A study was thus undertaken, involving not only the taxonomy of the species, but also mating (Silveira & Wright 2002) and isoenzymatic studies (Silveira et al. 2003) in order to establish relationships among the species.

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[1]This paper is part of the first author's thesis in partial fulfillment of the requirements for her Ph.D. from the University of Buenos Aires, Argentina. This research was supported by CAPES – Brasília/Brazil and PRHIDEB-CONICET/ Argentina.

†Dr. Jorge Eduardo Wright, deceased, January 4, 2005.

As emended by Donk (1960) and accepted by most later authors (Kreisel 1960; Jahn 1969; Bernicchia 1990; Niemelä & Kotiranta 1991; Ryvarden & Gilbertson 1994; Núñez & Ryvarden 1995b), *Polyporus* constitutes a fairly homogeneous genus diagnosed by a well developed to reduced stipe, growth directly on wood or from a sclerotium, a dimitic hyphal system with skeleto-binding hyphae (Corner 1984), hyaline, smooth, cylindric to subellipsoid, IKI- basidiospores, producing a white rot, and heterothallic and tetrapolar mating types.

Most authors currently accept *P. tuberaster* (Jacq.: Fr.) Fr. as the holotype of the genus (cf. Ryvarden 1991).

Polyporellus P. Karst., which was included the stipitate species growing on wood with a coriaceous to suberous pileus, was later divided by Quélet (1886) into *Cerioporus* Quél. and *Leucoporus* Quél. Patouillard (1887) created *Melanopus* for species with a black stipe. All those genera are currently regarded as synonyms of *Polyporus* (Murrill 1904; Donk 1960; Ryvarden 1991, Núñez & Ryvarden 1995b).

Singer (1986) cited the following synonyms for *Polyporus: Favolus* Fr.: Fr., *Polyporellus* P. Karst., *Bresadolia* Speg., *Leucoporus* Quél., *Melanopus* Pat., *Asterochaete* (Pat.) Bondartsev & Singer, *Echinochaete* D.A. Reid, and *Hexagonia* Pollini.

Several subgenera are currently accepted, such as: *Favolus*, *Melanopus*, *Polyporellus*, and *Polyporus* (Singer, 1986; Gibertoni et al., 2004; Ryvarden & Iturriaga, 2004).

Nuñez & Ryvarden (1995b) published a worldwide manual on *Polyporus* based on morphological traits. The goal of the current research was to present a morphological study of *Polyporus s. str.* taxa in southern South America. We propose to add to or modify Nuñez & Ryvarden's concepts.

Materials and Methods

Area of study —The area is currently known as the South Cone of America, which is usually understood as the triangular mass land south of the Tropic of Capricorn, but for practical reasons we have considered the parallel 20° S as the northernmost boundary. From the phytogeographic viewpoint it includes several regions (Cabrera & Willink 1980).

Materials studied —This study is based mostly on collections kept at BAFC, CTES and ICN. Holotypes are mainly from LPS, K, UPS, and PC. Abbreviations are those of Holmgren & Holmgren (1992). Colours are based on Munsell (1954). Several field trips were undertaken with the aim of obtaining more samples.

Trips were made to: a) Barra do Ribeiro, Rio Grande do Sul, Brazil; b) Canela, Rio Grande do Sul, Brazil; c) Chicligasta, Tucumán, Argentina; d) Curitiba, Paraná, Brazil; e) Florianópolis, Santa Catarina, Brazil; f) La Plata, Buenos Aires, Argentina; g) Monteros, Tucumán, Argentina; h) Nova Petrópolis, Rio Grande do Sul, Brazil; i) Iguazú Nat'l Park, Misiones, Argentina; j) Lago Puelo Nat'l Park, Chubut, Argentina; k) Los Alerces Nat'l Park, Chubut, Argentina; l) St. Hilaire Park, Viamão, Rio Grande do Sul, Brazil; m) Porto Alegre, Rio Grande do Sul, Brazil; n) Santa Catalina, Buenos Aires, Argentina. Map on Fig. 1 shows the areas where materials were collected.

Figure 1: Map of southern South America showing the areas where materials were collected. ¬ Barra do Ribeiro, Porto Alegre and St. Hilaire Park (Viamão) - RS, Brazil; ¤ Canela and Nova Petrópolis - RS, Brazil; u Chicligasta and Monteros – Tucumán, Argentina; l Curitiba - PR, Brazil; n Florianópolis - SC, Brazil; x La Plata and Santa Catalina- Buenos Aires, Argentina; v Iguazú Nat'l Park – Misiones, Argentina; μ Lago Puelo Nat'l Park and Los Alerces Nat'l Park – Chubut, Argentina.

Microscopic examination of basidiocarps was made from freehand sections mounted in a drop of 5 % KOH solution and 1% aqueous phloxine solution; amyloid or dextrinoid reactions were observed in Melzer´s reagent. Measurements were obtained from at least 20 spores. For each species, representative basidiomes were chosen and photographed. Microscopic structures were observed and drawn with the aid of a Wild camera lucida

Delimitation of some species is based on molecular biology (Silveira et al., 2003) and mating tests (Silveira & Wright, 2002), which are added as possible techniques for studying populations.

Taxonomy

Key for the determination of genera and species studied

1. Stipe dark brown to black, sometimes only at the base 2
1'. Stipe concolorous with pileus surface, or absent 9

2. Pores large, 0.5-4 per mm 3
2'. Pores medium sized to small, 4-9 per mm 6

3. Surface of pileus brown to vinaceous brown, pores circular to angular, 1-4 per mm ..... **9. *P. guianensis var. guianensis***
3'. Surface of pileus cream coloured to yellowish brown or ashy beige, pores 0.5-4 per mm 4

4. Basidiomata small, 1.3-2.5 cm in diam., on roots of living grasses ..... **14. *P. rhizophilus***
4'. Basidiomata up to 11.0 cm in diam., on dead wood of angiosperms 5

5. Basidiomata centrally stipitate, pores ellipsoid to angular, 0.5-1.5 per mm ..... **10. *P. guianensis var. puttemansii***
5'. Basidiomata laterally stipitate, pores circular to angular, 2-4 per mm ..... **21. *P. virgatus***

6. Pileus surface cream coloured to light brown, smooth to finely striate radially. ..... **20. *P. varius***
6'. Pileus surface brown to vinaceous brown or tobacco coloured 7

7. Pileus flabelliform, very thin, 0.5-1 mm thick, surface tobacco coloured ..... **11. *P. leprieurii***
7'. Pileus flabelliform to circular or infundibuliform, 1-4 mm thick, surface brown to vinaceous brown 8

8. Pores 3-7 per mm, in temperate-cold zones, on *Nothofagus* wood ..... **12. *P. melanopus***
8'. Pores 6-9 per mm, in subtropical-tropical zones, on wood of several angiosperms ..... **7. *P. dictyopus***

9. Basidiomata coriaceous, stipe central to eccentric stipitate 10
9'. Basidiomata fleshy to coriaceous, stipe lateral or excentric or absent 14

10. Pores hexagonal, radially elongated, 1-3 per mm 11
10'. Pores circular to angular, 3-9 per mm 12

11. Pileus surface with triangular scales, marginal cilia squamiform.. **3. *P. arcularius***
11'. Pileus surface without scales, margin entire or lobulate ..... 2. ***P. arcularioides***

12. Pores angular, medium sized, 3-5 per mm ..... **18. *P. tucumanensis***
12'. Pores circular, small, 5-9 per mm. 13

13. Basidiomata small, 0.7-2.5 cm in diam., solitary or cespitose, surface cream coloured to light brown, margin with filiform cilia ..... **17. *P. tricholoma***
13´. Basidiomata 2.0-7.0 cm in diam., solitary, surface brown to dark brown, margin ciliate or entire ..... **4. *P. ciliatus***

14. Setoid elements present in the hymenium and tube mouths .... **1. *Echinochaete brachypora***
14´. Setoid elements lacking 15

15. Pores medium sized to small, 4-7 per mm, pileus sometimes infundibuliform..... ..... **6. *P. cyathiformis***
15´. Pores large, 0.5-4 per mm, pileus predominantly flabelliform 16

16. Stipe absent or reduced to a mucro, pileus flabelliform to conchoid, in *Nothofagus* woods. ..... **8. *P. gayanus***
16´. Stipe present, sometimes reduced, pileus circular to flabelliform 17

17. Generative hyphae simple septate ..... **15. *P. saltensis***
17´. Generative hyphae clamped 18

18. Spores very large, 13-17 x 5-7 μm ..... **5. *P. curtipes***
18´. Spores smaller, 7-13 x 2.5-4.5 μm 19

19. Pileus surface brown to dark brown, context spongy and watery when fresh, corky upon drying ..... **19. *P. udus***
19´. Pileus surface white to light brown, context cottony to corky 20

20. Pileus surface beige to light brown, pores 1-3 per mm .... **13. *P. philippinensis***
20´. Pileus surface white to cream colored, pores 0.6-1.5 per mm 16. ***P. tenuiculus***

Descriptions of genera and species

ECHINOCHAETE **D.A. Reid,** Kew Bull. 17: 283. 1963.

Basidiocarp annual, flabelliform to spathulate, with a short mucro-like stipe. **Pileus** velutinous, especially near the base, glabrous when old, whitish to pinkish when fresh, reddish to brown when dry. **Pores** angular to hexagonal, small to large. **Hyphal system** dimitic; generative hyphae hyaline, thin-walled, clamped; skeleto-binding hyphae thick-walled, golden to ferrugineous. **Context** hyphae strongly dextrinoid; spiny setae-like elements present in the pileus surface, hymenium and tube walls. **Basidiospores** cylindric to ellipsoid, hyaline, smooth, thin-walled. On wood of deciduous trees causing a white rot.

Type species: *Polyporus megaloporus* Mont.

Remarks: the genus is characterized by the setoid elements on the pileus surface, hymenium and pores, and by the strongly dextrinoid context hyphae. We maintain the genus separate from *Polyporus* on this basis, criterion also used by different authors to separate genera in other polypores. It is also accepted by Núñez & Ryvarden (1995b).

Species separation is based mainly on measurements, particularly of the setoid elements.

1. *Echinochaete brachypora* (Mont.) Ryvarden, Bull. Jard. Bot. Nat. Belgique 48: 101. 1978, as *'brachysporus'*. **FIGURE 2 and PLATE 1A**

= *Polyporus brachyporus* Mont., Ann. Sci. Nat., ser. 4, 1: 131. 1854.- *P. megaloporus* Mont., ibid., p. 124. 1854 non *P. megaloporus* Pers. 1825.- *Favolus brunneolus* Berk. & M.A. Curtis, J. Linn. Soc. London X, part 1: 321. 1869.- *Favolus princeps* Berk. & M.A. Curtis, J. Linn. Soc. London X, part 1: 321. 1869.- *F. balansae* Speg., Rev. Mycol. 11(42): 94. 1889.

Basidiocarp annual, lateral to eccentrically stipitate; **pileus** flabelliform, sometimes lobulate, 20-75 x 20-55 mm in diam. and up to 2 mm thick, fragile, easily broken upon drying. **Pileus surface** glabrous, smooth, concentrically zonate, brown (5YR 4/4) to dark brown (5YR 3/3 to 10YR 3/2), when dry. **Margin** smooth, entire to slightly lobulate. **Stipe** cylindric, 4-18 mm long, and up to 8 mm in diam., rigid when dry, glabrous, concolorous with the hymenophore. **Hymenophore** brown (5YR 3/4) to dark brown (10YR 2/2). **Pores** circular to angular, 3-4 per mm (in the holotype), 1-2 per mm (in other collections), tubes up to 2 mm long. **Context** homogeneous, waxy, beige to dark brown, up 1 mm thick.

Hyphal system dimitic; generative hyphae clamped, hyaline, thin-walled, 2.5-5.0 μm in diam., abundant throughout the basidiome; skeleto-binding hyphae thick-walled, lumen visible, 4.5-12.0 μm in diam., hyaline to golden, moderately to much branched, abundant throughout the basidiome. **Setae** with pointed or blunt protuberances, present in the hymenium and trama, thick-walled, yellow or light brown, 20-50 x 4-13 μm. **Hymenium** formed by clavate basidia. **Basidiospores** cylindric, thin-walled, hyaline, 8.5-13.0 x 3-5 μm.

Cultural features: unknown.

Substrate: dead undetermined dicot wood.

Distribution: NE Argentina, Cuba, French Guyana, Paraguay. Pantropical according to Núñez & Ryvarden (1995b).

SPECIMENS EXAMINED — **ARGENTINA. MISIONES:** Iguazú Nat'l Park, Falls, 5.III.1982, leg. J. E. Wright M3518 (**BAFC** 28297). **CUBA.** leg. C. Wright 317 (**HOLOTYPUS** of *Favolus princeps* **K** 77609): 327 (**HOLOTYPUS** of *F. brunneolus* **K** 77608). **FRENCH GUYANA.** leg. Leprieur 959 (**HOLOTYPUS** of *Polyporus brachyporus* **PC**); leg. Leprieur (**HOLOTYPUS** of *P. megaloporus* **PC**). **PARAGUAY.** *Guarapi*, 1884, leg. Balansa (**HOLOTYPUS** of *Favolus balansae* **LPS** *21253*).

Remarks: Our collections agree with the descriptions of Reid (1963) and Nuñez & Ryvarden (1995b).

POLYPORUS Fr.: Fr. Observ. Mycol. 1: 121. 1815

=*Hexagonia* Pollini, Hort.Veron. p. 35, 1818 (*H. mori* Pollini, nom. rejiciendum, see ICBN, Appendix IIIA).- *Favolus* Fr., Elench. Fung. 1: 44. 1828 (*Daedalea brasiliensis* Fr.).- *Polyporellus* P. Karst., Meded. Soc. Fauna Fl. Fenn. 5: 37. 1880 (*Boletus brumalis* Pers.).- *Bresadolia* Speg., An. Soc. Cient. Argent. 16: 277. 1883. (*B. paradoxa* Speg.).-

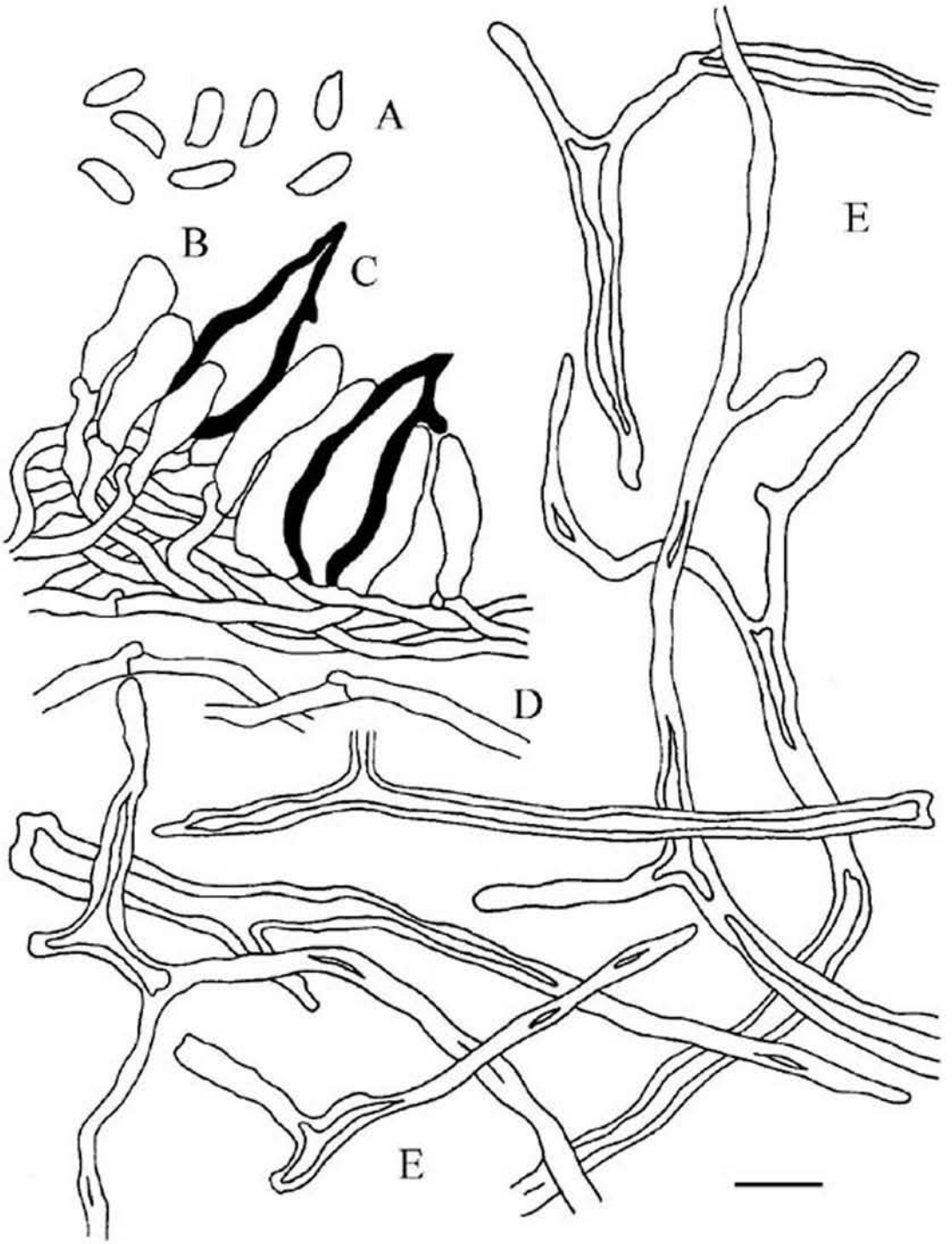

Figure 2: *Echinochaete brachyporus* (BAFC 28297). A) spores; B) basidioles; C) setoid elements; D) generative hyphae; E) skeleto-binding hyphae. Scale bar = 13 μm.

Cerioporus Quél., Ench. Fung. P. 167. 1886 (*Boletus squamosus* Huds.).- *Cladomeris* Quél., Ench. Fung. P. 167. 1886 (*P. umbellatus* Fr.).- *Leucoporus* Quél., Ench. Fung., p. 165. 1886 (*P. ciliaris* Fr.).- *Melanopus* Pat., Hymen. Europ. p. 137. 1887 (*Boletus squamosus* Huds.).- *Pseudofavolus* Pat., Essai. Tax. Hymen. p. 80. 1900 (*P. miquelii* Mont.).- *Lentus* Torrend, Broteria (ser. Bot.) 18: 121. 1920 (*Boletus brumalis* Pers.).-

Atroporus Ryvarden, Norw. J. Bot. 20: 2. 1973 (*P. diabolicus* Berk.).- *Dendropolyporus* (Pouzar) Jülich, Bibliot. Mycol. 85: 397. 1981 (*P. umbellatus* Fr.).- *Royoporus* A.B. De, Mycotaxon 60: 143, 1996.

Basidiocarp annual or biannual, central to laterally stipitate or substipitate. **Pileus** circular to dimidiate, convex or infundibuliform, smooth to scaly, glabrous to finely tomentose, white, brown or black, coriaceous when fresh, rigid or fragile when dry. **Pore** surface white to cream coloured, or dark brown when dry; pores entire, circular to angular, small to large, decurrent or not on the stipe. **Context** white to light brown. **Stipe** cream coloured to black, glabrous to finely tomentose, with or without a cuticle, smooth or longitudinally wrinkled, in some species originating from a sclerotium, in others transformed from rhizomorphs.

Hyphal system dimitic; generative hyphae hyaline, mostly with clamps, some species with simple septa, brown on the pileus surface and stipe, thick-walled, forming a palisade or cutis; skeleto-binding hyphae hyaline to brown, solid or with visible lumen. **Cystidia** absent. **Hyphal pegs** present or absent. **Basidia** clavate, 4-spored. **Basidiospores** cylindric to subellipsoid, straight or slightly curved, thin-walled, smooth, hyaline, IKI-. On living or dead wood, rarely on conifers, or developing from a sclerotium buried in the ground or immersed in wood. Saprophytic, rarely parasitic, producing a white rot. Heterothallic and tetrapolar. Cosmopolitan genus.

Type species: *Polyporus tuberaster* (Jacq.: Fr.) Fr.

Remarks: *Echinochaete* is here circumscribed in the strict sense in which it is accepted today. It is characterized by the stipitate basidiome and the dimitic hyphal system with skeleto-binding hyphae.

Infra-generic scheme and disposition of southern South American taxa

Subgenus 1. *Polyporus*

Basidiocarps fleshy, more than 10 mm thick when fresh, pores medium sized, spores longer than 8 μm.

P. cyathiformis Lév., *P. udus* Jungh.

Subgenus 2. *Melanopus* Pat., Hyménomyc. Eur.: 137. 1887.

Basidiocarps coriaceous, up to 10 mm thick, with a melanized cortex, at least at the base of stipe.

P. dictyopus Mont., *P. guianensis* Mont., *P. guianensis* var. *puttemansii* (Henn.) R.M. Silveira & J.E. Wright, *P. leprieurii* Mont., *P. melanopus* (Pers.:Fr.) Fr., *P. rhizophilus* Pat., *P. varius* Fr.: Fr., *P. virgatus* Berk. & M.A. Curtis

Subgenus 3. *Polyporellus* P. Karst., Meddn. Soc. Fauna Flora Fenn. 5: 37. 1879.

Basidiocarps coriaceous, centrally to eccentrically stipitate, without a melanized cortex on the stipe.

P. arcularioides A. David & Rajchenb., *P. arcularius* (Batsch : Fr.) Fr., *P. ciliatus* Fr.: Fr., *P. tricholoma* Mont., *P. tucumanensis* Speg.

Subgenus 4. *Favolus* P. Beauv.: Fr., Elench. Fung. 1: 44. 1828.

Basidiocarps fleshy to membranous when fresh, laterally stipitate, flabelliform, up to 8 mm thick; pores large, up to 3 per mm; spores generally longer than 10 μm.

P. curtipes (Berk. & M.A. Curtis) Ryvarden, *P. philippinensis* Berk., *P. saltensis* (Speg.) R.M. Silveira & J.E. Wright, *P. tenuiculus* (P. Beauv.: Fr.) Fr.

Subgenus 5. *Austropolyporus* R.M. Silveira & J.E. Wright, **subgen. nov.**

Basidiocarpus tenax vel lignosus, stipes absens, dimidiatus vel conchatus, tantum in Nothofagetum. Typus hic designatus: ***P. gayanus*** *Lév.*

Basidiocarps resistant to woody, stipe absent or only a mucro, dimidiate to conchoid, only found in the *Nothofagus* area.

Remarks: Nuñez & Ryvarden (1995b) included *Polyporus gayanus* in the "*Admirabilis* group" together with *P. admirabilis* Peck and *P. pseudobetulinus* (Murashk. ex Pilát) Thorn, Kotir. & Niemelä – two species not present in the area under study. This group includes species with convex to flat, substipitate basidiocarps that are thicker than 8 mm. Because these authors did not propose a formal name for the group, we propose a new subgenus to accommodate *P. gayanus* based on its restricted distribution.

2. *Polyporus arcularioides* A. David & Rajchenb., Mycotaxon 22: 285. 1985.

FIGURE 3

Basidiocarp annual, central to eccentrically stipitate. Pileus circular, plane to infundibuliform, 15-40 mm in diam. and up to 3 mm thick, coriaceous when fresh, fragile and friable when dry. Pileus surface glabrous or downy, wrinkled when dry, brown (5YR 3/4) to ochraceus brown (7.5YR 5/6) or beige (10YR 7/4) when dry. Margin smooth, entire to lobulate, recurved when dry. Stipe cylindric or tapering towards the base, 15-35 mm long and up to 3 mm in diam., rigid when dry, glabrous, concolorous with the hymenophore. Hymenophore beige (10YR 7/4) to light brown (10YR 5/6). Pores hexagonal alveolate, radially elongated, 1-3 per mm, decurrent on the stipe, tubes up to 2.5 mm long, with the mouths fimbriate. Context homogeneous, cottony, beige, up to 0.5 mm thick.

Hyphal system dimitic; generative hyphae clamped, hyaline, thin-walled, 2-5 μm in diam., sclerified in the stipe, arranged parallel to the main axis, skeleto-binding hyphae thick-walled, lumen visible, 3-5 μm in diam., hyaline to yellowish, moderately branched, dominating in the context. **Hymenium** formed by clavate, 4-spored basidia, 15-25 x 5-6 μm. **Basidiospores** cylindric to subellipsoid, thin-walled, hyaline, 6-8(-9) x 2.5-3.5 μm.

Cultural features: unknown.

Susbtrate: dead wood of undetermined dicots.

Distribution: Argentina, Bolivia, S Brazil, Martinique and Paraguay.

SPECIMENS EXAMINED — ARGENTINA. MISIONES: Colonia Belgrano, II.1965, leg. C. E. Gómez (BAFC 50668); forest SE of Forestry Station, 29.X.1973, leg. Wright, Deschamps & Del Busto M2470 (BAFC 50669); Iguazú Nat'l Park, I.1980, leg. J. E. Wright (BAFC 50670). **BOLIVIA.** *Pando*, Sena, Río Madre de Dios, 15.X.1923, leg. J. R. Weir (BAFC 25194). **BRAZIL. PARANÁ:** Gral. Carneiro, Fazenda São Pedro,

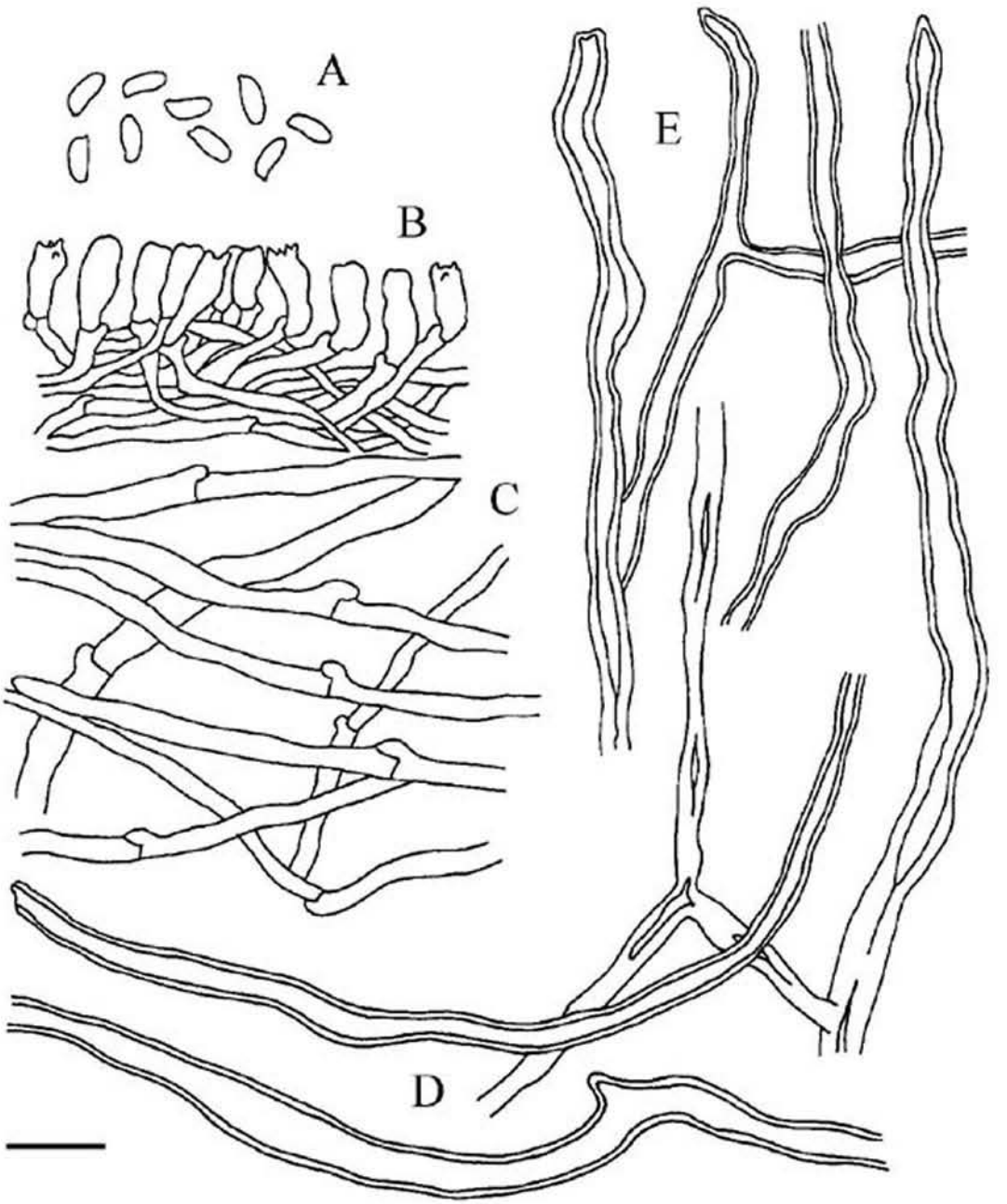

Figure 3: *Polyporus arcularioides* (BAFC 50669). A) spores; B) basidia and basidioles; C) generative hyphae; D) skeleto-binding hyphae (context); E) skeleto-binding hyphae (dissepiments). Scale bar = 13 μm.

4.X.1989, leg. A. de Meijer 1380 (BAFC 50744); **São Paulo:** Itu, Fazenda São Miguel, 24.X.1987, leg. A. de Meijer 936 (BAFC 31305). **MARTINIQUE.** Prêcheur, 19.VII.1972, leg. A. David (**HOLOTYPUS, LY**-AD 1323). **PARAGUAY.** *Alto Paraná*, Reserva Itabó, 9.X.1990, leg. O. Popoff *et al.* 846 (CTES).

Remarks: it is easy to mistake *Polyporus arcularioides* for *P. arcularius*, which is separated by the presence of pilear scales, of cilia on the margin and of hyphal pegs in the tubes. Furthermore, its pores are somewhat larger than in *P. arcularioides*.

3. *Polyporus arcularius* (Batsch: Fr.) Fr., Syst. Mycol. 1: 342. 1821.

FIGURE 4 and PLATE 1B

=*Boletus arcularius* Batsch, Elench. Fung. p. 97. 1783.- *Favolus ciliaris* Mont., Ann. Mag. Nat. Hist. Sci. Nat., sér. 2, 20: 364. 1843.-*Polyporus agariceus* Berk., Ann. Mag. Nat. Hist. 10: 371. 1843.- *P. nanus* Durieu & Mont., Syll. Gen. Spec. P. 153. 1856.- *Favolus curtisii* Berk., Grevillea 1: 68. 1872.- *F. squamiger* Berk., Grevillea 1: 166. 1872.

Basidiocarp annual, centrally stipitate. **Pileus** circular, umbilicate, 20-30 mm in diam., but may reach up to 60 mm and 3 mm thick, coriaceus when fresh, breakable upon drying. **Pileus** surface scaly, scales triangular, concentrically arranged on all the surface, light brown (10YR 6/6) to ochraceous brown (10YR 5/6). **Margin** provided with squamiform, triangular cilia. **Stipe** cylindric, somewhat broadened towards the base, 25-40 mm long and 2 mm in diam., fibrous, glabrous, concolorous with the pileus. **Hymenophore** beige (10YR 7/4) to light brown (10YR 6/6), or ochraceus (7.5YR 5/6). **Pores** hexagonal, alveolar, radially elongated, 1-2 per mm, decurrent on stem, tubes up to 3 mm long, with hyphal pegs on the walls. **Context** much reduced, ca. 0.2 mm thick, homogeneous, waxy, cream coloured.

Hyphal system dimitic; generative hyphae clamped, hyaline, thin- to slightly thick-walled, 1.5-4 μm in diam., sclerified in the stipe, arranged parallel to the principal axis and up to 7 μm diam; skeleto-binding hyphae thick-walled to solid, 2-8 μm in diam., up to 10 μm diam.in the context, hyaline to yellowish, moderately branched, dominating in the dissepiments and context. **Hymenium** formed by clavate 4-spored basidia with a basal clamp, 14-20 x 4-5 μm. **Basidiospores** cylindric to subellipsoid, thin-walled, hyaline, 6-9 x 2-3 μm.

[Cultural features: Wright (1948, as *Favolus squamiger*); Nobles (1948, 1958, 1965, 1971); Matters et al. (1952); Bakshi et al. (1969); Siepmann (1971); Nakasone & Gilbertson (1978), Stalpers (1978, as *P. alveolaris*).

Substrate: dead wood of several dicots like *Ailanthus, Eucalyptus, Ligustrim, Salix, Ulmus*. Also on dead wood of conifers of the genus *Pinus*.

Distribution: Argentina (Buenos Aires and Entre Ríos), Brazil, French Guyana, Paraguay, Trinidad and Uruguay. Cosmopolitan, according to Núñez & Ryvarden (1995b), excepting the boreal region.

SPECIMENS EXAMINED — **ALGERIA.** Mascara, leg. Durieu (**HOLOTYPUS** of *Polyporus nanus* **PC**).**ARGENTINA. BUENOS AIRES:** Belén de Escobar, El Cazador, 14.II.1971, leg. G. Guzmán (BAFC 50648), in woods of *Pinus* and *Eucalyptus;* Paraná de las Palmas, 31-XII-1972, leg. Deschamps, Rovetta & Viccari (BAFC 50655), on branchlet of *Salix humboldtiana*; Delta of Paraná, 7.XII.1964, leg. Singer S457 (BAFC 50658); Derqui, 21.XI.1987, leg. D. Cabral (BAFC 31071); Ezeiza or Delta, XII.1967, leg. J. E. Wright (BAFC 50650); Ezeiza, 29.X.1967, leg. ibid (BAFC 50657); 11.XI.1969, leg. J. E. Wright & J. R. Deschamps (BAFC 50663): La Plata, La Balandra, 29.XI.1961, leg. J. R. Deschamps (BAFC 50651), on stump of *S. humboldtiana*; Punta Lara, 4.XI.1962, leg. L. Bettucci (BAFC 50660); 27.II.1973, leg. Ruiz (BAFC 50654); 28.XI.1997, leg. R. M. Silveira & E. Albertó 346 (BAFC 50673); Llavallol, Sta. Catalina, 15.VIII.1970, leg. J. R. Deschamps (BAFC 50666), on dead wood of *Ulmus* sp., 24-XII-1971, leg. J. R. Deschamps and G. Rovetta (BAFC 50659); 5.III-1972, leg. J. E. Wright (BAFC 50664, 59665); 20.XII, 1972, leg. Deschamps,

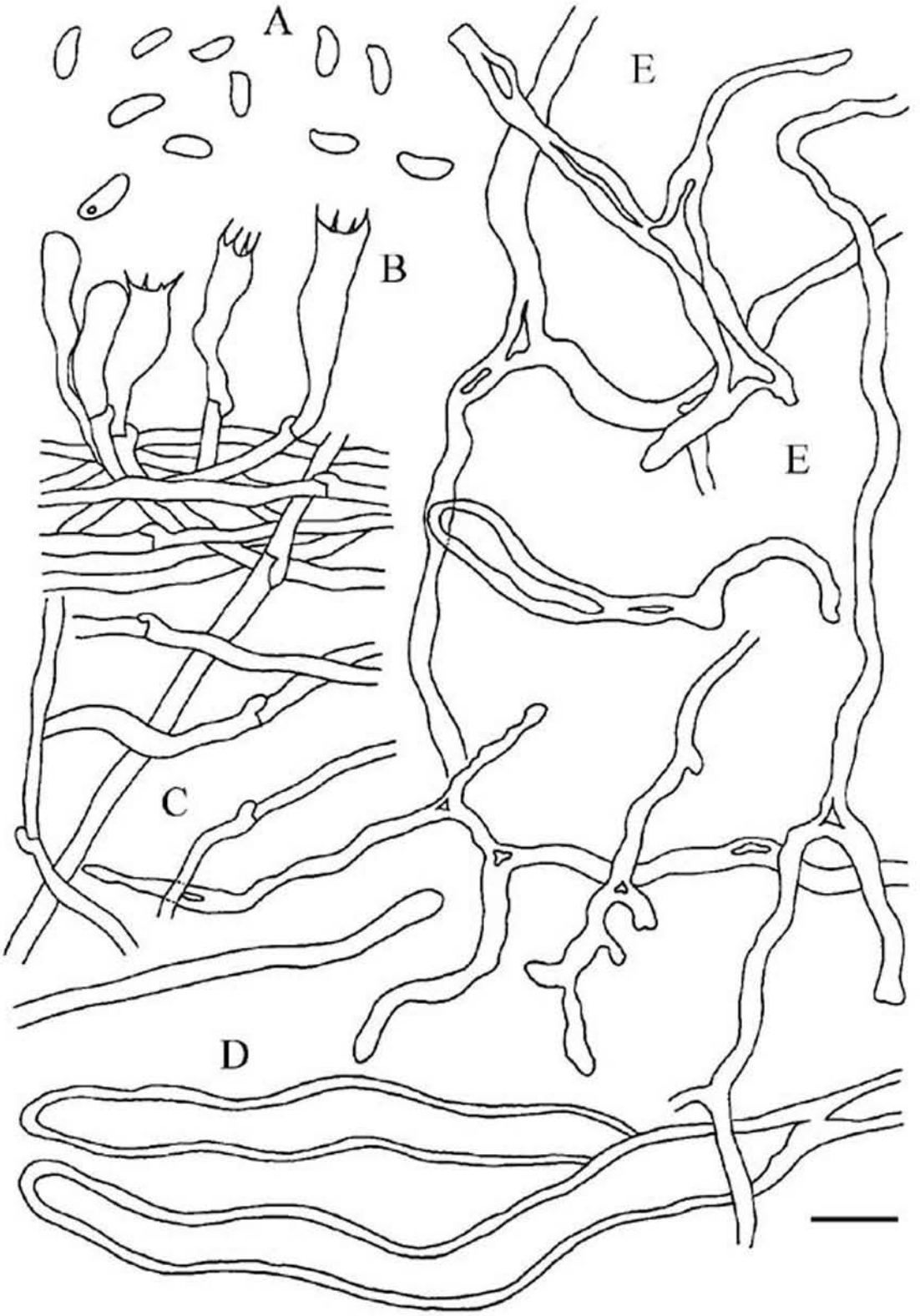

Figure 4: *Polyporus arcularius* (BAFC 33970). A) spores; B) basidia; C) generative hyphae; D) skeleto-binding hyphae (context); E) skeleto-binding hyphae (dissepiments). Scale bar = 13 μm.

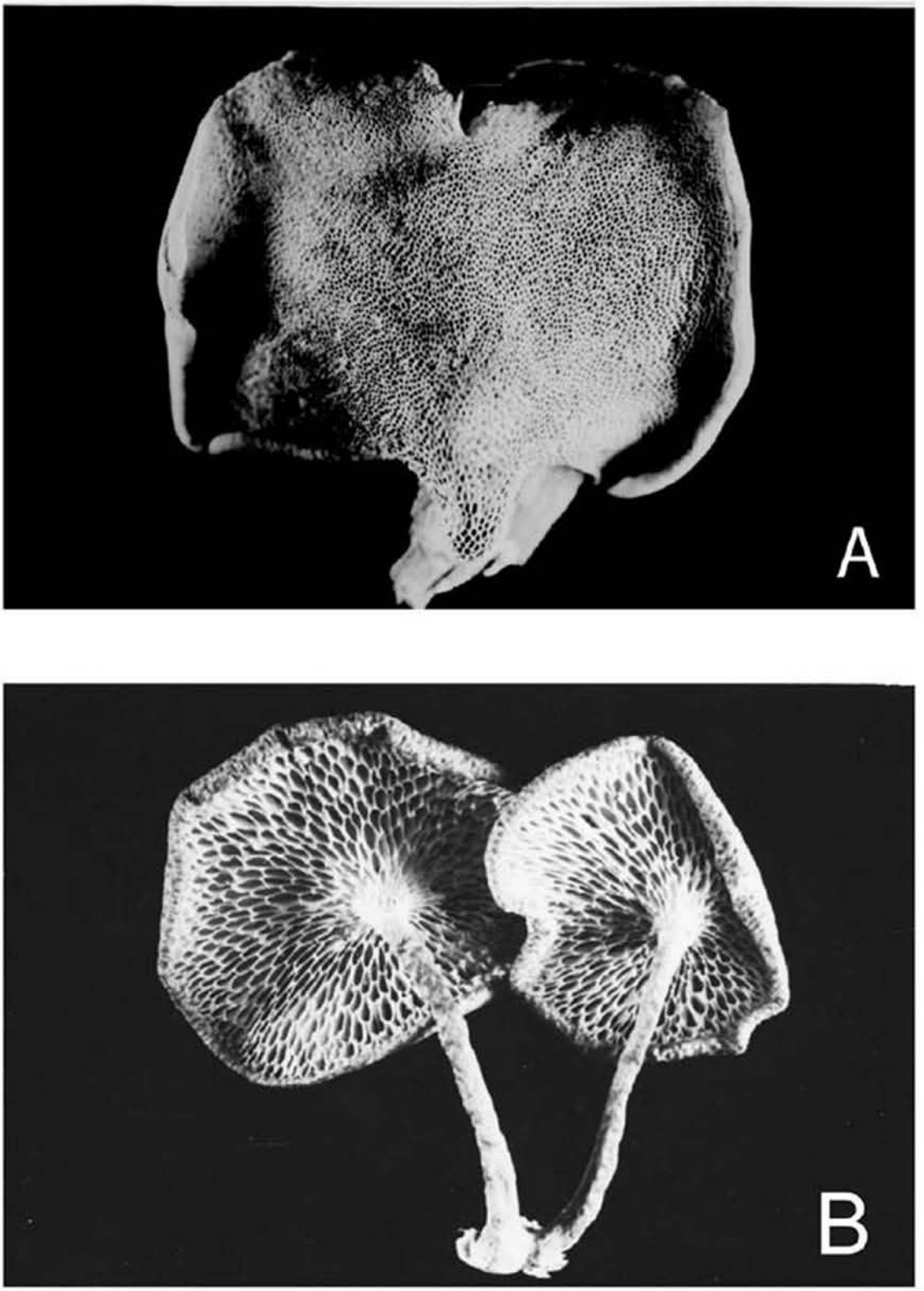

Plate 1. A) *Echinochaete brachyporus* (BAFC 28297). B) *Polyporus arcularius* (BAFC 33970). Scale bar = 10 mm.

Rovetta & Vicari (BAFC 50656), on partially rotten trunk of *U. procera*; 4.II.1973 (BAFC 50653), on fallen branchlet of *Ligustrum lucidum*; 23.XI.1993, leg. E. Albertó & E. Fernández (BAFC 33250); San Fernando, XI-1967, leg. R. Akselman (BAFC 50649); Tigre, Paseo "Las Rosas", 18.X.1995, leg. A. Fazio (BAFC 33970). **Entre Ríos:** El Palmar Nat'l Park, Colón, 8.XI.1979, leg. A. Maranta (BAFC 24512), on dead palm and spathe of *Butia yatay*; Delta, 6.III.1942, leg. J. M. Jozami (BAFC 50667). **MADAGASCAR:** leg. Goudot (**HOLOTYPUS** of *F. ciliaris* **PC**). **SRI LANKA:** leg. Konig (**HOLOTYPUS** of *P. agariceus* **K** 57282). **USA:** *North Carolina*: leg. M. A. Curtis 335 (**HOLOTYPUS** of *F. curtisii* **K** *77602*).

Remarks: *Polyporus arcularius* is easily recognized by its large, hexagonal pores and the scaly pilear surface with the margin notoriously ciliate. It is probably an introduced species in the area studied, since it has not been found in native forests.

4. *Polyporus ciliatus* Fr. : Fr., Syst. Mycol 1: 349. 1821.

Figure 5 and Plate 6A

= *Polyporus platensis* Speg., An. Soc. Cient. Argent. 12: 83. 1881.- *P. penningtonii* Speg., An. Mus. Nac. Buenos Aires 8 ser. 3 vol. 1: 52-53. 1902.- *P. diabolicus* Speg., Bol. Acad. Nac. Cienc. Córdoba 11(4): 435-436. 1889.- *P. guarapiensis* Speg., An. Soc. Cient. Arg. 16: 83. 1888.- *P. pauperculus* Speg., Bol. Acad. Nac. Cienc. Córdoba 11: 483. 1889.- *P. stipitarius* Berk. & M.A. Curtis var. *pusilla* Speg., An. Mus. Nac. Buenos Aires 6: 162. 1898.

Basidiocarp annual, centrally stipitate. **Pileus** circular, umbilicate, 20-70 mm in diam. and up to 3 mm thick, coriaceous when fresh, very hard and resistant upon drying. **Pileus** surface glabrous, wrinkled when dry, brown (10YR 4/4) to light brown (10YR 6/6) or dark brown (10YR 4/3). **Margin** with large elongated cilia, incurved when dry, sometimes lacking cilia and completely entire. **Stipe** cylindric, somewhat broadened towards the base, 15-60 mm long and up to 1-5 mm in diam., fibrous, glabrous, concolorous or lighter than the pilear surface. **Hymenophore** cream coloured (2.5Y 8/4 to 8/6). **Pores** circular, angular when dry, margin fimbriate, 5-7 per mm, tubes up to 2 mm long. **Context** homogeneous, white to cream coloured, cottony –fibrous up to 2 mm thick, separated from the hymenophore by a darker line.

Hyphal system dimitic; generative hyphae clamped, hyaline, with thin- to slightly thickened walls, 2-4.5 μm diam., inflated in the context up to 16 μm, sclerified in the context, arranged parallel to the principal axis, and up to 9 μm diam.; skeleto-binding hyphae thick.walled, rarely solid, 2-5.5 μm in diam., hyaline to yellowish, moderately branched, abundant in the dissepiments. **Hymenium** formed by clavate to subglobose, 4-spored basidia, 11-22 x 4-6 μm. **Basidiospores** cylindric to ellipsoid, thin-walled, hyaline, 5-8.5 x 2-3 μm.

Cultural features: Nobles (1971, as *P. platensis*); David & Romagnesi (1972); Stalpers (1978).

Substrate: dead dicot wood of several genera, such as *Alnus, Betula, Populus, Ligustrum, Salix, Ulmus*. Also on dead conifer wood of the genus *Pinus*.

Distribution: Argentina, S. Brazil, Paraguay and Perú. Very common in temperate Eurasia and Europe, unknown from North America and Japan, according to Núñez & Ryvarden (1995b).

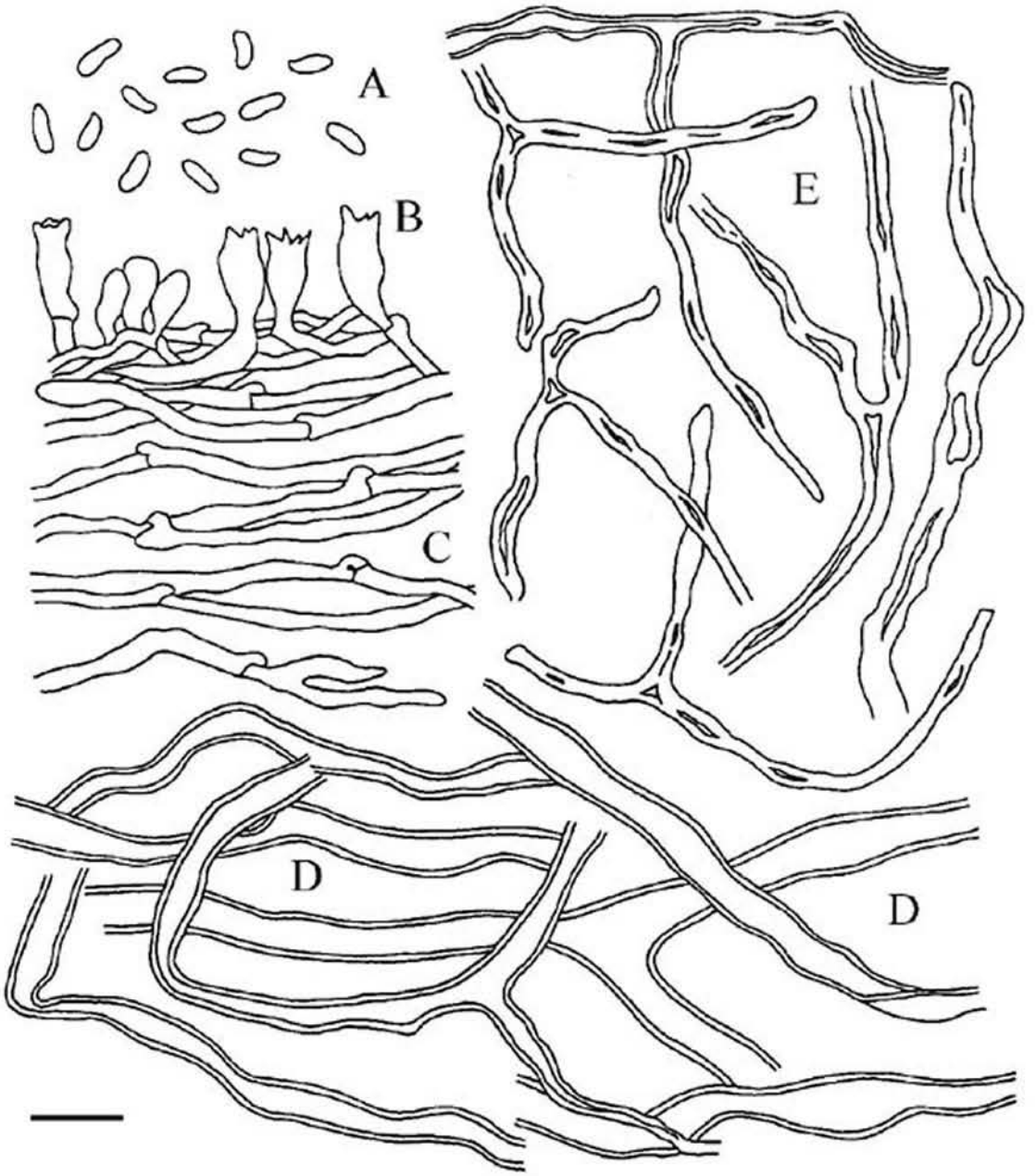

Figure 5: *Polyporus ciliatus* (BAFC 50370). A) spores; B) basidia; C) generative hyphae; D) skeleto-binding hyphae (context); E) skeleto-binding hyphae (dissepiments). Scale bar = 13 μm.

SPECIMENS EXAMINED — **ARGENTINA. Buenos Aires:** *Buenos Aires City*: Reserva Costanera Sur, 14.X.1993, leg. L. Biglieri (BAFC 33253); *Buenos Aires:* Tigre, Río Sarmiento, El Ferroviario, 2.II.1975, leg. D. Cabral BA2669 (BAFC 50845); Castelar, Parque Leloir, 5.XII.1999, leg. M. B. Pildain & R. M. Silveira 442 (BAFC 50824); Ezeiza, 11.XI. 1969, leg. Wright & J. R. Deschamps (BAFC 50853); 29.X.1972, leg. J. R. Deschamps (BAFC 50674), on fallen branches of *Ligustrum lucidum;* Don Torcuato, 17.IX.1981, leg. C. A. Capelli (BAFC 28510); La Plata, leg. C. Spegazzini (**HOLOTYPUS** of *Polyporus platensis* **LPS** 25778); III.1889, leg. C. Spegazzini

(**LECTOTYPUS** of *P. stipitarius* var. *pusillus* **LPS** 25073); Llavallol, Sta. Catalina, 24.IX.1972, leg. Deschamps, Rovetta & Viccari (BAFC 31898), on fallen branch of *Ulmus procera* (BAFC 31899); 18.XII.1972, leg. ibid. (BAFC 50849), on branch of *L. lucidum*; 4.II.1973, leg. ibid. (BAFC 50846), on branch of *U. procera*; X.1995, leg. E. Albertó Ed226 (BAFC 34051); 20.X.2000, leg. E. Albertó Ed873 (BAFC 50826); Inst. Fitotécnico, 2.XI.1969, leg. J. R. Deschamps (BAFC 50852), on decayed trunk of *Ligustrum* sp.;23.XI.1969, leg. J. R. Deschamps (BAFC 31897), on decaying *Ulmus* sp.; Punta Lara, XII.1971, leg. Merlo (BAFC 50850); leg. J. E. Wright PL1157 (BAFC 50847). **Corrientes:** Gral. Paz, El Tacuaral, 20.IX.1987, leg. O. Popoff 224 (CTES). **Entre Ríos:** Paraná, Est. Berduq, Parque Gral. San Martín, 9.X.1977, leg. J. R. Deschamps ER2993 (BAFC 50854); Paraná Guazú, leg. S. Pennington (**HOLOTYPUS** of *P. penningtonii* **LPS** 25787). **Misiones:** Puerto Esperanza, 20.IX.1979, leg. J. E. Wright M3215 (BAFC 24513); Ruinas de Loreto, 22.IX.1979, leg. D. Cabral & S. López M3216 (BAFC 24514). **BRAZIL. Rio Grande do Sul:** Cambará do Sul, Aparados da Serra Nat'l Park, 19.XI.1987, leg. R. M. Silveira & R. T. Guerrero 046, 128, 140, 242, 248, 259 (ICN 80489, 80850, 80505, 80531, 80535, 80533); Nova Petrópolis, 8.VIII.1997, leg. R. M. Silveira 313, 314, 317, 318, 319, 320 (BAFC 50796, 50797, 50798, 50799, 50800, 50801); Porto Alegre, Lami, 20.X.1997, leg. R. T. Guerrero & Marinês (ICN102.682); Taquara, RS 2 Taquara-S. F. de Paula Hway, 21.III.1973, leg. M. H. Homrich & Lara Labarthe 686 (ICN 6370); Torres, 6.XII.1991, leg. R. T. Guerrero (ICN 80803); Viamão, Parque St.-Hilaire, 17.X.1998, leg. R. M. Silveira 420, 423, 426, 427, 428, 429, 430, 431, 432, 433, 435, 436, 437 (BAFC 50360, 50361, 50363, 50364, 50365, 50366, 50367, 50368, 50369, 50370, 50371, 50372, 50373). **São Paulo:** Apiahy, VI.1881, leg. Puiggari 1032 (**HOLOTYPUS** of *P. pauperculus* **LPS** 25786); IV.1888, leg. Balansa (**HOLOTYPUS** of *P. diabolicus* **LPS** 25784). **PARAGUAY.** *Alto Paraná*, Reserva Biológica Itabó, 6 km N of Administration, 9.X.1991, leg. Popoff *et al.* 762 (CTES); Guarapi, X. 1883, leg. Balansa 4090 (**HOLOTYPUS** of *P. guarapiensis* **LPS** 25776).

Remarks: *Polyporus ciliatus* is characterized by its centrally stipitate, brown basidiocarps with very light coloured hymenophore and small pores, the pileus margin may be ciliate or not so. It is one of the most common species in the area studied. According to Núñez & Ryvarden (1995b), the spores of *P. ciliatus* measure 5-7 x 2 μm, whereas those of our materials are somewhat longer and wider, viz. 5-8.5 x 2-3 μm. The feature of having or not marginal cilia has created a confusion with *P. brumalis*, from which it may be separated by pore size. The latter species does not appear to be present in the area under study.

Jahn (1969) makes interesting observations on the differences (and confusion!) between *P. ciliatus* and *P. brumalis*, and stresses the importance of pore size to separate them. He states that *P. ciliatus* does not grow in winter, as does *P. brumalis*, and that, sometimes, they are only found together in spring. *P. brumalis* would thus be a winter fungus. In the area under study, *P. ciliatus* grows from September to June (Southern hemisphere).

5. *Polyporus curtipes* (Berk. & M.A. Curtis) Ryvarden, Synopsis Fungorum 5: 213, 1991. **Figure 6 and Plate 5E**

= *Favolus curtipes* Berk. & M.A. Curtis, Hooker J. Bot. 1: 234. 1849. - *Favolus cucullatus* Mont., Ann. Sci. Nat., sér. 2, 17: 125. 1842.- *Pseudofavolus cucullatus* (Mont.) Pat., Essai

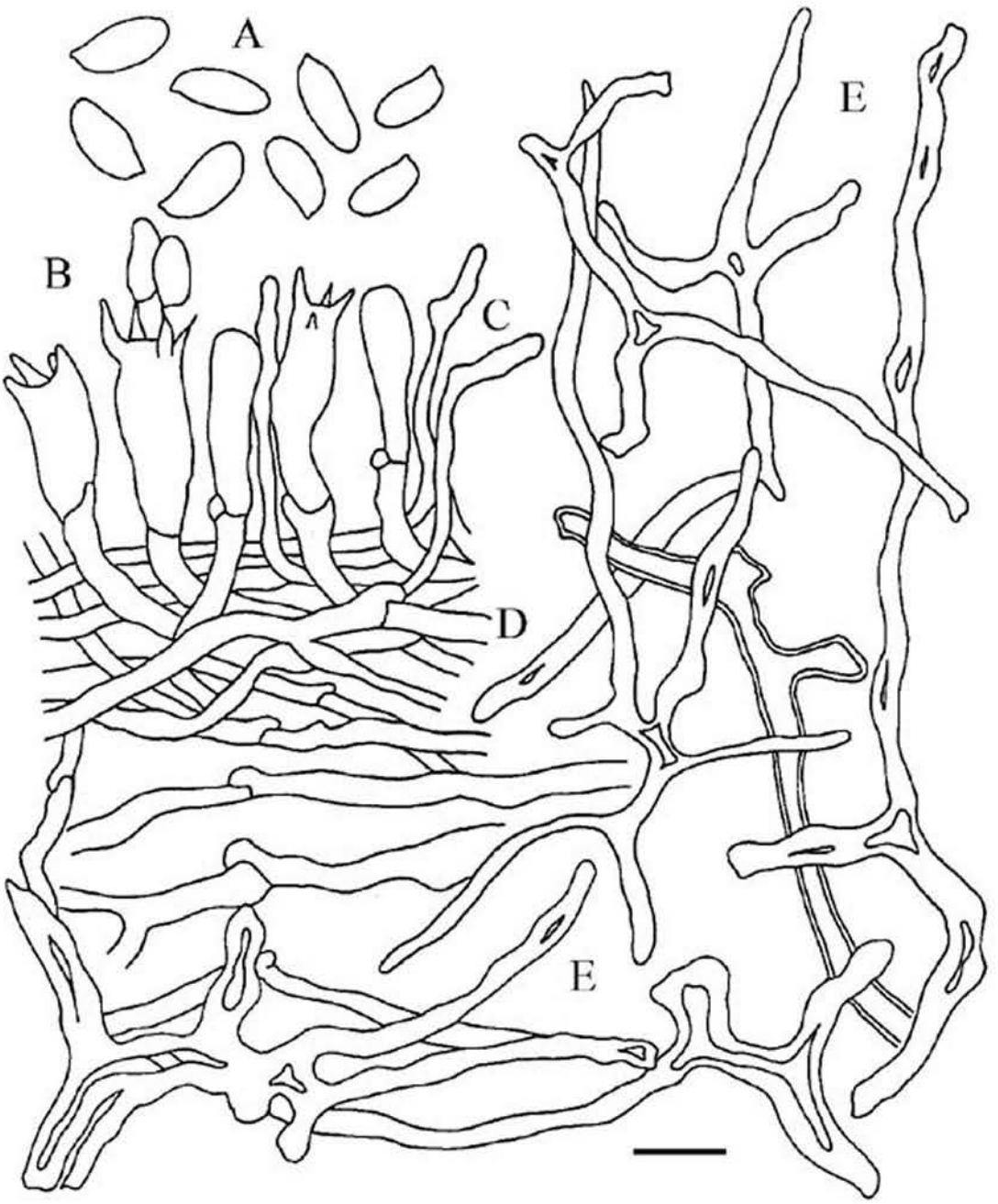

Figure 6: *Polyporus curtipes* (BAFC 50350). A) spores; B) basidia; C) dendrohyphidia D) generative hyphae; E) skeleto-binding hyphae. Scale bar = 13 μm.

Taxon. P. 81. 1900, non *Polyporus cucullatus* Berk. & M.A. Curtis, North American Fungi n° 134, Ann. Mag. Nat. Hist., 2 ser., 12: 417. 1853; 3 ser. 4: 284. 1859.

Basidiocarp annual, solitary or several pilei imbricate growing from a single point, laterally to eccentrically adhered. **Pileus** semicircular to circular, some drying

semiconchoid, 15-65 x 15-50 mm, and 2-4 mm thick, fragile and breakable when dry. **Pileus surface** glabrous, smooth or with the print of pores, beige (10YR 7/6) to yellowish (10YR 7/6 to 7/8) or ferrugineous (7.5YR 5/6) when dry. **Margin** entire, smooth, brown (7.5YR 4/4 to 5/6), involute when dry. **Stipe** as a disciform pseudostipe, 3-8 mm diam, rigid when dry, beige (10YR 7/4 to 8/4). **Hymenophore** beige (10YR 6/6 to 8/4) to light brown (7.5YR 5/4 to 5/6) when dry. **Pores** circular to angular when dry, with the margin either entire or fimbriate, (0.5-)1-2 per mm, tubes up to 3 mm long. **Context** homogeneous, corky, beige, up to 1.5 mm thick.

Hyphal system dimitic; generative hyphae clamped, hyaline, thin-walled, 3-5 μm in diam.; skeleto-binding hyphae very thick-walled, lumen visible to solid, 2.5-5 μm in diam., and up to 7 μm in the context, yellowish, much branched, dominating throughout the fructification, variably dextrinoid in the dissepiments. **Hymenium** formed by clavate basidia with a basal clamp, 24-47 x 6-13 μm. **Cystidia** absent, but dendrohyphidia and cystidioles present between the basidia. **Basidiospores** cylindric to subellipsoid, thin-walled, hyaline, 13-17 x 5-7 μm.

Cultural features: unknown.

Substrate: on rotting undetermined dicots.

Distribution: NE Argentina, Cuba. Common in the tropics according to Núñez & Ryvarden (1995b)

> **SPECIMENS EXAMINED — ARGENTINA. Misiones:** Iguazú Nat'l Park, 26.IX.1979. leg. J. E. Wright M3206 (BAFC 25176); lower circuit of falls, 5.IV.1984, leg. Job & Rajchenberg M3557 (BAFC 30023); Sendero Macuco, 2.VI.1998, leg. R. M. Silveira, A. Fazio & E. Albertó 395 (BAFC 50350); forbidden zone, 300 m from boundary, 7.IV.1984, leg. Wright, Rajchenberg & Job M3621 (BAFC 30024). CUBA: leg. Ramón de la Sagra & C. Wright (**HOLOTYPUS** of *Favolus cucullatus* **PC**).

Remarks: *Polyporus curtipes* is characterized by its large isodiametric pores, very thin context and very large spores; the latter separating it from other species with large pores.

This species is morphologically close to *P. tenuiculus* but in isoenzymatic analysis these species are easily distinguished (Silveira et al., 2003).

Montagne (1842) described this taxon as *Favolus*. For the reasons given above on the genus *Polyporus*, we consider that *F. cucullatus* Mont. should be included in *Polyporus*. However, although this is a proritary name it cannot be used in *Polyporus* because it is preoccupied by *P. cucullatus* Berk. & M.A. Curtis; for this reason Ryvarden (1991) proposed the new combination *P. curtipes* as the correct name for the species.

6. *Polyporus cyathiformis* Lév., Ann. Sci. Nat. Bot., sér. 3, 2: 181. 1844.

Figure 7 and Plate 6E

= *Polyporus craterellus* Berk. & M.A. Curtis, J. Linn. Soc. Bot. 10: 305. 1868.

Basidiocarp annual, eccentrically stipitate, circular to flabelliform, infundibuliform or plane, 25-80 mm in diam., and up to 4 mm thick, fragile and breakable upon drying. **Pileus surface** glabrous, wrinkled when dry, beige (10YR 6/6) to brown (7.5YR 5/6 to 4/4) when dry. **Margin** entire, sometimes incurved when dry. **Stipe** cylindric, 15-50 mm long and 2-10 mm in diam., rigid when dry, glabrous, concolorous with the

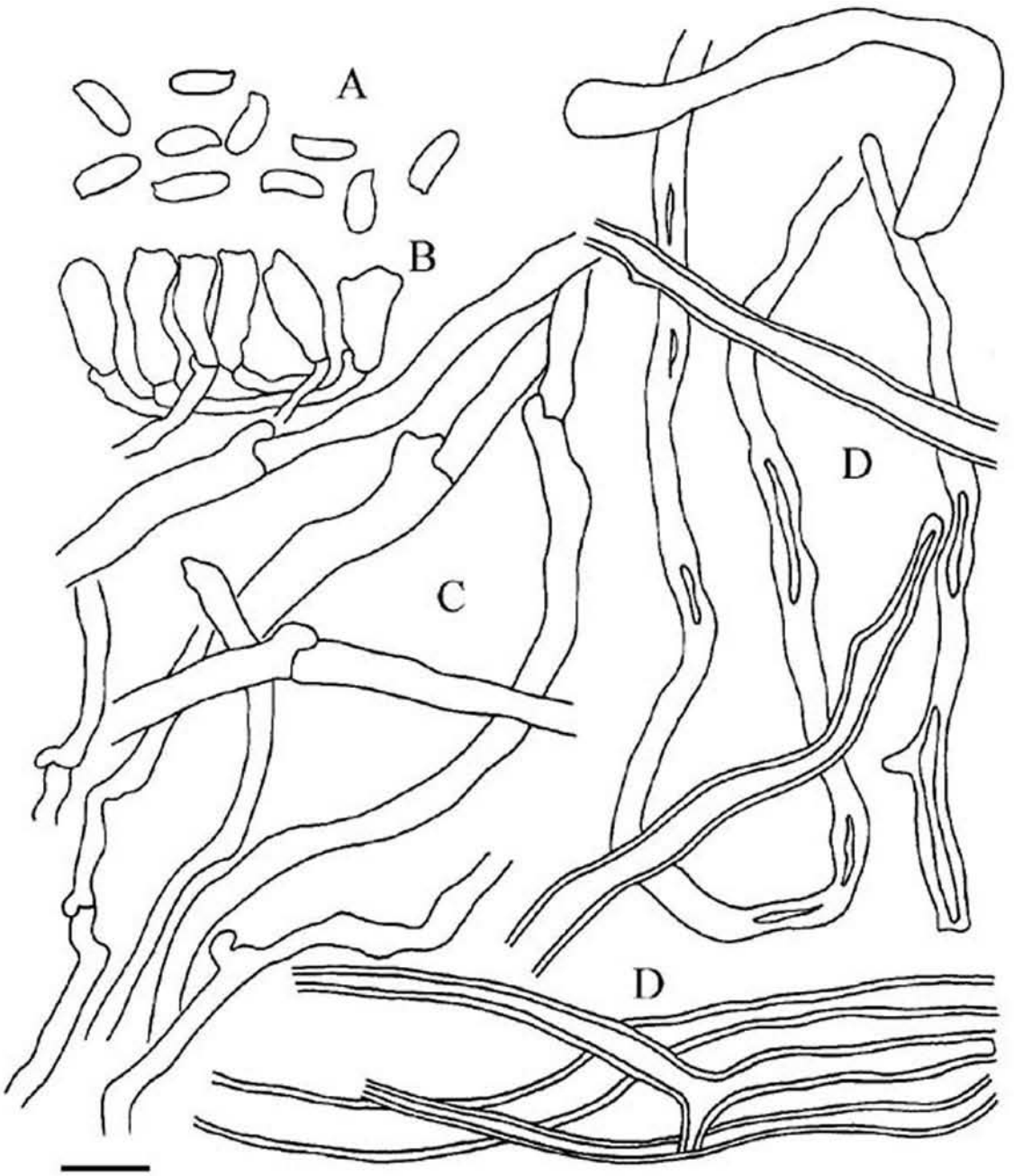

Figure 7: *Polyporus cyathiformis* (BAFC 30586). A) spores; B) basidioles; C) generative hyphae; D) skeleto-binding hyphae. Scale bar = 13 μm.

hymenophore. **Hymenophore** beige (10YR 7/4) to light brown (10YR 5/6) or brown (7.5YR 5/4). **Pores** circular to angular, 4–7 per mm, reaching almost to the base of the stipe, tubes up to 1.5 mm long. **Context** homogeneous, cottony, beige, up to 3 mm thick.

Hyphal system dimitic; generative hyphae clamped, hyaline, thin-walled, 3-5 μm in diam., inflated in the context up to 14 μm in diam., dominating throughout the

basidiome; skeleto-binding hyphae thick-walled, lumen visible, 4-10 μm in diam., hyaline to yellowish, hardly branched, present in the context. **Hymenium** formed by clavate, 4-spored basidia, 20-25 x 5-7 μm. **Basidiospores** cylindric to subellipsoid, thin-walled, hyaline, 8-10 x 3-4 μm.

Cultural features: unkown.

Substrate: dead undetermined dicots and gymnosperms of the genera *Araucaria* and *Pinus*.

Distribution: Bolivia, S Brazil, Cuba and Dominican Republic.

SPECIMENS EXAMINED — **BOLIVIA. La Paz:** Nor-Yungas, Capillaria, alt. 1800-1900 masl, 22-II.1956, leg. Singer B1324 (BAFC 30586), on dicot trunk out of forest. **BRAZIL. Paraná:** Campo Largo, Estancia Ouro Fino, 21.XII.1988, leg. A. de Meijer 1190 (Herb. Meijer), on rotten *Pinus* trunk, in *Pinus* plantation; Foz do Iguaçú, Cataratas do Iguaçú Nat'l Park, 31.XII.1992, leg. A. de Meijer 2396 (Herb. Meijer); S of Iratí, São Paolino, alt. 960 masl, 17.I.1981. leg. Plank & Broggi 3449 (BAFC 26558), on root of *Araucaria angustifolia* stump. **CUBA.** leg. C. Wright 377 (**HOLOTYPUS** of *Polyporus craterellus* **K** 57285).

Remarks:*Polyporus cyathiformis,* whose type, according to Ryvarden, is not extant, has not been considered by many authors. Most have preferred to use Berkeley & Curtis´epithet. However, and taking into account Lloyd´s (1910) statement-who apparently saw the types-we consider that Léveillé's name is the correct name for the species, and our materials coincide with his description (Léveillé, 1844).

7. *Polyporus dictyopus* Mont., Ann. Sci. Nat., sér. II, 3: 349. 1835.

Figure 8 and Plate 5A

= *P. rhizomorpha* Mont., Ann. Sci. Nat., sér. II, 13: 202. 1840. – *P. infernalis* Berk., Hooker London J. Bot. 2: 637. 1843. – *P. blanchettianus* Berk. & Mont., Ann. Sci. Nat. sér. II, 11: 238. 1849.- *P. diabolicus* Berk., Hooker London J. Bot. 8: 174. 1856.- *P. rufoatratus* Berk., Hooker London J. Bot. 8: 174. 1856. – *P. vernicosus* Berk., Hooker London J. Bot. 8: 175. 1856.- ? *P. decolor* Berk., Hooker London J. Bot. 8: 195. 1856.- *P. neprhidius* Berk., Hooker London J. Bot. 8: 195. 1856.- *P. hydniceps* Berk. & M.A. Curtis, Linn. Soc. Bot. 10: 305. 1868. – *P. dibaphus* Berk. & M.A. Curtis, Grevillea 1: 32. 1872.- *P. parvimarginatus* Speg., An. Soc. Cient. Argent. 16: 280. 1883.- *P. puiggarii* Speg., Bol. Acad. Nac. Cienc. Córdoba 11: 141. 1889.

Basidiocarp annual, eccentric to sublaterally stipitate. **Pileus** flabelliform to circular or semiinfundibuliform, 20-50 x 15-52 mm and 1-3 mm thick, coriaceous when fresh, rigid and woody when dry. **Pileus surface** glabrous, smooth or with fine radial striae, brown (2.5YR 3/6) to vinaceous brown (2.5YR 3/4), or dark vinaceous brown (5YR 2/2). **Margin** entire, smooth or wrinkled when dry. **Stipe** cylindric, sometimes slightly broadened at the base, 10-70 mm long and 1-6 mm in diam., woody, rigid when dry, dark brown to black (5YR 3/2 to 2/2). **Hymenophore** light brown (10YR 6/4) to grayish (10YR 5/3 to 4/2). **Pores** circular to angular when dry, decurrent on the stipe, 6-9 per mm, tubes 0.5-2 mm long. **Context** homogeneous, corky to cottony, cream coloured to beige, 0.5-1 mm thick.

Hyphal system dimitic; generative hyphae clamped, difficult to observe in dry specimens, hyaline, thin-walled, 2-5 μm in diam.; skeleto-binding hyphae with much

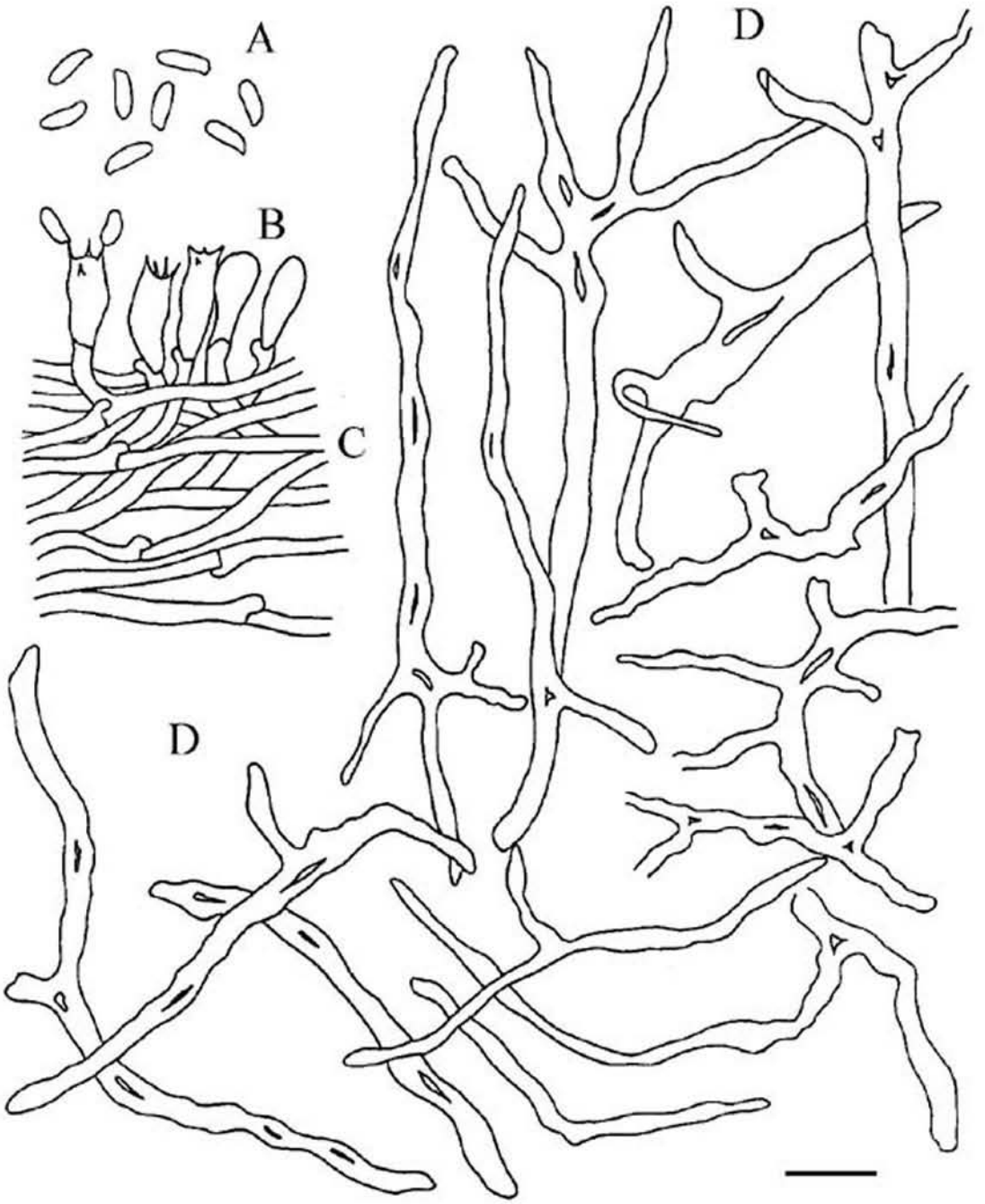

Figure 8: *Polyporus dictyopus* (BAFC 50783). A) spores; B) basidia and basidioles; C) generative hyphae; D) skeleto-binding hyphae. Scale bar = 13 μm.

thickened walls, lumen visible to solid, 2-7 μm in diam., pale yellowish, branched and tortuous, dominating throughout the pileus, dextrinoid in the dissepiments. **Stipe** cortex formed by a basal layer of much differentiated hyphae, resembling pieces of a jig-saw puzzle, irregularly polygonal and much appressed, disguised by a melanoid substance

which includes them as a basal band, and an external layer of hyphae with terminal cells, thick-walled, cylindric-clavate, arranged in a palisade,10-13 x 4-7 μm. **Hymenium** formed by clavate, 4-spored basidia, 13-20 x 4-6 μm. **Basidiospores** cylindrical to ellipsoid, thin-walled, hyaline, 6-8 x 2-3 μm.

Cultural features: unknown.

Substrate: dead wood of undetermined dicots.

Distribution: Argentina, Bolivia, Brazil, Chile, Cuba. French Guyana, Guyana, Panamá, Paraguay and Venezuela. Pantropical according to Núñez & Ryvarden (1995b).

SPECIMENS EXAMINED — **ARGENTINA. Missiones:** Garuhapé, brook banks near Arboretum, 1.II.1962, leg. Wright *et al.* (BAFC 50827); Iguazú Nat'l Park, route 101 at Park entrance, 11-IV.1984, leg. Rajchenberg & Job M3736, M3750 (BAFC 30134, 30151); Yacuy, nr police squad., 22.IX.1984, leg. D. Job M3786 (BAFC 30414); Sendero Macuco, 22.IX.1984, leg. Job & Rajchenberg M3573 (BAFC 30047); 8.IV.1984, leg. Wright, Rajchenberg & Job M3652, M3677 (BAFC 30075, 30088); 23.IX.1984, leg. D. Job M3811, M3807 (BAFC 30412, 30416); 2.VI.1998, leg. R. M. Silveira, A. Fazio & E. Albertó 398 (BAFC 50783); 8.IV.1984, leg. Wright, Rajchenberg & Job M3673 (BAFC 30087); 23.IX.1984, leg. D. Job M3807, M3811 (BAFC 30416, 30412); forbidden zone, 300 m from boundary, 7.IV.1984, leg. Wright, Rajchenberg & Job M3630 (BAFC 30055). *Salta*: Gral. San Martín, Yacuy, 6.II.1965, leg. C. E. Gómez (BAFC 50830). **Tucumán:** Tafi Viejo, 7.II.1965, leg. Bettucci & Guerrero (BAFC 50831). **BOLIVIA. Beni:** Vaca Diez, Guayamerín, 8.III.1956, leg. Singer B1728 (LIL); 23.II.1956, leg. Singer B1386 (LIL). **BRAZIL.** leg. Spruce 195 (**HOLOTYPUS** of *Polyporus diabolicus* **K** 41844); 164 (**HOLOTYPUS** of *P. nephridius* **K** 60285); **Bahia:** leg. Blanchet (**HOLOTYPUS** of *P. blanchettianus* **PC**); **Minas Gerais:** Arrial des Merces, X.1840 (**HOLOTYPUS** of *P. infernalis* **K** 60280); **Paraná:** Curitiba, Parque Bariguí, 28.XI.1990, leg. A. de Meijer 1879 (Herb. Meijer); Morretes, Parque Morumbi, BR 277, 13.IV.1991, leg. A. de Meijer 1928 (Herb. Meijer); **Rio Grande do Sul:** Cambará do Sul, Aparados da Serra Nat'l Park, 19.XI.1987, leg. R. M. Silveira & R. T. Guerrero 041, 042 (ICN 80491, 80492); Canela, Parque do Pinheiro Grosso, 22.I.1997, leg. R. M. Silveira 312 (BAFC 50786); Tenente Portela, Parque Turvo, 7.VII.1975, leg. María Alves (BAFC 50834; ICN 6442); Torres, 22.XII.1979 (ICN 102073); Río do Terra, 28.II.1978, leg. U. Dias (ICN 102115); Viamão, Parque St.-Hilaire, 19.VI.1996, leg. R. M. Silveira 303 (BAFC 50787); **Santa Catarina:** Florianópolis, Saco Grande, UFSC-UCAD, 16.I.1998, leg. R. M. Silveira 348, 349 (BAFC 50788, 50789); **São Paulo:** Apiahy, IV.1888, leg. J. Puiggari (**HOLOTYPUS** of *Polystictus puiggarii* **LPS** 25780); Guarapi 1880, leg. Balansa 3408 (**HOLOTYPUS** of *Polyporus parvimarginatus* **LPS** 25206); Panuré, leg. Spruce 47 (**HOLOTYPUS** of *P. decolor* **K** 57286); 196 ex Herb. Berkeley (**HOLOTYPUS** of *P. rufo-atratus* **K** 60287); (**HOLOTYPUS** of *P. vernicosus* **K** 60294). **CHILE.** Corral, XII.1905, leg. R. Thaxter (BAFC 50828); *Juan Fernández:* leg. Bertero (**HOLOTYPUS** of *P. dictyopus* **PC**). **CUBA.** leg. C. Wright 354 (**HOLOTYPUS** of *P. hydniceps* **K** 57293). **FRENCH GUYANA.** Leprieur 573 (**HOLOTYPUS** of P. *rhizomorpha* **PC**). **PANAMA.** Chiriqui, Valley of upper Río Chirique, 7.IX.1935, leg. Martin 2678 (BPI, BAFC 29520), 1600-1800 masl. **USA.** *Alabama*: leg. Peters (**HOLOTYPUS** of *P. dibaphus* **K** 57287).

Remarks: The study of the holotypes of all the species names given above confirms their synonymy, which is shared by other workers (Núñez & Ryvarden, 1995b). Núñez & Ryvarden (op. cit.) consider *P. decolor* a synonym of *P. dictyopus*. However, we are

unable to confirm this synonmy: the type material is in such poor condition and the hyphae so collapsed that it is impossible to find skeleto-binding hyphae, the primary criterion for identifying the species. *Polyporus melanopus* also has a pileus surface brown to vinaceous brown, a dark stipe and small pores and some collections may be identified as *P. dictyopus*. Nevertheless, *P. melanopus* belongs to temperate cold zones and grows on wood of *Nothofagus*, whereas *P. dictyopus* is from tropical to subtropical zones and associated with various species of angiosperms.

8. *Polyporus gayanus* Lév., Ann. Sci. Nat., sér. III, 5: 54. 1846.

FIGURE 9 and PLATE 5C

= *Polyporus fuegianus* Speg., Bol. Acad. Nac. Cienc. Córdoba 11: 161. 1887.

Basidiocarp annual, dimidiate, flabelliform to conchoid or irregularly undulate, 45-75 x 35-55 mm and up to 5 mm thick when dry, resistant to woody, hard upon drying. **Pileus surface** glabrous, wrinkled when dry, sometimes slightly striate, light brown (10YR 6/6) to darker (10YR 5/4) when dry. **Margin** entire or lobed, recurved when dry. **Stipe** absent, adhered to substrate by a mere notch in the pileus margin, or by a more or less distinct mucro. **Hymenophore** cream coloured to light brown (10YR 7/4 to 6/4), or brown (10YR 4/4). **Pores** circular to angular when dry, 2-4 per mm, dissepiments with denticulate borders, tubes up to 2 mm long. **Context** homogeneous, cottony, white to cream coloured, up to 3 mm thick.

Hyphal system dimitic; generative hyphae clamped, hard to observe in dried specimens, thin-walled, hyaline, 2-5 μm in diam.; skeleto-binding hyphae thick-walled to solid, with the trunk branched, 2-6 μm in diam. and up to 8 μm in the context, hyaline to pale yellowish, dominating throughout the context and dissepiments. **Hymenium** formed by clavate, 4-spored basidia, 15-22 x 5-8 μm. **Basidiospores** cylindric to subellipsoid, thin-walled, hyaline, 8.5-10.5 x 2.5-3-5 μm.

Cultural features: Wright & Deschamps (1972); Rajchenberg & Greslebin (1995).

Substrate: dead wood of species of *Nothofagus*.

Distribution: S Argentina and Chile. Reported from New Zealand, according to Núñez & Ryvarden (1995b).

SPECIMENS EXAMINED — **ARGENTINA. CHUBUT:** Lago Puelo Nat'l Park, N bank, W piedmont of Valle de las Lágrimas, 4.V.1998, leg. R. M. Silveira & M. Rajchenberg 366 (BAFC 50745), on dead branch of *Nothofagus dombeyi* ("coihue"); Futaleufú, Cerro de la Torta, in *N. pumilio* woods, 5.V.1998, leg. R. M. Silveira and A. Greslebin 368, 369, 370, 371, 372, 373, 374 (BAFC 50746, 50747, 50748, 50749, 50750, 50751, 50752), on dead branches of *N. pumilio* ("lenga"); Los Alerces Nat'l Park, Lago Futalaufquen, path to Lago Krugger, 6.V.1998, leg. R. M. Silveira and M. Rajchenberg 375 (BAFC 50753); Lago Menéndez, S arm, 8.V.1998, leg. Ibid. 379 (BAFC 50754); Lago Rivadavia, camping area, 9.V.1998, leg. Ibid. 380, 381, 382, 383, 384 (BAFC 50755, 50756, 50757, 50758, 50759), on branches of *N. dombeyi* ("coihue"). **NEUQUÉN:** Lanin Nat'l Park, Lago Echulaufquen, II.1984, leg. C. A. Capelli (BAFC 29559); leg. Singer M1722 (BAFC 22336); Lago Frías (P. Alegre), 10.V.1961,leg. I. Gamundí (BAFC 21189); Quetrihué, 11.XI.1966, leg. Singer M6061 (BAFC 22450); 20.I.1976, leg. J. R. Deschamps (BAFC 50761), on branchlets of *N. dombeyi;* Villa La Angostura, 22.I.1971, leg. Pablo Wright (BAFC 22633), on dead branch of *N. dombeyi*.

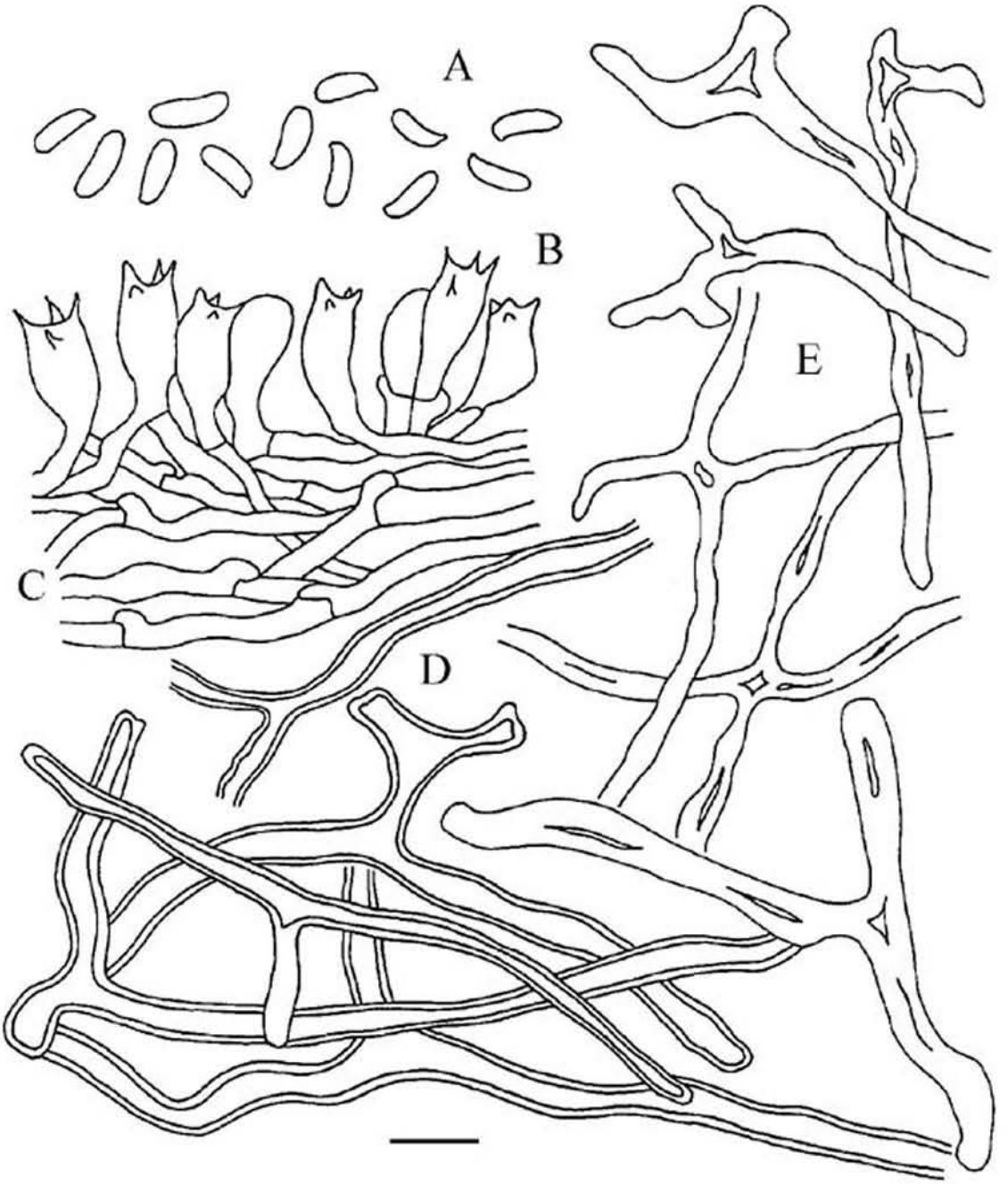

Figure 9: *Polyporus gayanus* (BAFC 50749). A) spores; B) basidia and basidioles; C) generative hyphae; D) skeleto-binding hyphae (context); E) skeleto-binding hyphae (dissepiments). Scale bar = 13 μm.

Río Negro: Cerro Catedral, 25.IV.1965, leg. Singer 5182B (BAFC 22449); Lago Roca, II.1981, leg. C. A. Capelli (BAFC 26685), on *Nothofagus*. **Tierra del Fuego:** Tierra del Fuego Nat'l Park, leg. J. E. Wright (BAFC 30666), on trunk of *Nothofagus*, site named Mallin (BAFC 30669); Lago El Indio, 29.I.1973, leg. Wright, Godeas & Del Busto (BAFC 22784), in reconstituted *N. pumilio* woods, road to Lapataia, passing the bridge; Lapataia, road to 2 de Mayo, II.1974, leg. C. E. Gómez (BAFC 50762); Glaciar Martial, 21.II.2000, leg. V. Suárez 6

(BAFC 50719), on dead fallen trunk, 800 m from entrance; Kosovo, 27.X.1989, leg. C. Loguercio Leite (BAFC 50760), on *Nothofagus*, Laguna Negra, 17.II.1974, leg. C. E. Gómez (BAFC 23218), on rotten trunk of *Nothofagus*; Ea. Nueva Argentina, 22.II.1950, leg. Singer M186 (BAFC 22634); USHUAIA: V.1882, leg. Spegazzini (**HOLOTYPUS** of *Polyporus fuegianus* **LPS** 24999).

Remarks: The conchoid basidiocarp lacking a proper stipe, and the large pores characterize this species, which is restricted to temperate zones with *Nothofagus* woods. Ryvarden (1991) erroneously synonymized the name *P. gayanus* with *Trametes marianna* (Pers.) Ryvarden, but it is a true *Polyporus*. Núñez & Ryvarden (1995b) consider it a good species.

9. *Polyporus guianensis* Mont. **var. *guianensis*,** Ann. Sci. Nat. Bot., sér. II, 13: 201. 1840. **FIGURE 10 and PLATE 2A**

= *Favolus melanopus* Mont., Ann. Mag. Nat. Hist, IV, 1: 136. 1854.- *Polyporus aemulans* Berk. & M.A. Curtis, J. Linn. Soc. Bot. 10: 304. 1868.- *P. seminigrita* Cooke, J. Linn. Soc. Bot. 15: 377. 1876.

Basidiocarp annual, central to sublaterally stipitate. **Pileus** circular to flabellate and infundibuliform, 23-25 mm in diam., 1-3 mm thick, coriaceous when fresh, rigid or breakable when dry. **Pileus surface** glabrous, smooth or with very fine radial striae, brown (5YR 5/6) to vinaceous brown (2.5YR 3/4) or beige (10YR 7/4). **Margin** entire, smooth. **Stipe** cylindric, sometimes slightly broadened at the base, 10-40 mm long, 2-4 mm in diam., woody, rigid when dry, dark brown (10YR 3/3 to 5YR 2/2). **Hymenophore** beige (10YR 7/4 to 6/4). **Pores** circular to angular, radially elongated, decurrent on the stem, 1-4 per mm, tubes 1-2 mm long. **Context** homogeneous, cottony, cream coloured to beige, up to 1 mm thick.

Hyphal system dimitic; generative hyphae clamped, hyaline, thin-walled, 2-5 μm in diam.; skeleto-binding hyphae very thick-walled, lumen visible to solid, 3-5.5 μm in diam., and up to 8 μm in the context, yellowish, branched and tortuous, dominating throughout the pileus. **Stipe** cortex formed by a single visible layer, composed of much appressed cells, appearing as an epithelium, more isodiametric outwardly, finally appearing in the surface as inflated elements provided with digitiform projections or short horns, 13-15 x 4-11 μm, all the layer masked by a melanoid substance. **Hymenium** formed by clavate, 4-spored basidia, 22-35 x 6-8 μm. **Basidiospores** cylindric to subellipsoid, thin-walled, hyaline, 8-12 x 2.5-4 μm.

Cultural features: Núñez & Ryvarden (1995b).

Substrate: dead wood of undetermined dicots.

Distribution: Argentina, Brazil, Chile, Colombia, Cuba, French Guyana, Guyana, Paraguay and Venezuela. According to Núñez & Ryvarden (1995b) it occurs in tropical Asia and South America, apparently not common.

SPECIMENS EXAMINED — **ARGENTINA. MISIONES:** Iguazú Nat'l Park, 16.V.1993, leg. Wright, Moreno & Altés (BAFC 33642); road to Apepú, 8.III.1979, leg. Wright, Deschamps & Del Busto M3380 (BAFC 31989). **TUCUMÁN:** Horco Molle, 9.IV.1987, leg. D. Job 3927 (BAFC); Tafí Viejo, 7.II.1965, leg. Bettucci & Guerrero (BAFC, 2 collections). **BRAZIL. AMAZONAS:** Juruá, 1900, leg. Ule (ex NY, BAFC 27462); **BAHIA:** leg. Torrend (CGL Herb. 43255, BPI); **PARÁ:** Obydos, 1874, leg. Traill

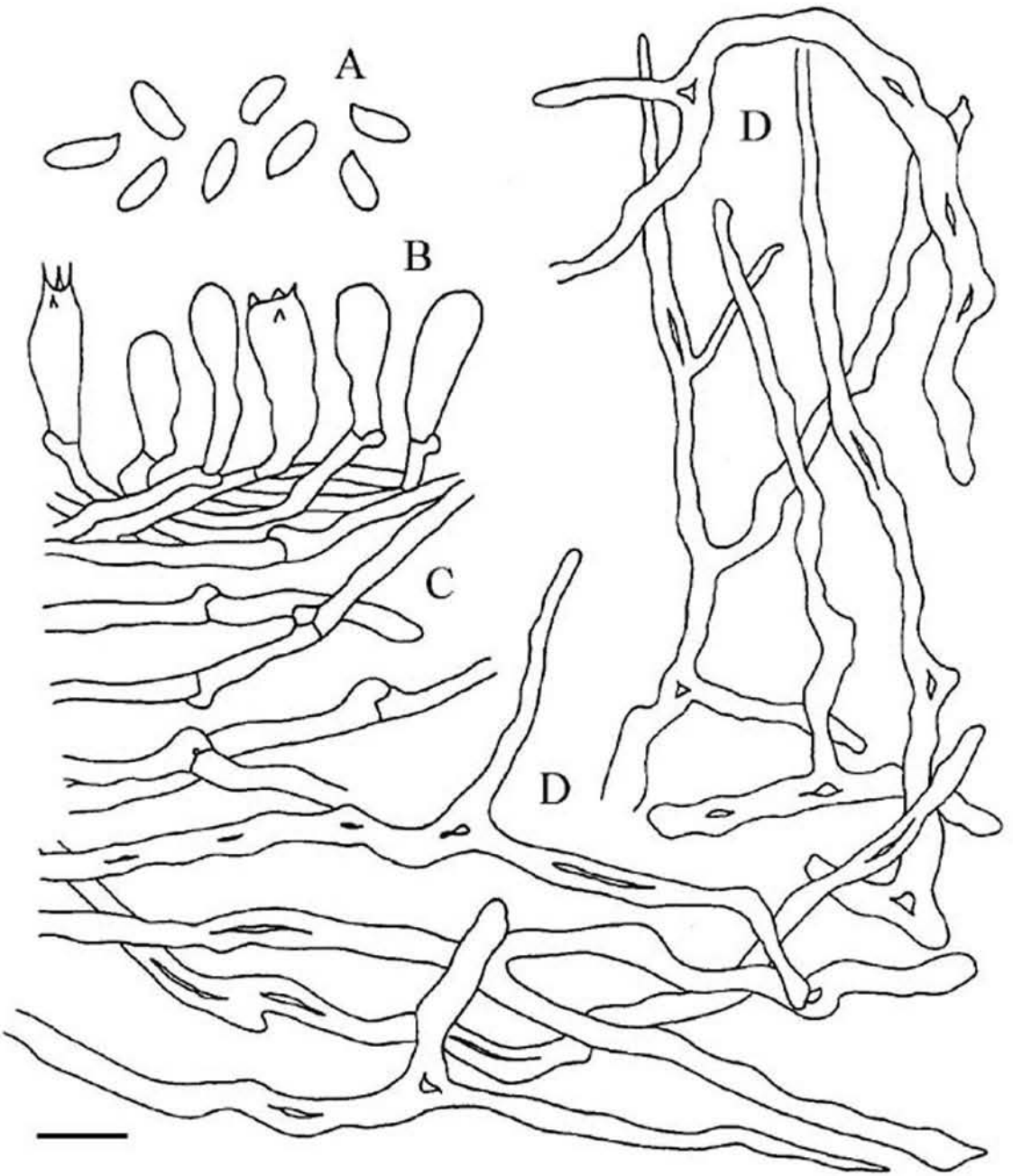

Figure 10: *Polyporus guianensis* (BAFC 50839). A) spores; B) basidia and basidioles; C) generative hyphae; D) skeleto-binding hyphae. Scale bar = 13 μm.

102 (**HOLOTYPUS** of *Polyporus seminigrita* **K** 60289); **Paraná:** Curitiba, Parque Barigüi, 26.I.1998, leg. R. M. Silveira & A. de Meijer 355, 356, 357, 358, 359 (BAFC 50795, 50807, 50808, 50809, 50810). **CUBA.** leg. C. Wright 91 (**HOLOTYPUS** of *P. aemulans* **K** 57281). **FRENCH GUYANA.** Cayenne, leg. Leprieur 538 (**HOLOTYPUS** of *P. guianensis* **PC**); leg. Leprieur(**HOLOTYPUS** of *Favolus melanopus* **PC**); Montsinery, concession des F.R.G., piste des Risquetonit, 15 km from DR5, 12.XII.1979, leg. H. Jacquenin 2437 (ex PC, BAFC 26953). **VENEZUELA.** Isla El Ratón, 31.V.1940, leg. L. Williams 13200 (BAFC 50837).

10. *Polyporus guianensis* var. *puttemansii* (Henn.) R.M. Silveira & J.E. Wright, **comb. nov.** **FIGURE 10 and PLATE 2B**

Basionym: *Polyporus puttemansii* Henn., Hedwigia 43: 200. 1904.

It is distinguished from var. *guianensis* by the following characters: pileus large, 20-110 mm in diam. and 10-80 mm high, margin concolorous with the pileus surface, stem insertion with a tendency to be central; pores with a tendency to be more ellipsoid to angular, and of larger size, 0.5-1.5 per mm.

SPECIMENS EXAMINED — ARGENTINA. MISIONES: Bernardo de Irigoyen, 27.II.1960, leg. M. Ledda & R. T. Guerrero 94 (BAFC 50838); Iguazú Nat'l Park, route 101 to Sto. Domingo, left of road towards Yacuy, 9.IV.1984, leg. Wright, Rajchenberg & Job M3721 (BAFC 30122); **TUCUMÁN:** Horco Molle, nursery, 11.IV.1987, leg. D. Job & A. Hladki 3992 (BAFC 50839). **BRAZIL. PARANÁ:** Curitiba, Parque Barreirinha, 19.I.1989, leg. A. de Meijer 1197 (BAFC 50840); Parque Marumbi, 7.V.1992, leg. A. de Meijer 2250 (BAFC 50844); **RIO GRANDE DO SUL:** Cambará do Sul, Aparados da Serra Nat'l Park, 27.XII.1988, leg. R. M. Silveira & R. T. Guerrero 162 (ICN 80493).

Remarks: Although some authors consider Hennings' epithet as synonymous with *P. guianensis*, we have treated *P. puttemansii* as a variety because the differences from the type appear stable and have been found in several collections (see Table 1). Lloyd (1910) reached a similar conclusion.

11. *Polyporus leprieurii* Mont., Ann. Sci. Nat. sér. II, 13: 203. 1840.

FIGURE 11 and PLATES 2C, 5D

= *Polyporus tephromelas* Mont., Ann. Sci. Nat. sér. II, 13: 203. 1840.

Basidiocarp annual, lateral to sublaterally stipitate. **Pileus** flabelliform, 17-50 x 23-35 mm and 0.5-1 mm thick, coriaceous when fresh, breakable when dry. **Pileus surface** glabrous, smooth or with fine radial striae, sometimes concentrically undulate; brown (10YR 4/3 to 5/6) to tobacco brown (10YR 4/4). **Margin** lobate, concolorous with the surface of pileus. **Stipe** cylindric, sometimes slightly broadened at the base, 5-50 mm long, 1-3 mm in diam., fragile to woody, breakable to rigid when dry, dark brown (10YR 3/2) to black (10YR 2/2), and may elongate to form rhizomorphs. **Hymenophore** brown (10YR 5/4) to tobacco brown (10YR 3/4 to 4/4). **Pores** circular to angular when dry, uniformly distributed, 5-9 per mm, tubes 0.1-0.2 mm long. **Context** homogeneous, cottony, brown when dry, up to 1 mm thick.

Hyphal system dimitic; generative hyphae clamped, hyaline, thin-walled, 2-4 μm in diam.; skeleto-binding hyphae with very thickened walls, lumen visible to solid, 2.5-4 μm diam.and up to 9 μm in the context, yellowish, branched and tortuous, dominating throughout the pileus, variably dextrinoid in the dissepiments. **Stipe cortex** formed by a single layer composed of much appressed, polyhedric cells with sinuous walls, forming outwardly large, cylindric-clavate, thick-walled projections, 4-5.6 μm diam, and bulbiform endings with a much thinner, blunt rostrum, 1-2 μm diam; all the layer is masked by a melanoid substance. **Hymenium** formed by clavate, 4-spored basidia, 17-23 x 4-6 μm. **Basidiospores** subcylindric to ellipsoid, thin-walled, hyaline, 7-11 x 2.5-4 μm.

Cultural features: unknown.

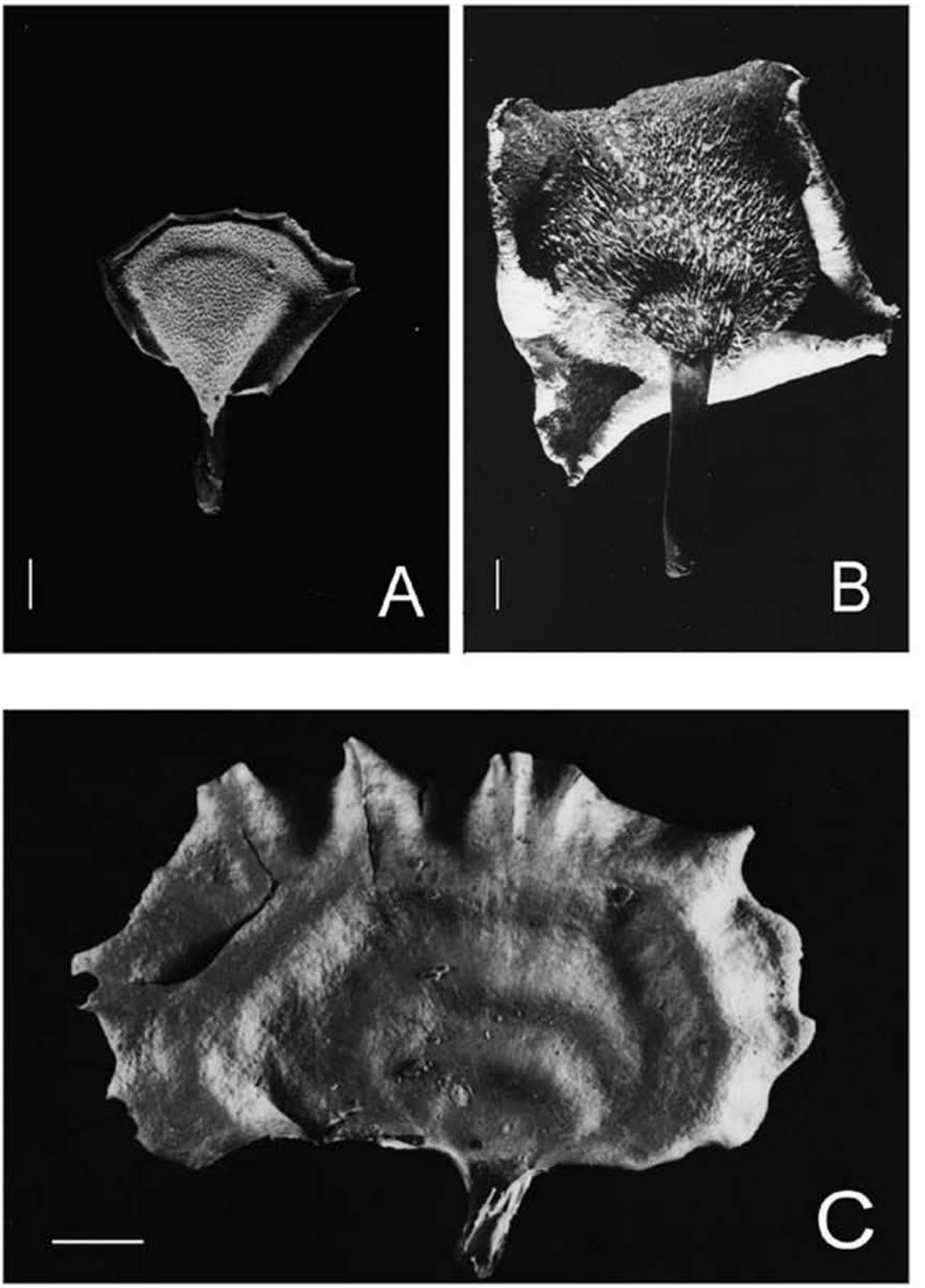

Plate 2. A) *Polyporus guianensis* var. *guianensis* (BAFC 50809). B) *P. guianensis* var. *puttemansii* (BAFC 50844). C) *P. leprieurii* (Guyana – FH). Scale bar = 10 mm.

Substrate: dead wood of undetermined dicots.

Distribution: NE Argentina, Brazil, Colombia, Costa Rica , French Guyana, Guyana, Perú, Surinam, Trinidad and Venezuela. According to Núñez & Ryvarden (1995b), it is a tropical to subtropical species of South America and E Asia.

SPECIMENS EXAMINED—ARGENTINA. MISIONES: Iguazú Nat'l Park, 5.III.1982, leg. M. Grosso M3493 (BAFC 28296); route 101, entrance to Park, 11.IV.1984, leg. Rajchenberg & Job M3749 (BAFC 30143); Sendero Macuco, 5.VI.1998, leg. R. M. Silveira, A. Fazio & E. Albertó 418 (BAFC 50784). **BRAZIL. AMAZONAS:** VIII, 1901, leg. E. Ule 2760 (FH); VII.1961, leg. H. Cordeiro (ICN 102497); **PARANÁ:** Morretes, P. E. Marumbi, 15.III.1987, leg. A. de Meijer 796 (BAFC 31307); **RIO GRANDE DO SUL:** Barra do Ribeiro, Horto Florestal Barba Negra (Riocell), 13.XI.1996, leg. R. M. Silveira 302 (BAFC 50785) on stump of felled *Eucalyptus*; **SANTA CATARINA:** Florianópolis, Saco Grande UFSC-UCAD, 16.I.1998, leg. R. M. Silveira 350, 351, 353 (BAFC 50790, 50791, 50792); Prov.?, Araguarí, leg. Furtado (ex SP). **COSTA RICA:** Jocasal, 1.VI.1928, leg. Karl A. Danielson 181 (BAFC 50324). **FRENCH GUYANA:** Cayenne, leg. Leprieur 531 (**HOLOTYPUS** of *Polyporus leprieurii* **PC**); leg. Leprieur (**HOLOTYPUS** of *P. tephromelas* **PC**). **GUYANA:** 17.XII.1923 (FH).

Remarks: *Polyporus leprieurii* is characterized by its flabelliform basidiocarp, with a black, lateral stipe, tobacco brown pileus, and small pores. The closest species is *P. guianensis* whose larger pores allow an easy separation.

Table 1. Comparison between *P. leprieurii*, *P. guianensis*, and *P. guianensis* var. *puttemansii*

	P. leprieurii	*P. guianensis var. guianensis*	*P. guianensis var. puttemansii*
Pileus colour	brown to tobacco brown	beige to brown	cream colour to beige
Margin colour	concolorous with pileus surface	vinaceous brown	concolorous with pileus surface
Stipe insertion	lateral to sublateral	central to sublateral	central
Pore arrangement	uniformly distributed	radially elongated	radially elongated
Pore shape	Circular to angular	elongated hexagonal	ellipsoid to angular
Pore size	5-9 per mm	1-4 per mm	0.5-1.5 per mm
Spore size	(5.5) 6.5-10 x 2-4μm	8.5-12 x 3-4μm	8-10.5 x 2.5-4μm
Q (spores)	2.5-3μm	2.1-3.4μm	2.3-3.4 μm
IKI	dissepiments dextrinoid	negative	negative

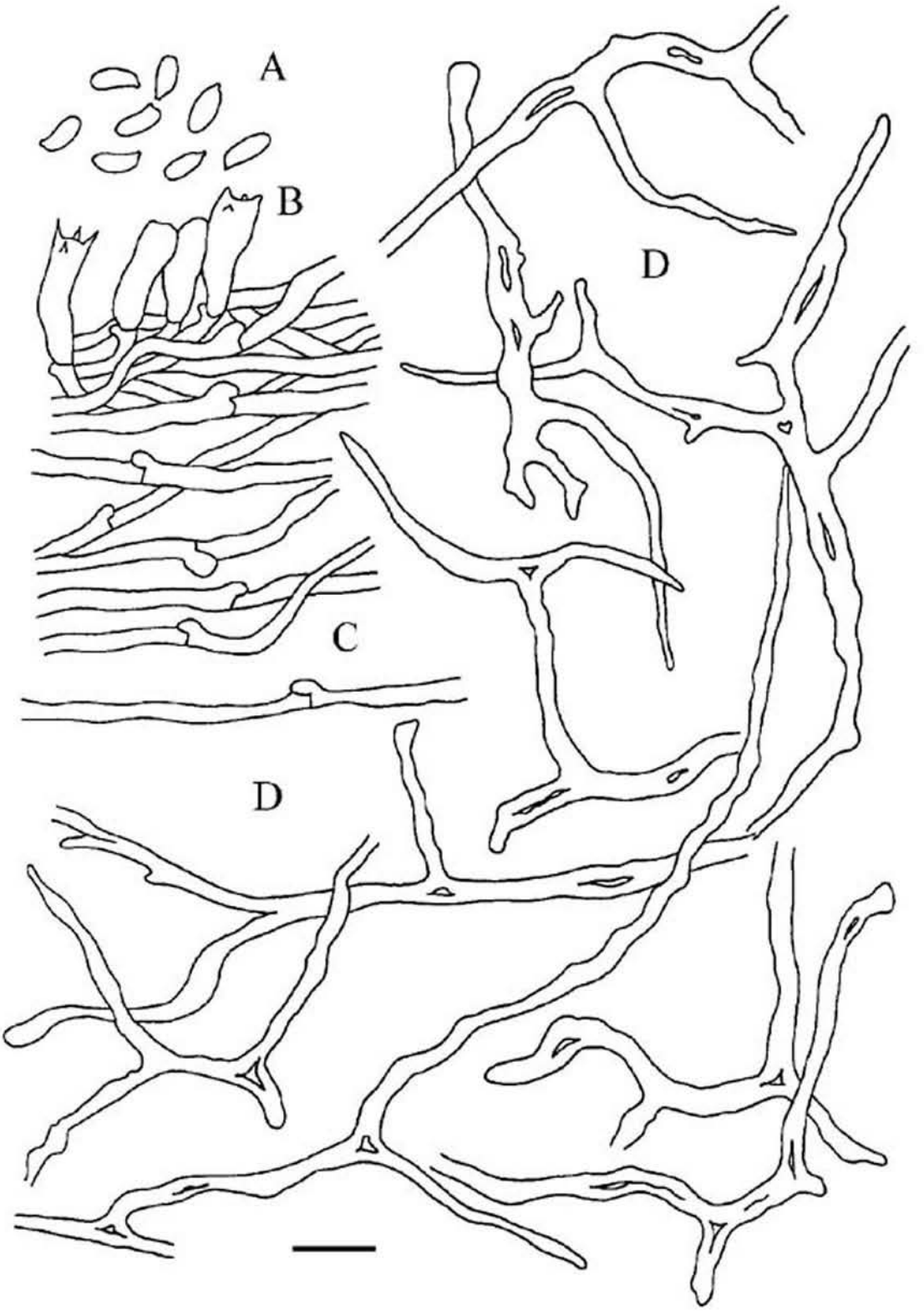

Figure 11: *Polyporus leprieurii* (Ule 2760). A) spores; B) basidia and basidioles; C) generative hyphae; D) skeleto-binding hyphae. Scale bar = 13 μm

12. *Polyporus melanopus* (Pers. : Fr.) Fr., Syst. Mycol. 1: 347. 1821.

FIGURE 12 and PLATE 5B

= *Boletus melanopus* Pers., Tent. Disp. Meth. Fung.: 70, 1797.- *Polyporus fissus* Berk., Hooker London J. Bot 6: 318. 1847.

Basidiocarp annual, solitary to cespitose, central, eccentrical to sublaterally stipitate. **Pileus** infundibuliform, semicircular to irregularly circular, finally festooned-lobed, 35-120 mm in diam., 20-80 mm high, 1-4 mm thick, coriaceous to woody when fresh, breakable to rigid when dry. **Pileus surface** glabrous, smooth, wrinkled when dry, dark brown (10YR 3/2 to 7.5YR 3/2) to brown (5YR 3/4). **Margin** smooth to lobed-festooned, involute when dry. **Stipe** cylindric to flattened, slightly broadened basally, 6-50 mm long, 7-13 mm in diam., woody, very rigid and wrinkled when dry, surface velutinous, dark brown (10YR 3/2). **Hymenophore** cream coloured (2.5YR 7/4) to beige (10YR 5/4) or brown (7.5YR 5/6). **Pores** circular to angular when dry, decurrent on stem, 3-7 per mm, tubes 1-2 mm long. **Context** homogeneous, corky to woody, cream coloured to beige, 1.5-3 mm thick.

Hyphal system dimitic; generative hyphae clamped, hyaline, thin- to slightly thickened walls, 2-6 μm in diam.; skeleto-binding hyphae very thick-walled, lumen visible to solid, 2.5-5 μm in diam. and up to 6 μm in the context, yellowish, much branched, dominating throughout the context and dissepiments. **Stipe cortex** formed by a basal layer composed of appressed hyphae, more or less quadrangular in shape, with sinuous walls, and an external layer of clavate, very thick-walled elements, 20-22 x 5-8 μm, arranged in a loose palisade, its thickness equal to that of the basal layer, masked by a melanoid substance that forms an external band. **Hymenium** formed by clavate, 4-spored basidia, 16-24 x 5.5-8 μm. **Cystidioles** rostrate, 18-32 x 4-6 μm, present among the basidia. **Basidiospores** subcylindric to ellipsoid, thin-walled, hyaline, 6.5-9 x 3-4 μm.

Cultural features: Nobles (1958, 1971); Siepmann (1971); Wright & Deschamps (1972); Deschamps & Wright (1975); Stalpers (1978).

Substrate: on dead wood of *Araucaria araucana, Aristotelia maqui, Austrocedrus chilensis, Maytenus boaria, Nothofagus antarctica* and *N. dombeyi*.

Distribution: S Argentina and Chile, Brazil (Amazonas?). Circumpolar in temperate zones, according to Núñez & Ryvarden (1995b).

SPECIMENS EXAMINED — ARGENTINA. CHUBUT: Lago Puelo Nat'l Park, N bank, W piedmont of the Valle de las Lágrimas, 4.V.1998, leg. R. M. Silveira & M. Rajchenberg 360 (BAFC 50767), on *Aristotelia maqui*; ibid., 361, 362, 363, 364, 365, 367 (BAFC 50768, 50769, 50770, 50771, 50772, 50773), on *Nothofagus dombeyi*; Los Alerces Nat'l Park, Río Arrayanes, nr. Park Headq., 5.VI.1999, leg. M. Rajchenberg 11945 (BAFC 50781), on felled trunk in *N. dombeyi* and *A. chilensis* woods; Lago Futalaufquen, path to Lago Krugger, 6.V.1998, leg. R.M. Silveira & M. Rajchenberg 376, 377, 378 (BAFC 50774, 50775, 50776, on fallen *Maytenus boaria*; Lago Rivadavia, camping area, 9.V.1998, leg. R. M. Silveira & M. Rajchenberg 385 (BAFC 50777), on *N. antarctica* ("ñire"). **NEUQUÉN:** Lago Nahuel-Huapi, Villa La Angostura, 30.IV.1958, leg. C. Pujals & I. Gamundí (BAFC 20382): Nahuel-Huapi Nat'l Park, Villa Tacul, 20.III.1963, leg. I. Gamundí (BAFC 21314), on dead trunk of *Nothofagus* ("coihue"); Lanin Nat'l Park, Tromen, 20.V.1999, leg. M. Rajchenberg 11935 (BAFC 50782),

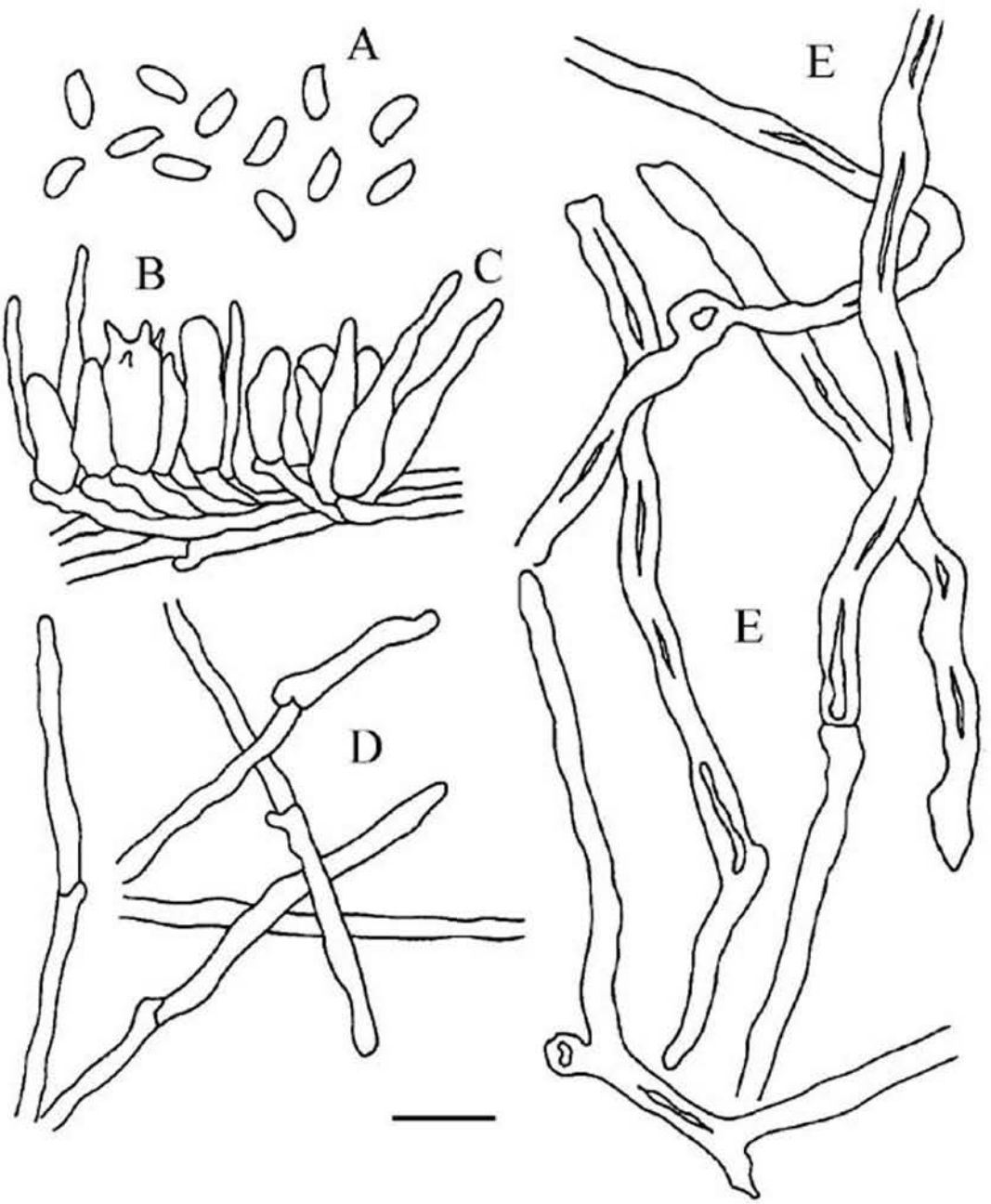

Figure 12: *Polyporus melanopus* (BAFC 50768). A) spores; B) basidia; C) rostrate cystidioles; D) generative hyphae; E) skeleto-binding hyphae. Scale bar = 13 μm.

on stump of *Araucaria araucana*; Puerto Manzano, 26.IV.1963, leg. Singer M3605 (BAFC 22636); 8.IV.1965, leg. Singer (BAFC 34712); 18.IV.1965, leg. Singer M5039 (BAFC 34711); III.1965, leg. J. Diem 3258 (BAFC 34712, *"in silva nothofagineo-austrocedrina"*; Selva Triste, 21.I.1971, leg. J. E. Wright (BAFC 22448), on dead fallen trunk of *Nothofagus* sp. **Río Negro:** Bariloche, Mallín Ahogado, Río Azul, 15.V.1998, leg. R. M. Silveira & M. Rajchenberg 386, 387, 388 (BAFC 50778, 50779, 50780); Lago Nahuel-Huapi, Brazo Tristeza, 7.V.1964, leg. Singer M3976 (BAFC 22582); Lago Guglielmo, 20.I.1974, leg. G. Rosso (BAFC 50835); Lago Gutiérrez, 11.V.1978,

leg. J. R. Deschamps (BAFC 50836), on *N. dombeyi*. **Tucumán:** Ciudad Universitaria, 12.I.1959, leg. Singer (BAFC 34713), on dead undetermined trunks. **CHILE:** *Magallanes*: Puerto Natales, P. Antonio Vares, 12.III.1984, leg. Bresinsky & Garrido (BAFC 30728), on trunk of *N. antarctica*; *Talca*: San Clemente, Parque Gil de Vilches, 12.IV.1980, leg. Garrido (BAFC 30729), on rotten trunks of "hualle". **USA. North Carolina:** Waynesville (**HOLOTYPUS** of *Polyporus fissus* **K** 57289). Collection data unknown (Presumed **HOLOTYPUS** of *P. melanopus* **K** 82679).

Remarks: According to Núñez & Ryvarden (1995b), *Polyporus melanopus* has large pores (3-4 per mm). All our collections have smaller pores (3-7 per mm) and the holotype of the species has pores 5-8 per mm. Furthermore, the former authors consider *P. fissus* Berk. a synonym of *P. melanopus*. We have also studied the holotype of *P. fissus* and found it has 10-12 pores per mm. Therefore, both holotypes studied are nearer to the pore dimensions of our collections. *Polyporus dictyopus* is very similar morphologically to *P. melanopus*, both species have small pores, differing mainly in the type of substrate and distribution (Silveira & Wright, 2002).

13. *Polyporus philippinensis* Berk., Hooker London J. Bot. 1: 148. 1842.

Figure 13 and Plate 6D

= *Favolus fibrillosus* Lév., Ann. Sci. Nat, sér. III, 2: 201. 1844.- *F. junghuhnii* Lév. Ann. Sci. Nat., sér. III, 2: 202. 1844.

Basidiocarp annual, laterally stipitate. **Pileus** flabelliform to lobate or semiinfundibuliform, 30-95 x 25-80 mm and 2-8 mm thick, coriaceous to rigid when dry. **Pileus surface** glabrous, smooth to radially striate, beige (2.5YR 7/4) to light brown (2.5YR 6/4) when fresh, cream coloured (2.5YR 8/4) to light brown (10YR 7/6 to 5/4) when dry. **Margin** entire or scooped, fertile below or with a sterile band. **Stipe** a disciform pseudostipe or a mere attenuated, eccentric prolongation of the pileus, 3-12 mm in diam., resistant, hard, concolorous with the pileus surface. **Hymenophore** cream coloured (2.5YR 8/4) to beige (10YR 7/6 to 6/6). **Pores** circular to angular, 1-2 per mm when fresh, radially elongated, 1-3 per mm when dry, tubes 2-5 mm long. **Context** homogeneous, waxy to cottony, white to cream coloured, 1-5 mm thick.

Hyphal system dimitic; generative hyphae tenuous, scantily clamped, hyaline, thin-walled, 2-7 μm in diam.; skeleto-binding hyphae thick-walled to solid, 2.5-11 μm in diam., pale yellowish, moderately branched, abundant in the dissepiments and context. **Hymenium** formed by clavate, 4-spored basidia, 20-30 x 6-7 μm. **Basidiospores** cylindric to ellipsoid, thin-walled, hyaline, 7-10(-11) x 3-4 μm. **Cultural features:** Stalpers (1978); De (1977); De & Roy (1981).

Substrate: dead wood of undetermined dicots.

Distribution: NE Argentina, Brazil, Indonesia and Philippines. According to Núñez & Ryvarden (1995b), in tropical and subtropical regions, rare in Africa.

SPECIMENS EXAMINED — ARGENTINA. Misiones: Manuel Belgrano, IFONA, 14.IX.1978, leg. Wright, Del Busto & Cabral (BAFC 25174), on rotten trunk in forest, whitish-cream; Iguazú Nat'l Park, Sendero Macuco, 6.IV.1984, leg. Job & Rajchenberg M3563 (BAFC 30.008); 2.VI.1998, leg. R. M. Silveira & A. Fazio 397, 419 (BAFC 50765, 50766). **BRAZIL. Amazonas:** Manaus, Reserva Ducke, 13.V.1977, leg. M. A. Sousa (BAFC 25199), on dry trunk; **Rio Grande do Sul:** Nova Petrópolis, mato

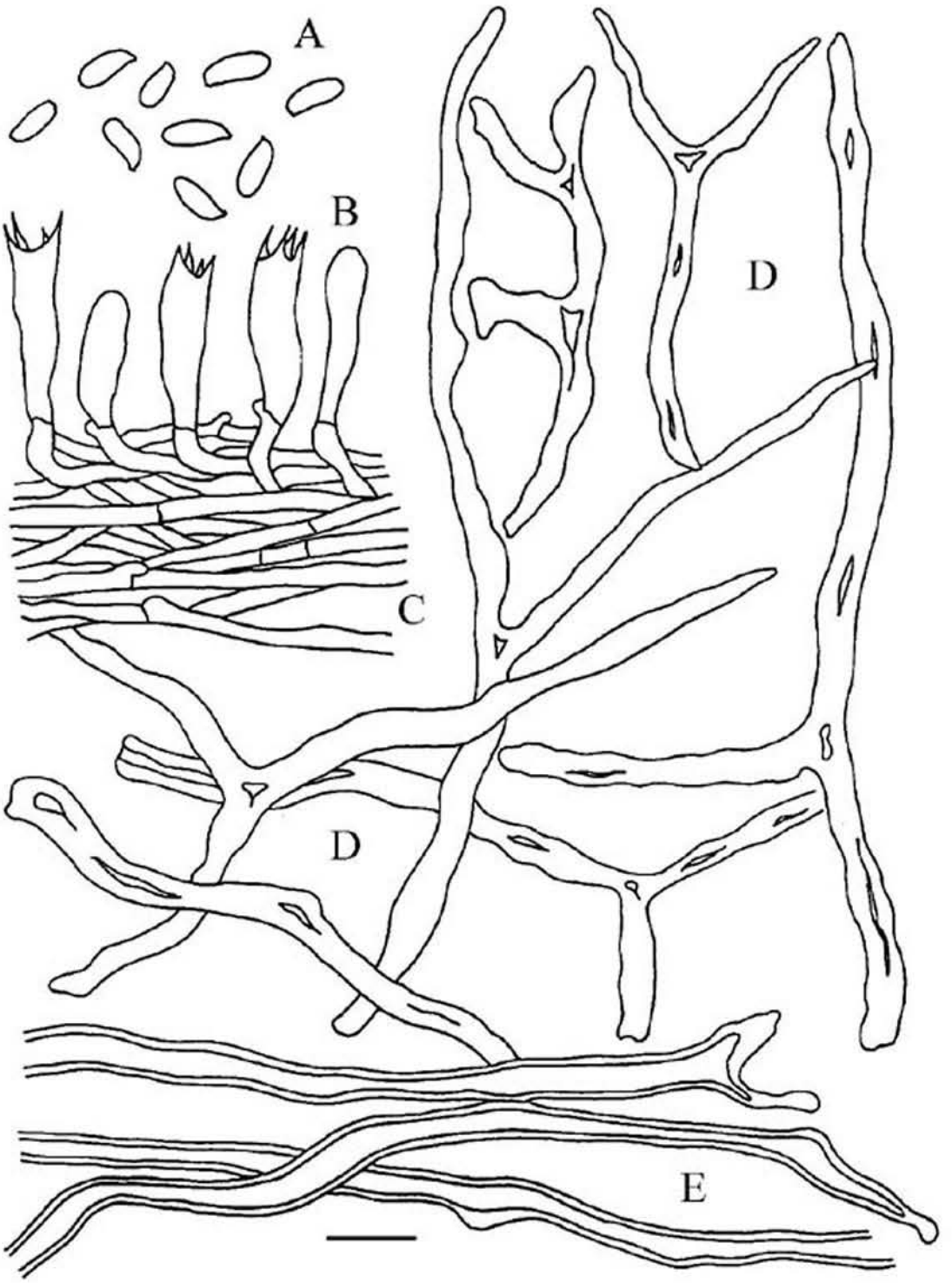

Figure 13: *Polyporus philippinensis* (BAFC 50763). A) spores; B) basidia and basidioles; C) generative hyphae; D) skeleto-binding hyphae (dissepiments); E) skeleto-binding hyphae (context). Scale bar = 13 μm.

dos atiradores, 8.VIII.1997, leg. R. M. Silveira 315 (BAFC 50763); mato do Lenz, leg. R. M. Silveira 316 (BAFC 50764). **PHILIPPINES:** (**HOLOTYPUS** of *Favolus? philippinensis* **K** 60286). **INDONESIA:** Java, Batam (**HOLOTYPUS** of *Favolus junghuhnii* **PC**); Manila (**HOLOTYPUS** of *F. fibrillosus* **PC**).

Remarks: *Polyporus philippinensis* has been many times mistaken with *P. tenuiculus*, from which it may be distinguished by the light brown colour of the pileus surface with fine radial striae and its firmer consistency; furthermore the pores are somewhat smaller than in *P. tenuiculus*. In herbarium specimens, these differences are more difficult to observe. Some crossings between *P. philippinensis* and *P. tenuiculus* were negative, confirming that these species are different (Silveira & Wright, 2002).

14. *Polyporus rhizophilus* Pat., Journ. Bot. 8: 219. 1894.

Figure 14 and Plates 3A, 5F

Basidiocarp annual, central to eccentrically stipitate. **Pileus** circular, 13-25 mm diam., and up to 3 mm thick, woody, rigid when dry. **Pileus surface** glabrous, smooth, wrinkled when dry, beige (10YR 6/4) to greyish beige (10YR 7/2). **Margin** entire or slightly lobed, smooth. **Stipe** cylindric, slightly broadened at the base, glabrous, 10-20 mm long and 2-4 mm in diam., woody, rigid when dry, dark brown (10YR 3/3). **Hymenophore** yellowish (10YR 6/6) to beige (10YR 6/4). **Pores** circular to angular when dry, 3-4 per mm, tubes up to 2 mm long. **Context** homogeneous, cottony, white, up to 3 mm thick.

Hyphal system dimitic; generative hyphae clamped, hyaline, thin- to slightly thickened walls, 2.5-6 μm in diam., very abundant throughout the fruitbody; skeleto-binding hyphae thick-walled, lumen generally visible, sometimes solid, 2.5-5.5 μm diam., hyaline, scantily branched, abundant in all the pileus. **Stipe cortex** formed by a pseudohymeniodermis of clavate, thick-walled elements with narrow lumen, forming a single coloured layer 10-15 μm thick.

Hymenium formed by clavate, 4-spored basidia, 17-25 x 5-8 μm. **Basidiospores** cylindric to fusoid or subellipsoid, thin-walled, hyaline, 8-12 x 3.5-4 μm.

Cultural features: unknown.

Substrate: on roots of living grasses, mostly species of the genus *Stipa*.

Distribution: Argentina. The species is rare and known only from fields of S. and Central Europe, Morocco, Central Asia and Central US, according to Núñez & Ryvarden (1995b).

SPECIMENS EXAMINED — ARGENTINA. Corrientes: Mburucuyá, Ea. Sta. Teresa, 14.V.1969, leg. Pedersen (BAFC 50940). **CZECHOSLOVAKIA. Bohemia Centralis:** Praha-Podbaba, in saxis ad Sedlec, 12.VI.1971, leg. Z. Pouzar (BAFC 50841), at the base of living *Stipa capillata*. **Collection observed in the area: ARGENTINA. Buenos Aires:** Villa Gesell, II.1972, leg. J. E. Wright, on culms of living *Stipa* sp. in maritime dunes (material lost).

Remarks: Due to the loss of part of the local material, the description given is based primarily on the Czech collection. It is possible that we are dealing with a species parasitic on grasses and introduced with them, particularly in species of *Stipa* employed for the fixation of dunes.

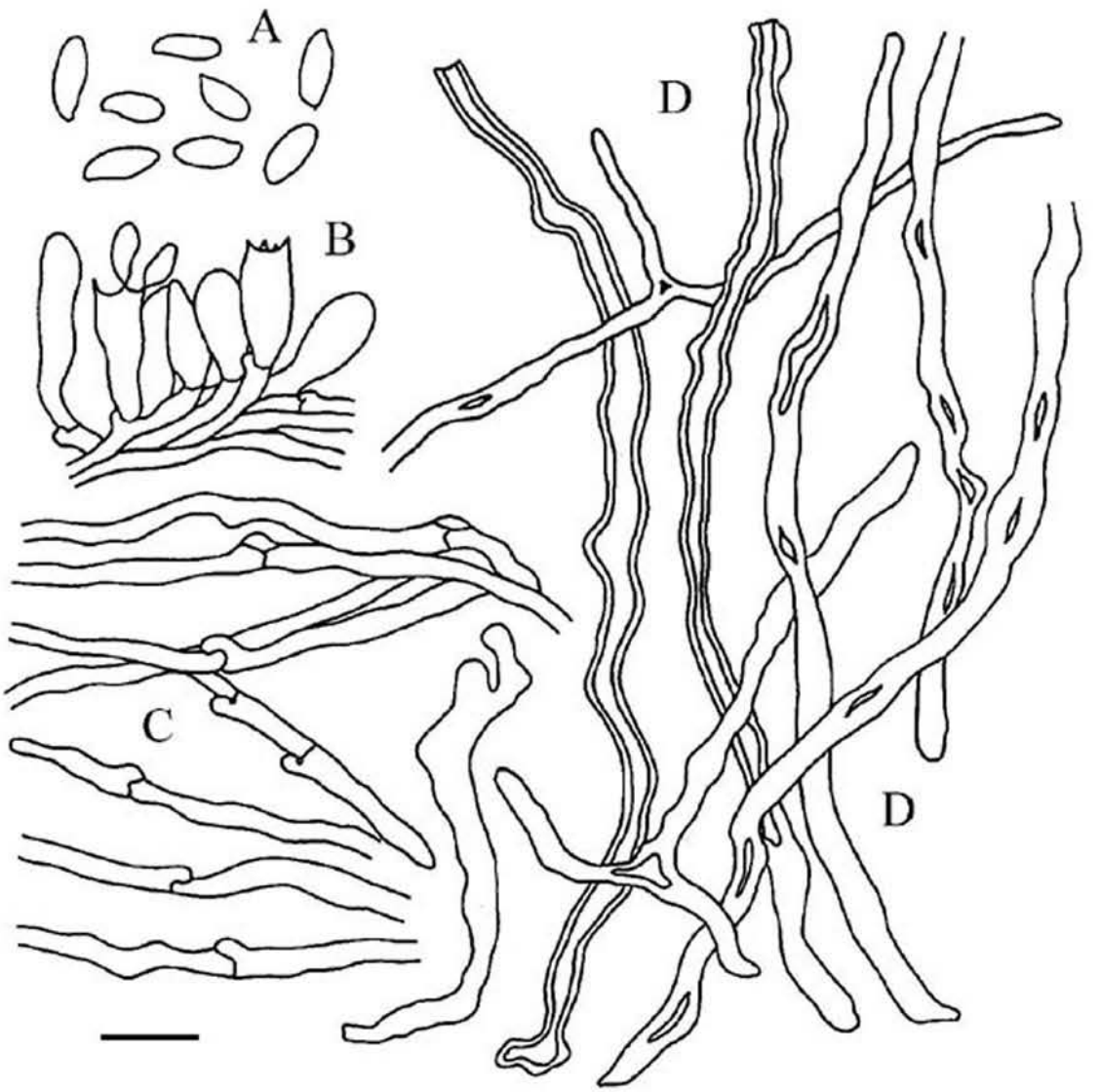

Figure 14: *Polyporus rhizophilus* (BAFC 50841). A) spores; B) basidia and basidioles; C) generative hyphae; D) skeleto-binding hyphae. Scale bar = 13 μm.

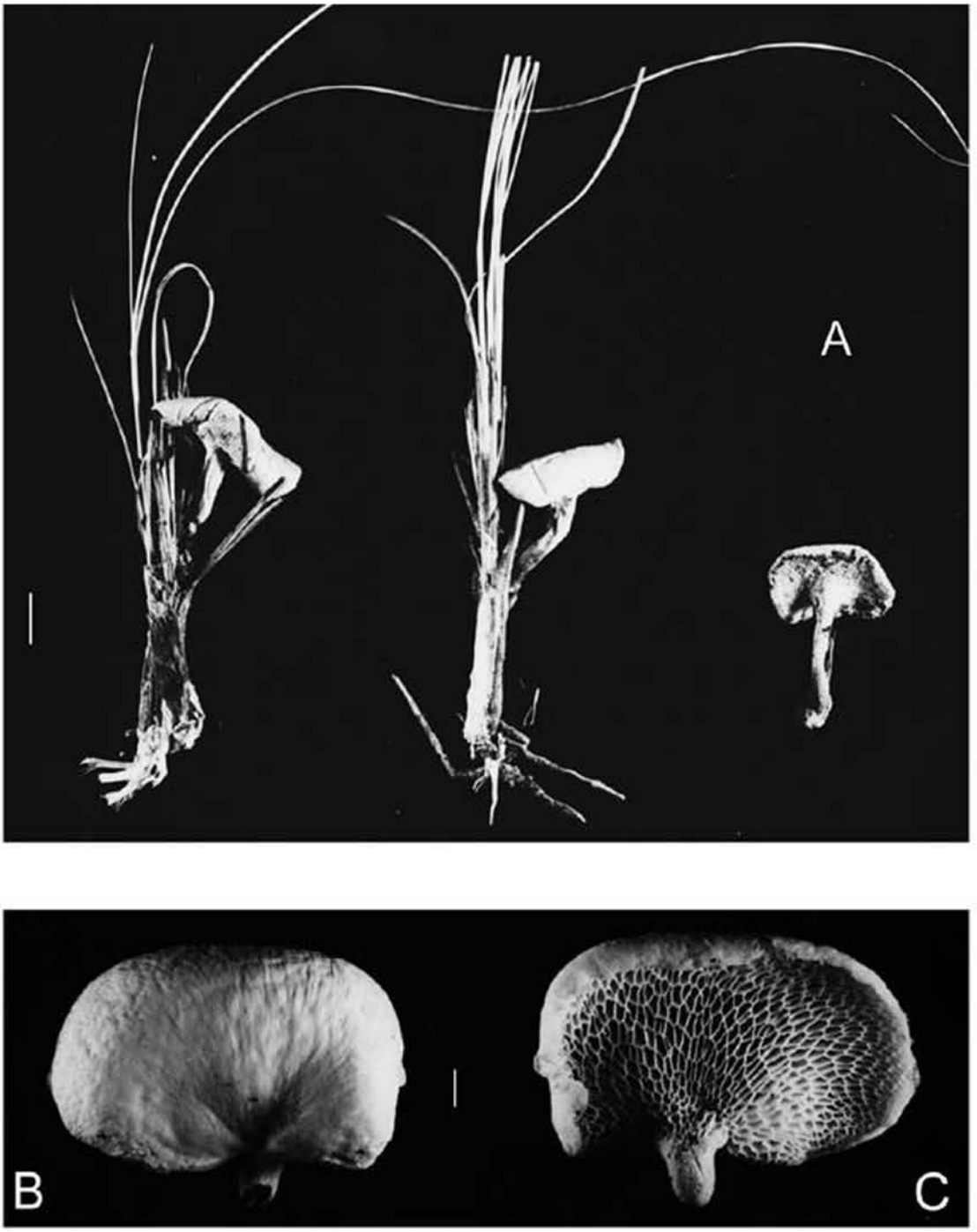

Plate 3. A) *Polyporus rhizophilus* (BAFC 50841). B, C) *P. tenuiculus* (BAFC 50332). Scale bar = 20 mm.

15. *Polyporus saltensis* (Speg.) R.M. Silveira & J.E. Wright, **comb. nov.**

FIGURE 15 and PLATE 6C

Basionym: *Favolus saltensis* Speg., An. Mus. Nac. Buenos Aires 6: 176. 1898.

Basidiocarp annual, solitary to imbricate, lateral to eccentrically stipitate. **Pileus** flabelliform to almost circular, 15-100 x 20-65 mm and up to 3 mm thick, fleshy when fresh, fragile, breakable and very light when dry. **Pileus surface** glabrous, with fine radial striae, white to yellowish when fresh, beige (10YR 7/6 to 6/6) to brown (10YR 5/8) when dry. **Margin** entire to lobed, smooth, slightly involute when dry, sometimes darker than the pileus surface. **Stipe** cylindric, short or reduced to a disciform pseudostipe, 3-15 mm long and 2-9 mm diam., rigid when dry, surface glabrous, smooth when dry, concolorous with pileus. **Hymenophore** beige (10YR 8/4) to light brown (10YR 6/6) when dry. **Pores** circular to angular, radially elongated, 1.5-3 per mm, tubes up to 1.5 mm long. **Context** homogeneous, cottony, beige, up to 2 mm thick.

Hyphal system dimitic; generative hyphae without clamps, simple septate, hyaline, thin-walled, 3-7 μm in diam., abundant in all the fruitbody; skeleto-binding hyphae thick-walled, lumen visible to solid, 3-7 μm in diam., hyaline to pale yellowish, fairly branched, abundant throughout the pileus. **Hymenium** formed by clavate, 4-spored basidia, 20-30 x 5-7 μm. **Cystidioles** present among the basidia. **Basidiospores** cylindric to subellipsoid, thin-walled, hyaline, 8-12 x 3-4 μm.

Cultural features: unknown.

Substrate: dead wood of undetermined dicots.

Distribution: NW Argentina.

SPECIMENS EXAMINED — **ARGENTINA. TUCUMÁN:** Camino del Infiernillo, 22.IV.1966, leg. C.E. Gómez 1032 (BAFC 25193); Tafí del Valle, 7.II.1965, leg. Guerrero & Bettucci (BAFC 50856, 50857, 50858), yellowish-white, on *Piper tucumanensis*; ibid., 7.II.1965, leg. Guerrero & Bettucci (BAFC 50855, 50859, 50860), flabellate, stipe short, yellow; 25.I.1965, leg. Bettucci & Guerrero (BAFC 31187); *Salta:* La Viña, I.1897, leg. C. Spegazzini (**HOLOTYPUS** of *Favolus saltensis* **LPS** 21549).

Remarks: Núñez & Ryvarden (1995b) consider *Polyporus saltensis* a synonym of *P. tenuiculus*; however, it can easily be distinguished from it, which it closely resembles, by the absence of clamps, as well as by the smaller pores and the pileus surface, which may have fine radial striae. Núñez & Ryvarden (*op. cit.*) mention that *P. tenuiculus* may or may not have clamps, feature which we have not observed in our materials. The present species seems restricted to the region of the Yungas. Rajchenberg & Wright (1987) considered it was a good name for the species of *Favolus* with simple septa.

16. *Polyporus tenuiculus* (P. Beauv. : Fr.) Fr., Syst. Mycol. 1: 344. 1821.

FIGURE 16 and PLATE 3B, 3C

= *Favolus tenuiculus* P. Beauv., Fl. Oware Benin Afriq. 1: 74. 1806.- *Daedalea brasiliensis* Fr., Syst. Mycol. 1: 1821.- *Favolus flaccidus* Fr., Linnaea 5: 511. 1830.- *F. tessellatus* Mont., Ann. Sci. Nat., sér. II, 2: 365. 1843.- *F. fissus* Lév., Ann. Sci. Nat, sér. III, 2: 201. 1844.- *F. peltatus* Lév., Ann. Sci. Nat., sér. III, 2: 203. 1844.- *F. alutaceus* Berk. & Mont., Ann. Sci. Nat., sér. II, 11: 240. 1849.- *F. lacerus* Fr., Nova Acta Soc. Sci. Upsal., ser. 3, 12: 103. 1851.- *F. sundaicus* Fr., Nova Acta Soc. Sci. Upsal., ser. 3 12: 103. 1851.- *F.*

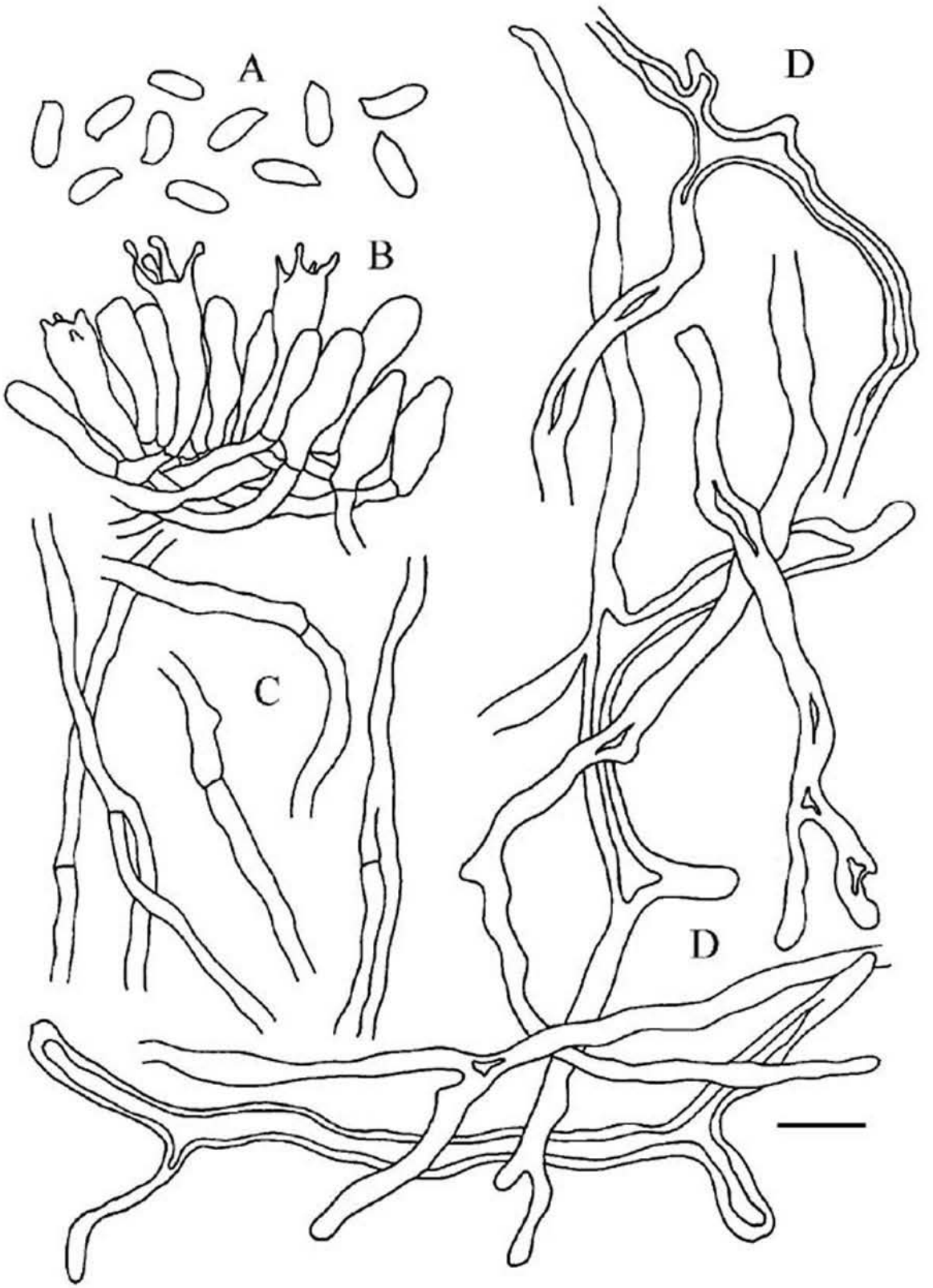

Figure 15: *Polyporus saltensis* (BAFC 50858). A) spores; B) basidia and basidioles; C) generative hyphae; D) skeleto-binding hyphae. Scale bar = 13 μm.

ohiensis Mont., Syll. Fung. p. 171. 1856.- *F. giganteus* Mont., Ann. Sci. Nat., sér. IV, 5: 370. 1857.- *Hexagonia rhombispora* Mont., Ann. Sci. Nat., sér. IV, 5: 370. 1857.- *F. friesii* Berk. & M.A. Curtis, J.- Linn. Soc. Bot. 10: 321. 1868.- *F. hispidulus* Berk. & M.A. Curtis, J. Linn. Soc. Bot. 10: 321. 1868.- *F. purpurascens* Berk. & M.A. Curtis, J. Linn. Soc. Bot. X, part 1: 321. 1869.- *F. scaber* Berk. & Broome, J. Linn. Soc. Bot. 14: 29. 1873.- *Polyporus lenzitoides* Berk., Vid. Selsk. Kobenhavn Medd. 1879: 34. 1879.- *Favolus paraguayensis* Speg., An. Soc. Cient.. Argent. 17: 71. 1884.- *F. specious* Speg., An. Soc. Cient. Arg. 17: 71. 1884.- *F. fimbriatus* Speg., An. Soc. Cient. Argent. 17: 72. 1884.- *F. bresadolianus* Speg., Bol. Acad . Nac. Cienc. Córdoba 28: 353. 1926.

Basidiocarp annual, solitary to imbricate, lateral, eccentrical or centrally stipitate. **Pileus** flabelliform to circular or infundibuliform, more rarely spathulate, 10-180 x 6-110 mm and 0.5-10 mm thick, fleshy to membranous when fresh, fragile, breakable and very light upon drying. **Pileus surface** glabrous, smooth to radially striate and wrinkled when dry, white to cream coloured (5Y 8/3) when fresh, cream coloured (2.5Y 8/6 to 7/4) to yellowish (10YR 6/6 to 7/8) or beige (10YR 5/8) when dry. **Margin** entire or lobed, smooth or fimbriate, involute and, sometimes, light brown (10YR 5/8) when dry. **Stipe** cylindric, 2-40 mm long and 1-13 mm diám., fibrous when fresh, rigid to fragile when dry, surface glabrous, smooth or wrinkled when dry, concolorous or slightly lighter than the pileus surface. **Hymenophore** white to cream coloured (5Y 7/4) when fresh, beige (10YR 8/6 to 5/6) to yellowish (2.5Y 7/6 to 7/8) or light brown (10YR 4/4) when dry. **Pores** circular to angular, radially elongated, decurrent on the stipe, with entire or fimbriate borders, 0.6-1.5 per mm, tubes 0.5-9 mm long. **Hyphal pegs** sometimes present in the tube walls. **Context** homogeneous, tough cottony to corky, white to cream coloured or beige, 0.3-2 mm thick., sometimes not discernible.

Hyphal system dimitic; generative hyphae clamped, hyaline, with thin- to slightly thickened walls in the stipe and context, 2-6 μm in diam., abundant throughout the fruitbody; skeleto-binding hyphae thick- to very thick-walled, lumen visible to solid, 2.5-5 μm in diam., and up to 9 μm diam.in the stipe, hyaline to yellowsh or golden, moderately to much branched, dominating in the context and stipe.

Hymenium formed by clavate, 4-spored basidia, 20-35 x 5-8 μm. **Cystidioles** ampulliform, 20-30 x 6-8 μm and hyphidia sometimes present among the basidia. **Basidiospores** cylindric to subellipsoid, thin-walled, hyaline, 8-13(-15) x 2.5-4(-5) μm.

Cultural features: Sen (1973, as *Favolus brasiliensis*); Stalpers (1978).

Substrate: dead wood of undetermined dicots and gymnosperms.

Distribution: Argentina, Bolivia, Brazil, Colombia, Cuba, French Guyana, Indonesia, Paraguay, Perú, Trinidad and Venezuela. Pantropical, according to Núñez & Ryvarden (1995b).

SPECIMENS EXAMINED — ARGENTINA. Corrientes: Capital, 28.IV.1988, leg. O. Popoff 402; Fac. Cs. Agrarias, 23.X.1995, leg. O. Popoff 2784; Bella Vista, behind Estac. Exp. INTA, in marginal forest, 14.VIII.1972, leg. Wright, Deschamps & Del Busto Ctes 1831 (BAFC 25167); Concepción, Tabay, in forest of implanted Grevillea robusta; 16.IV.1987, leg. A. Schinini 35336 (CTES); Ea. Sta. Teresa, 14.V.1962, leg. Pedersen (BAFC 25168); Isma Meza, S zone, in gallery forest, 12.XII.1992, leg. O. Popoff 1268 (CTES); Riachuelo, 18.X.1996, leg. O. Popoff 3243 (CTES); San Miguel, Ea. Curupayti,

interior of forest island, 3.III.1990, leg. R. Vanni et al. 1752 (CTES); Sto. Tomé, Ea. Garruchos, potrero Puente, 4.II.1972, leg. A. Krapovickas & C. L. Cristóbal 22235 (CTES), forest island. **Misiones:** road to Bernardo de Irigoyen, leg. Wright, Deschamps & Del Busto M2438 (BAFC 25172); Frontera, Gral Manuel Belgrano, 20.IV.1957, leg. Singer M1143 (BAFC 25190), on wood in subtropical forest of *Araucaria angustifolia*; Garupá, near brook, 16.IV.1976, leg. J. de Cricel (BAFC 25173); Gruta India, route 12, 7.VIII.1977, leg. J. De Cricel (BAFC 25171); Guaraní, track to El Soberbio brook, 30.XI.1994, leg. G. Lvia et al. 45 (CTES); Predio Guaraní, 8.IX.1994, leg. O. Popoff et al. 2459 (CTES); Sendero Arroyo Itapirú, 19.IX.1995, leg. V. Mruak (CTES); pr. H. Irigoyen, camping on Ñacanguazú brook, 25.X.1973, leg. Wright, Deschamps & Del Busto M2329 (BAFC 25170), on felled trunk of undet. broadleaf; Iguazú Nat'l Park, 5.III.1982, leg. J. E. Wright (BAFC 28008); camping El Ñandú, 7.IV.1984, leg. Wright, Rajchenberg & Job M3644 (BAFC 30067); lower circuit of falls, 5.IV.1984, leg. Job & Rajchenberg M3554 (BAFC 30010), in mixed forest of palo rosa and palmetto route 101); 4.VI.1998, leg. R. M. Silveira, A. Fazio & E. Albertó 410, 411 (BAFC 50811, 59357), on *Bastardiopsis densiflora* ("loro blanco"); palmital at intersection of route 101 and entrance to Park, 4.VI.1998, leg. R. M. Silveira, A. Fazio & E. Albertó 414, 415, 416 (BAFC 50812, 50358, 59359); Isla San Martín, 3.VI.1998, leg. R. M. Silveira, A. Fazio & E. Albertó 406, 407, 408, 409 (BAFC 50353, 50354, 50355, 50356); Sendero Macuco, 6.IV. 1998, leg. Job & Rajchenberg M3564 (BAFC 30009); 3.IV.1996, leg. O. Popoff et al. 3181 , 3225 (CTES); 2,VI.1998, leg. R. M. Silveira, A. Fazio & E. Albertó 393, 394, 396, 397, 399 (BAFC 50349, 50813, 50350, 50765, 50352); picada paralela, 8.IV.1984, leg. Wright, Rajchenberg & Job M3661 (BAFC 30081); track to falls, 7.IX. 1996, leg. I. Gazzola (BAFC 34370); 3.VI.1998, leg. R. M. Silveira, A. Fazio & E. Albertó 400, 401, 402 (BAFC 50814, 50815, 50816); forbidden zone , 300 m from boundary, al right of road, 7.IV.1984, leg. Wright, Rajchenberg & Job M3641 (BAFC 30064); Puerto Iguazú, 12.IV.1957, leg. Singer M957 (LIL), on dead liana in subtropical forest; San Ignacio, II.1965, leg. Martínez Crovetto G184 (BAFC 25169), Santa Ana, 18.IX.1979, leg. D. Cabral & S. López M3211 (BAFC 25292); Jesuitic Ruins, 24.X.1973, leg. Wright, Deschamps & Del Busto M2309 (BAFC 25191), on dead trunk of Enterolobium ("timbó") in the cemetery. **Salta:** Sta. Victoria, Los Toldos, El Astillero, 17.III.1986, leg. Palací 440. **BOLIVIA:** leg. Weddell (**HOLOTYPUS** of *Hexagonia rhombispora* **PC**); **Beni:** Beni: Vaca Diez, Guayaramerín, 7.III.1956, leg. Singer B1632 (BAFC 25195). **BRAZIL.** (**HOLOTYPUS** of *Favolus flaccidus* **UPS**); **Amazonas:** Manaus, Reserva Ducke, 18.V.1977, leg. M. A. Sousa,(ex Manaus 248); **Bahia:** leg. Blanchet (**HOLOTYPUS** of *F. alutaceus* **K** 77569). **Paraná:** Curitiba, Res. Biol. Cambuí, 4.IV.1980, leg. A. de Meijer 423 (BAFC 31699). **Rio Grande do Sul:** leg. Angelo Schneider (ICN 102683); Canela, Parque das Sequoias, 22.I.1997, leg. R. M. Silveira & R. T. Guerrero 311 (BAFC 50817), on dead branch of gymnosperm; Porto Alegre, Parque Farroupilha, 25.XI.1996, leg. R. M. Silveira & R. T. Guerrero 304 (BAFC 50793)0, on base of banana tree; Salvador do Sul, IX.1997, leg. R. T. Guerrero (ICN 102667); Tenente Portela, Parque do Turvo, 23.XI.1975, leg. M. A. Sousa (BAFC 25179); 24.XI.1975, leg. M. A. Sousa, (BAFC 25180); Viamão, Parque St.-Hilaire, 4.XII. 1996, leg. R. M. Silveira & R. T. Guerrero 306, 307, 308 (BAFC 50818, 50332, 50333); 17.X.19998, leg. R. M. Silveira 422, 424, 425, 434, 438 (BAFC 50819, 50362, 50820, 50821, 50822). **Rio de Janeiro:** Rio de Janeiro, III.1836, Voyage de M. Gaudichaud (**HOLOTYPUS** of *F. fissus* **PC**); leg. Glaziou (**HOLOTYPUS** of *Polyporus lenzitoides* **K** 60284); Corcovado, leg. Zelinek (**HOLOTYPUS** of *F. brasiliensis* **UPS**); Floresta da Tijuca, X.1961, leg. Singer 4045 (BAFC 25197). **Santa Catarina:** Florianópolis, Saco Grande, UFSC-UCAD, 16.I.1998, leg. R. M. Silveira 352 (BAFC 50823). **CUBA:**

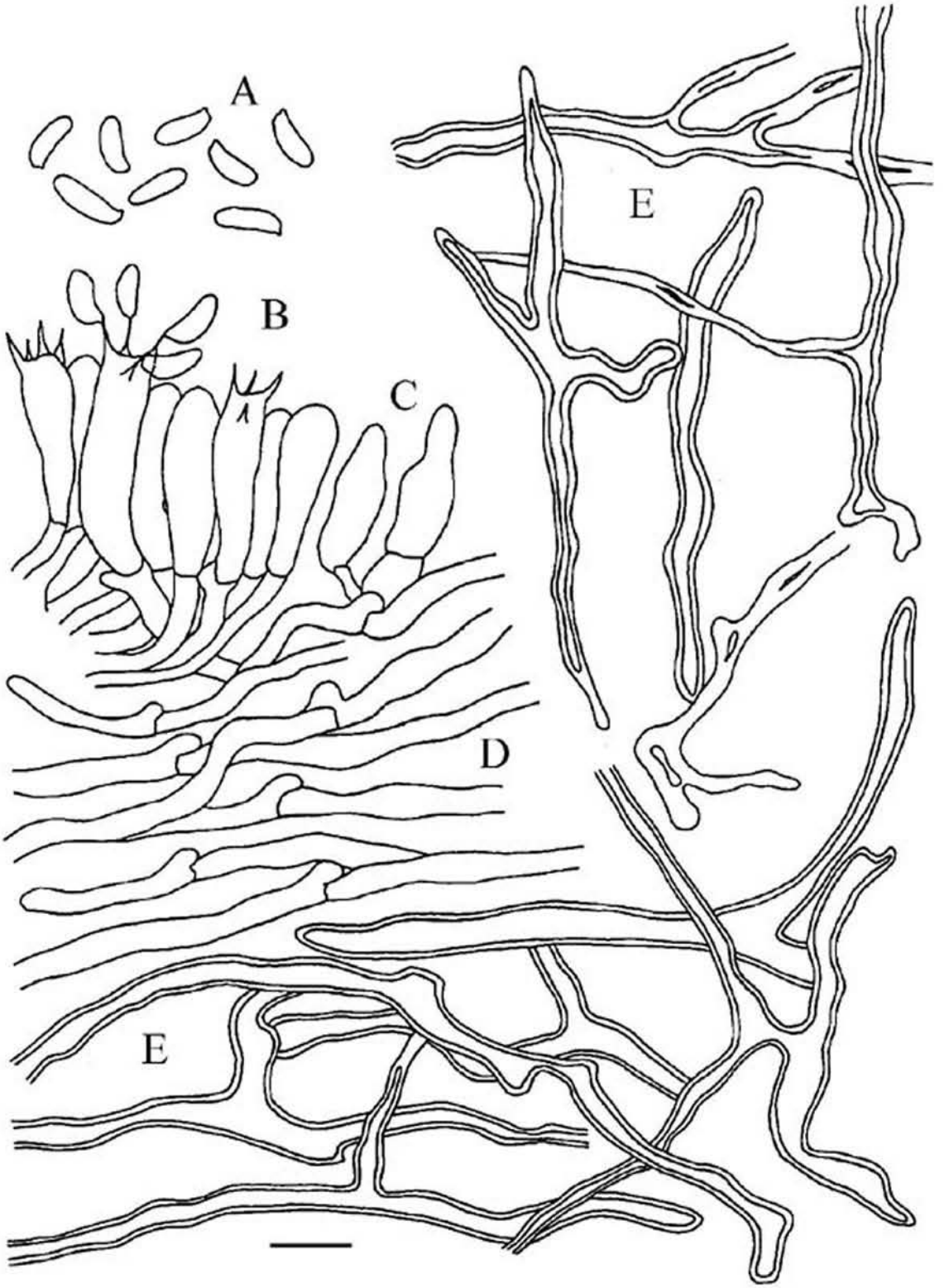

Figure 16: *Polyporus tenuiculus* (BAFC 50356). A) spores; B) basidia and basidioles; C) cystidia ampulliform D) generative hyphae; E) skeleto-binding hyphae. Scale bar = 13 μm.

leg. C. Wright 324 (**HOLOTYPUS** of *F. hispidulus* **K** 77570); 318 (**HOLOTYPUS** of *F. purpurascens* **K** 77605); leg. C. Wright (**HOLOTYPUS** of *F. lacerus* K 77595). **FRENCH GUYANA:** leg. Leprieur 958 (**HOLOTYPUS** of F. giganteus **PC**); 579 (**HOLOTYPUS** of F. tessellatus **PC**). **INDONESIA. JAVA** (**HOLOTYPUS** of *F. peltatus* **PC**); Sundaöarna, Sulo Milo, leg. Diedrichsen (**HOLOTYPUS** of *F. sundaicus* **UPS**). **PARAGUAY:** Caazapá, Sta. Ursula, 37 km N of Yuty, 23.III.1993, leg. O. Popoff et al. 1480 (CTES); Cordillera, Altos, Bernal-Cué, 20.VI.1973, leg. A. Schinini 6762 (CTES), on posts on ground; Guaira, Colonia Independencia, banks of Arroyo Tilinsky, 25.III.1993, leg. O. Popoff et al. 1584 (CTES); Guarapi, 30.V.1883, leg. Balansa 3918 (**HOLOTYPUS** of *F. speciosus* **LPS** 21552); 1880, leg. Balansa 3342 (**HOLOTYPUS** of *F. bresadolianus* **LPS** 21527); Paraguarí, V-1883, leg. Balansa 3906 (**HOLOTYPUS** of *F. paraguayensis* **LPS** 21545); VI.1883, leg. Balansa 3907 (**HOLOTYPUS** of *F. fimbriatus* **LPS** 21531); 27.VII.1993, leg. G. Mälme (ex S). **SRI LANKA:** South of island, leg. Thwaites (**HOLOTYPUS** of *F. scaber* **K** 77594).

Remarks: *Polyporus tenuiculus* is a very polymorphic species, which has given rise to the numerous synonyms, as listed. Furthermore, its aspect may change according to ambient conditions, see Silveira & Wright (2002). Rajchenberg & Wright (1987) and Popoff & Wright (1998) supported *Favolus paraguayensis* Speg. and *Favolus bresadolianus* Speg. as a good species. After the holotypes analysis and, considering the great polymorphism of *Polyporus tenuiculus*, we concluded that the morphological differences presented to both taxa do not justify their separation in an autonomous species.

In general, it is easy to identify by the features described, principally by the white to cream colour and fleshy consistency of the fruitbodies, as well as the large hexagonal pores. Our collections are all clamped. *Polyporus saltensis* may be separated by the absence of clamps.

17. *Polyporus tricholoma* Mont., Ann. Sci. Nat., sér. II, 8: 365. 1837.

FIGURE 17

=?*Polyporus similis* Berk., Hooker London J. Bot. 2: 635. 1843.- ?*P. stipitarius* Berk. & M.A. Curtis, J. Linn. Soc. Bot. 10: 305. 1868.

Basidiocarp annual, solitary to caespitose, centrally stipitate. **Pileus** circular, umbilicate to infundibuliform, 7-25 mm in diam. and 1-2 mm thick, coriaceous when fresh, rigid upon drying. **Pileus surface** glabrous, smooth to wrinkled when dry, cream coloured (2.5Y 8/4 to 10YR 8/4), to light brown (10YR 7/6 to 5/6). **Margin** entire, ciliate, cilia filiform, 1-2 mm long. **Stipe** cylindric, somewhat broadened at the base, 8-30 mm long, 1-2 mm in diam., fragile when dry, surface glabrous, smooth to wrinkled when dry, concolorous with pileus surface. **Hymenophore** cream coloured (2.5Y 8/4 to 7/4 or 10YR 8/4). **Pores** circular to angular when dry, 5-9 per mm, tubes up to 1 mm long. **Context** homogeneous, cottony, white to cream coloured, up to 1 mm thick.

Hyphal system dimitic; generative hyphae clamped, hyaline, thin- to slightly thickened walls, 2.5-5 μm in diam., inflated in the context, up to 10 μm in diam. in the stipe, sclerified, arranged parallel to the principal axis; skeleto-binding hyphae thick-walled, lumen visible to solid, 2-5 μm in diam., pale yellowish, moderately branched, dominating in the context and dissepiments. **Hymenium** formed by clavate, 4-spored

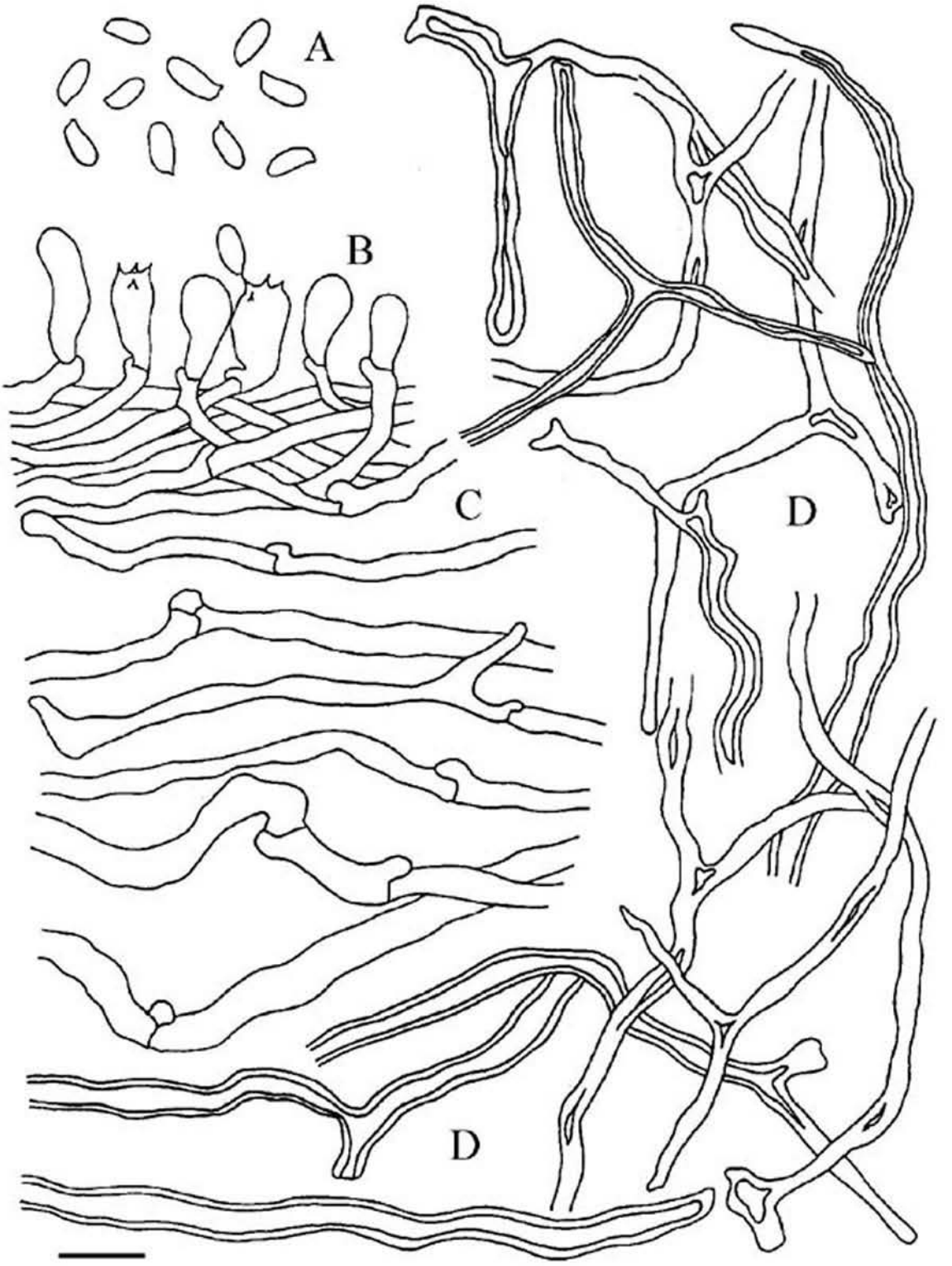

Figure 17: *Polyporus tricholoma* (BAFC 31151). A) spores; B) basidia and basidioles; C) generative hyphae; D) skeleto-binding hyphae. Scale bar = 13 μm.

basidia, 14-20 x 5-7 μm. **Basidiospores** subcylindric to ellipsoid, thin-walled, hyaline, varying in size in the same basidioma, 6-9 x 3-4 μm.

Cultural features: Roy & De (1977); David and Rajchenberg (1985).

Substrate: dead wood of undetermined dicots.

Distribution: Argentina, Bolivia, Brazil, Cuba, Ecuador, French Guyana, Paraguay, Perú, Trinidad and Venezuela. According to Núñez & Ryvarden (1995b), it is common in the neotropics and very rare in the paleotropics.

SPECIMENS EXAMINED — ARGENTINA. Catamarca: Cuesta del Totoral, 2.II.1997, leg. D. Cabral (BAFC 34450). Misiones: Iguazú Nat'l Park, 30 km on route 101, 28.X.1973, leg. Wright, Deschamps & Del Busto M2422 (BAFC 50862), on rotten trunk of "laurel negro" in "palo rosa" forest; Puerto Piray, La Celulosa, old *Araucaria angustifolia* plantation (1943), 26.X.1973, leg. Wright, Descamps & Del Busto M2369 (BAFC 50863), on semirotten trunk of *A. angustifolia*. Salta: C° San Bernardo-C°. 20 de febrero, 14.IV.1987, leg. D. Job 3967, 3987 (BAFC 31149, 31150). Tucumán: route 9, road to El Cadillal, 26.IV.1973, leg. T. del Valle Ruiz (BAFC 50843); Burruyacu, route 310, 3rd. Stop, km 31 from Villa Padre Monti, alt. 1450 masl, mixed woods of *Podocarpus*, *Grabouxia* and *Fragaria*, 1.IV.1998, leg. A. Hladki (LIL); Trancas, La higuera, Ea. Medina, 16.IV.1987, leg. D. Job & A. Hladki 4011, 4013, 4028 (BAFC 31151, 31152, 31153). **BOLIVIA.** La Paz: Nor-Yungas, Carmen Pampa, 26.II.1956, leg. Singer B1497 (LIL), 2000 masl. **BRAZIL.** Rio Grande do Sul: Cambará do Sul, Aparados da Serra Nat'l Park, 18.XI.1987, leg. R. M. Silveira & R. T. Guerrero 034, 131, 133, 156 (ICN 80497, 80501, 80502, 80504); Porto Alegre, Belém Novo, XII.1991, leg. M. S. Hamme (ICN 80806). Rio de Janeiro: Serra dos Órgãos, 24.X.1961, leg. Singer B4030 (BAFC 50864), ca. 1500 masl. **CUBA.** leg. Ramón de la Sagra (**HOLOTYPUS** of *Polyporus tricholoma* **PC**); leg. C. Wright 86 (**HOLOTYPUS** of *P. similis* **K** 60290); 90 (**HOLOTYPUS** of *P. stipitarius* **K** 60291).

Remarks: *Polyporus tricholoma* is also a very polymorphic species of the American tropics. Typical slender, yellowish forms are easy to identify, but larger and more robust ones are not. The study of the holotypes of *P. similis* and *P. stipitarius*, due to their present condition, did not allow a definite conclusion of their synonymy with the present species. An exhaustive study of all of them, on the basis of cultures and DNA would give us a more complete picture of this constellation.

18. *Polyporus tucumanensis* Speg., An. Mus. Nac. Buenos Aires 6: 162. 1898.

Figure 18 and Plate 6B

=?*Favolus apiahynus* Speg., Bol. Acad. Nac. Cienc. Córdoba 23: 407-408. 1919.

Basidiocarp annual, central to eccentrically stipitate. **Pileus** circular, umbilicate, 15-60 mm in diam. when fresh, 10-40 mm in diam. and up to 3 mm thick when dry, fleshy to coriaceous when fresh, hard and breakable upon drying. **Pileus surface** glabrous or with deciduous and scattered squamules, more abundant towards the margin, wrinkled upon drying, brown (10YR 5/4 to 6/4) to light brown (2.5Y 6/4 to 5/4) or cream coloured (10YR 6/6 to 8/3) when fresh, brown (5YR 8/4) to dark brown (7.5YR 3/2) or light brown (7.5YR 6/6), when dry. **Margin** entire or ciliate, incurved

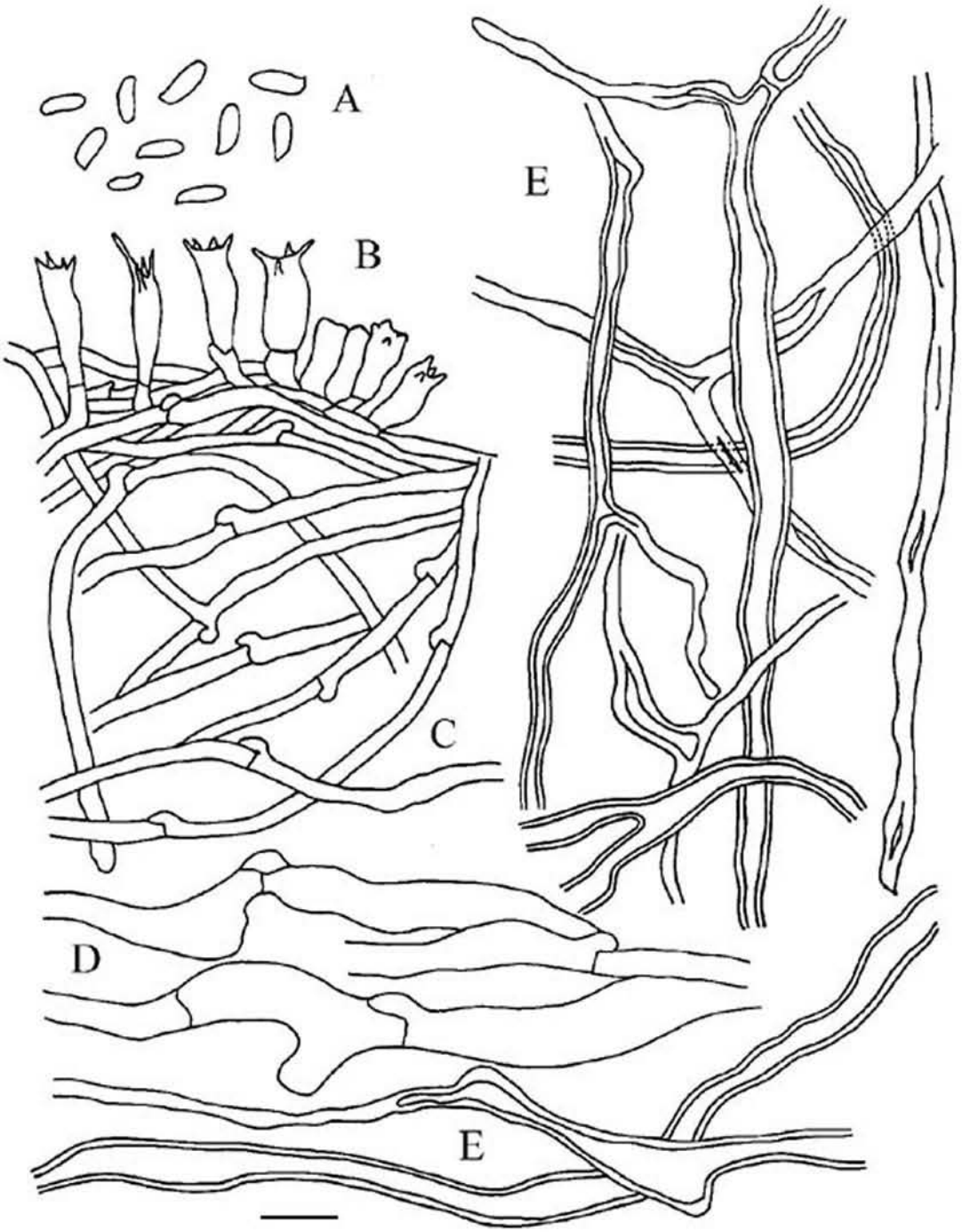

Figure 18: *Polyporus tucumanensis* (BAFC 50340). A) spores; B) basidia and basidioles; C) generative hyphae (dissepiments); D) inflated generative hyphae (context); E) skeleto-binding hyphae. Scale bar = 13 μm.

when dry. **Stipe** cylindric to laterally depressed, 20-70 mm long and 3-5 mm in diam. when fresh, fibrous, glabrous, concolorous or somewhat darker than the pileus surface. **Hymenophore** cream coloured (2.5Y 8/4 to 5Y 7/3) when fresh, ochraceous brown (10YR 5/6 to 7/8) or beige (10YR 8/4) when dry. **Pores** angular, elongated, when young abruptly discontinuous with regards to the stipe, when dry they may appear decurrent on the stem, 3-5 per mm, tubes up to 1 mm long.

Context homogeneous, cottony-stringy, white or cream coloured, up to 1 mm thick.

Hyphal system dimitic; generative hyphae clamped, hyaline, thin- to slightly thickened walls, 2-5 μm in diam., inflated in the context, up to 23 μm; sclerified in the stipe, arranged parallel to the principal axis, 5-15 μm in diam.; skeleto-binding hyphae thick-walled, rarely solid, 2.5-6.5 μm in diam., hyaline to pale yellowish, moderately branched, present in the dissepiments. **Hymenium** formed by clavate to subglobose, 4-spored basidia, 16-23 x 5-7.5 μm. **Basidiospores** cylindric to subellipsoid, thin-walled, hyaline, 6-9 x 2-3 μm.

Cultural features: unknown.

Substrate: dead wood of undetermined dicots.

Distribution: NW Argentina, Brazil?.

SPECIMENS EXAMINED — **ARGENTINA. Buenos Aires:** Sta. Catalina, 11.II.1990, leg. E. Albertó & B. Lechner Ed700 (BAFC 50802). **Tucumán:** I.1894, leg. C. Spegazzini (**HOLOTYPUS** of *Polyporus tucumanensis* **LPS** 25777); Chicligasta, Río Cochuna, 14.X.1997, leg. R. M. Silveira & M. Catania 324, 325, 328, 329, 332, 333, 334 (BAFC 50336, 50803, 50339, 50340, 50342, 50343, 50344); ibid., leg. R. M. Silveira & A. Hladki 326, 327, 331, 335, 336, 337, 338 (BAFC 50337, 50338, 50341, 50804, 50345, 50805, 50806); Monteros, Arroyo Las Azucenas, road to Tafí del Valle, 15.X.1997, leg. R. M. Silveira & A.Hladki 322, 323, 342, 343, 344 (BAFC 50334, 50335, 60346, 50347, 50348), in *Alnus jorullensis* forest, 1300 masl. **BRAZIL. São Paulo:** Apiahy, 1883/1888, leg. J. Puiggari 113 and 2916 (**HOLOTYPUS** of *Favolus apiahynus* **LPS** 21521).

Remarks: *Polyporus tucumanensis* has been mistaken for *P. brumalis* by having medium sized pores, and with *P. ciliatus* by having marginal cilia. But it differs from both because its pores are of a different shape from those of *P. brumalis*, and are larger than in *P. ciliatus*. Furthermore, all attempts to mate this species with collections of *P. ciliatus* were negative; see Silveira & Wright (2002). In addition, both species presented significant differences in the isoenzymatic analysis (Silveira et al., 2003). This supports keeping the two species separate. Regarding *P. brumalis*, it is possible that this species is not present in native forests of South America. The distribution of *P. tucumanensis* seems restricted to the region of the Yungas (Cabrera & Willink 1980). For this reason, we consider the synonymy with *F. apiahynus* dubious.

19. *Polyporus udus* Jungh., Tidschr. V. Nat. Gesch. Phys. 7: 289. 1840.

Figure 19 and plate 6F

=*Polyporus discoideus* Berk. & M.A. Curtis, J. Linn. Soc. Bot. 10: 305. 1868.- *P. paraguayensis* Speg., An. Soc. Cient. Argent. 17: 72. 1883.- *Bresadolia paradoxa* Speg., An. Mus. Nac. Buenos Aires 6: 161.1898.

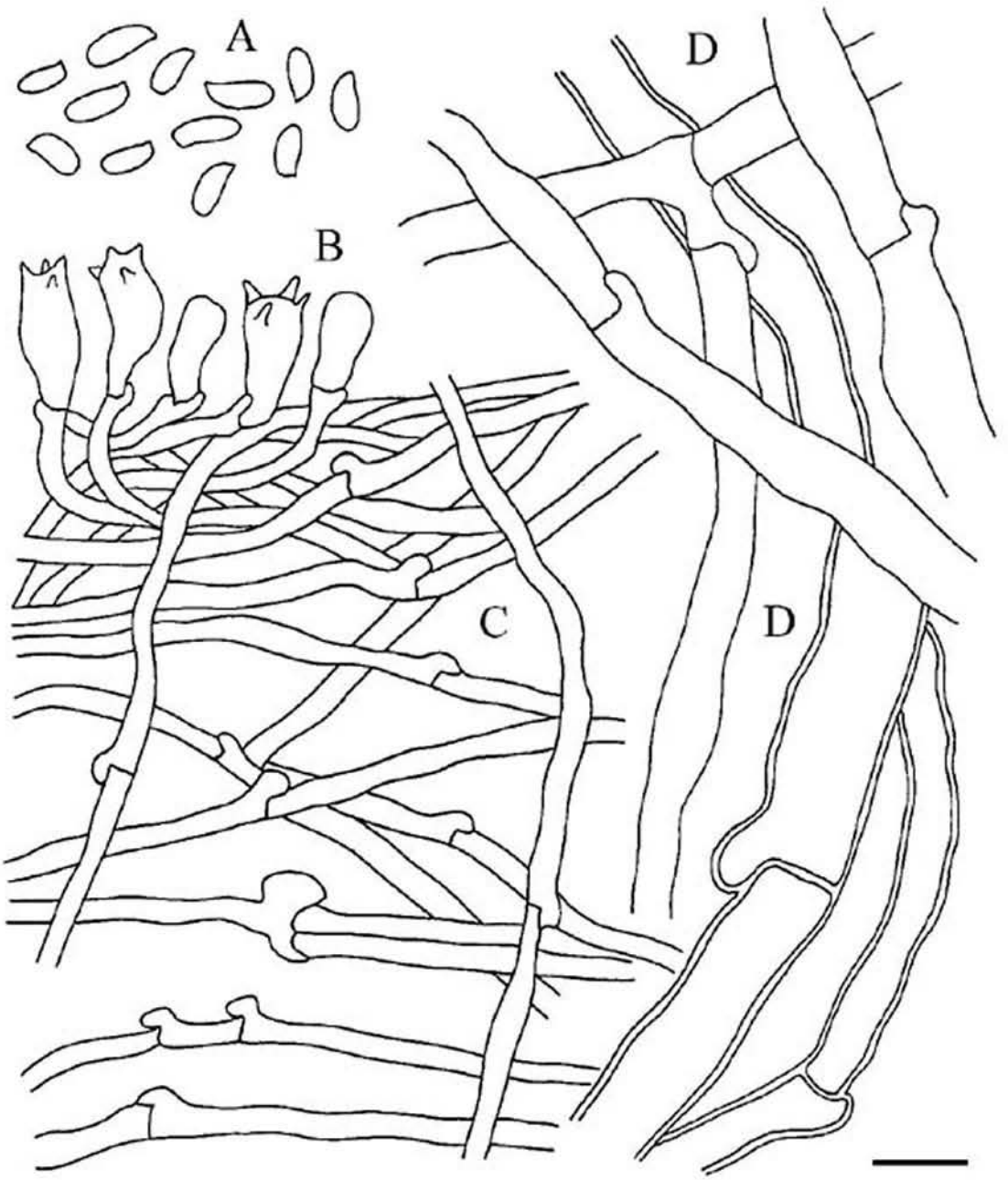

Figure 19: *Polyporus udus* (BAFC 30450). A) spores; B) basidia and basidioles; C) generative hyphae (dissepiments); D) inflated generative hyphae (context). Scale bar = 13 μm.

Basidiocarp annual, lateral to eccentrically stipitate. **Pileus** semicircular to circular or flabelliform, 30-200 x 50-150 mm, and 5-15 mm thick, fleshy and watery when fresh, fragile and very light when dry. **Pileus surface** glabrous, smooth, wrinkled when dry, brown (7.5YR 5/6 to 4/2) or dark brown (5YR 4/3 to 3/3), with dark brown spots. **Margin** entire, smooth, involute when dry. **Stipe**, when present, cylindric, somewhat broadened at the base, 25-40 mm long, and 9-25 mm in diam., woody and rigid when

dry, surface glabrous, smooth or wrinkled when dry, concolorous with the pileus surface or somewhat darker. **Hymenophore** yellowish orange (7.5YR 7/6 to 5/8) or dark brown (7.5YR 4/4 to 3/2). **Pores** circular to angular when dry, decurrent on the stipe, 1-3 per mm, tubes up to 5 mm long.

[**Context** homogeneous, spongy and watery when fresh, corky when dry, cream coloured to beige, up to 10 mm thick.

Hyphal system dimitic; generative hyphae clamped, hyaline, thin- to slightly thick-walled, 2.5-5 μm in diam., inflated in the context. up to 15 μm in diam., sclerified in the stipe and pileus cuticle, arranged parallel to the principal axis and coloured by a melanoid substance; skeleto-binding hyphae not observed. **Hymenium** formed by clavate, 4-spored basidia, 20-30 x 7-10 μm. **Basidiospores** cylindric to subellipsoid, thin-walled, hyaline and of variable size in the same basidioma, 8-10.5 x 3.5-4.5 μm.

Cultural features: Núñez & Ryvarden (1995a).

Substrate: fallen and semirotten branches of undetermined dicots; sometimes on standing trees.

Distribution: Argentina, Bolivia, Brazil, Cuba, Indonesia, Paraguay and Perú. Pantropical, also known from the warm-temperate zones of Japan, according to Núñez & Ryvarden (1995b).

SPECIMENS EXAMINED — ARGENTINA. CHACO: Resistencia, Laguna Cook, 20.XI.1975, leg. J. R. Deschamps (BAFC 50842), on semirotten trunk of *Astronium balansae*. **CORRIENTES:** Saladas, marginal forest of Río Sta. Lucía, 7.II.1972, leg. J. R. Deschamps (ERCIV 5). **MISIONES:** Iguazú Nat'l Park, Sendero Macuco, from Park Headq. to large bridge, 26.IX.1984, leg. D. Job M3825 (BAFC 30410). **BOLIVIA. BENI:** Vaca Diez, Ivon, 190 masl, 3.IV.1956, leg. Singer B2448 (BAFC 28874). **BRAZIL. PARANÁ:** Foz do Iguaçú, Cataratas do Iguaçú Nat'l Park, 29.XII.1992, leg. A. de Meijer 2384 (Herb. Meijer); São José dos Pinhais, 5.XI.1991, leg. A. de Meijer 2010 (Herb. Meijer). **CUBA:** leg. C. Wright 379 (**HOLOTYPUS** of *Polyporus discoideus* **K** 57288). **PARAGUAY.** Guarapi, XII.1881, leg. Balansa 3364 (**HOLOTYPUS** of *P. paraguayensis* **LPS** 25781); Paraguarí, III.1883, leg. Balansa 3913 (**HOLOTYPUS** of *Bresadolia paradoxa* **LPS** 15714). **INDONESIA. JAVA:** Pangarango (**HOLOTYPUS** of *Polyporus udus* **L**).

Remarks: *Polyporus udus* is another polymorphic species which may attain variable sizes, and is characterized by the watery nature of context in fresh specimens, and the pileus surface formed by a thin, dark brown cuticle. It deserves more research.

20. ***Polyporus varius*** Fr.: Fr., Syst. Mycol. 1: 352. 1821.

FIGURE 20 and PLATE 4A

= *Polyporus guilfoylei* Berk. & Broome, Trans. Linn. Soc. Bot. 2: 58. 1883.

Basidiocarp annual, laterally stipitate. **Pileus** flabelliform to semicircular, or irregularly semicircular, 30-55 x 25-50 mm and 1-7 mm thick, woody and rigid when dry, punky when fresh. **Pileus surface** glabrous, smooth to finely radially striate, brown (10YR 4/4) to light brown (10YR 5/3) in the region next to stipe, lighter, cream coloured (2.5Y 8/4) to beige (10YR7/4) towards the margin. **Margin** entire, smooth or undulate, festooned or lobed. **Stipe** cylindric, somewhat broadened at the base, 5-20 mm long

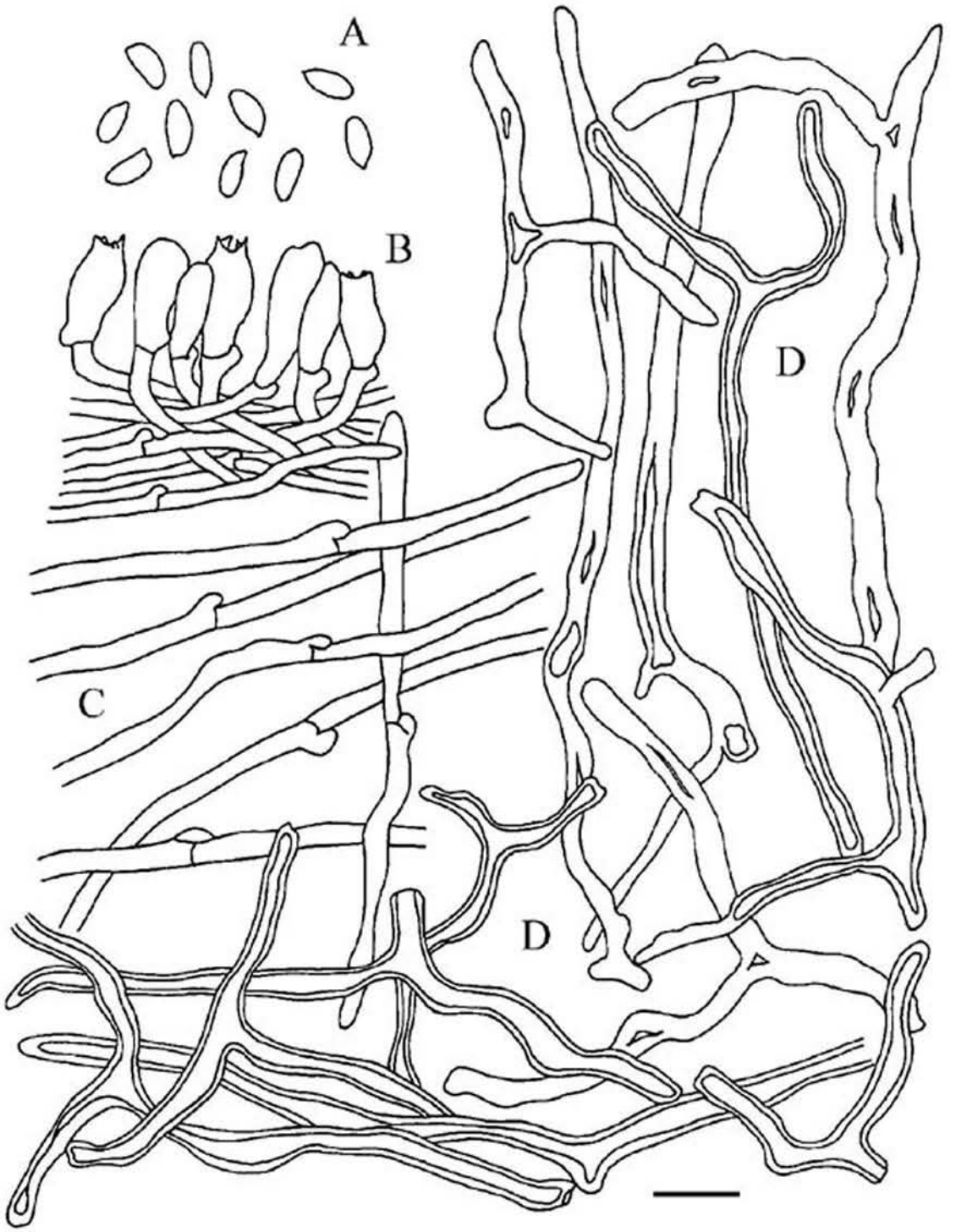

Figure 20: *Polyporus varius* (ICN 80496). A) spores; B) basidia and basidioles; C) generative hyphae; D) skeleto-binding hyphae. Scale bar = 13 μm.

and 2-6 mm in diam., woody, rigid when dry, surface glabrous, smooth to wrinkled when dry, black (10YR 2/2). **Hymenophore** beige (10YR 7/6) to grayish beige (2.5Y 6/2) to brown (10YR 5/4). **Pores** circular, 6-9 per mm, tubes up to 3 mm long. **Context** homogeneous, corky, cream coloured to beige, up to 4 mm thick.

Hyphal system dimitic; generative hyphae clamped, hyaline to pale yellowish, thin-walled, 2-5 µm in diam.; skeleto-binding hyphae very thick-walled, lumen visible to solid, 2.5-7 µm in diam., yellowish to golden, moderately branched, dominating throughout the pileus, variably dextrinoid in the dissepiments. **Stipe** cortex formed by a basal layer composed of more or less quadrangular, appressed cells with sinuous walls, and an external layer of clavate elements, 27-31 x 5-12 µm, thick-walled, arranged in a loose palisade, of about the same thickness as the basal layer, both masked by a melanoid substance forming an external band. **Hymenium** formed by clavate, 4-spored basidia, 15-19 x 6-7 µm. **Basidiospores** subcylindric to ellipsoid, thin-walled, hyaline, 7-9 x 3-3.5 µm

Cultural features: Nobles (1958, 1971); Ingold (1991).

Substrate: dead wood of undetermined dicots.

Distribution: Brazil and Ecuador. See Núñez & Ryvarden (1995b).

SPECIMENS EXAMINED — AUSTRALIA: Queensland, Brisbane, Logan River, leg. F. M. Bailey 211 (**HOLOTYPUS** of *Polyporus guilfoylei* K 57291). **BRAZIL. RIO GRANDE DO SUL:** Cambará do Sul, Aparados da Serra Nat'l Park, 19.XI.1988, leg. R. M. Silveira & R. T. Guerrero 141 (ICN 80494); leg. ibid. 209, 30.IV.1989 (ICN 80495); Gramado, 10.XI-1987, leg. ibid. 029 (ICN 80496), on living centenary trunk of *Araucaria angustifolia*; Nonoai, V.1996, leg. R. T. Guerrero (BAFC 50825).

Remarks: *Polyporus varius* is easy to identify by its cream coloured to light brown, smooth to finely radially striate pileus and its black stipe. According to Núñez & Ryvarden (1995b), *P. varius* has spores 9-12 µm long, whereas our collections have shorter ones (7-9 µm). Our materials are coincident with the description of Jahn (1969).

21. *Polyporus virgatus* Berk. & M.A. Curtis, J. Linn. Soc. Bot. 10: 304. 1868.

Figure 21 and Plate 4B

= *Polyporus guaraniticus* Speg., An. Soc. Cient. Argent. 26: 6. 1883.

Basidiocarp annual, laterally stipitate. **Pileus** flabelliform to petaloid, 85 x 55 mm and 3-5 mm thick, breakable when dry. **Pileus surface** glabrous, rugose, yellowish brown (7.5YR 5/6), darker to almost black towards the stipe (7.5YR 3/2). **Margin** entire to festooned-undulate, with very dark lineal spots or markings on a beige background (10YR 6/6). **Stipe** cylindric, sometimes slightly enlarged towards the base, 20 mm long and 8 mm in diam., woody, rigid when dry, surface velutinous, black (10YR 2/2). **Hymenophore** beige (10YR 6/6). **Pores** circular to angular when dry, 2-4 per mm, tubes up to 2 mm long, with the mouths entire to denticulate. **Context** homogeneous, corky, cream coloured, up to 1.5 mm thick.

Hyphal system dimitic; generative hyphae clamped, hyaline, thin-walled, 2-3.5 µm in diam.; skeleto-binding hyphae very thick-walled, lumen visible to solid, 3.5-9(-12) µm diam., pale yellowish, much branched, dominating throughout the context and dissepiments. **Stipe cortex** formed by a basal layer composed of appressed, more or less quadrangular cells with sinuous walls, and an external layer of clavate, thick-walled elements, 21-28 x 5-12 µm, arranged in a loose palisade, of equal thickness

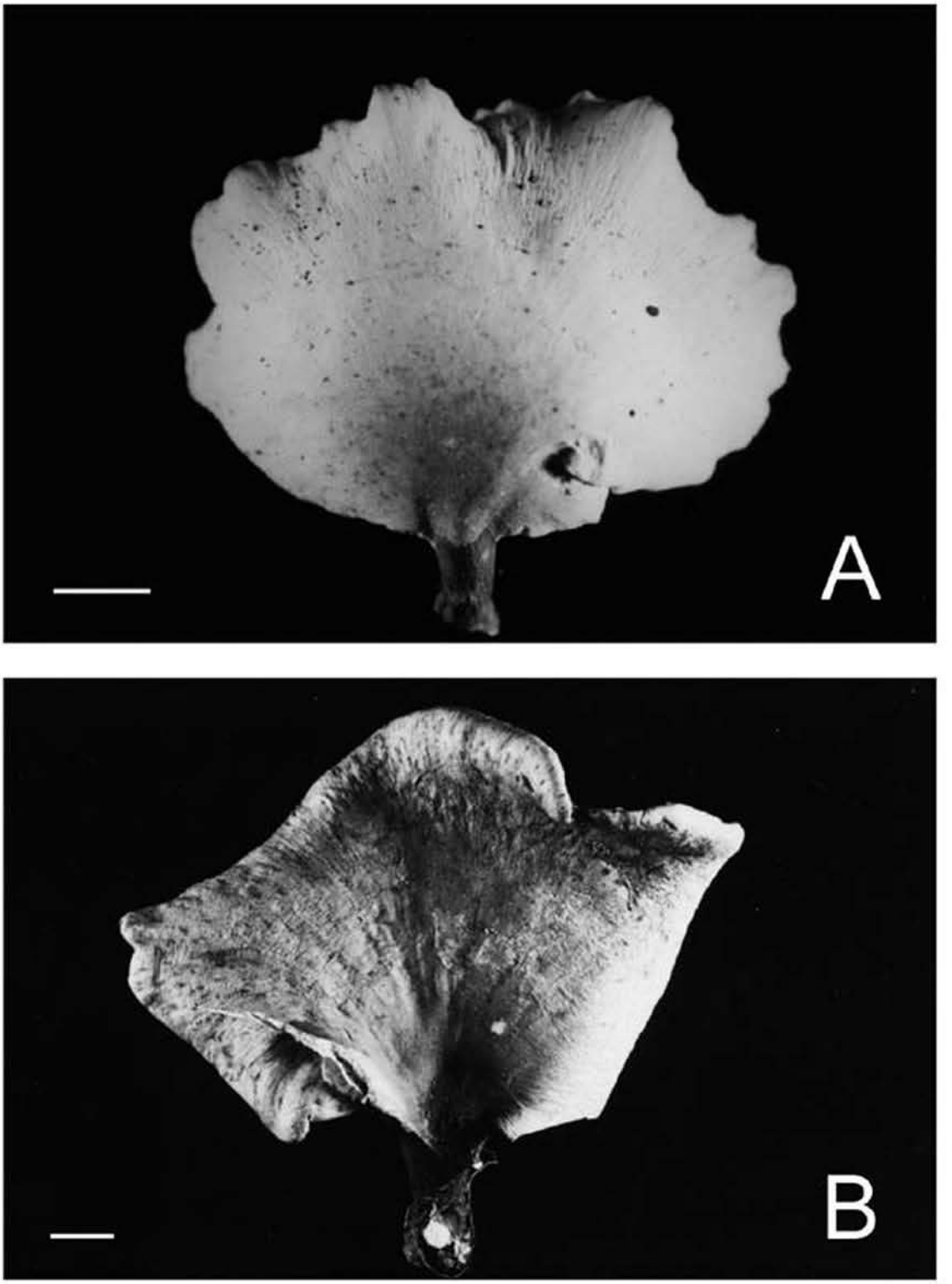

Plate 4. A) *Polyporus varius* (ICN 80496). B) *P. virgatus* (BAFC 31597). Scale bar = 10 mm.

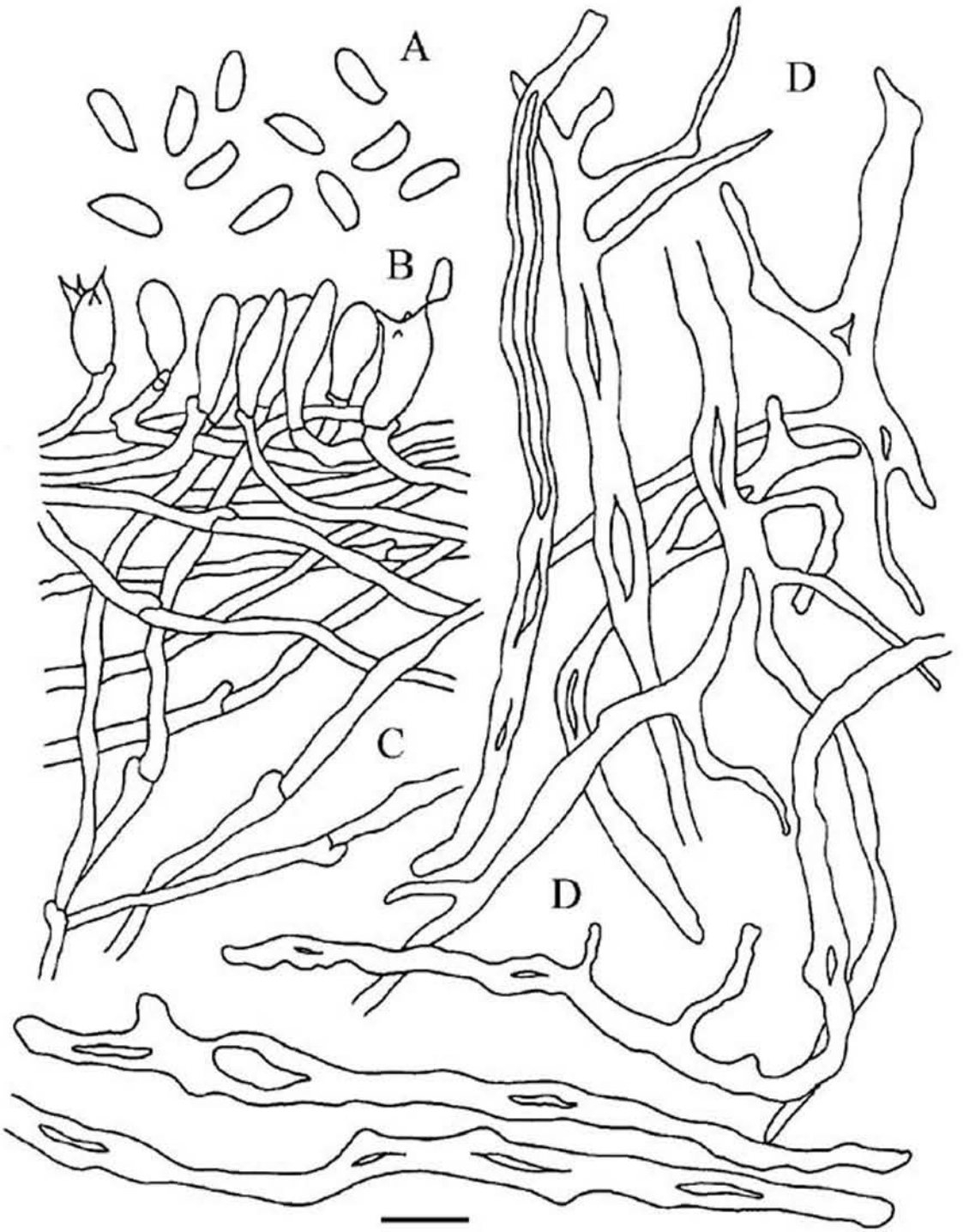

Figure 21: *Polyporus virgatus* (BAFC 31597). A) spores; B) basidia and basidioles; C) generative hyphae; D) skeleto-binding hyphae. Scale bar = 13 μm.

as the basal layer, both masked by a melanoid substance that forms the external band. **Hymenium** formed by clavate, 4-spored basidia, 15-20 x 6-8 μm. **Cystidia** sometimes present among the basidia, and then fusoid, 15-20 x 4.5-6 μm. **Basidiospores** cylindric to subellipsoid, thin-walled, hyaline, 8.5-10.5 x 3-4 μm.

Cultural features: unknown.

Substrate: dead wood of undetermined dicots.

Distribution: Argentina, Brazil, Cuba, Paraguay and Venezuela. Pantropical to subtropical, but not very abundant, according to Núñez & Ryvarden (1995b).

SPECIMENS EXAMINED — ARGENTINA: San Lorenzo, 10.VII.1988 (BAFC 31597). CUBA: leg. C. Wright 94 (**HOLOTYPUS** of *Polyporus virgatus* **K** 60295). **PARAGUAY:** Villa Rica, Sta. Bárbara, I.1882, leg. Balansa 3365 (**HOLOTYPUS** of *P. guaraniticus* **LPS** 25783).

Remarks: *Polyporus virgatus* is easy to recognize by its rather large, flabelliform to petaloid, yellowish brown pileus with dark lineal marking on the margin, and black stipe. It is a relatively rare species in the area under study.

Excluded names

Polyporus anisoporus Delastre & Mont., Ann. Mag. Nat. Hist. 3, 4: 357. 1845.
The specimen is in poor condition.

Polyporus columbiensis Berk., Hooker London J. Bot.1: 454. 1842.
The specimen is sterile.

Polyporus lentus Berk., In Smith, Engl. Flora 5: 134. 1836.
The specimen is in poor condition.

Polyporus luridus Berk. & M.A. Curtis, Grevillea 1: 37. 1872.
The specimen is sterile.

Polyporus grammocephalus Berk., Hooker London J. Bot.1: 148. 1842.
Ryvarden & Meijer (2002: Studies in neotropical polypores 14: New species from the state of Paraná, Brazil) include *Polyporus grammocephalus*. Our analyses of Paraná state collections do not include this species. *Polyporus grammocephalus*, which is morphologically close to *P. philippinensis* Berk., differs primarily in pore size. Pore sizes of the holotypes are 4-5 per mm for *P. grammocephalus* and 1-2 per mm for *P. philippinensis*.

Polyporus maculatissimus Lloyd, Mycol. Notes 66: 1113. 1922.
= *Neolentiporus maculatissimus* (Lloyd) Rajchenb.
See Rajchenberg (1995).

Polyporus repando-lobatus Speg., An. Soc. Cient. Argent. 26: 7. 1888.
The specimen is covered with secondary moulds and indeterminable.

Polyporus tuba Berk. & M.A. Curtis, J. Linn. Soc., Bot. 10(45): 305. 1868.
= *Microporellus obovatus* (Jungh.) Ryvarden. A very badly developed specimen.
See Ryvarden (1984).

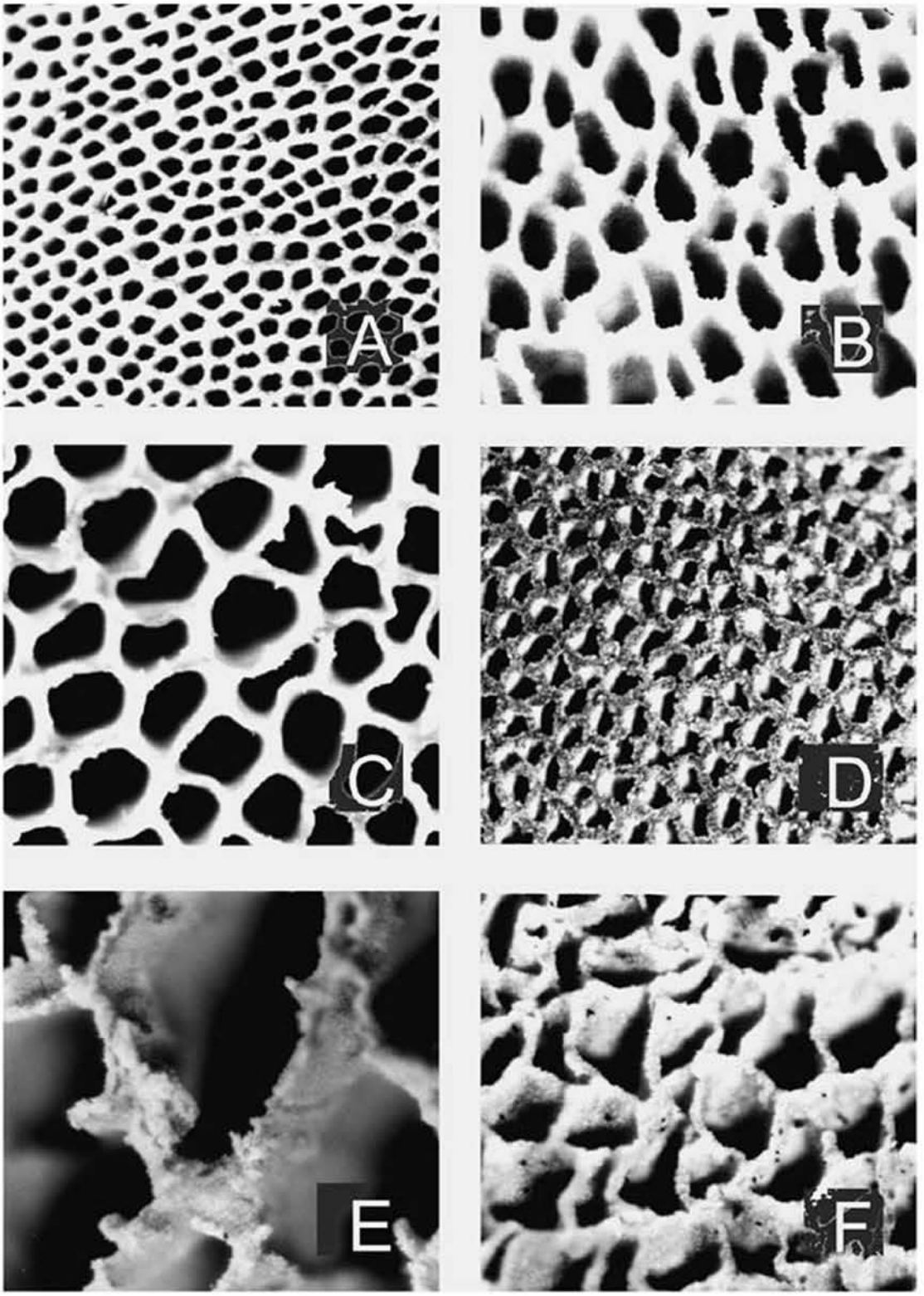

Plate 5. Pore surfaces. A) *Polyporus dictyopus* (BAFC 50787). B) *P. melanopus* (BAFC 50781). C) *P. gayanus* (BAFC 50755). D) *P. leprieurii* (Furtado - ex SP). E) *P. curtipes* (BAFC 25176). F) *P. rhizophilus* (BAFC 50841). All observations under 50 x magnification.

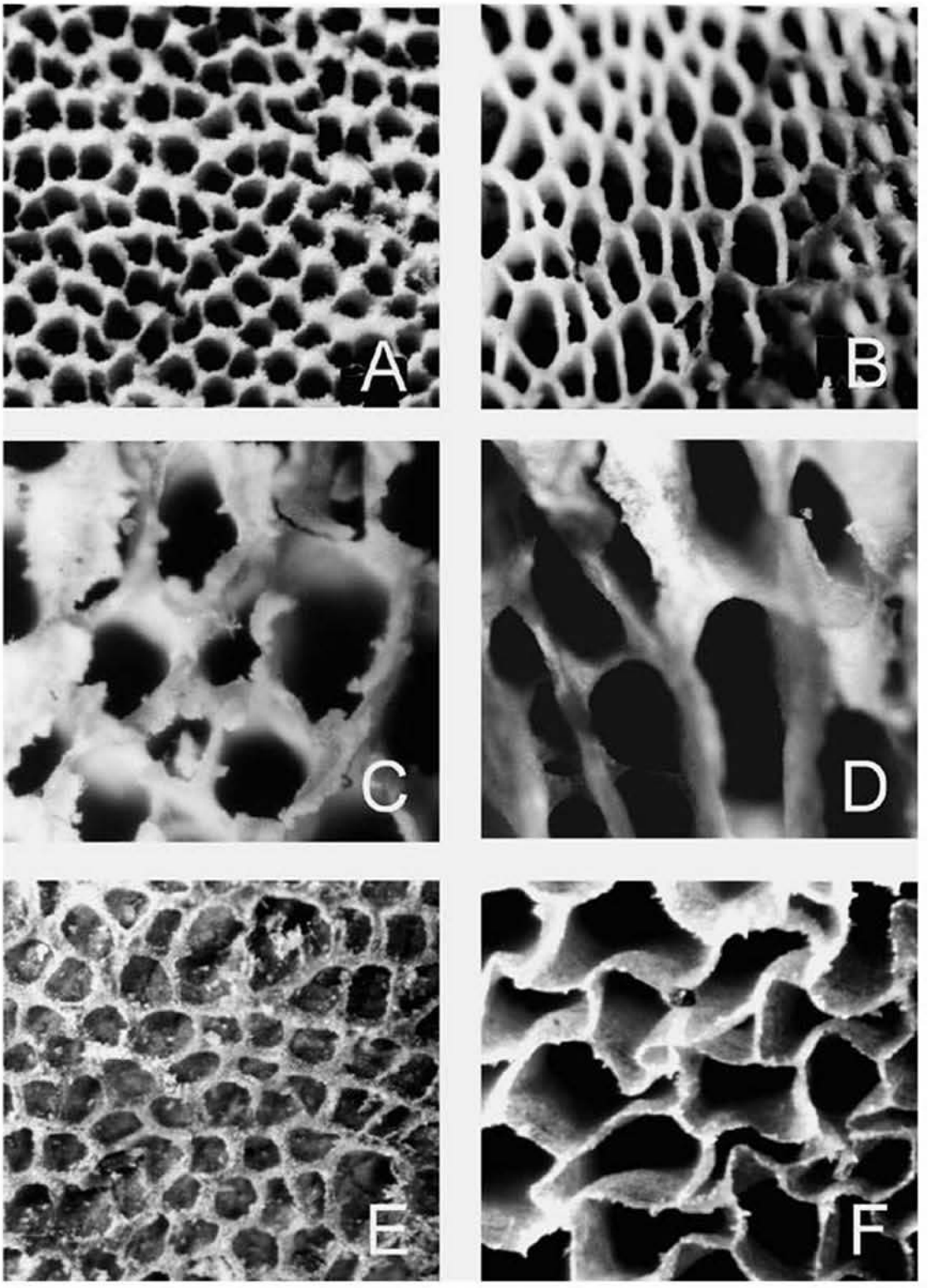

Plate 6. Pore surfaces. A) *Polyporus ciliatus* (BAFC 50369). B) *P. tucumanensis* (BAFC 50339). C) *P. saltensis* (BAFC 31187). D) *P. phillipinensis* (BAFC 50766). E) *P. cyathiformis* (BAFC 30586). F) *P. udus* (A. de Meijer 2010). All observations under 50 x magnification.

Conclusions

We concluded, as did Núñez & Ryvarden (1995b), that *Echinochaete* is an autonomous genus due to the presence of setae on the pileus. A similar criterion has been applied by most authors for the separation of other genera of polypores. Only one species, *E. brachypora*, was found in the area under study.

The four established subgenera: *Polyporus*, *Melanopus*, *Polyporellus*, and *Favolus* are accepted and a new subgenus, *Austropolyporus*, is proposed to accommodate *Polyporus gayanus*.

From this study we concluded that *Pseudofavolus* should not be considered an independent genus, but a synonym of *Polyporus s.str.*, and their species are included here within the subgenus *Favolus*.

Polyporus arcularioides (David & Rajchenberg, 1985) is accepted as an autonomous taxon.

Polyporus brumalis does not appear so far to have been found in the area under study.

Polyporus saltensis is considered an autonomous taxon, different from *P. tenuiculus*, on the basis of the lack of clamps and its apparent restricted distribution to the zone of the Yungas.

Polyporus tucumanensis is considered an autonomous taxon, different from *P. ciliatus*, due to its distribution apparently restricted to the Yungas and the larger pores.

Polyporus guianensis var. *puttemansii* is proposed as a new combination.

Twenty species of *Polyporus s. str.* were identified from the area under study, on the basis of the study of 350 collections and 88 holotypes.

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We wish to thank very especially the Curators of UPS, L, K, LPS and PC for the loan of valuable holotypes of species of *Polyporus*. The herbaria SP, BAFC, CTES, LIL, ICN and NYS, made available specimens in their keeping, which we gratefully acknowledge. Several colleagues assisted us in different ways, and we wish to state here our gratitude to Dr. Mario Rajchenberg, for cooperating in field trips to the Southern Andean Cordillera Nat'l Parks undertaken by the first author, as well as reading the MS and making invaluable suggestions. We also thank Dra. Rosa T. Guerrero (UFRGS) for collaborating with *Polyporus* collections from Rio Grande do Sul, Brazil. Several colleagues from the Dept. of Biological Sciences, University of Buenos Aires, cooperated in one way or another in the fulfillment of this work. Among them, we wish to thank Dr. Edgardo Albertó, Dr. Bernardo E. Lechner, Dra. Andrea I. Romero for their invaluable collaboration, Lic. Suzana Nietiedt, for line drawings and Vagner Gularte Cortez provided expert technical assistance in the drawings and photographs. Dr. John David (CMI) provided important information concerning the status of the order *Polyporales*. This is paper nº 147 of the PRHIDEB-CONICET. We are grateful to Doctors James Ginns and Mario Rajchenberg for critically revising the manuscript.

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Type studies of some *Ganoderma* species from China

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Abstract—Results from the study of the types of *Ganoderma microsporum* and *G. formosanum* reveal that they are synonyms of *G. weberianum* and *G. sinense* respectively. The description of *G. shangsiense* is extended to cover a wider range of basidiospore size based on study of the type and other collections. Full descriptions of *G. weberianum* and *G. sinense* are also provided and the nomenclature of a recently proposed new species, *G. guangxiicum*, is discussed.

Key words—*Ganodermataceae*, *Polyporales*, revision, synonym, taxonomy

中文摘要

小孢灵芝（*Ganoderma microsporum*）和台湾灵芝（*G. formosanum*）模式标本研究的结果显示它们分别是韦伯灵芝（*G. weberianum*）和紫芝（*G. sinense*）的同物异名。基于模式和其他标本的研究，上思灵芝（*G. shangsiense*）的描述得到了扩展，以包括更大的孢子尺寸范围。本文也提供了韦伯灵芝和紫芝的全面描述，并就最近报道的广西灵芝（*G. guangxiicum*）新种的命名法问题进行了讨论。

Introduction

Species of *Ganoderma* P. Karst. have been recorded as 'Chi Zhi', 'Ling Zhi', 'Ling Chi', 'Ling Chih', 'Ling Qi', 'Reishi', 'Zi Zhi', '10,000 year mushroom', 'Herb of spiritual potency' and 'Mushroom of Immortality' in the Chinese literature for thousands of years, but the modern taxonomy of *Ganoderma* only began early last century in China. With the efforts of many researchers, especially Teng (1934, 1939, 1963) and Zhao and his colleagues (Zhao et al. 1981, Zhao 1989), a large number of species in the genus have been found in China. In total, 76 species are recognized in the Chinese mycota of *Ganoderma* (Zhao & Zhang 2000), including 37 new species described from this country. Nine new species reported from China were excluded by Zhao & Zhang (2000), because the type material was not available for study. Among the new species accepted by Zhao & Zhang (2000), 18 were described from Hainan, four from Yunnan, three from Guangxi and Taiwan respectively, two from Fujian, and one from

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Beijing, Guangdong, Guizhou, Jiangxi, Shandong, Sichuan and Xizang successively. However, nearly 60% of these new species were published based on a single collection. In a recently published illustration of *Ganodermataceae* in China, Wu & Dai (2005) included 77 *Ganoderma* species reinstalling two of the species previously excluded by Zhao & Zhang (2000), and proposing a new species and a new Chinese record.

In an investigation of molecular systematics of *Ganoderma* species reported from China, morphological studies of specimens were carried out to ensure the correct material for molecular work. A revision of type material of three species is presented here with re-determination of some of the collections involved and an extension of the morphological description of the species. Comments on nomenclature of the new species recently proposed in Wu & Dai (2005) are also provided.

Materials and Methods

Specimens observed in this study were mainly herbarium collections from China. A strain named *G. capense* (Lloyd) Teng, housed in the China General Microbiological Culture Collection Center, Beijing, China (CGMCC), numbered as AS 5.71, was cultivated on a substrate containing cottonseed shell, hardwood sawdust, wheat bran and lime. The basidioma was collected as a voucher specimen and deposited in HMAS, with the accession number HMAS 97365.

Cutis sections from the base of pileus were cut by a razorblade. The 5% KOH solution and Melzer's reagent were used as the mounting medium. Optical microscopy studies were carried out at × 400 and × 1000. Size ranges of basidiospores and cuticle cells were based on ocular micrometer measurements. For representative data from each species, at least 20 basidiospores were measured in each specimen. The basidiospore size was given both with and without the myxosporium in the species description, but with the myxosporium in the discussion of species in question. Images of cutis structure and basidiospores were captured with a video system mounted on a Zeiss Axioskop microscope using Differential Interference (DIC) microscopy.

Scanning electron microscopy (SEM) was performed for the surface structure of basidiospores. Samples were taken from hymenophore fragments of herbarium collections and mounted directly on ca. 1.0 cm diam. stubs, using double-sided 'sellotape'. The mounted specimens were coated with gold by a SCD005 Sputter Coater and observed in a FEI QUANTA 200 scanning electron microscope.

Taxonomy

The type collections of *G. formosanum*, *G. microsporum*, *G. shangsiense*, and *G. sinense* were studied. The former two were re-determined as *G. sinense* and *G. weberianum* respectively, and a description of these two types is included under the correct names of the species.

Ganoderma shangsiense J.D. Zhao in Acta Mycol. Sin. 7: 13 (1988). **Figs 1 & 2**

Basidioma annual to perennial, sessile but with a slightly or distinctly contracted base, woody. *Pileus* 6.0–8.5 × 9.5–13.5 cm, 0.2–5.0 cm thick, reniform, dimidiate

or flabelliform, applanate or convex; upper surface dull, buff, greyish brown to rusty brown, usually covered with a layer of brown basidiospores, with many narrow grooves or not; margin thin or obtuse, concolorous with the pileus or buff. *Pore surface* white to yellowish when young, purplish brown on bruising or at maturity, sometimes vividly yellow near the margin; tubes stratified in old specimens with or without intervening layers of context tissue, up to 2.5 cm long at the base, brown; pores 4–5 per mm, circular, 130–200 μm diam., dissepiments 50–180 μm thick. *Context* up to 5 mm thick, duplex, upper layer yellow or pale buff, lower layer red brown near the tubes, usually with deposits of melanoid substances in two distinct lines; hyphal system trimitic; generative hyphae 3.0–5.0 μm diam., hyaline, thin-walled, with clamp-connexions; skeletal hyphae 5.5–7.0 μm diam., golden brown in 5% KOH solution, dextrinoid in Melzer's reagent; ligative hyphae 1.0–2.5 μm diam., thick-walled. *Basidiospores* 7.5–12.5 (–13.0) × 6.0–9.0 μm, including myxosporium and 7.5–9.0 × 5.5–7.5 (–8.0) μm, excluding myxosporium; broadly ovoid to subspherical; brown, with a dark brown eusporium bearing few and thick echinulae, overlaid by a hyaline myxosporium; slightly truncate or not at the apex. *Basidia* not seen. *Cutis* anamixodermic, thin, easily cracked, composed of hyaline hyphae only, dextrinoid in Melzer's reagent.

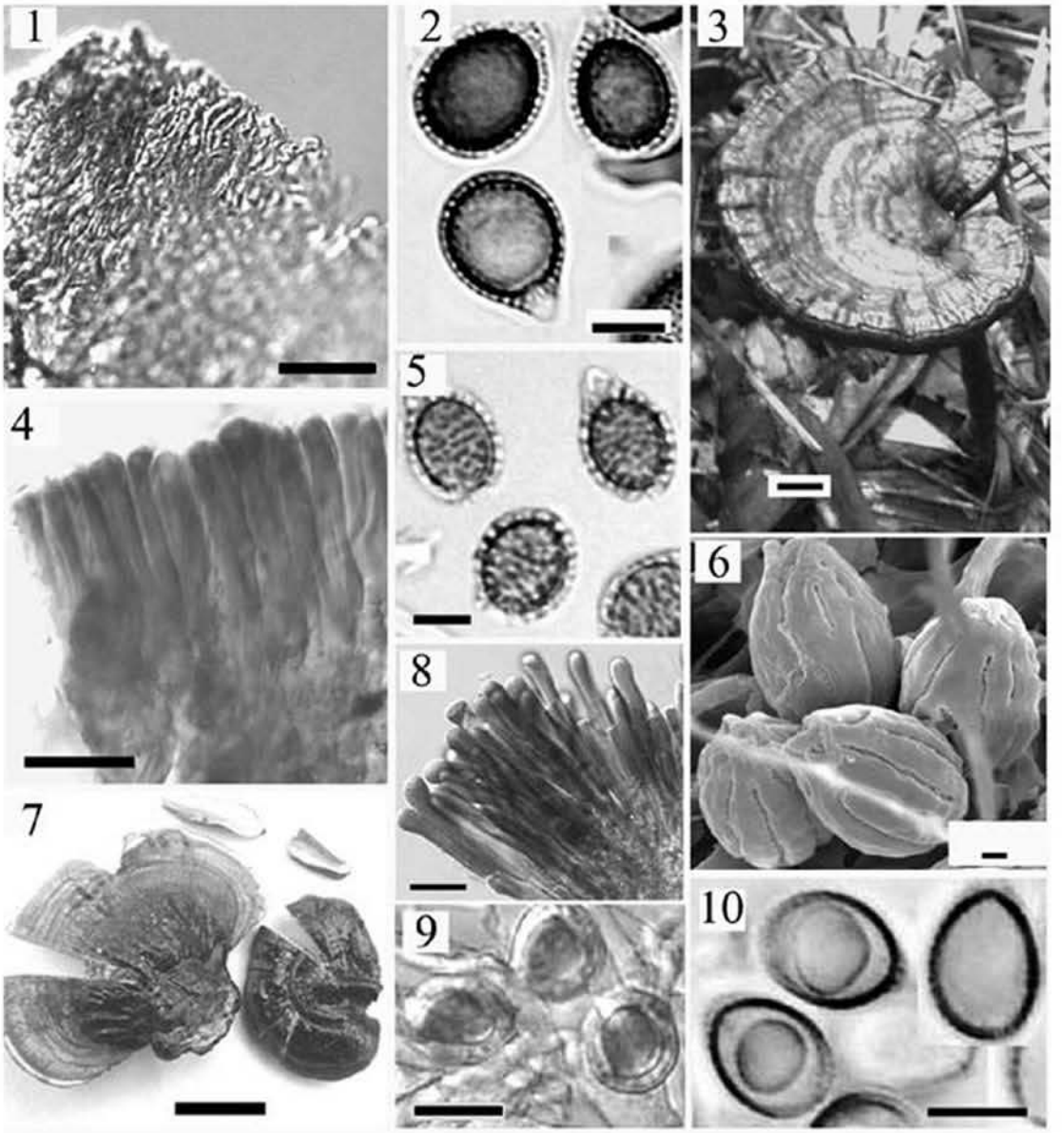
Specimen examined: **China**: **Guangxi**, Shangsi, on rotten wood, 5 Nov. 1958, Z.-C. Liang 1652, HMAS 29741. **Hainan**, Diaoluoshan, on rotten wood, 29 Sept. 1958, J.-H. Yu 325, HMAS 29739 (holotype); Diaoluoshan, on rotten wood, 29 Sept. 1958, J.-H. Yu 147, HMAS 29740; Diaoluoshan, on living tree, 4 Oct. 1958, J.-H. Yu 350, HMAS 29742; Diaoluoshan, on rotten wood of broad-leaved tree, 11 April 1993, J.-P. Lai 1799, HMAS 73477; Diaoluoshan, on dead wood of *Quercus patelliformis* Chun, 13 Dec. 2003, D.-M. Wang 28, HMAS 130043.

Distribution: Guangxi and Hainan provinces, China (Zhao & Zhang 2000, this study).

The above description is based on the listed specimens. This species is characterized by dull upper surface of pileus, duplex context with melanoid substances and broadly ovoid to subspherical basidiospores. The size range of basidiospores was described as 7.5–9.0 (–10.0) × 6.0–7.5 (–8.5) μm by Zhao (1988) and Zhao & Zhang (2000). Examination of the type material, two basidiomata cut in several pieces, revealed that the basidiospore sizes were different between the two basidiomata, although both of them exhibited typical morphological characters of the species. Basidiospores from one of the basidiomata measured 7.5–9.0 (–10.0) × 6.0–7.5 (–8.5) μm (with myxosporium, the same in the followings) and 9.0–10.5 × 8.0–9.0 μm in the other. However, larger basidiospores were also found in the most recent collection cited above, HMAS 130043, reaching 13.0 × 9.0 μm.

Re-examination of the specimens cited in Zhao & Zhang (2000) also revealed that *G. applanatum* (Pers.) Pat. and *G. adspersum* (Schulzer) Donk were involved in some of them, such as HMAS 19804, HMAS 20729, HMAS 26551, HMAS 39668 and HMAS 47653. All of these specimens have concentrically sulcate upper surface of pileus or duplex context, but the yellow to red brown context, broadly ovoid to subspherical basidiospore distinguish *G. shangsiense* from *G. applanatum* and *G. adspersum*. Further, the basidiospores are ovoid and smaller than 8.5 × 6.5 μm in *G. applanatum*, and ellipsoid and 8.5–12.5 × 5.7–7.5 μm in *G. adspersum* (Pegler & Young 1973), compared with those of *G. shangsiense*.

Ganoderma shangsiense has been reported from several provinces of China, i.e. Guangxi, Hainan, Heilongjiang, Sichuan and Xizang (Zhao & Zhang 2000). The distribution of this species in Heilongjiang, Sichuan and Xizang, based on a single misidentified collection, should be excluded. *Ganoderma shangsiense* is a tropical and subtropical species.



Figs 1–10. Photographs of *Ganoderma* spp. Figs 1 & 2. *Ganoderma shangsiense* (HMAS 130043). Fig. 1. Sections of cutis; Fig. 2. Basidiospores. Figs 3–6. *Ganoderma sinense* (Figs 4–6: HMAS 37722, holotype; Fig. 3: HMAS 130316). Fig. 3. Basidioma; Fig. 4. Section of cutis; Fig. 5. Basidiospores under light microscope; Fig. 6. Basidiospores under SEM. Figs 7–10. *Ganoderma weberianum* (Figs. 7–8 & 10: HMAS 57945, isotype; Fig. 9: HMAS 10475). Fig. 7. Basidomata; Fig. 8. Section of cutis; Fig. 9. Gasterospores; Fig. 10. Basidiospores. Bars = 20 μm in Figs 1, 4 & 8; = 5 μm in Figs 2, 5, 6, 9 & 10; = 1 cm in Figs 3 & 7.

Ganoderma sinense J.D. Zhao, L.W. Xu & K.Q. Zhang in Acta Microbiol.Sin. **19**: 272 (1979). **Figs 3–6**

=*Ganoderma formosanum* T.T. Chang & T. Chen in Trans. Br. Mycol. Soc. **82:** 731 (1984).

Misapplications:

Ganoderma japonicum (Fr.) Lloyd in Teng, Fungi of China: 447 (1963); Tai, Syll. Fung. Sin.: 469 (1979); Teng, Fungi of China: 326 (1996), non *Polyporus japonicus* Fr., Epicrisis: 442 (1838) (≡*Ganoderma japonicum* (Fr.) Lloyd, Mycol. Writ. 3: Syn. Stip. Polyp.: 102 (1912)).

Ganoderma lucidum (Leyss.) P. Karst. var. *japonicum* (Fr.) Bres. in Teng in Sinensia **5**: 199 (1934), non *Polyporus japonicus* Fr., Epicrisis: 442 (1838).

Basidoma annual, stipitate, corky-woody. *Pileus* 2.5–6.5 × 5.2–8.0 cm, 0.2–1.2 cm thick in nature, 2.5–6.5 × 3.5–12.0 cm, 0.5–1.5 cm thick when cultivated, dimidiate; upper surface usually purplish black to black, laccate, concentrically sulcate or not, radially rugose; margin often subtruncated. *Pore surface* pale brown to dark brown; tubes up to 1.4 cm long, grey-brown; pores 5–6 per mm, circular, 50–180 μm diam., dissepiments 40–160 μm thick. *Stipe* 6–19 cm long, 0.5–1.0 cm thick, lateral, dorso-lateral or excentric, cylindrical or flattened; concolorous with the pileus, laccate. *Context* 1–5 mm thick, uniformly brown or red brown near the tube layer or with whitish streaks and patches near cutis; hyphal system trimitic; generative hyphae 3.0–5.0 μm diam., hyaline, thin-walled, with clamp-connexions; skeletal hyphae 4.5–7.0 μm diam., golden brown in 5% KOH solution, dextrinoid in Melzer's reagent; ligative hyphae 1.0–2.5 μm diam., thick-walled, much branched. *Basidiospores* 10.5–13.5 (–14.5) × 7.0–9.0 (–10.0) μm, including myxosporium and 8.0–9.0 × 5.5–7.0 μm, excluding myxosporium; ovoid; brown, with a dark brown eusporium bearing few and thick echinulae, overlaid by a hyaline myxosporium, truncate or not at the apex. *Basidia* not seen. *Cutis* hymeniodermic; elements 20–60 × 4.0–8.0 μm, clavate, amyloid in Melzer's reagent.

Specimens examined: **China**: **Anhui**, Dabieshan, cultivated, 5 June 2002, G.-H. Xi, HMAS 77021. **Guangxi**, Rong'an, cultivated, 22 May 2002, N. Li 2, HMAS 77023. **Guizhou**, Ceheng, Ronghong, on rotten wood, 2 July 1986, X.-L. Wu 1012, HMAS 62422 (originally identified as *G. formosanum*); Leigongshan, on rotten wood, 26 May 1986, X.-L. Wu 0234, HMAS 61789; Libo, Maolan, on rotten wood, 25 April 1984, X.-L. Wu 0692, HMAS 66205. **Hainan**, purchased from market, July 2002, Y.-C. Dai HN213, HMAS 97364; Anding, 19 Dec. 1934, X.-K. Deng 7709, HMAS 7509; Diaoluoshan, on rotten wood of hardwood trees, 13 Dec. 2003, D.-M. Wang, wdm37, HMAS 97368; Diaoluoshan, on rotten wood, 12 Dec. 2003, S.-M. Huang, wdm25, HMAS 97367; Diaoluoshan, on the ground with rotten wood of hardwood trees, 13 Dec. 2003, D.-M. Wang 32L, HMAS 130316 and 32S, HMAS 97366; Jianfengling, Sept. 1969, D.-Z. Wang, HN20, HMAS 37722 (holotype of *G. sinense* Zhao, Xu & Zhang); Jianfengling, on the base of *Dacrydium pierrei* Hichel, Sept. 1969, J. Huang, HN17, HMAS 37870; Jianfengling, on the ground with falling wood, 14 Nov. 1969, Y.-N. Yu et al., HN19, HMAS 37869; Wuzhishan, on hardwoods, 1 Feb. 2002, Z.-C. Xie, HMAS 76761. **Jiangxi**, Wanzai, cultivated, 1995, Y.-X. Li and H.-B. Yang 9519, HMAS 76498. **Zhejiang**, Xianju, cultivated on *Tilia* sp., 15 May 2001, Z.-Y. Wang 3, HMAS 77001. **Taiwan**, Tauyuen, on the stem bases of the Formosan sweet gum

(*Liquidambar formosana* Hance), Oct. 1981, T.-T. Chang, TAI 8002 (holotype of *G. formosanum* Chang & Chen).

Distribution: China and Japan (Zhao & Zhang 2000).

The above description is mainly based on the specimens cited above, but the type of *G. sinense* has now become very scanty. It is sad to record that the type comprises only a part of a pileus, compared to the complete basidioma with a long and thin stipe as illustrated in Zhao et al. (1979), where *G. sinense* was published as a new species.

This species is frequently referred by Chinese authors (e.g. Teng 1934, 1939, 1963) to either *G. lucidum* or *G. japonicum*. *Ganoderma sinense* differs from *G. lucidum* in thin-fleshed basidiomata, with longated, slender stipes, rarely branched skeleto-ligative hyphae, together with hyaline *Bovista*-type ligative hyphae (Pegler & Yao 1996). *Ganoderma japonicum* has a yellow pileus when young, red brown or rusty brown at maturity and off-white context (Pegler & Yao 1996), and is distinguished from the purplish black to black pileus and brown context in *G. sinense*.

Ganoderma formosanum is a species described from Taiwan by Chang & Chen (1984) and is very similar to *G. sinense* in habit and both macro- and microscopical morphology. The former species was accepted as a distinct species for the duplex context and ovoid basidiospores with persistent apex by Zhao & Zhang (2000) and this conclusion was followed by Wu & Dai (2005). By examination of the holotype of *G. formosanum* and the specimens of *G. sinense* including the holotype, it is concluded here that the differences used for the discrimination between these two taxa resulted from variable characters and incomplete description. The papillate apex of basidiospores (Chang & Chen 1984) can vary in length and is not persistent, easily broken in old specimens, e.g. the holotype of *G. formosanum*. The elongated depressions on the basidiospores of *G. formosanum* were also observed in specimens of *G. sinense*, although these were not described by Zhao et al. (1979) and Zhao & Zhang (2000). On the context color, Chang & Chen (1984) mentioned that *G. formosanum* had context of a white thin upper part and a dark brown (as 'Warm Sepia, Auburn') lower part next to the tube layer, whilst Zhao et al. (1979) reported uniformly brown context in *G. sinense*. In the present study, it was noticed that the context in some specimens of *G. sinense* was brown with white patches or becoming woody near the cutis. Furthermore, ITS sequences from collections named as the two taxa were very similar to each other (Moncalvo et al. 1995b) and this was also confirmed by this study (data not shown). Based on both morphological and molecular data, it is concluded here that *G. formosanum* and *G. sinense* are synonyms and the latter is the correct name to be used.

Ganoderma weberianum (Bres. & Henn. ex Sacc.) Steyaert in Persoonia **7**: 79 (1972). **Figs 7–10**

≡*Fomes weberianus* Bres. & Henn. ex Sacc., Syll. Fung. **9**: 174 (1891).

=*Ganoderma microsporum* R.S. Hseu in Mycotaxon **35**: 36 (1989).

Misapplications:

Ganoderma subumbraculum Imazeki in Pilát in Ann. Mycol. **38**: 79 (1940), non Imazeki in Bull Nat. Sci Mus Tokyo **1**: 38 (1939).

Ganoderma capense (Lloyd) Teng in Teng, Fungi of China: 448 (1963) pro part., non *Polyporus capensis* Lloyd, Mycol. Writ. 5, Let. **63**: 10 (1916).

Basidioma annual, sessile to stipitate, corky-woody. *Pileus* 1.5–4.5 × 3.5–5.0 cm, 0.2–0.5 cm thick, flabelliform to conchate, applanate or convex; upper surface initially yellow, then with a transitional yellowish red zone to purplish black, almost black at maturity; concentrically and narrowly zonate or sulcate, radially and finely rugose, strongly laccate; margin thin, sometimes incurved, broadly sterile below, white when young, yellowish red or almost black at maturity. *Pore surface* at first cream-white, then vividly yellow, staining dark brown at maturity or on bruising; tubes up to 2 mm long, grey-brown, contrasting with context; pores 5–6 per mm, circular, 120–160 μm diam., dissepiments 20–80 μm thick. *Stipe* 0.7–1.0 × 0.4–1.5 cm, horizontal or dorsally lateral, stumpy or cylindrical; almost black, strongly laccate. *Context* 2–4 mm thick, uniformly pale buff or upper layer pale woody or pale buff, lower layer cinnamon brown; usually with thin, shiny and horn-like deposits, with a few gasterospores; hyphal system trimitic; generative hyphae 3.0–5.0 μm diam., hyaline, thin-walled, with clamp-connexions; skeletal hyphae 4.0–6.5 μm diam., hyaline to pale yellow in 5% KOH solution, dextrinoid in Melzer's reagent; ligative hyphae 1.0–2.5 μm diam., abundant near the cutis, thick-walled. *Basidiospores* 6.0–9.0 × 4.5–6.5 μm, including myxosporium and 4.5–7.0 × 3.5–4.5 μm, excluding myxosporium; ovoid to subspherical; brown, with a dark brown eusporium bearing fine and barely visible echinulae, overlaid by a hyaline myxosporium. *Basidia* not seen. *Cutis* hymeniodermic; elements 40–90 × 5.0–12.0 μm, clavate, amyloid in Melzer's reagent.

Specimens examined: **China: Beijing**, Huairou, Edible Mushroom Farm, cultivated from AS 5.71 in the China General Microbiological Culture Collection Centre (CGMCC) labelled as *G. capense* from Hainan, 27 Aug. 2003, D.-M. Wang, HMAS 97365. **Taiwan**, Taipei, on *Salix babylonica* Linn., 21 Aug. 1983, R.-S. Hseu, HMAS 57945 (isotype of *G. microsporum* Hseu). **Tianjin**, habit unrecorded, 27 Oct. 1925, Emilio Licentio 1266, HMAS 10475 (originally identified as *G. subumbraculum* Murrill by A. Pilát). **Yunnan**, Xiaguan, on rotten wood of broad-leaved tree, 24 Aug. 1985, Q.-X. Wu 544, HMAS 54010 (originally identified as *G. capense* and redetermined as *G. microsporum* by X.-Q. Zhang).

Distribution: Africa, Indonesia and Samoa Islands (Steyaert 1972); Australia, South-east Asia and the Pacific regions (Smith & Sivasithamparam 2003); North of China (this study).

The above description was mainly based on the isotype of *G. microsporum* and is similar to that of Hseu et al. (1989), although gasterospores and horny-like deposits were not mentioned in the protologue. All the specimens examined in this study have horizontal to dorsally lateral stipe, flabelliform to conchate pileus with concentrically colored zones and distinct, fine wrinkles, light-colored context, and small basidiospores (6.0–9.0 × 4.5–6.5 μm) with short and barely visible interpillar echinulae. These features basically conform to the descriptions of *G. weberianum* (Bres. & Henn. ex Sacc.) Steyaert (see Steyaert 1972). The phylogenetic analysis of ITS sequences from the strain named *G. capense* in this study (data not shown), the holotype of *G. microsporum* (Moncalvo et al. 1995a, X78751 and X78772), and collections of *G. weberianum* from eastern Asia (Moncalvo et al. 1995a, X78751 and X78772; Moncalvo et al. 1995b, Z37064 and Z37086) and from Australia (Smith & Sivasithamparam 2000, sequences not deposited in the public databases), also suggested the conspecific relationship of these collections.

According to the principle of priority in the ICBN (Greuter et al. 2000), *G. weberianum* is the correct name for use.

Teng (1963) reported *G. capense* from Yunnan and Hainan, China, with description of a dark purplish pileus, 7–12 × 11–19 × 1–1.5 cm, woody context, lateral and stumpy stipe when present, and small basidiospores 7.5–10 × 5.5–7 μm. This description is very similar to that of *G. weberianum*. The living strain, AS 5.71 from which HMAS 97365 (cited above) was cultivated, was apparently named after Teng's (1963) concept as '*Ganoderma capense* (Lloyd) Teng', isolated by Guangdong Institute of Microbiology from Hainan. However, examination of two other specimens in HMAS determined as *G. capense* by S.-C. Teng, HMAS 31829 and HMAS 23627, showed that they belonged to other species. HMAS 31829 differed from *G. weberianum* by red brown context, short crust elements (less than 20 μm long) and larger basidiospores (reaching 11.5 × 7.0 μm) with distinct echinulae, and HMAS 23627 also has larger basidiospores (9.0–10.5 × 6.0–8.0 μm) although it is macroscopically similar to *G. weberianum*.

Ganoderma subumbraculum was published as a new species with strongly convex pileus, centrally attached stipe, three-layer context, cinnamon to off-white to dark cinnamon from cutis to tube layer and ovoid basidiospores 11–12 × 7–7.5 μm (Imazeki 1939). HMAS 10475 was identified as *G. subumbraculum* by Pilát (1940) and accepted by Zhao & Zhang (2000). Examination of the specimen in the present study showed typical morphological characters of *G. weberianum* and is almost identical to HMAS 97365 (cultivated from AS 5.71).

Steyaert (1972) mentioned two different sizes of cuticular elements in *G. weberianum* as 30 × 7–8 μm and 20 × 10–12 μm, and concluded that the collections with the former only had a few gasterospores in the context whilst those with the latter produced gasterospores in abundance. The variability in producing gasterospores was also found in the present study, very abundant in HMAS 97365 and HMAS 10475, a few in HMAS 57945 and none in HMAS 54010. The correlation between the size of cuticular elements and the gasterospore number, however, was not confirmed. The incongruence of cutis description between Steyaert (1972) and this study might result from different sampling sites, because the development of the cutis varies with age (see also Ryvarden 1995).

It was also noticed in this study that collections of *G. weberianum* might display horizontal stipe and distinct colored-zones on upper surface of pileus when young, becoming dorso-lateral sitpe and almost black pileus surface at maturity, e.g. HMAS 57945 (Fig. 1A) and HMAS 10475.

Ganoderma weberianum was reported as a tropical species by Steyaert (1972). The record in Tianjin, as specimen cited above, extends the distribution of this species to the north temperate zone. A distribution in temperate and tropical south east Asia, central to north-eastern Australia and Pacific regions was specified by Smith & Sivasithamparam (2003) although no evident specimens from all of these areas were cited in their work.

Ganoderma microsporum Hseu is a recent synonym and should not be used. The distribution of *G. subumbraculum* in China should also be excluded because the only record was reported by referring to one specimen (HMAS 10475), which proved to be *G. weberianum* as shown above.

Ganoderma guangxiicum X.L. Wu in Wu & Dai, Col. Illu. *Ganodermataceae* China: 145 (2005).

This is a recently proposed new species as '*Ganoderma guangxiica* X.L. Wu sp. nov.', with description in Chinese, in an illustration book (Wu & Dai 2005). The Latin diagnosis and designation of the type were lacking. According to Articles 32.1, 36.1 and 37.1 of ICBN (Greuter et al. 2000), this is an invalid name and is in need of validation. However, from the description and illustrations of the species provided in Wu & Dai (2005), it is not a typical member of *Ganoderma*, because the basidiospores were smooth without echinulae and not truncate at the apex.

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The authors are grateful to Professors D. N. Pegler and H. Knudsen for serving as pre-submission reviewers and for their valuable comments and suggestions, to Dr S.-H. Wu for the loan of the holotype of *Ganoderma formosanum*, to Dr. Y.-C. Dai and Mr. S.-M. Huang for the gift of *G. sinense* specimens and to Drs X.-Z. Liu, B. Liu, G.-Z. Zhao and Miss M.-H. Sun for their kind help in a field trip to Hainan. This project is supported by the Key Research Direction of Innovation Programme (KSCX2-SW-101C) and the scheme of Introduction of Overseas Outstanding Talents, operated by the Chinese Academy of Sciences, a project grant (30270006) and the National Science Fund for Distinguished Young Scholars (30025002) from the National Nature Science Foundation of China, and the National Hi-Tech Research and Development Plan (2004AA227100) from the Ministry of Science and Technology.

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MYCOTAXON

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Parmeliaceae (Ascomycota) lichens in China's mainland IV. *Melanelia* species new to China

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Abstract—Four *Melanelia* species are reported as new to China: *Melanelia exasperata*, *M. poeltii*, *M. tominii* and *M. villosella*.

Key words—brown *Parmeliae*, new distribution, Asia

Introduction

The brown species of *Parmelia* were first revised by Esslinger (1977) who initially recognized three subgenera: *Allantoparmelia* (Vain.) Essl., *Neofusca* (Gyeln.) Essl., and *Melanoparmelia* (Hue) Essl. Later (Esslinger 1978), these three taxa were raised to genus level, with subgenus *Melanoparmelia* becoming *Melanelia* Essl. These segregates have been widely, although not universally, accepted, and a recent paper (Blanco et al. 2004) using molecular, morphological, and chemical data has proposed a further rearrangement in which the majority of the species of *Melanelia* are segregated into at least two more genera, *Melanelixia* O. Blanco et al. and *Melanohalea* O. Blanco et al. Since that research is ongoing and a complete arrangement for all species of *Melanelia* was not provided, we have chosen in this paper to continue to use the genus *Melanelia* in its original sense.

Melanelia species are characterized by a foliose thallus, with an olive-brown to black brown upper surface (K–, HNO_3–); pseudocyphellae, soredia, or isidia may be present, and a few species have tiny, hyaline cortical hairs. The lower surface has simple, moderate to sparse rhizinae. Typically, they contain orcinol depsides or ß-orcinol depsidones in the medulla, although this is one of the few parmelioid groups with some species totally lacking medullary lichen compounds. As originally circumscribed, the genus *Melanelia* comprises about 40 species, distributed mainly in temperate to boreal regions of the Northern Hemisphere. In China nine species of *Melanelia* were reported in the enumeration by Wei (1991): *M. elegantula* (Zahlbr.) Essl., *M. exasperatula* (Nyl.) Essl., *M. fuliginosa* (Fr. ex Duby) Essl., *M. glabra* (Schaerer) Essl., *M. huei* (Asahina) Essl., *M. olivacea* (L.) Essl., *M. sorediata* (Ach.) Goward & Ahti, *M. stygia*

(L.) Essl., and *M. subverruculifera* (J.C. Wei & Y.M. Jiang) J.C. Wei. A tenth species, *M. subargentifera* (Nyl.) Essl., was reported from Xinjiang by Abbas and Wu (1998).

Recently, Zibirnisa et al. (2004) reported *M. glabroides* (Essl.) Essl., and *M. tominii* (Oxner) Essl. from Xinjiang in China. However, the report is brief and lacks a discussion, important synonyms, and related literature citations under each species. Also, these authors state that *M. tominii* contains lecanoric acid and gyrophoric acid, which puts the record in doubt. Our studies show *M. tominii*, which we herein report from three provinces of China, contains gyrophoric acid as the major lichen substance but lacks lecanoric acid. This is also in agreement with the results of Esslinger (1977, 1992). Our studies show that *M. exasperata*, *M. poeltii*, *M. subargentifera*, and *M. villosella* should also be added to the Chinese lichen flora.

Materials and methods

The specimens studied from mainland China are housed in HMAS-L (Lichen Section, Herbarium of the Institute of Microbiology, Academia Sinica) unless otherwise indicated. The morphology of the lichen specimens was examined using a Zeiss stereo microscope and Zeiss compound microscope. Chemical constituents were identified by thin layer chromatography (Culberson 1972).

The species

1. *Melanelia exasperata* (De Not.) Essl., Mycotaxon **7**: 47 (1978).
=*Parmelia exasperata* De Not., Giorn. Bot. Ital. **2**: 193 (1847).

This species is characterized by the numerous, more or less evenly scattered, conical to short-cylindrical papillae bearing distinctive pseudocyphellae at the tip, by the lack of soredia and true isidia, and by the absence of lichen substances in the medulla (K–, C–, KC–, PD–). The papillae or warts of *M. exasperata* have sometimes been referred to as isidia, but they are not true isidia, since they rarely if ever become detached. *Melanelia elegantula and M. laciniatula* have similar papillae, although they are usually smaller. In *M. elegantula* these papillae usually elongate to form cylindrical, usually branched isidia, and in *M. laciniatula* they often expand to form the lobules which more or less cover the central part of the thallus. By contrast, the papillae in *M. exasperata* are usually short, broad-based and more or less conical, or become short-cylindrical but they remain quite firm and are unlikely to break off with any frequency.

Melanelia exasperata has been reported from North America, Europe and North Africa (Esslinger 1977). New to China.

Specimen examined: CHINA. **Xinjiang,** Kermasen, *A. Abbas 9600229*.

2. *Melanelia poeltii* Essl., Mycotaxon **28**: 215 (1987).

This species is characterized by the narrow lobes (1-3mm wide), isidia which arise as small spherical papillae and become cylindrical to rather irregular, becoming short branched, the sparse pseudocyphellae (absent on some lobes), and the presence of fumarprotocetraric acid in the medulla (PD+ red-orange or PD– only in some older thallus parts, K–, C–, KC–). *Melanelia poeltii* is similar to *M. elegantula* in habit and habitat, but the latter species lacks detectable lichen substances. In fact, *M. poeltii* is

the only member of the genus with true isidia which contains fumarprotocetraric acid. Among other isidiate species, *M. elegantula*, *M. infumata*, *M. exasperatula* and *M. subelegantula* lack detectable lichen substances, and *M. fuliginosa* contains lecanoric acid (C+ red). Although *M. olivaceoides* also contains fumarprotocetraric acid and has isidia-like progagules, they are actually isidioid soredia rather than true isidia. Also, *M. olivaceoides* lacks pseudocyphellae.

Melanelia poeltii was previously known only from Nepal (Esslinger 1987). New to China, but known only from Sichuan of southwest China).

Specimen examined: CHINA. **Sichuan**, Maerkang, Mt. Mengbishan, alt. 4100m, on bark, *X Y. Wang & X. Xiao 11553*.

3. *Melanelia tominii* (Oxner) Essl., Lichenologist **24**: 17 (1992).

= *Parmelia tominii* Oxner, Zh. Bio.-Bot. Tsyklu, Kyev **1933(7-8)**: 171 (1933).
= *Parmelia substygia* Räsänen, Lichenes Fenniae Exs. **51** (1935).
= *Melanelia substygia* (Räsänen) Essl., Mycotaxon **7**: 47 (1978).
= *Parmelia borisorum* Oxner, Bot. Zh., Kyyiv **1**: 33 (1940).
= *Parmelia saximontana* R.A. Anderson & W.A. Weber, Bryologist **65**: 236 (1962).
= *Parmelia altaica* Oxner, Ukr. Bot. Zh.**27**: 175 (1970).

This species is characterized by the rather narrow lobes (1-3 mm wide), the laminal, distinct to somewhat obscure pseudocyphellae, the presence of gyrophoric acid in the medulla (K–, PD–, C+ rose–red), and the saxicolous habit. Most specimens have laminal and marginal, punctiform to capitate soralia composed of granular soredia, although, with varying frequency, esorediate specimens occur throughout much of its range. *M. tominii* is distinguished from other similar sorediate species by the presence of gyrophoric acid rather than perlatolic and stenosporic acids (C–) which occur in *M. disjuncta* and *M. sorediata*. In addition, *M. sorediata* lacks pseudocyphellae, and *M. disjuncta* has only submarginal pseudocyphellae which are often indistinct and obscure. After studying the relevant type specimens, Esslinger (1992) reduced *Parmelia altaica*, *P. borisorum* and *P. substygia* as synonyms of *M. tominii*. The morphological and chemical variation of this species were discussed by Krog (1966) and Esslinger (1977 & 1992).

As mentioned, *Melanelia tominii* is considered to be a sorediate species, but some specimens lack soredia or have only a few soredia. Chinese specimens of this species examined by us lack soredia. Esorediate specimens of *M. tominii* can be distinguished from similar esorediate species by its distinctive chemistry. In *M. tominii* the major medullary substances are gyrophoric acid, slightly smaller amounts of ovoic acid [reported originally as unknown W.G.-2 by Esslinger (1977)], and a trace of unknown W.G.-1. Rarely, as in the type specimen of *M. borisorum*, ovoic acid is replaced by umbilicaric acid (Esslinger 1992). Therefore, the report by Zibirnisa et al. (2004) of a Chinese specimen of *M. tomini* containing lecanoric acid as a major component may be based on a misidentification or other error.

Melanelia tominii is widely distributed in the Northern Hemisphere: North America, Europe, and Asia (Pakistan, Nepal, Mongolia, Siberia, and Kazakhstan).

Representative specimens examined: CHINA. **Beijing**, Mt Donglingshan, alt.2250m, *C. M. Wetmore 75102* (Herb. Esslinger). **Neimengguo**, Balingyouqi. alt. 1400m, *J. B. Chen 20182, 20220*. **Sichuan** , Mt. Gonggashan, alt. 3300m, *X. Y. Wang et al. 8987*.

4. *Melanelia villosella* (Essl.) Essl., Mycotaxon **7**: 49 (1978)

=*Parmelia villosella* Essl., J. Hattori Bot. Lab. **42**: 95 (1977).

This species is characterized by the cylindrical isidia and numerous cortical hairs on the upper surface and isidia, and the presence of lecanoric acid in the medulla (K–, P–, C+ red). *Melanelia villosella* is a very distinctive species not easily mistaken for any other. Closely related *M. subargentifera* occasionally has pustular soredia which might be confused for the isidia of *M. villosella*, except the pustules eventually break apart forming soredia and the true isidia do not. *Melanelia piliferella* (Essl.) Essl. from Australia is similar to *M. villosella*, with isidia and cortical hairs, but *M. piliferella* is a much finer species and contains gyrophoric acid rather than lecanoric acid.

Melanelia villosella occurs in Asia (India and Pakistan) (Esslinger 1977) and North America (Arizona) (Esslinger 2002). New to China.

Representative specimens examined: CHINA. **Shaanxi** , Mt.Taibeishan, alt. 2800m, *X. Q. Gao 2995*, **Sichuan**, Xiaaba, alt. 3100 m, *X. Y. Wang & X. Xiao 11192*.

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Zibirnisa Omar, Aziguli Keyimu & Abdulla Abbas. 2004. New Chinese records of the lichen genus *Melanelia*. Acta Botanica Yunnanica 26: 385-386. [NOTE: Although the third author's surname is Abbas and his given name Abdulla, this journal (and some others) presents it in reverse, as given here, both on the title page and on the journal contents page.]

MYCOTAXON

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Myxomycetes from Chihuahua, Mexico III

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Abstract— 19 taxa of *Myxomycetes* from the state of Chihuahua are described. Six of them are new records for Mexico: *Dianema corticatum, Macbrideola synsporos, Perichaena syncarpon, Physarum newtonii, Symphytocarpus amaurochaetoides* and *Trichia decipiens* var. *olivacea*. The others are new records for the state of Chihuahua: *Badhamia nitens* var. *aurantiaca, Clastoderma debaryanum, Craterium paraguayense, Comatricha elegans, C. tenerrima, Diderma effusum, Lamproderma gulielmae, Macbrideola cornea, Physarum didermoides, P. cinereum, Trichia agaves, T. varia* and *Willkommlangea reticulata*. Microphotographs of the taxa new for Mexico or little known species are given.

Key words — Myxomycota, SEM, taxonomy, chorology

Introduction

This work is a continuation of our studies on the *Myxomycetes* of the state of Chihuahua (Lizárraga et al. 2003, 2005), in which 87 taxa have been described. With the present contribution the number increases to 106 taxa. Veracruz and Tlaxcala are the states with major diversity of *Myxomycetes* with 133 and 112 taxa, respectively, followed by Baja California with 88.

Some of the described species, such as *Comatricha elegans, Dianema corticatum, Lamproderma gulielmae, Macbrideola synsporos, Perichaena syncarpon, Physarum newtonii, Symphytocarpus amaurochaetoides* and *Willkommlangea reticulata* are rare or little known taxa worldwide. Therefore, SEM photographs of their spore ornamentation are provided, in some cases the first ones published.

Materials and Methods

All the material has been either collected in the field or obtained in moist chamber cultures. The intention of the current work is to complete the information about ecology and chorology.

The specimens are deposited in the Herbarium UACJ of the "Departamento Ciencias Básicas Universidad Autónoma de Ciudad Juárez", Mexico. A duplicate of rare species or species new for Mexico are deposited in the herbarium AH of the "Departamento de Biología Vegetal (Botánica), Universidad de Alcalá, Alcalá de Henares, Madrid", Spain.

Detailed descriptions are given only for species that are first records for Mexico.

The collected material was mounted in Hoyer's medium and studied with a Nikon (Optiphot) microscope. Scanning electron microscopy (SEM) images were made with a Zeiss DSM-950. The optical microscope (OM) was used to make spore measurements under oil immersion and include surface structures such as spines or warts. Observations of the spore ornamentation by SEM have been made after applying the critical point drying technique as indicated in Moreno et al. (2002).

List of Species

Badhamia nitens* var. *aurantiaca (Lizárraga, G. Moreno & Illana) Lizárraga, G. Moreno & Illana, Mycotaxon 63: 289. 1997

= *Badhamia aurantiaca* Lizárraga, G. Moreno & Illana, in Lizárraga, Moreno, Illana & Castillo, II Congreso Internacional de Sistemática y Ecología de Myxomycetes, ICSEM2, Madrid: 56. 1996

SPECIMENS EXAMINED — MEXICO. CHIHUAHUA: Cumbres de Majalca, on bark of *Quercus* sp., *leg.* M. Lizárraga, G. Mendoza, H. Pelayo & P. García, obtained in moist chamber culture on 14-VI-2004, UACJ 647.

COMMENTS — *Badhamia nitens* var. *aurantiaca* is characterized by its sessile sporocarps, growing solitarily or in groups, with a single, orangish to ocraceous orangish peridium, its calcareous, orange capillitium with big nodes forming a three-dimensional net and by its spores forming clusters of 3-18 spores, each spore being subglobose to pyriform, 10-12 μm in diam., ornamented on 2/3 of its surface with spines, the other third lacking spines. In Mexico this variety is only known from Baja California (Lizárraga et al. 1997). *Badhamia nitens* var. *nitens* Berk. that has yellowish colorations has been cited from Baja California (Lizárraga et al. 1997) and Tlaxcala (Hernández-Cuevas & Estrada-Torres 1993).

Clastoderma debaryanum A. Blytt, Bot. Zeitung (Berlin) 38: 343. 1880

SPECIMENS EXAMINED — MEXICO. CHIHUAHUA: Basaseachic, Ocampo, on decomposing wood, *leg.* M. Lizárraga & H. Pelayo, 9-X-2004, UACJ 811, 813, 814 and 818.

COMMENTS — This species has been cited in Mexico in the states of Jalisco, Quintana Roo, Sinaloa, Veracruz (Illana et al. 2000) and recently from Yucatán (Stephenson et al. 2003).

Comatricha elegans (Racib.) G. Lister, Guide Brit. Mycetozoa, ed. 3: 31. 1909

FIGURES **1-3**

SPECIMENS EXAMINED — MEXICO. CHIHUAHUA: San Bernabé Cusihiciachi, Cuahutemoc, on bark of *Quercus* sp., *leg.* E. Orozco, obtained in moist chamber culture

on 07-I-2004, UACJ 577 in AH 31773 (together with *Macbrideola synsporos*). *Ibidem*, 12-III-2004, UACJ 611 and 652 in AH 31774.

COMMENTS — *Comatricha elegans* is characterized by its small, reddish brown sporocarps, with a columella typically splitting into several thick capillitium branches. The globose spores, 9-10 μm in diam., show an ornamentation formed by spines; under SEM dense baculae can be observed.

In order to determine this species we have followed the concept of Lister (1925), who drew sporocarps with a columella and ramifications as in our material. Recently Mitchell (2004) describes a *Comatricha elegans* collection with "primary branches of the capillitium arising abruptly either from the top of the stalk (columella absent) or from the tip of a short columella that rarely reaches to the centre of the sporotheca".

This species has been cited previously from Jalisco and Veracruz (Illana et al. 2000).

Comatricha tenerrima (M. A. Curtis) G. Lister, Guide Brit. Mycetozoa, ed. 4: 39. 1919 **FIGURE 4**

SPECIMENS EXAMINED — **MEXICO. CHIHUAHUA:** San Bernabé Cusihiciachi, Cuahutemoc, on stems of *Quercus* sp., *leg.* E. Orozco, obtained in moist chamber culture on 8-III-2004, UACJ 612 (together with *Macbrideola synsporos*).

COMMENTS — *Comatricha tenerrima* differs macroscopically by its sporocarps with sporothecae ending in a pointed apex and by its lax and spiny spore ornamentation. When viewed under SEM, the spore ornamentation is formed by characteristic baculae with stellate apices.

The spore ornamentation of this species agrees with the studies of Rammeloo (1983). The species was cited previously from Baja California, Guerrero, Jalisco and Tlaxcala (Illana et al. 2000) and from the states of Quintana Roo and Veracruz (Lado et al. 2003).

Craterium paraguayense (Speg.) G. Lister in Lister, Monogr. Mycetozoa, ed. 2: 95. 1911 **FIGURES 17-18**

SPECIMENS EXAMINED — **MEXICO. CHIHUAHUA:** Rancho "Las Tinajas", ctra. a Namiquipa km. 15, Chihuahua, on leaves of *Quercus* sp., *leg.* M. Lizárraga, H. Pelayo, E. Alvarez & L. de la Rosa. 27-VIII-2004, UACJ 679, 681, 682 in AH 31775 and 713.

COMMENTS — This species is characterized by its stalked sporocarps, its cylindrical, violaceous sporotheca with circumscissile dehiscence and by its capillitium that is also violaceous.

Castillo et al. (2002) did a comparative SEM study of the types of *Craterium paraguayense* and *Physarum newtonii* T. Macbr., as sometimes they can be confused macroscopically. The spore ornamentation of these two species is very different, as in the case of *P. newtonii* the strong spines seen with LM, are seen under SEM as very pronounced baculae. In the case of *C. paraguayense* the spores appear as small warts under LM, and under SEM as small verrucae alternating with short baculae. We have been able to confirm this type of spore ornamentation in the collections of Chihuahua.

This species, described from Paraguay (therefore its name), is considered by Martin & Alexopoulos (1969) as "largely subtropical or tropical". In Mexico it was found both in tropical zones, in Veracruz in Los Tuxtlas Tropical Biology Station (Lado et al. 2003) and Quintana Roo in El Edén Ecological Reserve (Stephenson et al. 2003), and in temperate regions, in Tlaxcala (Hernández-Cuevas et al. 1991, Rodríguez-Palma 1998).

Dianema corticatum Lister, Monogr. Mycetozoa: 205. 1894 FIGURES **5-6**

SPECIMENS EXAMINED — MEXICO. CHIHUAHUA: Cumbres de Majalca, on bark of *Quercus* sp., *leg.* M. Lizárraga, G. Mendoza, H. Pelayo & P. García, put in moist chamber on 3-III-2004, obtained on 11-III-2004, UACJ 610. *Ibidem*, obtained on 18-III-2004, UACJ 603. *Ibidem*, obtained on 26-III-2004, UACJ 623. *Ibidem*, 6-IV-2004, UACJ 618 in AH 31776.

DESCRIPTION — Fructifications sporocarpic to plasmodiocarpic, sessile, scattered, 0.2-1 mm in diam. Sporotheca flattened to subglobose, with irregular dehiscence. Peridium membranous, hyaline to greyish yellow. Columella absent. Hypothallus membranous, inconspicuous. Capillitium composed of filaments 1-2 μm in diam., attached to base and the upper peridium wall, bearing some swellings. Spores in clusters of 2-9 units, olivaceous in mass, light olivaceous by transmitted light, subglobose to pyriform, 10-12 μm in diam., spiny. Under SEM the spore ornamentation is seen to be formed of baculae.

COMMENTS — Although this species is common in spring in mountainous areas on coniferous wood and coincides sometimes with thawing of snow, it also fructifies in Mediterranean zones on wood of *Pinus halepensis* (Oltra 1995).

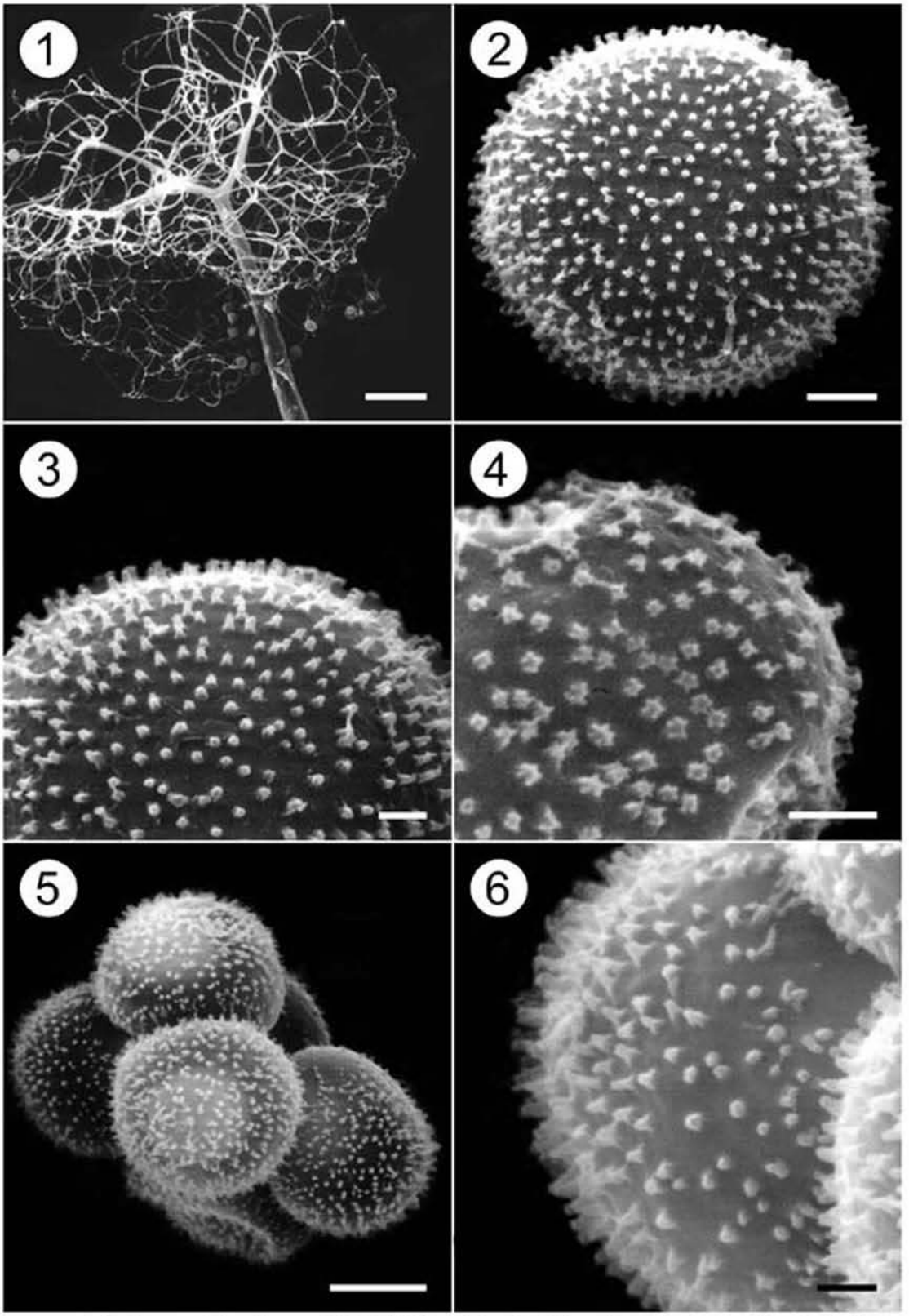
This represents the first record for Mexico. Keller & Braun (1977) cited a species of *Dianema*, "close to *D. corticatum*", which they identified as *Dianema* sp.

Diderma effusum (Schw.) Morgan, J. Cincinnati Soc. Nat. Hist. 16: 155. 1894

SPECIMENS EXAMINED — MEXICO. CHIHUAHUA: Rancho "Las Tinajas", ctra. a Namiquipa km. 15, Chihuahua, on leaves of *Quercus* sp., *leg.* M. Lizárraga, H. Pelayo, E. Alvarez & L. de la Rosa, 27-VIII-2004, UACJ 674, 684 and 690 in AH 31777. *Ibidem*, M. Lizárraga, D. López & M. Reyes, UACJ 710.

COMMENTS — *Diderma effusum* is characterized macroscopically by its fructifications forming sessile sporocarps to narrow plasmodiocarps with a double peridium, the outer layer being smooth, eggshell-like and the inner one membranous. All the specimens from Chihuahua have broad plasmodiocarps of low height and only the inner layer of the peridium can be observed, as the outer one has been lost. However, remainders at the edge of the fructifications can be observed. On the other hand, the microscopic characters are the same, as all the collections have a delicate, hyaline to slightly violaceous capillitium and light violaceous brown spores, 7-9 μm in diam., seeming almost smooth, with dense warts and darker areas.

The species has been cited from Chiapas (Emoto 1933), Jalisco (Lado et al. 1999), Quintana Roo (Lado et al. 2003, Stephenson et al. 2003) and Veracruz (Lado et al. 2003).



FIGURES **1-5.** ***Comatricha elegans*** (AH 31773). 1. Detail of the columella (bar = 50 μm). 2. Spore (bar = 2 μm). 3. Detail of spore ornamentation (bar = 1 μm). FIGURE **4.** ***Comatricha tenerrima*** (UACJ 612). 4. Detail of spore ornamentation (bar = 1 μm). FIGURES **5-6.** ***Dianema corticatum*** (AH 31776). 5. Spore cluster (bar = 5 μm). 6. Detail of spore ornamentation (bar = 1 μm).

Lamproderma gulielmae Meyl., Bull. Soc. Vaud. Sci. Nat. 52: 449. 1919

FIGURES **7-8**

SPECIMENS EXAMINED — **MEXICO. CHIHUAHUA:** San Juanito Bocoyna, on leaves of *Quercus crassifolia*, *leg.* M. Lizárraga & H. Pelayo, 17-IX-2004, UACJ 773 in AH 31778.

COMMENTS — This species from a not strictly nivicolous habitat can be distinguished, apart from its stalked sporocarps with a persistent, iridescent peridium bearing dark spots, by its very dark violaceous and strongly spiny spores. The studied material presents larger spores (15-17 μm in diam.) normally attributed to this species (12-15 μm). The rest of the characters are very similar.

This species can be confused with *Lamproderma maculatum* Kowalski, but the latter has a shorter stalk and a strictly nivicolous habitat.

Only one record is known for the state of Tlaxcala (Rodríguez-Palma 1998).

Macbrideola cornea (G. Lister & Cran) Alexop., Mycologia 59(1): 112. 1967

SPECIMENS EXAMINED — **MEXICO. CHIHUAHUA:** Cumbres de Majalca, on bark of *Quercus* sp., *leg.* M. Lizárraga, G. Mendoza, H. Pelayo & P. García, 15-XI-2003, obtained in moist chamber culture on 12-VI-2004, UACJ 648 in AH 31779.

COMMENTS — This species is characterized by its tiny sporocarps 0.5-0.6 mm high, its globose to subglobose sporotheca 0.1-0.2 mm in diam., its evanescent peridium persisting as a collar, its columella that penetrates 100-110 μm in the sporotheca, its capillitium dichotomously branched at the periphery with terminations 3-5 μm in diam., and by its spores 6-8 μm in diam., globose and warty.

Macbrideola cornea only has been cited previously from Guerrero (Keller & Braun 1977) and from Yucatán (Braun & Keller 1976, Keller & Braun 1977).

Macbrideola synsporos (Alexop.) Alexop., Mycologia 59(1): 115. 1967

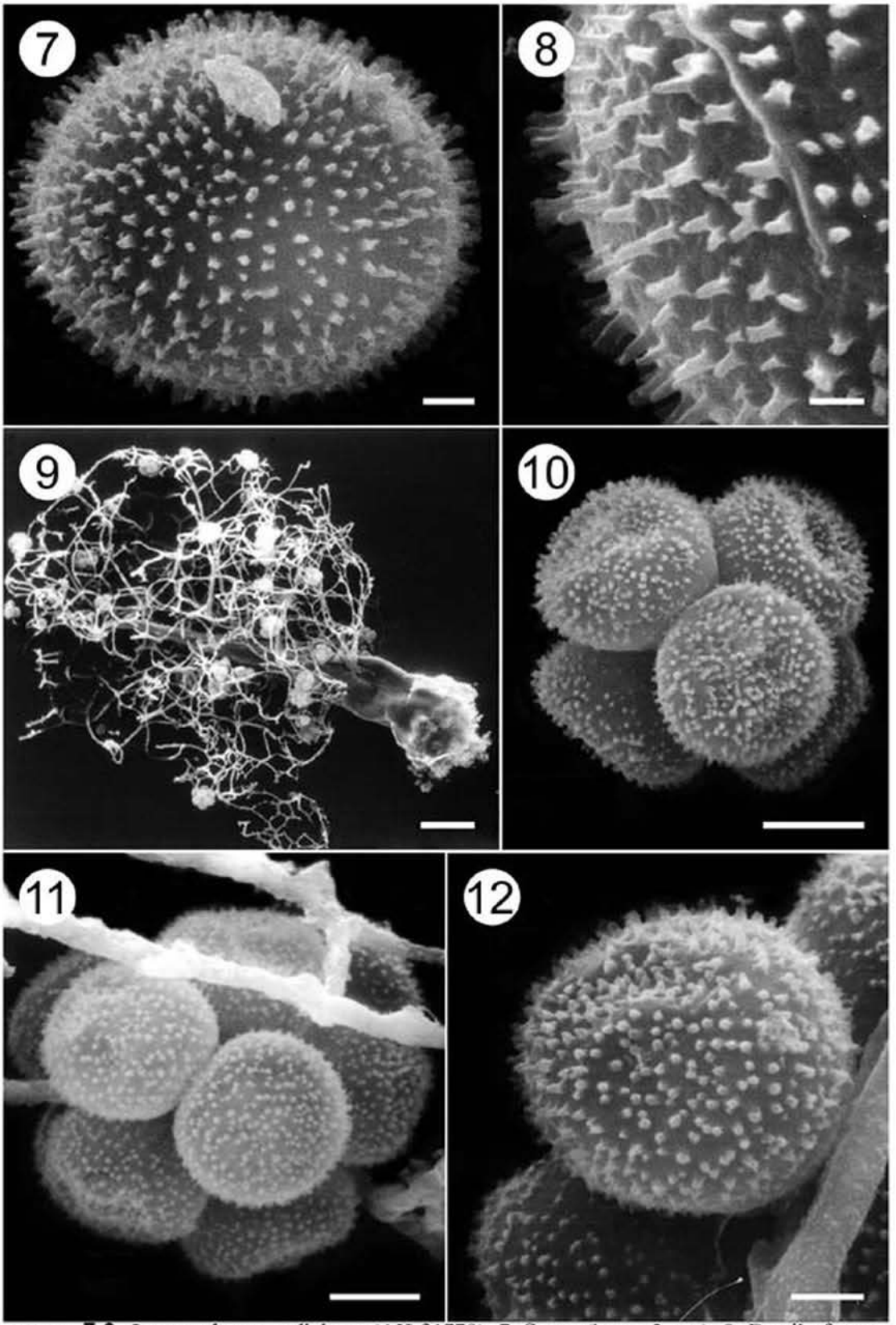
FIGURES **9-12**

SPECIMENS EXAMINED — **MEXICO. CHIHUAHUA:** San Bernabé Cusihiciachi, Cuahutemoc, on bark of *Quercus* sp., *leg.* E. Orozco, obtained in moist chamber on 07-III-2004, UACJ 576. *Ibidem*, on stems of *Quercus* sp., obtained on 26-II-2004, UACJ 231. *Ibidem*, 2-III-2004, UACJ 620 in AH 31781. *Ibidem*, 04-III-2004, UACJ 575 in AH 31780. *Ibidem*, 8-III-2004, UACJ 612. *Ibidem*, 23-III-2004, UACJ 621. *Ibidem*, 2-IV-2004, UACJ 624. *Ibidem*, 8-III-2004, UACJ 617.

DESCRIPTION — Sporocarps scattered, stalked, 0.4-0.8 mm high. Sporotheca subglobose, 0.3-0.5 in diam. Hypothallus membranous, inconspicuous. Peridium completely evanescent. Stalk brown, lighter at the widened base. Columella reaching half the height of the sporotheca. Capillitium branching, anastomosing, forming a net with a few free ends; threads 1-2 μm in diam., covered by numerous small spines.

Spores brown in mass, light violaceous by transmitted light, in clusters of 4-9 individuals, globose to subglobose, 10-12 μm in diam., spiny. Under SEM spore ornamentation is seen to be formed by dense baculae.

COMMENTS — This record represents the first for Mexico.



FIGURES **7-8.** ***Lamproderma gulielmae*** (AH 31778). 7. Spore (bar = 2 μm). 8. Detail of spore ornamentation (bar = 1 μm). FIGURES **9-12.** ***Macbrideola synsporos*** (AH 31780). 9. Detail of sporocarp (bar = 50 μm). 10-11. Spore clusters (bar = 5 μm). 12. Detail of spore ornamentation (bar = 1 μm).

Perichaena syncarpon T. E. Brooks, Mycologia 38(1): 110. 1946

FIGURES **13-14**

SPECIMENS EXAMINED — MEXICO. CHIHUAHUA: Cumbres de Majalca, on cow dung, *leg.* M. Lizárraga, G. Mendoza, H. Pelayo & P. García, 15-XI-2003, UACJ 644 in AH 31781, 613, 619 in AH 31782 and 622.

DESCRIPTION — Sporocarps sporocarpic to plasmodiocarpic, sessile, in groups to scattered, 0.3-0.5 mm in diam., 1-4 mm long. Sporotheca flattened to subglobose, with irregular dehiscence. Peridium membranous, double, with the outer layer yellowish to ocraceous yellowish and the inner layer hyaline, strongly united to the outer layer. Columella absent. Hypothallus membranous, inconspicuous. Capillitium scarce, formed by a net of hollow tubes 3-6 μm in diam., attached to the peridium, yellow. Spores golden yellow in mass, yellow in transmitted light, grouped in clusters of 4-12 spores, globose, subglobose to oval, 10-12 μm in diam., spiny. Under SEM spore ornamentation is seen to be formed by pilae.

COMMENTS — The material examined agrees closely with the description given by Brooks (1946). Although this species was first described as growing on leaves, *Perichaena syncarpon* was later considered a coprophilous species (Eliasson & Lundqvist 1979, Eliasson & Keller 1999).

Rammeloo (1984) studied type material of Brooks and enclosed in the packet SEM photographs of the inner side of the peridium and of the spore ornamentation. The foliicolous specimens studied by him present pilae with the upper part little developed, whereas the specimens from Chihuahua present pilae with a broader upper part.

According to our information, after the records of Brooks (1946) from USA (Kansas) and Eliasson & Lundqvist (1979) from Tanzania, the collections from Chihuahua represent the third record worldwide and the first one for Mexico.

Physarum cinereum (Batsch) Pers., Neues Mag. Bot. 1: 89. 1794

SPECIMENS EXAMINED — MEXICO. CHIHUAHUA: Rancho "Las Tinajas", ctra. a Namiquipa km. 15, Chihuahua, on leaves of *Quercus* sp., *leg.* M. Lizárraga, H. Pelayo, E. Alvarez & L. de la Rosa. 27-VIII-2004, UACJ 698, 701 and 705.

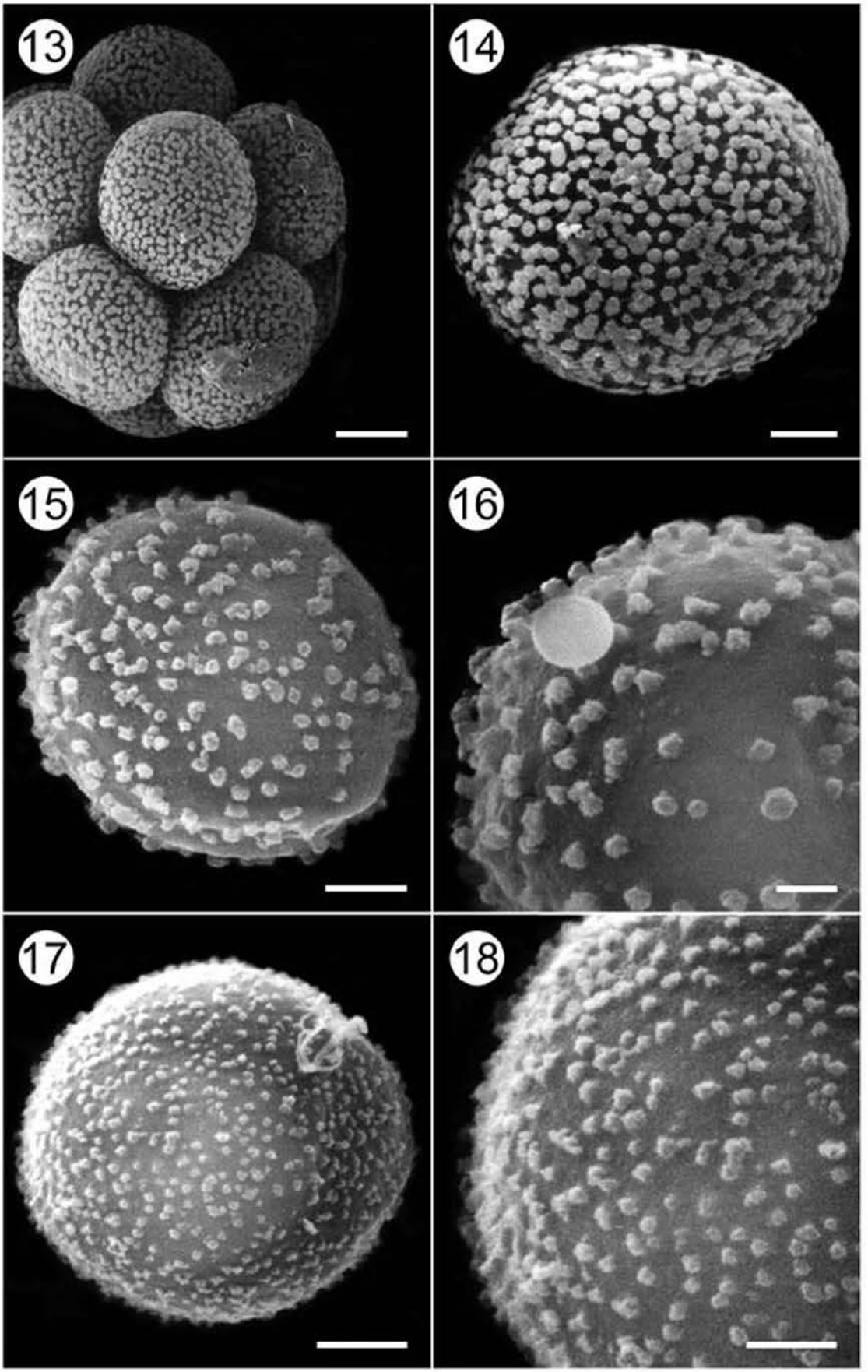
COMMENTS — Although this is a much cited species in Mexico (Illana et al. 2000), our collections of *Physarum cinereum* represent the first record for Chihuahua.

Physarum didermoides (Pers.) Rostaf., Sluzowce Monogr.: 97. 1874

SPECIMENS EXAMINED — MEXICO. CHIHUAHUA: Cumbres de Majalca, on *Agave* sp., *leg.* M. Lizárraga, G. Mendoza, H. Pelayo & P. García, 15-XI-2003, UACJ 494, 508 and 512.

COMMENTS — This is a much-cited species in Mexico (Illana et al. 2000), not previously registered from Chihuahua.

FIGURES **13-14.** ***Perichaena syncarpon*** (AH 31781). 13 Spore cluster (bar = 5 μm). 14. Spore (bar = 2 μm). FIGURES **15-16.** ***Physarum newtonii*** (AH 31784). 15. Spore (bar = 2 μm). 16. Detail of spore ornamentation (bar = 1 μm). FIGURES **17-18.** ***Craterium paraguayense*** (AH 31775). 17. Spore (bar = 2 μm). 18. Detail of spore ornamentation (bar = 1 μm).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Physarum newtonii T. Macbr., Bull. Iowa Univ. Lab. Nat. Hist. 2: 390. 1893

FIGURES **15-16**

SPECIMENS EXAMINED — MEXICO. CHIHUAHUA: San Juanito Bocoyna, on leaves of *Quercus* sp., *leg.* M. Lizárraga & H. Pelayo, 17-IX-2004, UACJ 748 and 749 in AH 31784.

DESCRIPTION — Sporocarps stalked, solitary or in groups, 0.8-1.2 mm high. Sporotheca globose to subglobose, 0.5-0.8 mm in diam. Peridium single, membranous, calcareous, violaceous. Stalk dark reddish, longitudinally striate, 0.3-0.6 mm high. Hypothallus dark, membranous. Capillitium formed by angular, calcareous nodes with more or less dark violaceous tones, interconnected by hyaline filaments. Spores black in mass, dark violaceous by transmitted light, with a clearer area, globose to subglobose, 10-11(13) μm in diam., with thick warts. Under SEM spore ornamentation is shown to be formed by irregularly distributed thick baculae.

COMMENTS — The differences between this species and *Craterium paraguayense* have been discussed above. This record of *Physarum newtonii* is the first for Mexico.

Symphytocarpus amaurochaetoides Nann.-Bremek. in Ing & Nannenga-Bremekamp, Proc. Kon. Ned. Akad. Wetensch., C. 70(2): 220. 1967

FIGURES **19-20**

SPECIMENS EXAMINED — MEXICO. CHIHUAHUA: San Juanito Bocoyna, on wood of *Pinus arizonica*, *leg.* M. Lizárraga & H. Pelayo, 17-IX-2004, UACJ 776 in AH 31785.

COMMENTS — *Symphytocarpus amaurochaetoides* is characterized macroscopically by its fructifications in the form of dark violaceous pseudoaethalia up to 3 x 2 cm. The spores are globose to subglobose, 7-8 μm in diam. and bear a reticulate ornamentation. Under SEM the spores show a typical reticulate ornamentation with horizontally perforated muri with irregular lumina, reminding us of the ornamentation of *Stemonitis fusca* Roth. *Symphytocarpus amaurochaetoides* and *Stemonitis fusca* can easily be distinguished microscopically, because the capillitium of the former species has free ends and does not form a surface net typical of the genus *Stemonitis*.

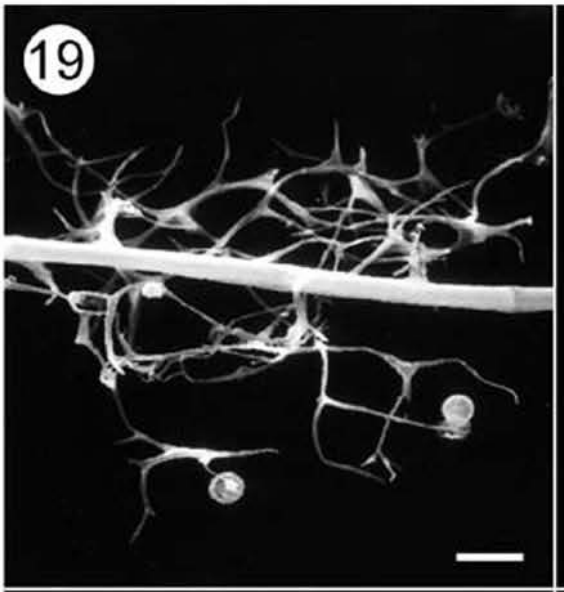
This is the first record for Mexico.

Trichia agaves (G. Moreno, Lizárraga & Illana) Mosquera, Lado, Estrada & Beltrán-Tej., Nomenmyx A nomenclatural taxabase of Myxomycetes : 82. 2001

= *Trichia perichaenoides* Mosquera, Lado, Estrada & Beltrán-Tej., Mycotaxon 75: 320. 2000

SPECIMENS EXAMINED — MEXICO. CHIHUAHUA: Basaseachic, Ocampo, on dry leaves of *Agave* sp., *leg.* M. Lizárraga & H. Pelayo, 23-V-2004, UACJ 654.

FIGURES **19-20.** ***Symphytocarpus amaurochaetoides*** (AH 31785). 19. Detail of the capillitium (bar = 20 μm). 20. Spore (bar = 2 μm). FIGURES **21-22.** ***Trichia decipiens* var. *olivacea*** (AH 31786). 21. Detail of elaters (bar = 5 μm). 22. Spore (bar = 2 μm). FIGURES **23-24.** ***Willkommlangea reticulata*** (UACJ 656). 23. Spore (bar = 2 μm). 24. Detail of spore ornamentation (bar = 1 μm).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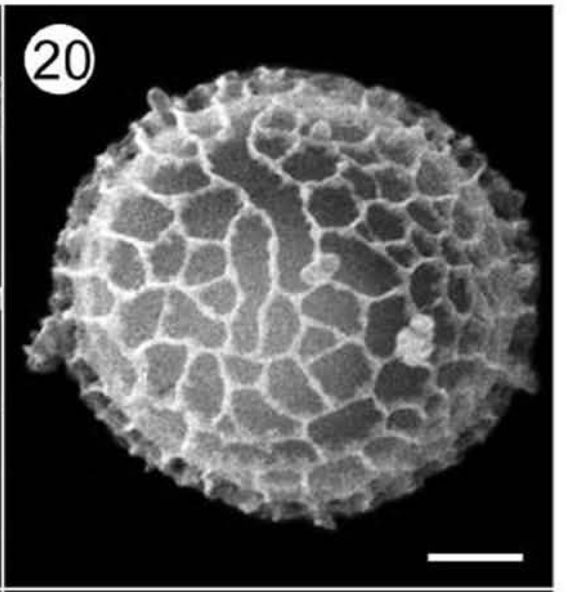
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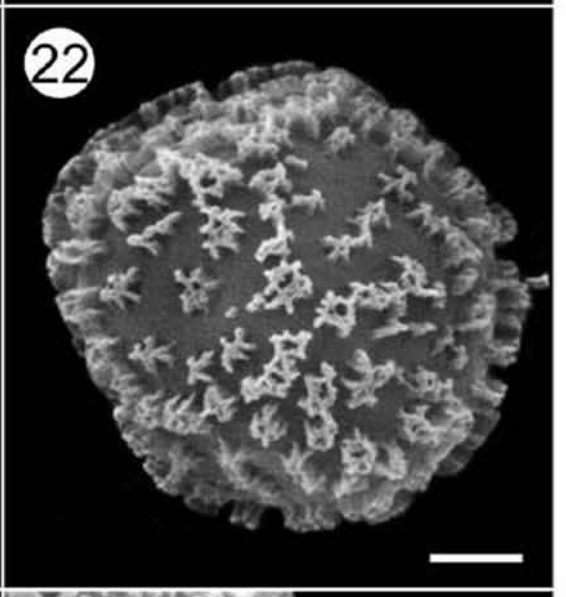
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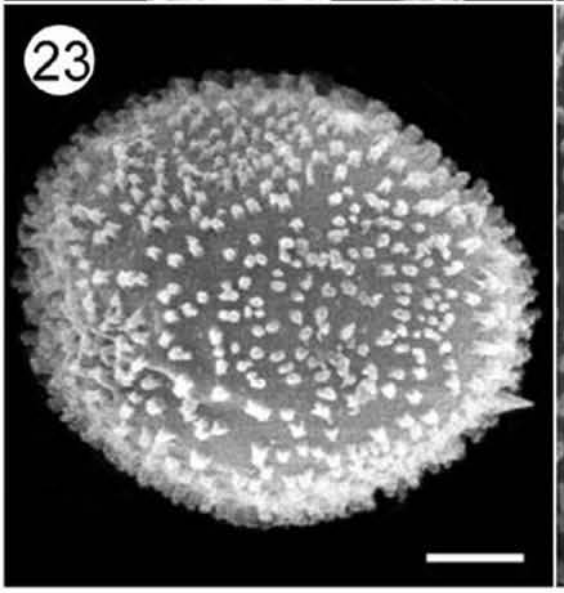
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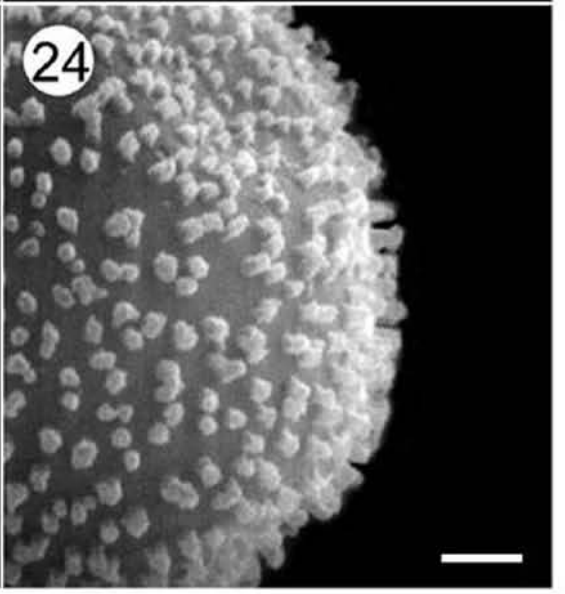
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COMMENTS — *Trichia agaves* is a species that is ecologically associated with crassulaceous plants (*Opuntia, Agave*), recently described from Mexico (Moreno et al. 2000) and also found in Peninsular Spain and the Canary Islands.

It is macroscopically similar to *Perichaena corticalis* (Batsch) Rostaf., but differs clearly by its capillitium formed of elaters ornamented with spines. In some specimens we have observed "hemitrichioid" forms where free ends can hardly be observed.

Trichia decipiens* var. *olivacea (Meyl.) Meyl., Bull. Soc. Vaud. Sci. Nat. 55: 244. 1924 **FIGURES 21-22**

SPECIMENS EXAMINED — **MEXICO. CHIHUAHUA:** Basaseachic, Ocampo, on decomposing wood, *leg.* M. Lizárraga & H. Pelayo, 9-X-2004, UACJ 781 in AH 31786 and 782.

COMMENTS — This variety of *Trichia decipiens* is characterized by its stalked sporocarps with a stalk filled with cysts. Microscopically it is defined by its elaters ornamented by smooth spiral bands, with long points. The spores are smaller than indicated in the literature, 9-10 μm in diam., ornamented by small crests that do form a closed reticulum. Under SEM spore ornamentation is seen to be composed of small crests formed by coalescent baculae.

Trichia decipiens appears much cited in Mexico, mainly in the centre of the country (Illana et al. 2000). This is the first record of *Trichia decipiens* var. *olivacea* for Mexico.

Trichia varia (Pers. ex J.F. Gmel.) Pers., Neues Mag. Bot. 1: 90. 1794

SPECIMENS EXAMINED — **MEXICO. CHIHUAHUA:** Basaseachic, Ocampo, on decomposing wood, *leg.* M. Lizárraga & H. Pelayo, 9-X-2004, UACJ 804, 805, 812 and 819. *Ibidem*, on dead leaves of *Agave* sp., 779, 780. *Ibidem*, on stems of *Quercus* sp., UACJ 801.

COMMENTS — This cosmopolitan species in Mexico is only known from the states of Baja California (Lizárraga et al. 2004), Jalisco (Trujillo-Flores et al. 1986) and Veracruz (Braun & Keller 1976).

Willkommlangea reticulata (Alb. & Schwein.) Kuntze, Revis. Gen. Pl. 2: 875. 1891 **FIGURES 23-24**

SPECIMENS EXAMINED — **MEXICO. CHIHUAHUA:** Basaseachic, Ocampo, on bark of *Quercus crassifolia*, *leg.* M. Lizárraga & H. Pelayo, 3-VIII-2004, UACJ 656.

COMMENTS — This species is characterized macroscopically by its sessile reticulate plasmodiocarps. Spore ornamentation under SEM is seen as formed by tight, regularly distributed spines.

This species has only has been cited in Mexico from the states of Jalisco (Trujillo-Flores et al. 1986), Nuevo León (Gómez-Sánchez & Castillo 1981) and Quintana-Roo (Lado et al. 2003, Stephenson et al. 2003).

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MYCOTAXON

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A new species of *Morchella* (*Pezizales*, Ascomycota) from southwestern China

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Abstract—A new species of *Morchella*, *M. bicostata*, is described from southwestern China. This species is characterized by reddish-brown to flesh-colored hymenia and tortuous, bicostate ribs. Its gross morphology and microscopic features are illustrated by photographs and line drawings.

Key words—morel, taxonomy

Introduction

Morels (*Morchella* spp.) are among the most expensive wild edible fungi in the world. Fifteen species of *Morchella* have been reported in China (Zang 1987, Mao 2000), including five species from southwestern China (Zang 1987, Ying & Zang 1994). In our recent studies on the genus, 145 specimens were examined from southwestern China. Among these was found a new species described herein as *M. bicostata*. This species differs from all known species of the genus in that the macro- and microscopic features of this fungus are distinct (Eckblad 1968, Guzmán & Tapia 1998).

Material and Methods

Field notes were taken for gross morphology of fresh ascomata. Microscopic examination of ascomata and measurements of microscopic structures were made from freehand sections mounted in 5% aqueous KOH, Melzer's reagent, Cotton-blue lactophenol, or in Congo-red. Cultures were not obtained from the dried specimens. Line drawings were made with the aid of a microscopic drawing tube. All specimens, including the holotype of *Morchella bicostata* cited in this paper, have been deposited in the Cryptogamic Herbarium, Kunming Institute of Botany, Academia Sinica (HKAS).

Taxonomy

Morchella bicostata J.Y. Chen & P.G. Liu, **sp. nov.** Fig. 1-7

Ascomata (30-) 35-45 (-50) mm alta, intus excavata. Capitulae (15-) 20-25 (-30) × (10-) 13-15 (-20) mm, subconicae vel subcylindrico-ovoideae, basi stipiti adnatae,

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rubiginosae vel carneae, superficiariter costis numeroeis neticulatis irregulariter tortuosis, bicostis, maculis inter costae rotundatis vel polygonis. Stipites 10-20 × 7-12 mm, pallidi vel cremei, cylindricis, sulcati vel rugosi, interdum basi inflati, superficiariter appendicibus faveotatis instructi. Asci (230-) 250-270 (-320) × 18-25 µm, subcylindracei vel cylindrici operculati, octospori. Ascosporae (18-) 22-24 (-26) × (11.5-) 12.5-13 (-16) µm, hyalinae, late ellipsoidae vel ovoideae, inamyloideae. Paraphyses (110-) 130-180 (-250) × 10-16 µm, cylindraceae, basi septatae et ramosae, hyalinae.

Habitat in terries in Abitibus spp. sylvis. Holotypus hic designatus HKAS 31285.

Etymology—From latin *bicosta*, bi- = double, costa = ribs, referring to pileus of the fruitbody with bicostate ribs which have a shallow groove down the center.

Ascomata (30-) 35-45 (-50) mm high, hollow, pileus adnate stipitate; pileus (15-) 20-25 (-30) × (10-) 13-15 (-20) mm, subconic to subcylindric-ovoid, ribs tortuous and bicostate, with a shallow groove running down the center; pits round to polygonal; pileus reddish-brown to flesh-colored when fresh, pale gray or grayish brown to black-brown and ribs more or less lighter than pits when dry; stipe 10-20 × 5-9 mm, cylindric, enlarged at its base, up to 12 mm wide, whitish to cream when fresh, honey-yellow to ochre when dry, furfuraceous-granular, lightly to strongly wrinkled at base; asci (230-) 250-270 (-320) × 18-25 µm, operculate, subcylindric or cylindric, some with a sub-bulbous base, 8-spored, hyaline; ascospores (18-) 22-24 (-26) × (11.5-) 12.5-13 (-16) µm, broadly elliptical to ovoid, thick-walled, with fine granulate striations on surface, hyaline and non-amyloid; paraphyses (110-) 130-180 (-250) × 10-16 µm, cylindrical, septate and branched near base, hyaline; flesh of pileus composed of hyaline, interwoven and septate hyphae, 5-14 µm wide, inner surface cells globose, subglobose or clavate; surface of stipe composed of large inflated cells, inner cells the same as the pileus.

Fig 1. (A) Habitat of *Morchella bicostata*, HKAS 31285 (holotype!). (B) Arrow indicates bicostate rib.

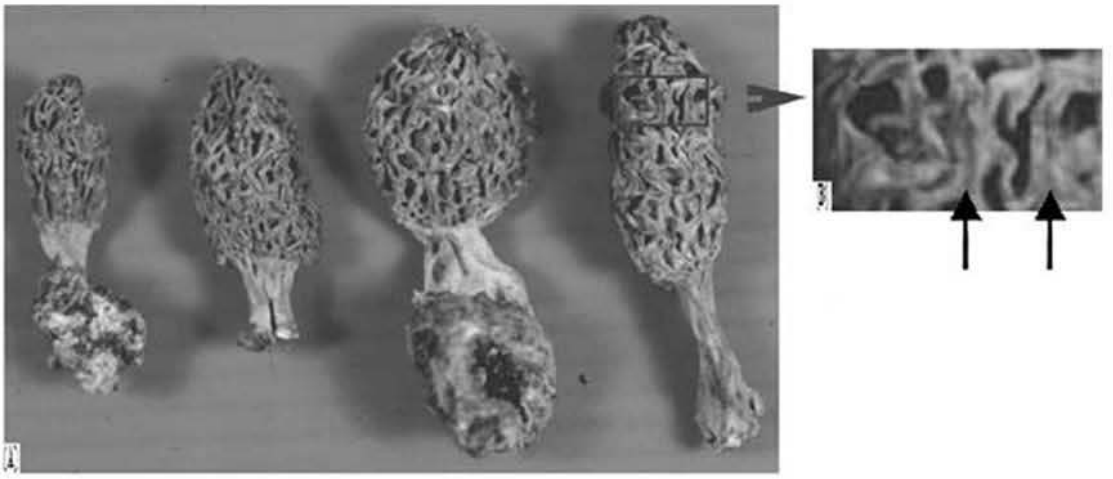

Fig 2. (A) Dry ascocarps of *Morchella bicostata*, HKAS 31285 (holotype!). (B) Arrows indicate bicostate ribs.

Specimen examined—Shuajing road crossing Shuajingsi village, Hongyuan County, Sichuan Province, China, alt. 3600m, on the ground under *Abies* spp., 14 May 1997, M.S. Yuan 2780, HKAS 31285 (Holotype!), labeled as *M. esculenta* (L.) Pers.

Notes—*M. bicostata* differs from all described species of the genus in its reddish-brown to flesh-colored pileus with tortuous, bicostate ribs. It is different from the morphologically similar species, *M. esculenta* (L.) Pers., in the shape and color of the pileus and the arrangement of its ribs and pits. *M. esculenta* possesses a subglobose, ovoid, or elongated pileus with rounded, irregular or occasionally longitudinally elongate pits which are yellowish within, becoming brownish or blackish when dry. In addition, its ribs are single with rounded edges that are lighter colored than the interior of the pits (Seaver 1928). *M. bicostata* is morphologically similar to *M. crispa* P. Karst.; however, the latter species produces compact, tortuous ribs and a sandy beige or buff pileus (Karsten 1887, Saccardo 1889).

Acknowledgements

The authors would like to thank Profs. M. Zang and Z. L. Yang (Kunming Institute of Botany, Academia Sinica) for their valuable suggestions and discussion. They also give thanks to Prof. and Dr. W.Y. Zhuang (Institute of Microbiology, Academia Sinica) and Dr. Kerry O'Donnell (NCAUR, ARS, USDA) for serving as pre-submission reviewers, Prof. Z. Y. Su (Kunming Institute of Botany, Academia Sinica) for checking the Latin description, and Mr. M. S. Yuan (Chengdu Institute of Biology, Academia Sinica) for providing the photographs used in this study. This study was supported in part by the National Natural Science Foundation of China (No. 30470011), the Knowledge Innovation Program of the Chinese Academy of Sciences Project (No. KSCX2-SW-101C; KSCX2-1-09-06), and the Natural Science Foundation of Yunnan (No. 2004C0050M).

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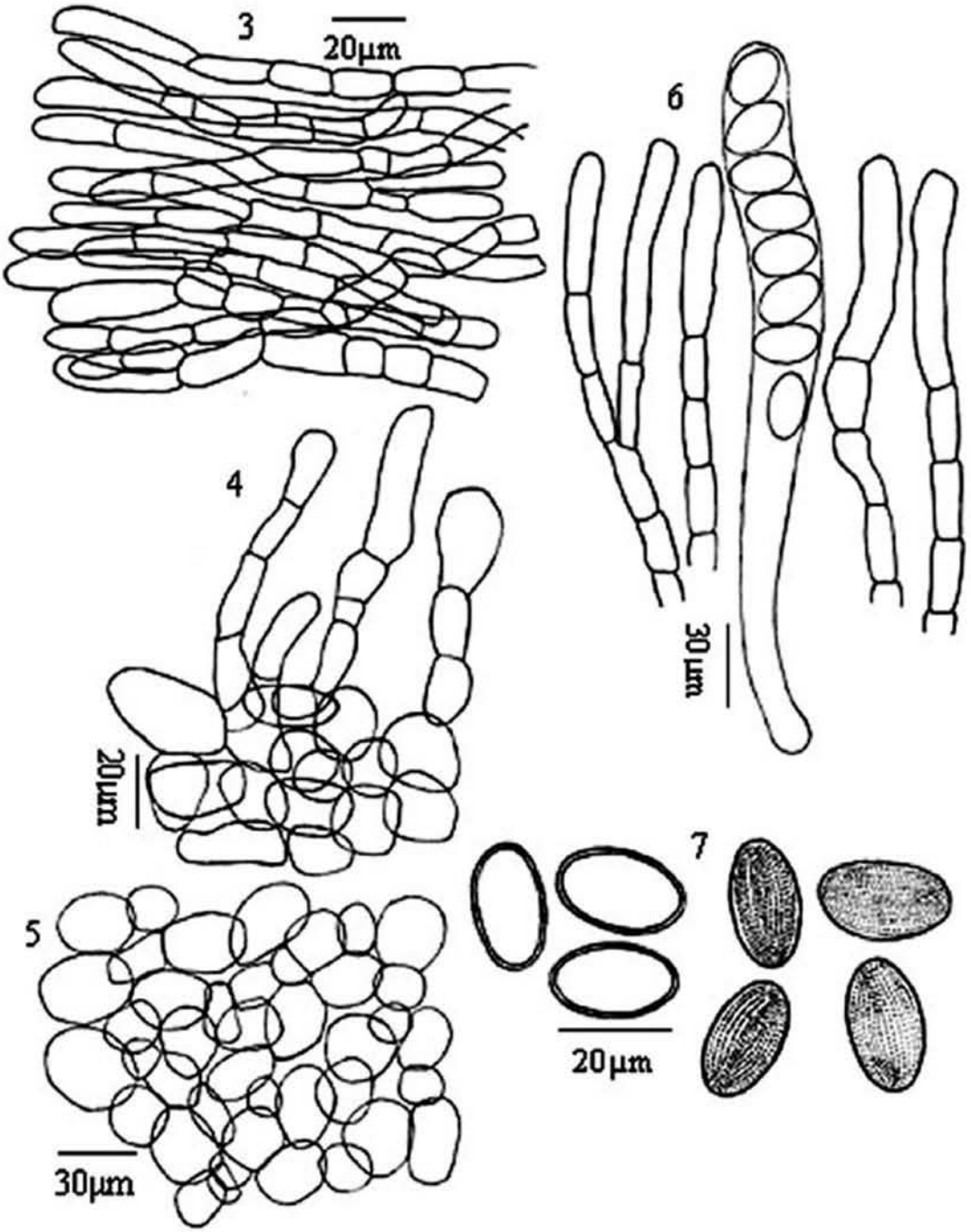

Fig 3-7. Microscopic features of *Morchella bicostata*, HKAS 31285 (holotype!) 3. Region adjacent to the hymenium composed of *textura intricata*; 4. Free chains of inflated cells on stipe inner surface; 5. Stipe surface composed of *textura angularis*; 6. Paraphyses and asci; 7. Ascospores.

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中国西南发现的羊肚菌一新种

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中文摘要 本文报道了采自中国四川省的羊肚菌一新种-双脉羊肚菌Morchella bicostata，其鉴别特征为：头部红棕色到肉红色，具有扭曲、不规则、双脉络的棱纹。文中提供了其宏观鉴别特征彩图和显微特征线条图。

关键词 双脉羊肚菌 新种 分类

MYCOTAXON

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A new species of *Psilocybe* (*Agaricales, Strophariaceae*) from southern Brazil

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Abstract— *Psilocybe rickii* is described as a new species from Rio Grande do Sul, Brazil. It belongs to the section *Cordisporae* and is characterized by the bulbous base of the stipe. The holotype was collected in 1908 by Rick.

Key words— Basidiomycota, hallucinogenic fungi, neotropical mycobiota

Introduction

In spite of recent studies on the genus *Psilocybe* (Fr.) P. Kumm. in southern Brazil (Guzmán & Cortez 2004; Cortez & Coelho 2004), an undescribed species was surprisingly found among the fungi collected by Johannes Rick. Several collections of *Psilocybe* by Rick were studied by Guzmán (1978, 1983) during his studies on the genus. The collection Fungi Rickiani is mainly deposited in the herbarium PACA (Instituto Anchietano de Pesquisas, São Leopoldo, Rio Grande do Sul, Brazil), but some specimens are deposited in North American and European herbaria (Fidalgo 1962). This paper deals with the description of another probable hallucinogenic fungus, a new species of *Psilocybe* collected by Rick in 1908, recently found in the Farlow Herbarium.

Materials and methods

Microscopic observations were made from sections mounted in 5% KOH solution, previously treated with ethanol for rehydration.

Description of the new species

Psilocybe rickii Guzmán & Cortez, **sp. nov.** FIGURES 1-4

Pileus circa 38 mm latus in sicco, convexo subumbonatus, pallide brunneolus, irregulariter atrovinaceo-rufescens, glaber. Lamellae subadnatae, cinnamomeae. Stipes circa 50 x 4 mm in sicco, rubrobrunneus, fibrosus, base pseudorhizali, bulbosa, cylindrico-pyriformi, usque ad 15-8 mm, albida. Basidiosporae 8-10 x 6-8 (-8.5) x (5-) 5.5-7 µm, in aspectu frontali oblongo-subrhomboideae, in aspectu obliquo subellipsoideae, crassitunicatae, luteobrunneae. Cheilocystidia 11-24 x 5-7.5 µm, hyalina, sublaginiformia. Pileipellis subgelatinosa. In terra arenacea. Brazil, Rio Grande do Sul, São Leopoldo, 1908. Holotypus hic designatus: Rick 52 (FH).

Pileus about 38 mm diam. as dried, convex subumbonate, pale brownish, irregularly staining dark vinaceous reddish, smooth, possibly subviscid. ***Lamellae*** subadnate, cinnamon brown, with concolorous edges. ***Stipe*** about 50 x 4 mm as dried, including the pseudorrhizal bulbous base, this base measures 15 x 8 mm and is cylindrical-pyriform, the remaining stem is cylindrical and uniform, reddish brown, fibrous, the pseudorrhizal base is whitish.

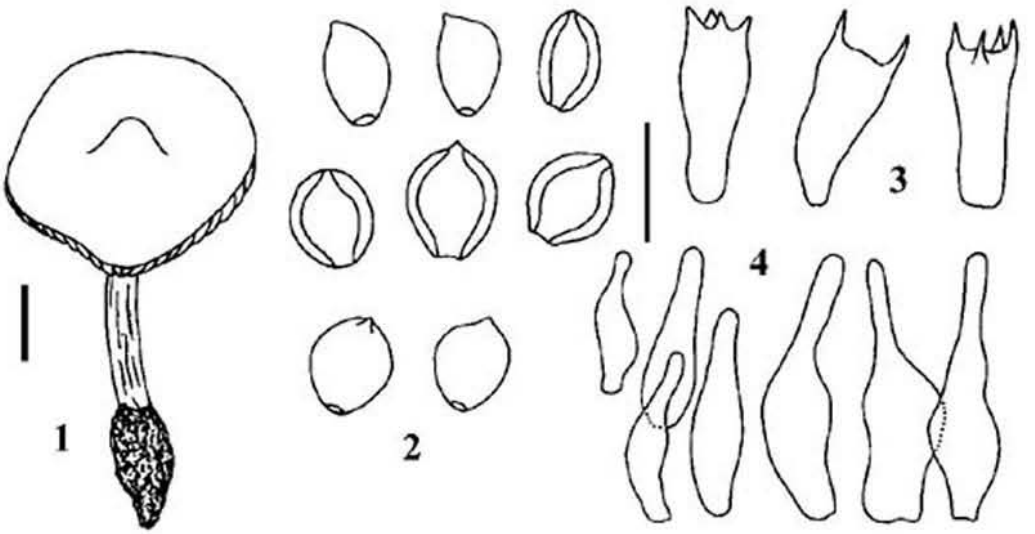
Basidiospores 8-10 x 6-8 (-8.5) x (5-) 5.5-7 µm, oblong-subrhomboid in face-view, subellipsoid in side-view, thick-walled, yellowish brown, with a distinct and broad germ pore on one end and a short apical appendage on the other. ***Basidia*** 13-18 x 6.5-7.5 µm, (2-)4-spored, hyaline, pyriform or subventricose. ***Pleurocystidia*** not observed (present?). ***Cheilocystidia*** 11-24 x 5-7.5 µm, hyaline, regularly or irregularly sublageniform, with a broad or narrow base. ***Subhymenium*** not differentiated. ***Hymenophoral trama*** regular, with hyaline hyphae 4-15 µm wide. ***Pileipellis*** subgelatinous, 15-25 µm thick, with hyaline hyphae 1.5-3 µm wide. ***Subpellis*** (hypodermium) collapsed. ***Context*** collapsed. ***Stipitipellis*** with yellowish prostrate hyphae. ***Mycelium*** in the bulbous base with hyaline hyphae, but yellowish in mass, 2-4 µm wide. ***Clamp connections*** present.

Habitat and distribution: On sandy soil, probably solitary. Known only from the type locality.

Material examined: BRAZIL. Rio Grande do Sul State: São Leopoldo, 1908, *Rick 52* (Herbarium F. Theissen at FH, without number, as *Psilocybe shafferi* Rick, *nomen nudum*, holotype).

Discussion: Because of its dark vinaceous tones when dried, this fungus is considered to be caerulescent. Dried specimens of *P. caerulescens* Murrill and *P. wrightii* Guzmán, both bluing fungi, are often similarly dark vinaceous, but not blue as dried. The hypogeous bulbous base of the stipe and the oblong-subrhomboid, thick-walled basidiospores are the main taxonomic features of *P. rickii*. For the form and structure of its basidiospores and its probable bluing feature, this fungus belongs to section *Cordisporae* Guzmán, where all the species belong to the hallucinogenic fungi, following the concept of Guzmán (1983, 1995).

Psilocybe rickii is related to *P. guatapensis* Guzmán et al. from Colombia (Guzmán et al. 1994) by the subbulbous base, but that species has shorter basidiospores [(5.5-) 6–6.5



Figures 1-4. *Psilocybe rickii* (holotype). 1) Basidioma. 2) Basidiospores. 3) Basidia. 4) Cheilocystidia. Scale bars: 10 mm for 1, 10 μm for 2-4.

(-7) μm long] and a conic to acute-campanulate pileus. The absence of pleurocystidia in *P. rickii* is doubtful, because these structures were probably not observed because tissues of the basidioma studied were collapsed

This new species is named in honor of the Priest Johannes Rick, considered the "Father of Brazilian Mycology" and who collected the specimen studied, for his long and important work on fungi from the State of Rio Grande do Sul in Brazil.

With the discovery of this new species, there are now 30 known species of *Psilocybe* in Brazil, 19 of which belong to the hallucinogenic group.

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MYCOTAXON

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Some new species and new records of discomycetes in China. XII

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Abstract—Collections of the cup-fungi from Qinghai and Xinjiang, China were examined. Among them, *Scutellinia korfiana* is described as new species. Distinctions between the new taxon and its closely related species are discussed. *Aleuria luteonitens* and *Rhodoscypha ovilla* are new records for China. A new combination is made for a previously described *Melastiza* species.

Key words—taxonomy, *Spooneromyces daliensis*

Introduction

In our recent studies on cup-fungi from northwestern China, a few collections of operculate discomycetes from Xinjiang and Qinghai were examined. One new species is found in the genus *Scutellinia* (Cooke) Lambotte, two species in *Aleuria* Fuckel and *Rhodoscypha* Dissing & Sivertsen are recorded for the first time from the country, and a name change for a previously reported fungus is made. More information about discomycetes from the areas may be gathered from scattered literature (Zhao & Mao 1986; Cao et al. 1990a, b; Zhang & Yu 1992; Mao 1998; Zhuang 1998, 2004).

Taxonomy

NEW SPECIES

Scutellinia korfiana W.Y. Zhuang, **sp. nov.** **Figs. 1-3**

Ab Scutellinia cubensi hymeniis aurantio-rufis; pilis latiusculis, 330–800 × 18–35(–41) µm; ascosporis angustis, 16.5–19 × 10.5–11.7(–12.7) µm; ornamentis ascosporarum vadosis et angustis differt.

Apothecia discoid, sessile, 5–10 mm in diam., hymenium surface orange red, receptacle covered with brown hairs; *hairs* arising from inner ectal excipular cells, setaceous, ventricose, with 2–4 rootlets, septate, thick-walled, brown, 330–800 µm long and 18–35(–41) µm wide, walls 3–7 µm thick; *ectal excipulum* of textura angularis, 110–180 µm thick, cells more or less isodiametric, 20–65 µm in diam. or up to 75 ×

50 μm, cell walls subhyaline to pale brown and thickened in the outer cells, subhyaline and thin-walled in the inner cells; *medullary excipulum* of textura intricata, 75–130 μm thick, hyphae subhyaline, 3.8–10 μm wide; *subhymenium* of textura intricata, 25–35 μm thick, hyphae densely interwoven; *hymenium* ca 210–230 μm thick; *asci* 8-spored, subcylindrical, J– in Melzer's reagent, 215–243 × 13–15 μm wide; *ascospores* ellipsoid with blunt ends, multiguttulate, some containing a de Bary bubble, surface nearly smooth to finely marked, uniseriate, 16.5–19 × 10.5–11.7 (–12.7) μm, spore ornamentations as very low warts and crests, irregular in shape, and somewhat interconnected under the light microscope, as interconnected warts and crests which are more or less reticulate viewed by SEM, 0.3–0.7(–1) μm wide and 0.2–0.5 μm high; *paraphyses* filiform and enlarged at apex, 5–7 μm wide at apex and 2.5–3 μm below.

Holotype here designated: CHINA. Xinjiang, Burqin, Hemuxiang, alt. 1100 m, 6 VIII 2003, on rotten wood, W.Y. Zhuang & Y. Nong 4760, HMAS 83558. Paratype: CHINA. Xinjiang, Burqin, Hemuxiang, alt. 1100 m, 6 VIII 2003, on rotten wood, W.Y. Zhuang & Y. Nong 4762, HMAS 83580.

Etymology: The specific epithet refers to Prof. Richard P. Korf for his contribution to fungal taxonomy and nomenclature.

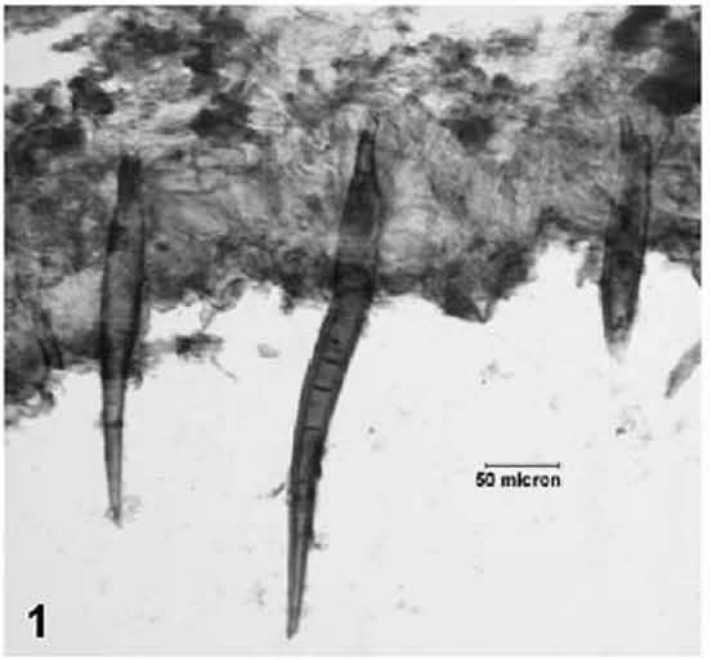
Notes: *Scutellinia korfiana* was found from Hemuxiang in the north of Xinjiang. Among the existing species of the genus, the size of apothecia and shape of ascospore ornamentations of the new species are somewhat similar to those of *S. cubensis* (Berk. & M.A. Curtis) Gamundí, a fungus commonly found in the tropical and subtropical regions (Schumacher 1990); whereas, the very low spore markings under light microscope recalls that of *S. sinosetosa* W.Y. Zhuang & Zheng Wang from Yunnan and Shaanxi provinces (Zhuang & Wang 1998). SEM study of the spore surface morphology of the new species reveals that the spore markings are much narrower and lower than those in *S. cubensis* [0.3– 0.7(–1) μm *vs.* 1–2.2 μm wide and 0.2–0.5 μm *vs.* 0.3–1.2 μm high] and the ascospores [16.5–19 × 10.5–11.7(–12.7) μm *vs.* 15.8–18.5 × 11.2–14.4 μm] and asci (13–15 μm *vs.* 15–21 μm wide) are both narrower under light microscope as well. Comparing with *S. sinosetosa*, the spore ornamentations of the new species are much wider.

NEW RECORDS FOR CHINA

Aleuria luteonitens (Berk. & Broome) Gillet, Champignons de France, Les Discomycétes p. 205, 1886.

Diagnostic features: *Apothecia* discoid with a short stalk embedded in soil, 2–2.8 cm in diam., hymenium orange, receptacle paler than hymenium; *ectal excipulum* of textura angularis, 25–43 μm thick; *medullary excipulum* of textura intricata, 230–280 μm thick; *hymenium* 190–200 μm thick; *asci* 8-spored, 7.5–8.5 μm wide; *ascospores* ellipsoid, biguttulate when young, with separate warts on surface, 10.7–12 × 5–6 μm; spore markings ca 0.4–0.7 μm in diam. and up to 0.5 μm high; *paraphyses* filiform, straight, 2–4 μm above and 1.5–2 μm below.

Figs. 1-3. *Scutellinia korfiana*: 1. Ectal excipular structure and rooting hairs; 2. Portion of hymenium showing asci and ascospores; 3. Ascospore surface morphology in SEM study. All from holotype.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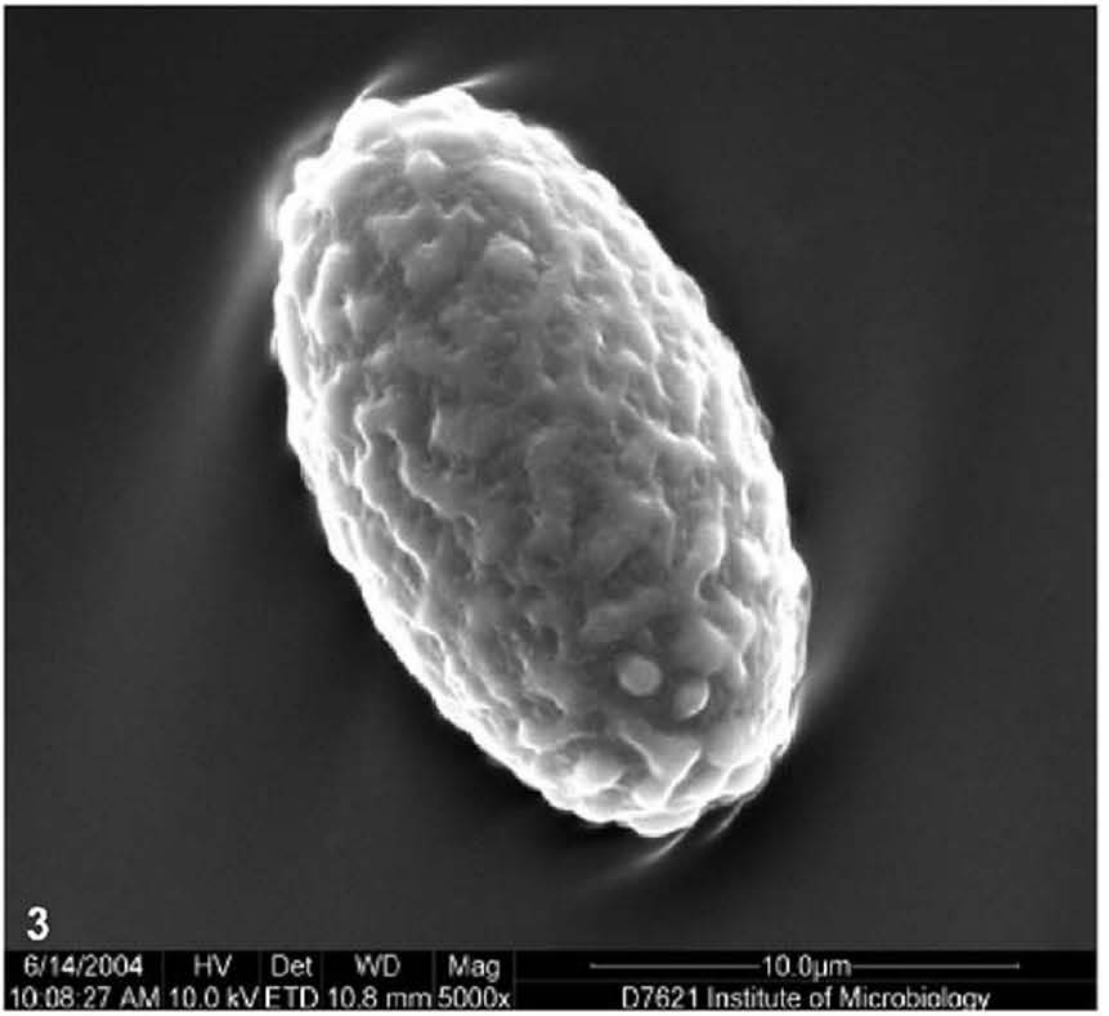
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Specimen examined: China. Qinghai, Menyuan, Xianmi, alt. 2800 m, on soil, 19 VIII 2004, W.Y. Zhuang & C.Y. Liu 5429, HMAS 97499.

Notes: The gross morphology of the fungus is similar to that described by Dennis (1978) and Häffner (1993). Ascospores seem slightly narrower than material from Europe.

Rhodoscypha ovilla Dissing & Sivertsen, Mycotaxon 16: 442, 1983.

Apothecia deeply cupulate with an small opening when young and becoming cupulate, tearing irregularly to open, with margin sometimes minutely dentate, sessile, 4-12 mm in diam., hymenium surface pink to orange-pink, receptacle surface downy, paler than hymenium; *hairs* arising from outer cells of the ectal excipulum, subcylindrical, straight or slightly undulate, hyaline, very thick- and smooth-walled, with a narrow lumen, up to 127 μm long and 20 μm wide, walls strongly refractive, neither dissolved in KOH aqueous solution and nor in Melzer's reagent, ca 6 μm thick; *ectal excipulum* of textura intricata, 80-150 μm thick, hyphae hyaline, thick-walled, walls 2-6(-9) μm thick; *medullary excipulum* of textura intricata, 100-800 μm thick, hyphae hyaline, 6-19 μm wide, walls somewhat refractive, 1-2 μm thick; *subhymenium* usually not clearly distinguishable from the medullary excipulum; *hymenium* 300-400 μm thick; *asci* operculate, 8-spored, subcylindrical above, with a narrow base, J- in Melzer's reagent, 18-22 μm wide; *ascospores* fusoid to broadly fusoid, hyaline, unicellular, biguttulate when young, with fine warts on surface, 31-39 × 10.7-14 μm, warts 0.2-0.6 μm in diam.; *paraphyses* subcylindrical with apex slightly enlarged, 5-8 μm wide above and 4-6 μm below.

Specimens examined: China. Qinghai, Datong, Dongxia, alt. 3000 m, on mossy soil, 17 VIII 2004, W.Y. Zhuang & C.Y. Liu 5384, 5397, HMAS 97500, 97501; Menyuan, Xianmi, alt. 2800 m, on mossy soil, 19 VIII 2004, W.Y. Zhuang & C.Y. Liu 5423, HMAS 97502; Qilian, Babaoxiang, alt. 2800 m, on mossy soil, 20 VIII 2004, W.Y. Zhuang & C.Y. Liu 5438, 5448, 5458, HMAS 97503, 97504, 97505.

Notes: The fungus is very characteristic by its pink apothecia, presence of interwoven hyphae on surface of the ectal excipulum, which are fairly thick-walled and hyaline, and the fusoid, finely marked ascospores. It was commonly found on the ground under conifer trees of different forests in Qinghai Province, which extends the distribution of the species from Europe, USA, and India (Dissing & Sivertsen, 1983) to northwestern China. Dissing & Sivertsen (1983) provided detailed description and illustrations of the fungus.

Harmaja (1977) and Dissing & Sievertsen (1983) had different opinions of hair morphology. Harmaja (1977) indicated the hairs as "the unusual thickness of sheath of the external hairs". Dissing & Sivertsen had a picture of hairs from a 2% KOH mount and stated that "hairs with thin inner wall and thick outer wall", which agrees to hairs shown in the Chinese material.

Harmaja (1977) described *Rhodoscypha ovilla* in detail, discussed its relationship to *Leucoscypha rhodoleuca* (Bres.) Svrček, and concluded that they are closely related but two different fungi. When morphology of the Chinese material of *R. ovilla* is compared with description and illustrations of *L. rhodoleuca* provided by Breitenbach & Kränzlin (1984), they are indeed similar to each other but with significantly distinct

hair morphology and ectal excipular structure. Apothecia of *L. rhodoleuca* are more or less semitranslucent compared with those of *R. ovilla*.

NAME CHANGE FOR A PREVIOUSLY DESCRIBED SPECIES

Spooneromyces daliensis (W.Y. Zhuang) W.Y. Zhuang, **comb. nov.**

= *Melastiza daliensis* W.Y. Zhuang, Fung. Divers. 18: 213, 2005.

Notes: As indicated in the original description, *Melastiza daliensis* is the most similar to *M. asperula* Spooner (Zhuang, 2005), a later synonym of *M. laeticolor* (P. Karst.) T. Schumach. which was proposed as the type species of a new genus *Spooneromyces* T. Schumach. & J. Moravec. A new species *S. helveticus* J. Breitenb. & F. Kränzl. with somewhat reticulate spore ornamentations was also included as one of the original species. Morphological features between *S. laeticolor* and taxa in the genus *Melastiza* are distinct. *Melastiza* and *Spooneromyces* are similar in the bright-colored apothecia, excipular structure, ornamented ascospores, and presence of hairs on receptacle surface. *Spooneromyces* differs in its stiff, somewhat pointed, multiseptate, and moderately thick-walled hairs instead of the short, obtuse, poorly developed ones in species of *Melastiza* (Schumacher & Moravec 1989; Hansen & Knudsen 2000). *M. daliensis* should be treated as a member of *Spooneromyces*.

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MYCOTAXON

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On three foliicolous *Helotiales* on *Dryas*

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Abstract—Two species on *Dryas* spp. from Europe and Asia are described and illustrated. One of these is a new species, *Fuscolachnum hainesii* n. spec. and another is a new combination *Incrucipulum uralense*.

Key words—fungi, discomycetes, *Incrupila*

Introduction

Microfungi on *Dryas octopetala* were recently thoroughly investigated (Chlebicki & Knudsen 2001, Chlebicki 2002, Chlebicki & Raitviir 2003, Chlebicki & Suková 2004). Eight taxa belonging to *Helotiales* were reported. One of the *Helotiales* published as *Fuscolachnum* sp. (Chlebicki 2002) is a new species in the genus *Fuscolachnum* J.H. Haines while another one, *Lachnum uralense* Chleb., should be transferred to the genus *Incrucipulum* Baral. Recently Raitviir (2004) transferred *Lachnum crystallophorum* Nograsek & Matzer to the genus *Incrupila* Raitv. Other species of *Helotiales* described on *Dryas* include: *Brunnipila dryadis* Nograsek & Matzer (Nograsek & Matzer 1991, Chlebicki 2002), *Crocicreas dryadis* (Nannf. ex L. Holm) S. E. Carp. var. *dryadis* [=*Grahamiella dryadis* (Nannf. ex L. Holm) Spooner], (L. Holm 1979, K. Holm & L. Holm 1984, Chlebicki 1995, 2002, Chlebicki & Suková 2004), *Crocicreas dryadis* var. *uniseptatum* Nograsek & Matzer (Nograsek & Matzer 1991, Chlebicki 1995, 2002, Chlebicki & Suková 2004), *Crocicreas variabile* Nograsek & Matzer (Nograsek & Matzer 1991, Chlebicki 2002, Chlebicki & Suková 2004), *Hymenoscyphus scutula* (Pers.) W. Phillips (Sprague 1955) and *Urceolella dryadicola* Raitv. (Chlebicki & Raitviir 2003, Chlebicki & Suková 2004, Raitviir 2004).

Material and Methods

Material was studied under a zoom stereo microscope Nikon SMZ 1500 and a light microscope (LM) Olympus BX-51 with an oil immersion lens, at magnification of

1000x. Slides in water were prepared for LM photographs of excipulum in longitudinal section. The amyloid reaction of the asco-apical apparatus was examined in Lugol's solution (IKI: 1% iodine, 3% KI in water), and Melzer's reagent (MLZ with 1% KOH pretreament). Measurements refer to dead ascospores in water (*Fuscolachnum*) and living ascospores (*Incrucipulum*), other characters were measured in lactophenol. For SEM studies, dried apothecia were coated with gold, and photographed using scanning electron microscope PHILIPS and Fei Quanta 200. The material that was mentioned above is deposited in KRAM F and PRM. The Latin names of the orders and families follow Kirk *et al.* (2001) and Raitviir (2004).

Results

Fuscolachnum hainesii Chleb. & Suková **nova sp.**, *Helotiales, Lachnaceae*

Figs. 1, 2A

Diagnosis: Apothecia minuta, sessilia, cupuliformia, 300-320 µm diam. Pili fusci, cylindracei, 1–3-septati, tenuitunicati, 20.5–33 x 5.2–6.2 µm, sparse verrucis. Asci uncinati (30-) 33–37.5(-40) x 6–7.5(-8) µm, apicibus conicis, poro amyloideo. Sporae hyalinae, aseptatae, 9-10 x 1.5 µm. Paraphyses cylindricae 1.6-2 µm diam., apicibus obtusis, ascos nonsuperantibus. Excipulum externum textura angulari, cellulibus 5–7 x 3.5–6 µm magnis.

Hab. In foliis emortuis Dryadis grandis.

Holotype here designated: Russia, Chukotka Peninsula, eastern part of the Peninsula, valley of Nyrvakinbtveen River, near Ozernoye, Krest Bay, 28 July 1971, *leg. Y.P. Kozhevnikov*, Herb. LE.

Host: Leaves of *Dryas grandis*.

Etymology: The epithet *hainesii* refers to the mycologist John Haldor Haines from New York, who established the genus *Fuscolachnum*.

Description: Apothecia cup-shaped, sessile, 300-320 µm diam. Hairs brown, cylindrical, 1–3-septate, 20.5–33 x 5.2–6.2 µm, thin-walled, walls up to 0.5 µm thick, sparsely and coarsely granulate, warts slightly rounded at the top, lower warts mostly elongated. Asci clavate, arising from croziers, (30-)33–37.5(-40) x 6–7.5(-8) µm, with conical apices, apical pore blue in Lugol without KOH as well as blue in MLZ both without and with KOH pretreatment. Ascospores hyaline, with medium sized guttules (dead state), one-celled 9-10 x 1.5 µm. Paraphyses hyaline, filiform slightly enlarged below apex, straight, 1.6-2 µm diam., sometimes branched in lower part, with rounded apices, not exceeding asci. Ectal excipulum of textura angularis, cells 5–7 x 3.5–6 µm.

Comments: The sessile apothecia with fuscous, septate hairs covered by granules, and clavate ascospores are typical of *Fuscolachnum*. The granules of the new species are distinctly scattered in comparison with other species, e.g., *F. dumorum* (Roberge ex Desm.) J.H. Haines, *F. inopinatum* (Kirschst.) J.H. Haines, or *F. misellum* (Roberge ex Desm.) J.H. Haines. The hairs of *H. hainesii* more resemble those of *F. pteridis* (Alb. & Schwein.) J.H. Haines and its var. *tumidipila* J.H. Haines, but in *F. hainesii* the granules are even more scattered. Moreover, these 'granules' are not exudet by the hair cell but rather protrusions of the cell wall. For this reason we have some hesitation in placing

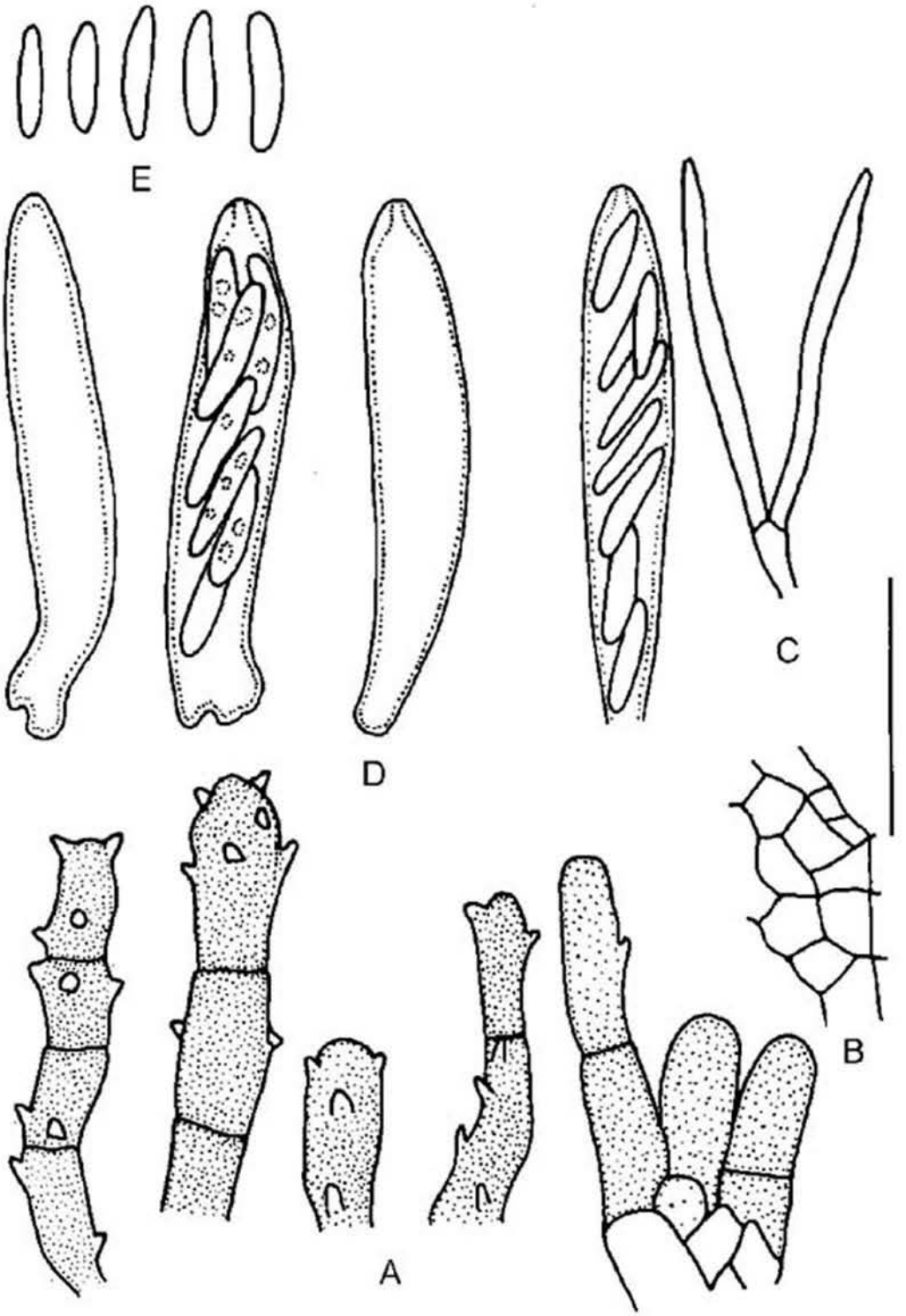

Fig. 1. *Fuscolachnum hainesii*: A - hairs with granules; B - part of excipulum (textura angularis); C - paraphyses, D -asci ; E – ascospores (dead state). Scale bar = 20 μm

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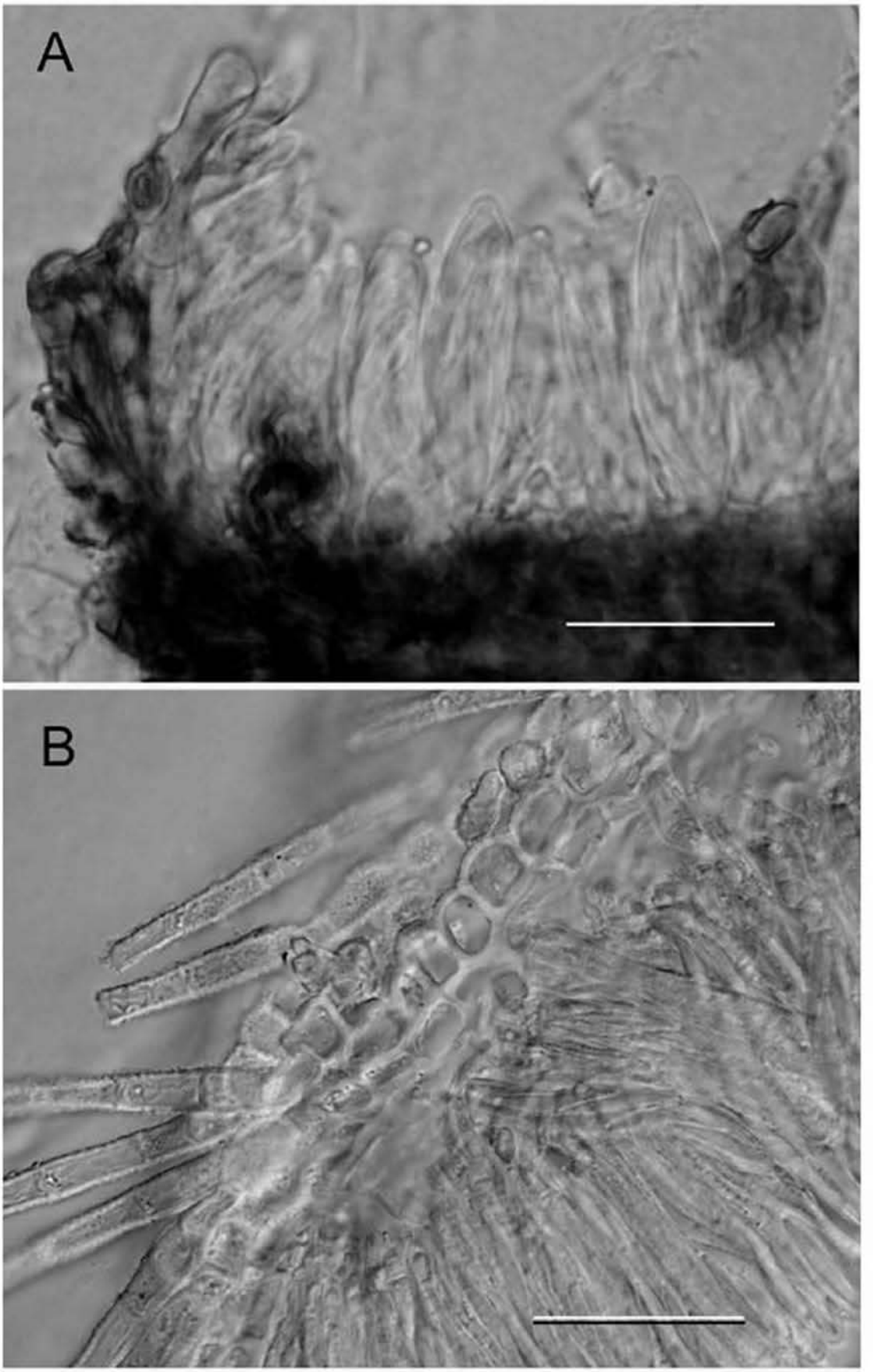
the new species in *Fuscolachnum*. At present only two species of *Fuscolachnum* are known from broadleaf plants: *F. misellum* and *F. dumorum* (Roberge ex Desm.) J.H.


A
B

Haines. But both these species possess hairs densely covered by granules and smaller ascospores. Paraphyses of *F. hainesii* are similar to these of *F. misellum*. Haines (1989) stated that the members of this genus are apparently host specific. We decided to describe this specimen as a new species in spite of very scanty material.

Incrucipulum uralense (Chleb.) Chleb. & Suková, **comb. nov.** *Helotiales, Lachnaceae* **(Figs. 3, 4A)**

Basionym: *Lachnum uralense* Chleb., Monographiae Botanicae 90: 84, 2002.

Because at present the type material of *Lachnum uralense* contains only one apothecium and single slide, we decided to provide a more precise description.

Description: Apothecia subsessile, whitish to pale-yellow, 140-200 µm diameter, surface of ectal excipulum distinctly granulate, surface layer composed of thick-walled quadratic cells, hairs clavate, 3-6 septate, 90-130 x 5-7 µm, hair wall 1-2.2 µm thick, scabrous, each hair tipped by octahedral crystals, asci clavate, arising from simple septa, 50-52 x 7-8 µm, narrowed below to the basal septum, ascospores hyaline, narrowly ellipsoid-subfusioid, one-celled 12-15 x 3-4 µm, with 2-3(5) large oil drops, paraphyses linear sublanceolate, widest point near the apex, slightly longer than the asci, up to 60 µm long and 1-1.5 µm wide.

Comments: The genus *Incrucipulum* was introduced by Baral (in Baral & Krieglsteiner 1985) for several species. We agree with Baral that *Incrucipulum* should be segregated from *Brunnipila, Capitotricha* and *Lachnum* on the basis of the excipular structure and character of the hairs. In longitudinal section the excipulum contains characteristic thick-walled quadratic cells in the surface layer. The hairs of *Incrucipulum* are warted, moderately thick-walled to thick-walled, tipped by apical crystals. Hair wall thickness of *I. uralense* is similar to that in . *I. virtembergense* (Matheis) Baral (Tab. 1).

Also ultrastructural studies of the morphology of the hair wall and ascus apical apparatus provide good support to identify the genera *Lachnum* s. str., *Brunnipila, Capitotricha* and *Incrucipulum* (Leenurm et al. 2000).

Hairs of *Lachnum uralense* are tipped by octahedral crystals. Similar crystals were observed also in *Incrucipulum ciliare* (Schrad.: Fr.) Baral (Fig. 4B). As the type of *L. uralense* contains only one apothecium and the character of the hairs is almost the same as in *I. ciliare,* we are sure that *L. uralense* belongs to the genus *Incrucipulum* (despite not studying the apothecium in longitudinal section). The excipulum of *I. ciliare* in longitudinal section contains the characteristic surface layer of thick-walled quadratic cells (Fig. 2B). Similar thick-walled quadratic cells covered by granules we observed in *L. uralense* in surface view.

Specimens examined: RUSSIA: Polar Ural Mts., patches of mountain tundra near unnamed pass, 510 m elev., 12 km S of Polyarnyj Ural railway station, on lower side of leaves of *Dryas octopetala*, 25 July 1995, coll.: A. Chlebicki (Holotype: KRAM F 43247).

Fig. 2. A - section of margin of apothecium of *Fuscolachnum hainesii*, LE. Scale bar 20 µm; B - Excipulum of *Incrucipulum ciliare* (Schrad.: Fr.) Baral in longitudinal section, PRM 900015. Scale bar 30µm

Comparative material of non-dryadicolous species of *Incrucipulum* studied:

Incrucipulum ciliare, Austria, Styria, Leibnitzer Feld, ca. 6.5 km NNE of Leibnitz, "Haslacher Auen", 280 m elev., 46° 50' N, 15° 33' E, on leaves of *Quercus robur*, 10 September 2002, coll.: M. Suková, PRM 900015.

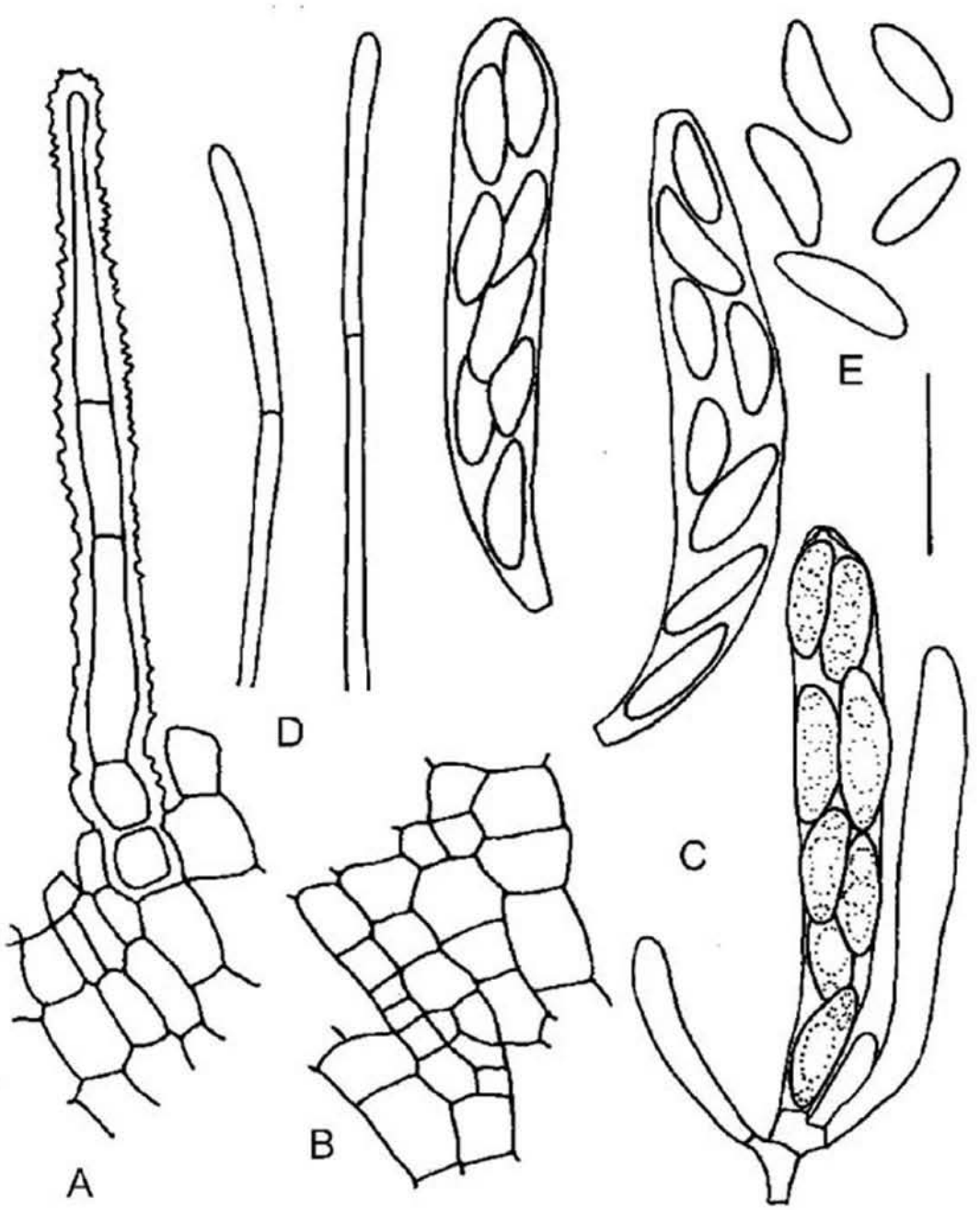


Fig. 3. *Incrucipulum uralense*: A – hair, B – extal excipulum, textura angularis, C – asci, D – paraphyses, E – ascospores, scale bar = 20 μm

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Fig. 4. A – *Incrucipulum uralense* – SEM photographs of apical crystals of hairs; B – *Incrucipulum ciliare* (Schrad.: Fr.) Baral - SEM photograph of apical crystals of hairs, PRM 900015

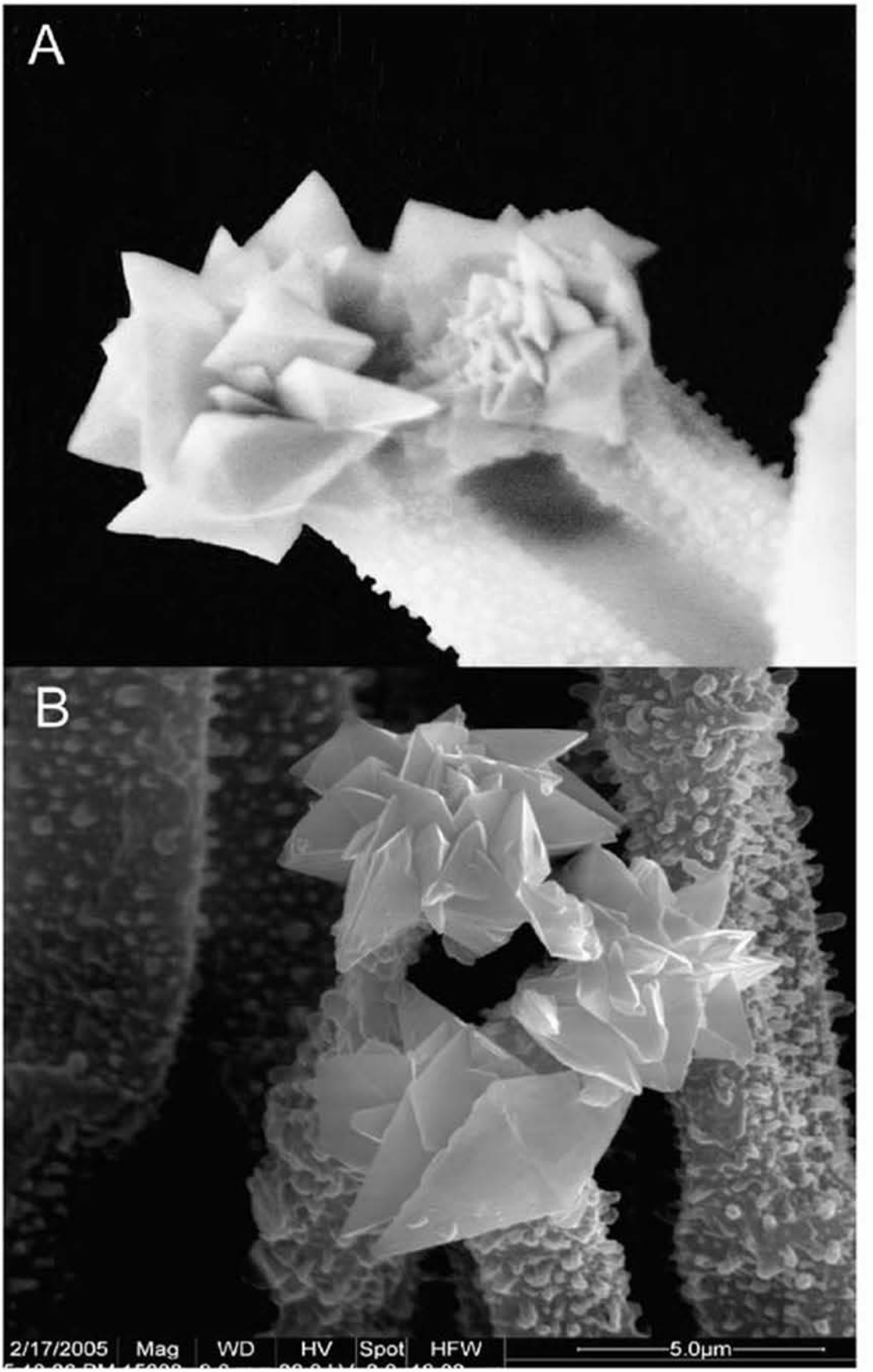
A
B
2/17/2005
Mag
WD
HV
Spot
HFW
5.0µm

Table 1. Hair wall thickness of some species of the genus *Incrucipulum*

Fungus	Wall thickness [μm]	Source
Incrucipulum capitatum	0.6-2.3	PRM 900745 – herb. material in KOH
Incrucipulum ciliare	0.5-1.2(1.4)	PRM 900015 – herb. material in KOH
Incrucipulum ciliare	0.5-1	Baral (2003) – living material
Incrucipulum virtembergense	(1-)1.5-2.5(-3)	Baral (2003) – living material
Incrucipulum virtembergense	2-2.5	Matheis (1977)
Lachnum uralense	1.5-2.5	KRAM F 43247 – herb. material in lactophenol

Incrupila crystallophora (Nograsek & Matzer) Raitv., Scripta mycologica 20: 77, 2004. *Helotiales, Hyaloscyphaceae*

Basionym: *Lachnum crystallophorum* Nograsek & Matzer, Nova Hedwigia 53: 455, 1991.

Comments: This interesting species was reported from the Eastern Carpathians in our previous article (Chlebicki & Sukova 2004). Raitviir (2004) transferred *Lachnum crystallophorum* to the genus *Incrupila* Raitv. We agree with the taxonomic decision of Raitviir.

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Cercospora agavicola – a new foliar pathogen of *Agave tequilana* var. *azul* from Mexico

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Abstract — *Cercospora agavicola* is newly described and illustrated on *Agave tequilana* var. *azul* from Mexico. Koch's postulates were successfully completed, confirming *C. agavicola* as the causal organism of Agave leaf spot and necrosis. *C. agavicola* is compared to cercosporoid species based on sequence data derived from the ITS nrDNA region, and part of the elongation factor 1-α, actin, calmodulin and histone H3 genes. Its taxonomic position, generic affinity and relatedness to allied species are discussed on the basis of morphological and molecular data.

Key words — mitosporic fungi, *Mycosphaerella* anamorphs, North America

Introduction

Agave cantula Roxb., *A. cupreata* Trel. & A. Berger, *A. longisepala* Tod., *A. palmaris* Trel., *A. pesmulae* Trel., *A. pseudotequilana* Trel., *A. subtilis* Trel. and *A. tequilana* F.A.C. Weber var. *azul* are cultivated in Mexico in the states of Guanajuato, Jalisco, Michoacán, Nayarit and Tamaulipas (Anonymous 2002). The latter species is the most economically significant cultivated agave because of its importance for 'tequila' extraction (Villalvazo 1986, Granados 1993). Penjamo in the state of Guanajuato is one of the regions in which agave was initially planted as crop. In January 2003, collaborators from the Agricultural Department of the State of Guanajuato observed a new disease on *Agave tequilana*. A fungus associated with symptomatic tissue was identified at the Instituto de Fitosanidad, Colegio de Postgraduados (CP) as an undescribed member

of the genus *Cercospora* Fresen. Material was sent to U. Braun in Germany for confirmation of the identification. Additionally, molecular analyses of the ITS nrDNA region, and part of the elongation factor 1-α, actin gene, calmodulin and histone H3 genes were carried out at CP and at the Centraalbureau voor Schimmelcultures in Utrecht, the Netherlands.

Materials and methods

Isolates

Isolates were obtained from symptomatic leaf pieces by placing disinfested necrotic tissue fragments in moisture chambers to enhance sporulation. Monoconidial cultures were subsequently established on water-agar (WA) (20 g agar / 1 L distilled water). Colonies were induced to sporulate on four different media: WA, agave-agar (AA) (40 g of agave leaf fragments boiled for 10 min and then blended with 20 g agar / 1 L distilled water), oatmeal-agar (OA) (15 g of oatmeal, 20 g agar / 1 L distilled water), and potato-dextrose agar (PDA) (200 g potatoes, 20 g dextrose, 20 g agar / 1 L distilled water). Dishes of all media were point inoculated and incubated for 3 wk at ± 24°C under continuous near-ultraviolet light, and inspected for sporulation at 3 d intervals. Morphological observations *in vitro* were based on sporulating cultures on AA. Thirty observations were made of each structure, with extremes given in parentheses.

DNA isolation, amplification and phylogenetic analysis

The protocol of Lee & Taylor (1990) was used to isolate genomic DNA from fungal mycelium of a monoconidial culture grown on MEA in Petri dishes. The primers ITS1 and ITS4 (White et al. 1990) were used to amplify part (ITS) of the nuclear rRNA operon spanning the 3' end of the 18S rRNA gene, the first internal transcribed spacer (ITS1), the 5.8S rRNA gene, the second ITS region and the 5' end of the 28S rRNA gene. To obtain additional sequence information, four other loci were sequenced. Part of the elongation factor 1-α gene (EF) was amplified with primers EF1-728F and EF1-986R, part of the actin gene (ACT) with primers ACT-512F and ACT-783R and part of the calmodulin gene (CAL) with primers CAL-228F and CAL-737R (Carbone & Kohn 1999). Part of the histone H3 gene (HIS) was amplified with primers H3-1a and H3-1b (Glass & Donaldson 1995). The PCR conditions, sequence alignment and subsequent phylogenetic analysis followed the methods of Crous et al. (2004a). To determine the taxonomic position of the fungus, the sequences were added to a subset of the alignment (TreeBASE matrix M2038) of Crous et al. (2004b). Sequence data were deposited in GenBank.

Koch's postulates

Pathogenicity tests were conducted on six-mo-old healthy seedlings of *A. tequilana* var. *azul* that were produced in the region of Tequila, Jalisco. The experiment consisted of six plants, of which 10 leaves per plant were inoculated (five wounded via a sterile toothpick, five unwounded). Agar disks (0.5 cm diam) colonized by the fungus were placed at the base of each leaf. All plants were incubated in a moist chamber (± 90% relative humidity) for 24 h, and subsequently transferred to a glasshouse (± 28°C,

normal daylight) until symptoms appeared. Controls consisted of two plants that were inoculated in a similar fashion with uncolonized agar plugs. Reisolations were made onto PDA to confirm Koch's postulates.

Results

DNA Phylogeny

Approximately 500, 315, 230, 320 and 410 bases were determined for ITS, EF, ACT, CAL, and HIS, respectively (GenBank accession numbers AY647237, AY966897, AY966898, AY966899, AY966900, respectively). A partition homogeneity test using the sequence data showed that all loci could be combined ($p = 0.073$) into a single analysis.

The data matrix contained 17 taxa (including the two outgroups) and 1702 characters including alignment gaps. Of these characters, 603 were parsimony-informative, 124 were variable and parsimony-uninformative, and 975 were constant. Neighbor-joining analysis using the three substitution models on the sequence data yielded trees with similar topology and bootstrap values. Parsimony analysis of the alignment yielded three most parsimonious trees (TL = 1230 steps; CI = 0.921; RI = 0.960; RC = 0.885), one of which is shown in Fig. 1. The neighbor-joining (using the uncorrected p, Kimura 2-parameter and F84 substitution models) and parsimony analyses provided trees with the same topology (data not shown). All of the *Cercospora* isolates formed a well-supported group (100 % bootstrap support) with the sequences of *Cercospora apii* and *C. beticola* clustering together with a bootstrap support value of 100 %. The isolate from *Agave tequilana* var. *azul* formed a distinct branch in the *Cercospora* clade, separate from the other *Cercospora* species in the tree.

Taxonomy

Cercospora agavicola Ayala-Escobar, **sp. nov.** MB500188 **Figs 2–14**

Differt a C. fourcroyae conidiophoris 20–100 µm longis, conidiis cylindraceis, ad apicem interdum distincte inflatis.

Holotype here designated: on *Agave tequilana* var. *azul* (*Agavaceae*), Mexico, State of Guanajuato, Penjamo, Jan. 2003, V. Ayala-Escobar and Ma. de Jesús Yáñez-Morales (CHAPA # 166), culture ex-type CBS 117292, CPC 11774.

Isotype: HAL 1839 F.

In vivo: Forming irregular necroses of variable size on leaves, dingy gray. Colonies punctiform to pustulate, scattered to dense, dark to blackish brown, later gray-brown to grayish white by abundant conidial formation, scattered to confluent, dense. Mycelium internal. Hyphae sparingly branched, 1.5–5 µm wide, septate, subhyaline to brownish, smooth, hyphae solitary or forming lax to dense ropes or planate aggregations of swollen cells up to 15 µm diam. Stromata well-developed, immersed, often somewhat erumpent, 20–150 µm diam or confluent and larger, composed of swollen hyphal cells,

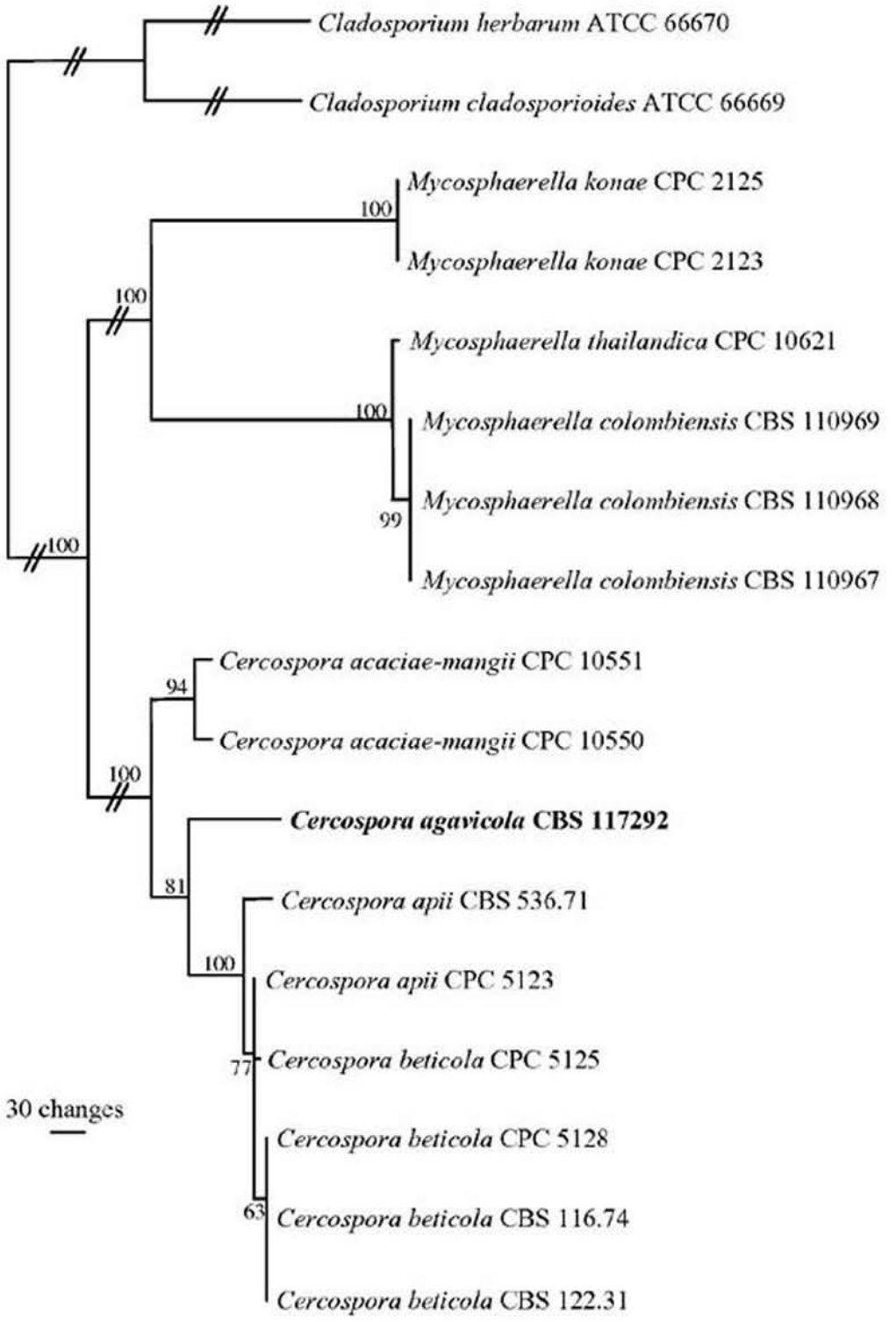
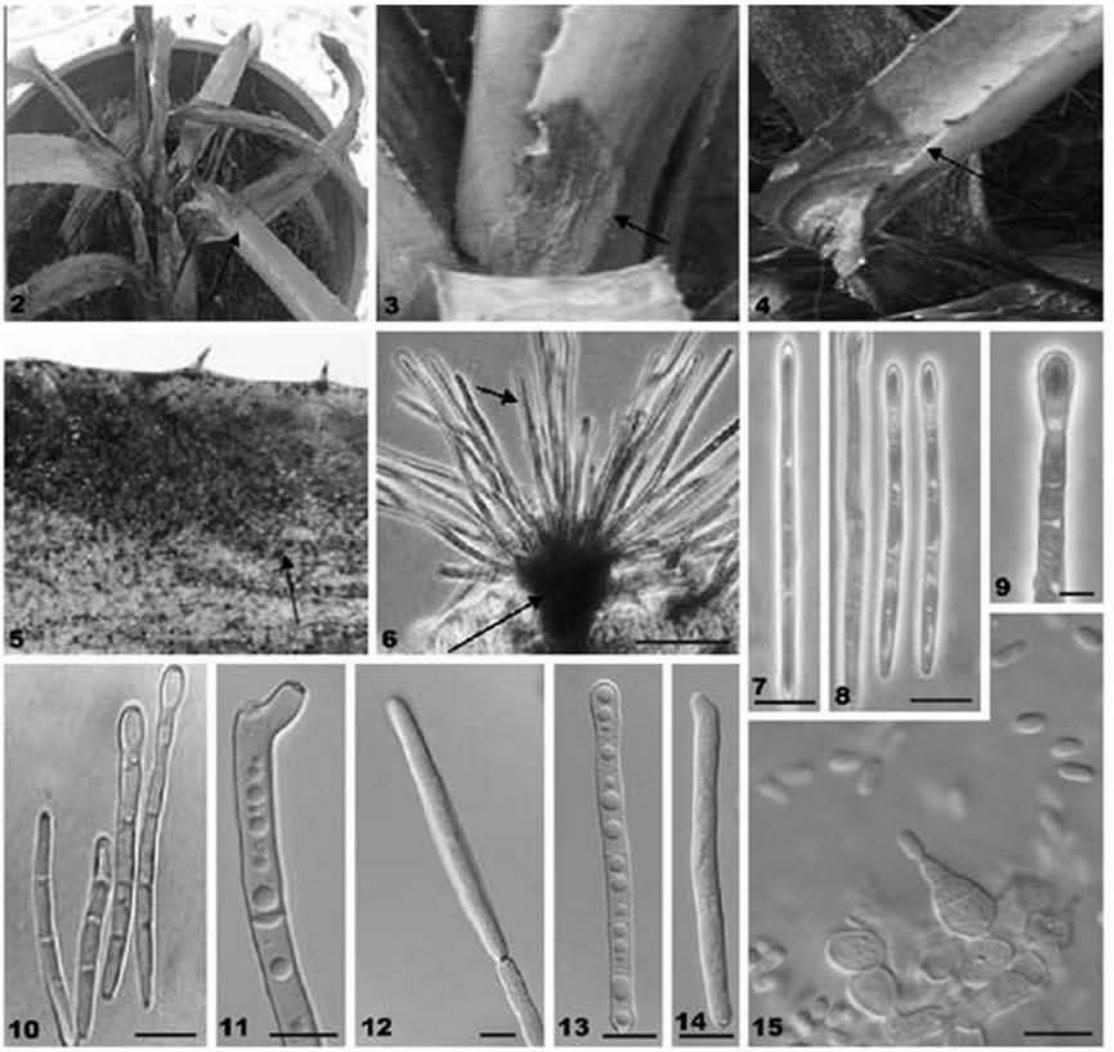


Fig. 1. One of three most parsimonious trees obtained from a heuristic search with 100 random taxon additions of the combined sequence alignment. The scale bar shows 30 changes and bootstrap replicate values from 1000 replicates are shown at the nodes. Strict consensus branches are thickened. The tree was rooted to two *Cladosporium* species. GenBank accession numbers of the sequences from TreeBASE matrix M2038 can be found in Crous et al. (2004b).



Figs 2–14. Disease symptoms and morphological structures of *Cercospora agavicola* on *Agave tequilana* var. *azul*. **2.** Leaf and stem necrosis. **3.** Basal necrosis of a leaf, 3 wk after inoculation. **4.** Basal leaf necrosis 3 mo after inoculation. **5.** Multiple dark stromata covering the basal leaf area. **6.** Fasciculate conidiophores arising from a basal stroma. **7–10.** Hyaline conidia with swollen apical cells *in vivo*. **11.** Brown conidiogenous cells with loci. **12.** Conidiogenous cell giving rise to a conidium. **13–14.** Conidia *in vitro*. **15.** Spermatogenous cells with spermatia *in vitro*. Scale bars: 5 = 100 μm, 6–7, 9 = 15 μm, 10–14 = 10 μm, 8 = 5 μm.

3–8 μm wide, brown. Conidiophores in small to moderately large, lax fascicles, erect, divergent, subcylindrical-filiform to flexuous-sinuous, barely geniculate, unbranched, occasionally with constrictions and swellings, 20–100 × 3–6(–7) μm (up to 200 μm in length and strongly branched under high humidity in moisture chambers), pluriseptate, at first subhyaline, later pale olivaceous, olivaceous-brown or pale brown, often paler towards the apex, thin-walled, smooth; conidiogenous cells integrated, terminal, 10–40 μm long; with a single or up to three conidiogenous loci, terminal and lateral, 2–3 μm diam, thickened and darkened. Conidia solitary, subcylindrical, (35–)40–100(–120) × 3–5.5 μm, (0–)3–8-septate, hyaline, thin-walled, smooth, apex obtuse, sometimes with distinctly swollen tips, base truncate to slightly obconically truncate, 1.5–2.5 μm wide, hila somewhat thickened and darkened.

***In vitro*:** Colonies on all culture media green to grayish, reaching 2 cm diam within 3 wk. Sporulation only observed on AA medium after 21 d. Conidiophores dense, 231–960 µm long, pluriseptate, with a single terminal conidiogenous locus or up to five slightly protruding lateral loci. Conidia straight, cylindrical, 25–120 µm long, 2–8-septate, hyaline, apical cells often swollen, subglobose to clavate. Spermatogonia formed on OA, exuding masses of hyaline, rod-shaped spermatia, 3–6 × 1–2 µm.

Koch's postulates

Disease symptoms were observed after 10 d, and consisted of pale to dark brown spots. Lesions were 3–4 cm long and 2 cm wide after 21 d, while the whole leaf (15 cm long) turned necrotic after 3 mo, also extending to the stem (Figs 2–4). *C. agavicola* was successfully re-isolated from the margins of symptomatic leaves within 2–3 wk after inoculation. No disease developed on unwounded leaves. Control plants remained healthy. Inoculated, wounded leaves developed stromata (Fig. 5), which, when placed in moist chambers, produced conidiophores within 5 d and conidia after 8 d.

Discussion

Cercospora leaf spot and necrosis is a new disease of *Agave* in Mexico and, as such, it is not known if this fungus also occurs in other states where the crop is grown. The common occurrence of spermatogonia on host material, as well as *in vitro* on agar media, suggests that it is very likely that this pathogen also has a *Mycosphaerella* teleomorph.

The generic affinity of this fungus to *Cercospora* was confirmed by BLASTn results obtained with the sequence data. The ITS sequence was highly similar to sequences of '*Cercospora sorghi* var. *maydis* Ellis & Everh.' (AF 297229, Goodwin et al. 2001; 99.8 % similarity), *C. nicotianae* Ellis & Everh. (AF 297230, Goodwin et al. 2001; with the same similarity as pervious taxon) and *C. asparagi* Sacc. (AF 297229, Goodwin et al. 2001; 2 bp different). '*Cercospora sorghi* var. *maydis*' is quite distinct from and not conspecific with *C. sorghi s. str.* (Chupp 1953, Goodwin et al. 2001) and, together with *C. nicotianae* and *C. asparagi*, belongs to the *C. apii* complex (Crous & Braun 2003). *C. agavicola* is genetically close to *C. apii s. lat.* based on ITS sequence data, but morphologically quite distinct by having very large stromata and consistently cylindrical conidia, often with swollen tips. From the phylogenetic tree obtained using the combined sequence data of five genomic loci, it is clear that *C. agavicola* is also genetically distinct from *C. apii s. lat.* *C. floricola* Heald & F.A. Wolf on *Yucca* spp. and *C. fourcroyae* Obreg.-Bot. on *Alstroemeria* sp. (*Alstroemeriaceae*) and *Fucraea* (*Fourcroya*) *gigantea* are two *Cercospora* species on hosts belonging to the *Agavaceae*. The latter species is morphologically close to *C. agavicola*, but differs in having very long conidiophores (up to 350 µm *in vivo*) and cylindrical-obclavate conidia without any apical swellings (Chupp 1953). *C. floricola* is characterized by its uniformly short conidiophores, 10–35 µm long, and cylindrical-obclavate conidia, 15–60(–70) × 3–6 µm, with 1–3(–5) septa, and non-swollen tips (type material of *C. floricola* examined: BPI 436450). *C. haemanthi* Kalchb. on *Haemanthus* and *Scadoxus* species of the allied family *Amaryllidaceae* is morphologically also close to the new species, but

distinguished by having larger conidiogenous loci, 3–4 μm diam, obclavate-cylindrical to subacicular wider conidia, (20–)40–120(–220) × 4–8 μm, without any swollen tips (type material of *C. haemanthi* examined: B).

Acknowledgements

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MYCOTAXON

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Albatrellus ginnsii sp.nov.

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Abstract — A new species of *Albatrellus, A. ginnsii*, is described and illustrated. The new species was found growing in soil under a *Ficus benghalensis* tree in Calcutta, West Bengal, India.

Key words — Basidiomycetes, *Polyporaceae*, taxonomy

Introduction

During a mycological excursion at Calcutta, West Bengal, India, the author collected some fresh poroid basidiocarps found growing in soil near a *Ficus benghalensis* L. tree. A microscopical examination showed it to be an *Albatrellus* species. A search of the available literature (Domanski et al. 1973, Gilbertson & Ryvarden 1986, Ginns 1994, 1997, Pouzar 1972, Roy & De 1996, Ryvarden 1976, Ryvarden & Johansen 1980, Smith & Smith 1973) gave no clue to its identity, and it was concluded that it represented an undescribed species.

Albatrellus ginnsii A.B. De, **sp. nov.** **FIGURES 1-11**

Fructificatio stipitata; pileus albus, laeves, 0.6-1.4 cm in diametero, 1-2 mm crassa; contextus albus; pori facies albus, pori 2-3 per mm; systema hypharum monomiticum, hyphae generativae hyalinae, non fibulatae vel fibulatae; basidia hyalina, 25-37 × 8 µm; basidiosporae subglobosae vel ellipsoideae, 6-7 (-9) × 4.5-5.0 (-5.5) µm, levis, hyalinae, tenuitunicatae, amyloideae, apiculo prominenti, noncyanophiles.

Etymologia: *Secundum nomen Dr. J.H.Ginns.*

Holotypus hic designatus: *Lectus ad locum Calcutta, West Bengal, India, die 16 Octobri, 1998 et positus in herbario fungorum in sectio Botanicae, Burdwan Raj College, Burdwan, West Bengal, India (sub numero BRCMH A981); isotypus in herb. DAOM (Canada) conservatus (DAOM 227124).*

Basidiocarp annual, terrestrial, centrally stipitate, white, soft and succulent when fresh, drying soft and brittle, caespitose, number of basidiocarps in a bunch was found to be up to six; pileus circular with an acute umbo, 0.6-1.4 cm in diameter, 1-2 mm thick; upper surface (Fig. 1) of pileus white, glabrous, azonate, margin rounded, concolourous, entire, inturned on drying, sterile; pore surface (Figs. 1 & 2) white, no colour change when touched or scraped or only slightly discoloured, not shining, pores circular to

angular, 2-3 per mm, pore tubes not stratose, concolourous with pore surface, up to 1 mm deep; context white, less than 1 mm thick, homogeneous; subhymeniun 20 µm thick; stipe central, white, up to 2 cm long and 2-3 mm thick, solid, glabrous, unbranched, somewhat flattened with median longitudinal furrow, base of stipe slightly expanded and bulbous, up to 4 mm in diameter, fused with stipes from other fruitbodies at the bulbous basal part.

Hyphal system monomitic, generative hyphae (Fig. 7) hyaline, thin-walled to very slightly thick-walled, variously inflated, in extreme cases up to 35 µm in diameter in inflated parts, branched, simple septate with rare clamp connections, in context (Fig. 4) and stipe generative hyphae are mostly unbranched, running parallel in a dense structure, hyphae in the subhymenium 2.5-3.0 µm in diameter, with clamp connections, tramal hyphae 3-12 µm in diameter, with clamp connections and simple septa, the walls hyaline, thin, with ropy oily inclusions. Gloeoplerous hyphae (Figs. 3&8) 3.5-7.0 µm in diameter. Basidia (Figs. 5&9) clavate, 25-37 × 8 µm, hyaline, thin-walled with a basal clamp connection (n = 8), tetrasterigmate, very rarely bisterigmate, each sterigma 5 µm long when mature, contents typically with oily inclusions. Basidiospores (Figs. 6 & 10) subglobose to broadly ellipsoid to ellipsoid, 6-7 (-9) × 4.5-5.0 (-5.5) µm (n=20), l/w = 1.2-1.5, the walls thin, hyaline, smooth, apiculate, weakly amyloid, acyanophilous, often with oily inclusions. Cystidioles (Fig.11) hyaline, thin-walled, smooth, 15-20 × 3.5-5.0µm.

Habitat: On soil adjacent to a *Ficus benghalensis* L. tree.

Type Locality: Calcutta, West Bengal, India.

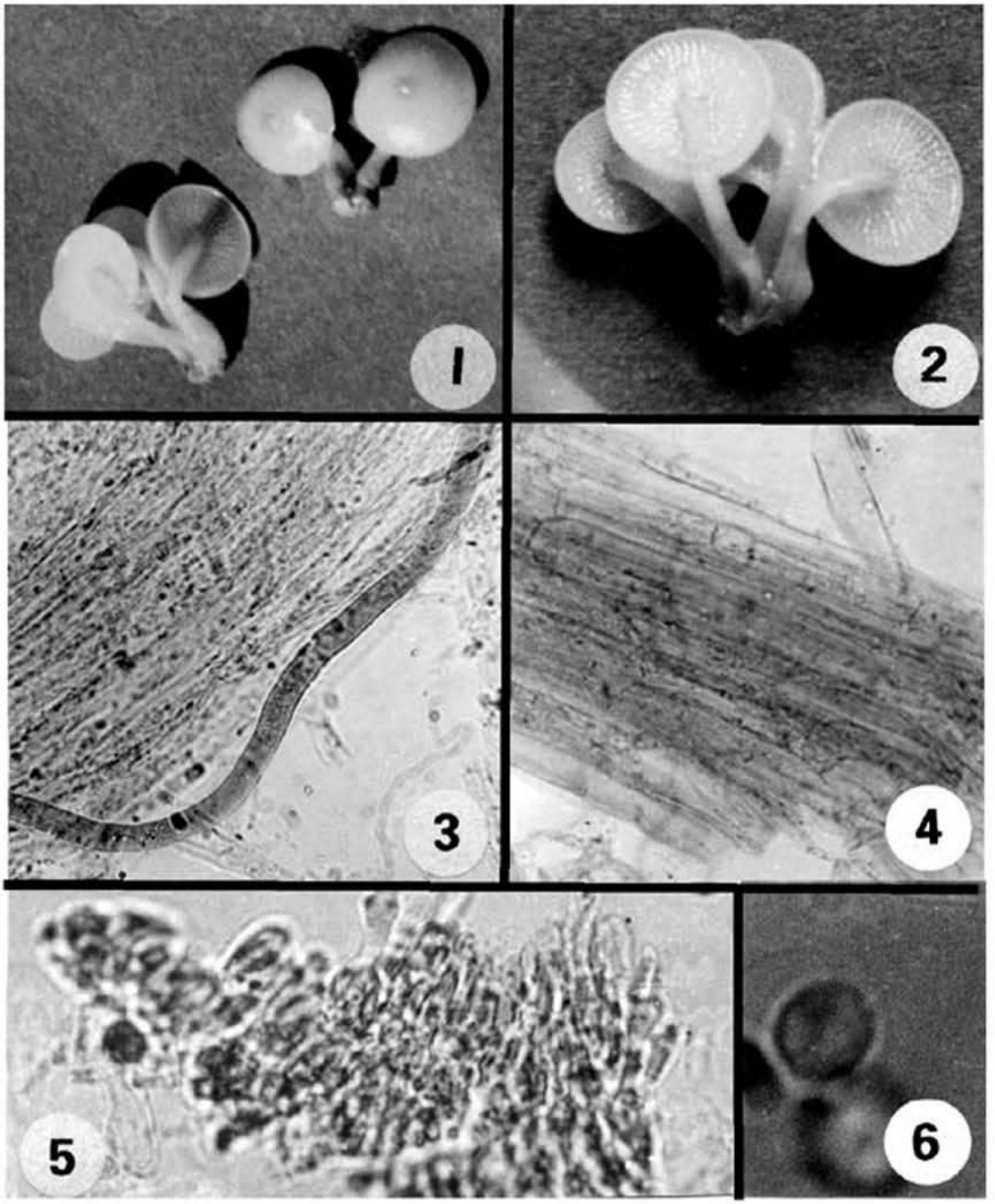
Etymology: The species name has been coined after the celebrated Canadian mycologist, Dr. J. H. Ginns.

Discussion

Albatrellus Gray is a genus of the family *Polyporaceae* sensu lato that is characterised by stipitate, fleshy basidiomes with a poroid hymenophore, monomitic hyphal system with inflated generative hyphae (with or without clamp connections), frequent gloeoplerous hyphae, and basidiospores that are hyaline, thin-walled, and ellipsoid to globose (Domanski et al. 1973; Ginns 1994, 1997; Pouzar 1972; Roy & De 1996; Ryvarden 1976; Ryvarden & Johansen 1980; Smith & Smith 1973). As the fungus described above possesses almost all of these characters, it is described in the genus *Albatrellus*.

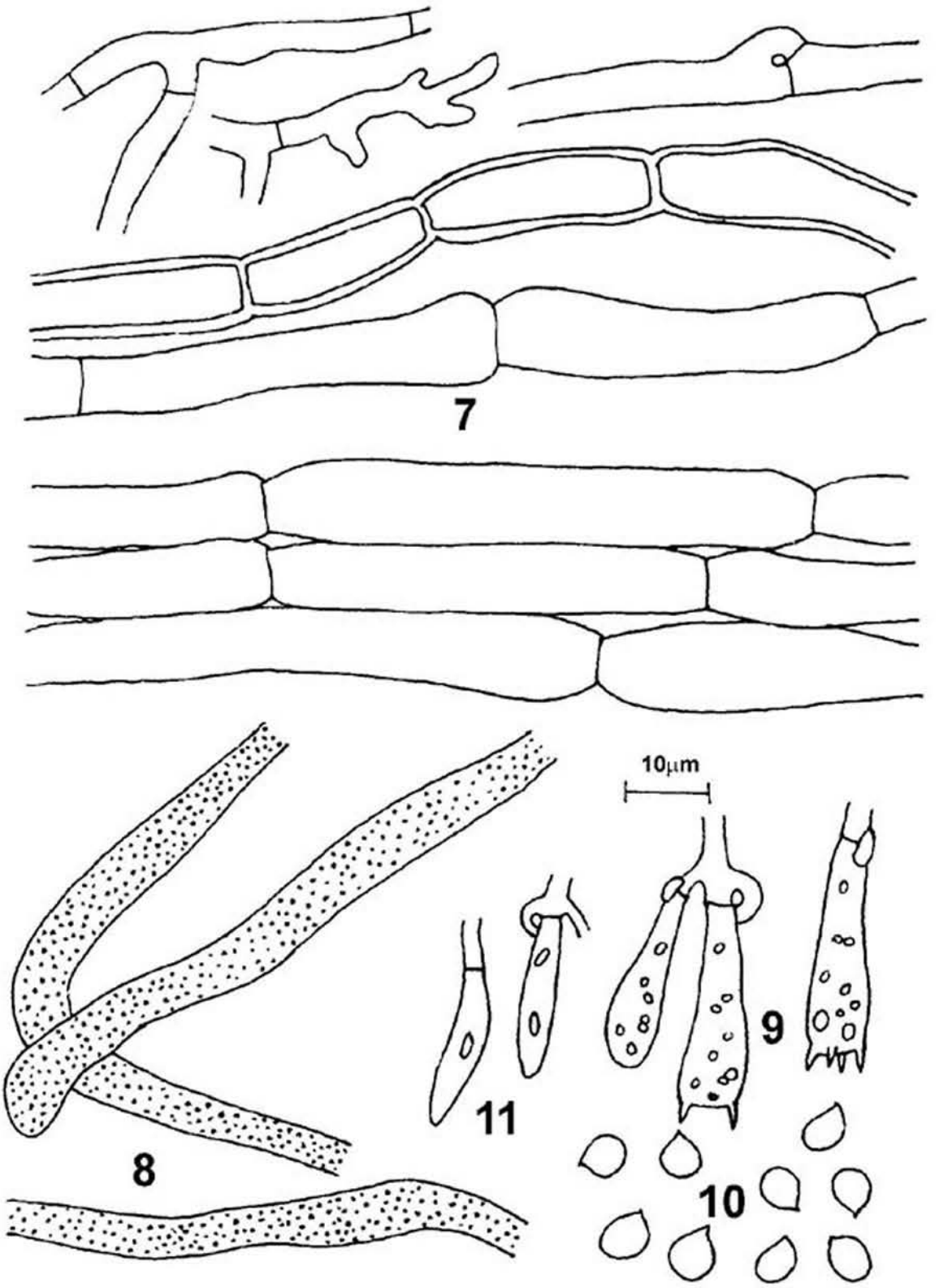
Albatrellus ginnsii can be distinguished from all other *Albatrellus* species, however, by the following combination of features: (i) caespitose small, white, centrally stipitate, basidiocarps with acutely umbonate, circular pilei and stipes with bulbous bases from which 5–6 fused basidiocarps arise; (ii) a white pore surface with 2–3 circular to angular pores per mm; (iii) generative hyphae with simple septa and extremely rare clamp connections; (iv) gloeoplerous hyphae 3.5-7.0 µm in diameter; (v) basally clamped basidia 25-37 × 8 µm; (vi) 6–9 × 4.5–5.5 µm basidiospores that are subglobose to ellipsoid, prominently apiculate, weakly amyloid; and (vii) hyaline, thin-walled, smooth cystidioles 15-20 × 3.5-5.0 µm.

Most *Albatrellus* basidiomes arise from soil or the litter layer (Ginns 1997). Gilbertson and Ryvarden (1986) stated, "All species have mycorrhizal connections



Figs. 1-6. *Albatrellus ginnsii* (holotype) : **1.** upper surface and hymenial surface of basidiocarps (× 1); **2.** hymenial surface of basidiocarps (× 1); **3.** gloeoplerous hypha (× 400); **4.** context tissue showing parallel arrangement of generative hyphae (× 500); **5.** hymenial layer showing a bisterigmatic basidium (× 500); 6. basidiospore (× 2000).

with trees" but Stalpers (1992) found "no indication of mycorrhizae." Mycorrhizae have been synthesized between *Albatrellus ovinus* (Schaeff. : Fr.) Kotl. & Pouzar and *Picea abies* (L.) Karst. roots (Agerer et al. 1996). The fungus described here was found growing on soil adjacent to a large tree of *Ficus benghalensis*. *A. ginnsii* may have a mycorrhizal relationship with this tree species but I have not yet been able to ascertain this aspect.



Figs. 7-11. Microscopic structures from basidiocarp of *Albatrellus ginnsii* (holotype): 7. generative hyphae; 8. gloeoplerous hyphae; 9. basidia; 10. basidiospores; 11. cystidioles.

Map 1. Distribution of the species of *Albatrellus* reported from India

Distribution of different species of *Albatrellus* in India

In India only three species of *Albatrellus* were known, namely, *Albatrellus cantharellus* (Lloyd) Pouzar, *Albatrellus confluens* (Alb. & Schwein. : Fr.) Kotl. & Pouzar and *Albatrellus dispansus* (Lloyd) Canf. & Gilb. (Bilgrami et al. 1991) until I collected the species described here. *A. ginnsii*, therefore, represents the fourth species of *Albatrellus* in India. Among these four species, only *A. ginnsii* has been collected from the plains; the other three species were collected from the northwestern Himalayas between 2005–2215 m. Locality data and a key to the four *Albatrellus* species occurring in India are given below and their distribution is shown above in Map 1.

***A. cantharellus*:** Dalhousie (H.P.), on soil among gymnosperm needles, alt. 2036 m.

***A. confluens*:** Mussoorie (U.P.), on soil under *Quercus incana* Roxb. forest, alt. 2215 m.

***A. dispansus*:** Dalhousie & Simla (H.P.), on soil under *Quercus* forest, alt. 2215 m.

***A. ginnsii*:** Calcutta (W.B.), on soil, adjacent to a *Ficus benghalensis* tree, alt. 15 m.

Key to the species of *Albatrellus* occurring in India

1. Each septum of generative hyphae provided with clamp connection, basidiospores weakly amyloid, pileus surface creamish-yellow, pale apricot to pinkish yellow, pores 2-4 per mm ..... ***A. confluens***
1. Not with above combination of characters **2**

2. Clamp connections absent, pores 4-7 per mm, basidiospores inamyloid ..... ***A. cantharellus***

2. Clamp connections extremely rare, pores 2-4 per mm, basidiospores amyloid ... 3

3. Pileus 2.0-6.0 cm in diameter, surface yellow to yellow tan when fresh, basidiocarps with many petaloid pilei arising from a common base ..... ***A. dispansus***

3. Pileus 0.6-1.4 cm. in diameter, surface white when fresh, up to six basidiocarps arising from a common base, pileus circular ..... ***A. ginnsii***

Acknowledgement

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A new combination in *Lacrymaria* (*Agaricales*)

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Abstract— The genus *Lacrymaria* (*Psathyrellaceae*) is reported for the first time in Brazil. *Psathyrella hypertropicalis* is transferred to *Lacrymaria* based on basidiome morphology and scanning electron microscopy studies (SEM) of the basidiospores. This species is characterized by the velutinate pileus and the verrucose basidiospores 9-12 x 6-8 μm with a well-developed germinal tube.

Key words— Basidiomycota, *Coprinaceae* s.l., *Psathyrellaceae*, *Psathyrella* subg. *Lacrymaria*, Brazil

Introduction

Studies on coprinaceous fungi in Brazil are very scarce (Putzke 1994). Some of the most relevant works on the group in Brazil are those of Alves & Cavalcanti (1996), Pegler (1997), Richardson (2001), Rick (1961), and Stijve & de Meijer (1993). However, the genus *Lacrymaria* Pat. has not been reported in these studies, either as considered an independent genus (Kits van Waveren 1985, Watling 1979, Watling & Gregory 1987) or as a subgenus of the large genus *Psathyrella* s.l. (Singer 1986, Smith 1972, Guzmán et al. 1990, Fouchier 1995).

Studies in molecular systematics have changed drastically the classification of this group of agarics (Hopple Jr. & Vilgalys 1999, Moncalvo et al. 2002), and a new family name – *Psathyrellaceae* (Singer) Vilgalys, Moncalvo & Redhead – was recently proposed by Redhead et al. (2001). In these works, *Lacrymaria* seems to form a well-supported clade within the *Psathyrellaceae*, justifying its generic status.

This paper reports for the first time a species of the genus *Lacrymaria* in Brazil. A new combination is also proposed, based on basidiomata morphology and scanning electron microscopy (SEM) study of the basidiospores.

Materials and Methods

Collected specimens were studied macro and microscopically. Microscopic analysis of the basidioma comprised 25 measurements of each microstructure (except for the basidiospores - 50 measurements), studied under 5% KOH and 1% Congo red solutions. Scanning electron microscopy (SEM) studies were conducted at the Center of Electron

Microscopy of the Universidade Federal do Rio Grande do Sul. The collected material is deposited in the herbarium ICN (Department of Botany, Universidade Federal do Rio Grande do Sul). Additional materials from the herbaria XAL (a topotype) and SP were studied for comparison.

Taxonomy

Lacrymaria hypertropicalis (Guzmán, Band.-Muñoz & Montoya) Cortez, **comb. nov.** FIGURES 1-5

Basonym: *Psathyrella hypertropicalis* Guzmán, Band.-Muñoz & Montoya, Brittonia 40: 229, 1988.

Pileus 58-60 mm in diameter, convex to campanulate; ferruginous brown on disc, pale brown toward the margin; surface dry, velutinous on disc to strigose at margin, which is also covered by appendiculate velar remnants; context thin (up to 2-3 mm), yellowish. ***Lamellae*** adnexed, somewhat close, blackish gray with a whitish edge, which presents milky droplets when fresh. ***Stipe*** 115-120 x 13-15 mm, central, cylindrical; yellowish to brownish yellow, with brown fibrils on surface; hollow, with a cottony internal mycelium, flesh brownish; annular zone present on center. ***Veil*** present both on pileus margin and stipe, in the form of glutinous and blackened fibrils, but not forming a well-developed annulus. ***Spore-print*** black.

Basidiospores 9-12 x 6-8 (-8.5) μm, ellipsoid to broad-ellipsoid, strongly verrucose and with a thickened wall under light microscopy, dark brown with blackish warts in KOH solution, but readily discoloring to pale violaceous when threatened with H_2SO_4, germ-pore present, wide and projecting. ***Basidia*** 27-34 x 10-13 μm, clavate, thin-walled, hyaline, bearing four sterigmata. ***Pleurocystidia*** present, but very scarce and very similar to the cheilocystidia, generally fasciculate in groups of no more than five. ***Cheilocystidia*** 46-68 (-92) x 9-13 μm, cylindrical with a capitate or subcapitate apex, hyaline, thin-walled, abundant in the gill edge. ***Pileipellis*** hymeniform, with subglobose and thin-walled 31-44 μm wide hyphae. ***Gill trama*** regular, composed of thin-walled (8-) 11-19 μm wide hyphae. ***Stipetipellis*** formed by parallel, hyaline, thin-walled hyphae 4-11 μm. ***Caulocystidia*** 65-94 x (9-) 11-15 (-17) μm, present in fascicles on stipe surface, very similar to the cheilocystidia but slightly larger. ***Clamp connections*** present.

Ecology: on soil between grasses, under a *Ceiba speciosa* (A. St.-Hil.) Ravenna ("paineira" - Malvaceae).

Material examined: BRAZIL. Rio Grande do Sul State: Porto Alegre, Universidade Federal do Rio Grande do Sul, *V.G. Cortez* 036/04, 28.VI.2004 (ICN). MEXICO. Veracruz, E of Cofre de Perote, Ingenio El Rosario, El Revolcadero, 28.VI.1985, *G. Guzmán* 28852 (XAL – topotype). **Additional specimen examined:** ***Lacrymaria lacrymabunda*** **(Bull.: Fr.) Pat.** (as *Hypholoma velutinum* (Fr.) Quél.): UNITED STATES. Iowa: Iowa City, *G.W. Martin*, 29.IX.1945 (SP 38996; MICH).

Discussion: Guzmán, et al. (1988) described *Psathyrella hypertropicalis* from the subtropical forests of Mexico, and it was defined by the strongly verrucose surface of the basidiospores, 10-12 x 7-7.5 μm, and with a conspicuous germinal tube.

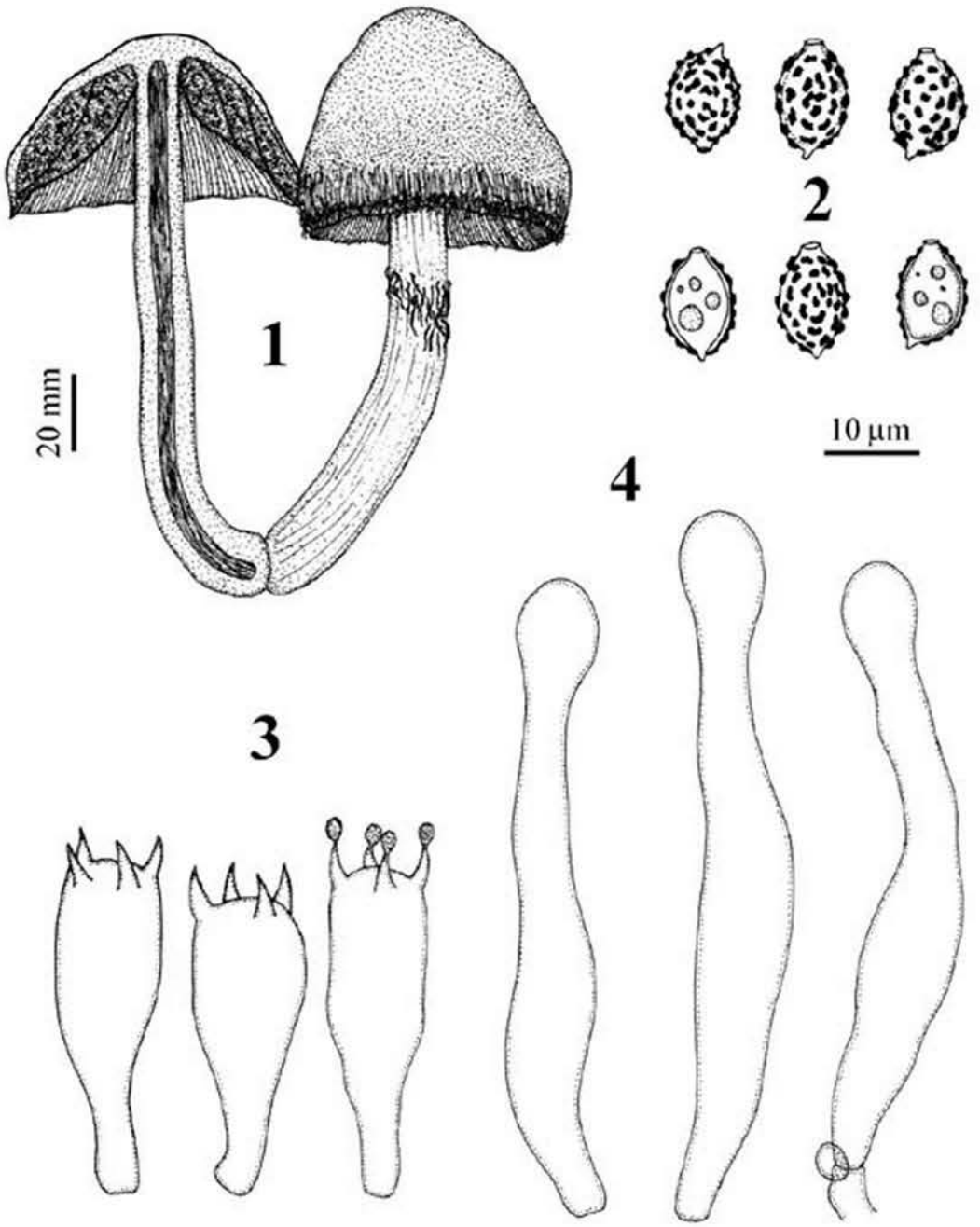

Figure 1-4. *Lacrymaria hypertropicalis*. 1. Habit and section. 2. Basidiospores. 3. Basidia. 4. Cheilocystidia.

Guzmán et al. (1990) recognized two additional varieties: *P. hypertropicalis* var. *microtubulata* Guzmán, Band.-Muñoz & Montoya, with a fibrillose to glabrous pileus, and *P. hypertropicalis* var. *pubescens* Guzmán, Band.-Muñoz & Montoya, with a velutinate pileus. Both varieties are separated from the typical variety for the germinal tube (0.8-1.2 µm long for the var. *hypertropicalis* against 0.4-0.8 µm for the varieties

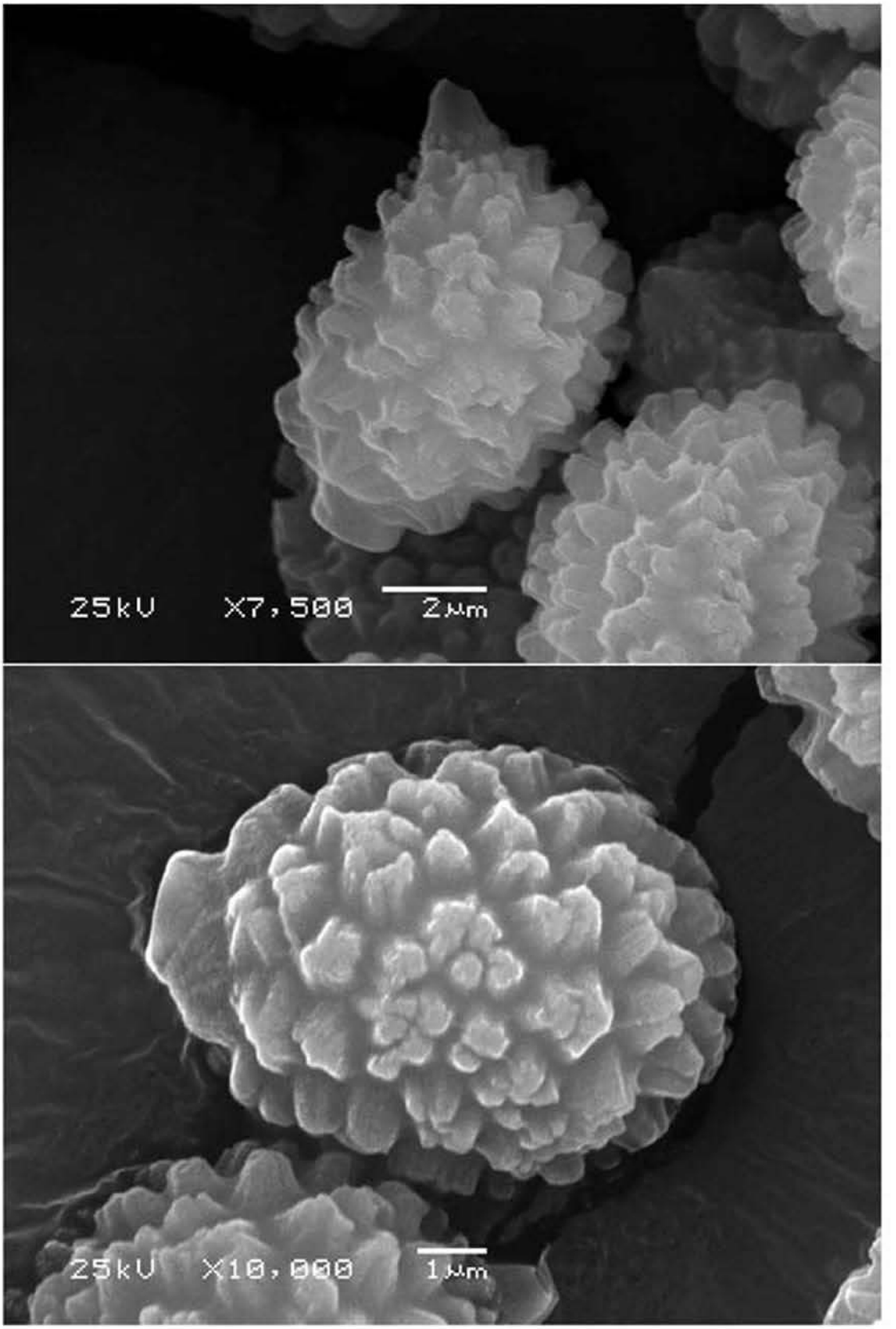

Figure 5. Scanning electron micrographs of the basidiospores of *Lacrymaria hypertropicalis*.

microtubulata and *pubescens*). We are not able to discuss these infra-specific taxa due the scarce Brazilian collected material, but according to the key presented by Guzmán et al. (1990), our collection must to belong to the var. *hypertropicalis* because it presents a germinal tube longer than 0.8 μm and a velutinate pileus.

Based on the basidiome and basidiospore morphology, this species is here transferred to the genus *Lacrymaria*, as it has been circumscribed by Watling (1979) and supported by recent molecular studies (Moncalvo et al. 2002).

The SEM studies revealed a strong ornamentation of the spore wall, in the form of warts (Fig. 5), as Guzmán et al. (1990) presented for *P. hypertropicalis*. This character was used by Guzmán et al. (1990) to separate this and other species (*P. asperospora* (Cleland) Guzmán, Band.-Muñoz & Montoya, *P. pseudovelutina* Guzmán, Band.-Muñoz & Montoya) from the temperate *L. lacrymabunda* (Bull.: Fr.) Pat. (= *L. velutina* (Pers.: Fr.) Konrad & Maubl.).

The Brazilian specimens were firstly identified as *L. lacrymabunda* following Dennis (1970) and Horak (1979). *Lacrymaria lacrymabunda* is common in Europe and North America but apparently not occurs in tropical America, as discussed by Guzmán et al. (1990). According to Guzmán et al. (1990), the reports of *L. lacrymabunda* from Venezuela by Dennis (1970) and from Argentina by Horak (1979) represent *L. hypertropicalis*. With the present report its distribution area is extended to Brazil.

Acknowledgements

Our deep gratitude is expressed to Dr. Gastón Guzmán and Dr. Roy Watling by the critical review of the present work. The authors also are acknowledged to Dr. Rinaldo Pires dos Santos (Department of Botany, UFRGS) and the Center of Electron Microscopy of the Universidade Federal do Rio Grande do Sul (CME/UFRGS) for allowing the SEM studies. The curators of the herbaria XAL (Instituto de Ecología, Xalapa, Mexico) and SP (Instituto de Botânica, São Paulo, Brazil) are acknowledged for the loan of specimens. The senior author thanks to CNPq (Brazil) for financial support.

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MYCOTAXON

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A new species of *Vizella* from Australia

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Abstract–*Vizella philothecae* sp. nov. is described from living leaves of *Philotheca myoporoides* (*Rutaceae*). It is distinguished from other *Vizella* species by the combination of ascospore size, obovoid shape and absence of a hyaline basal cell. It is known only from a single specimen collected in southeastern Australia.

Key words–*Vizellaceae, Entopeltis, Eriostemon*

An examination of *Vizella* Sacc. (Ascomycota: *Vizellaceae*) specimens in VPRI (Victorian Department of Primary Industries, Australia) revealed a previously undescribed species on *Philotheca myoporoides* (*Rutaceae*). It is known only from a single specimen.

Material was mounted in lactic acid, warmed and examined using Nomarski interference contrast microscopy.

Vizella philothecae Cunnington **sp. nov.** **FIGURES 1–3**

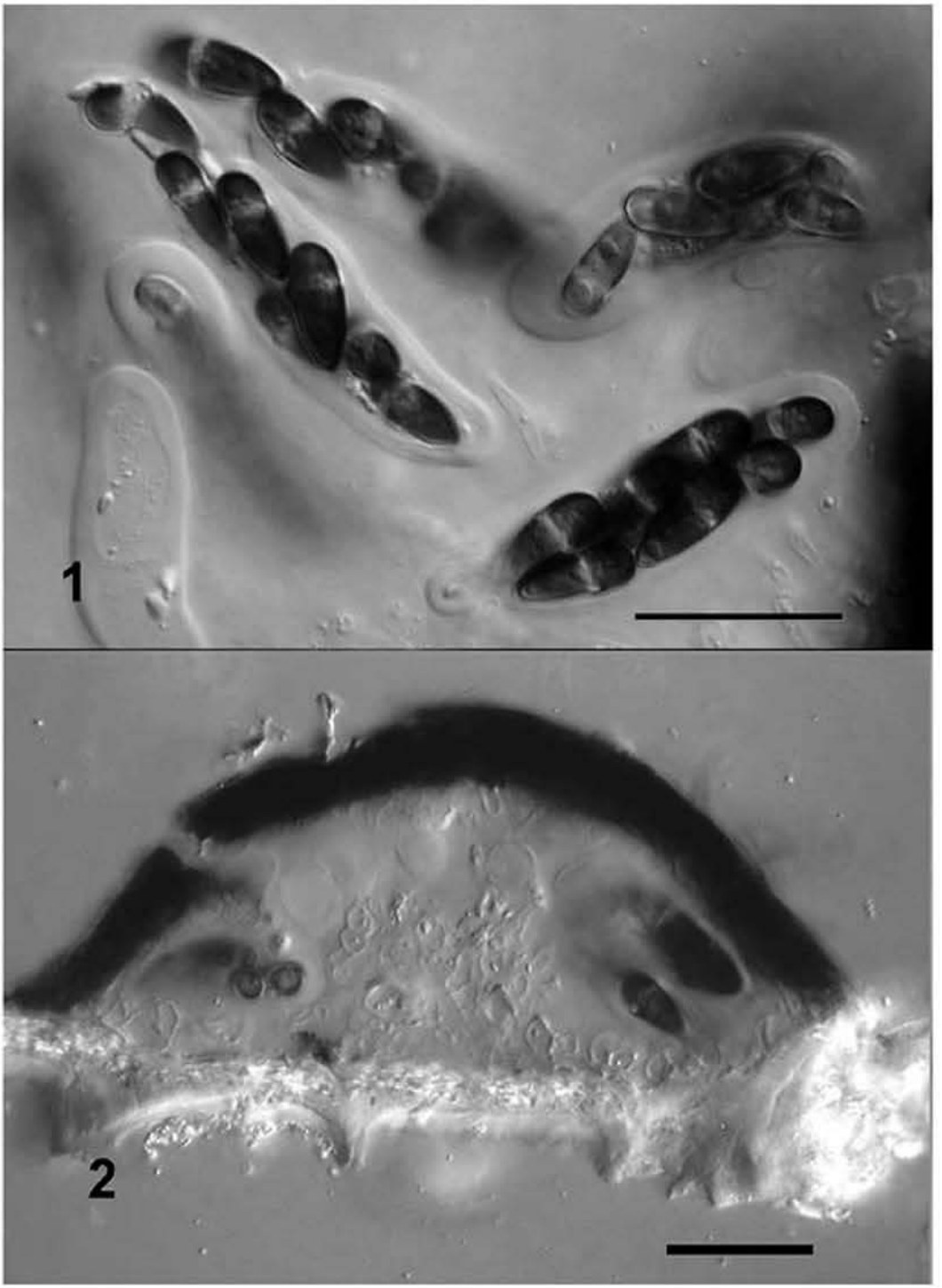
Coloniae superficialiae, epiphyllae, in cuticulae crescentes. Hyphae vitiformes, usque 5 µm latae, hyalinis vel pallide brunneis, septis incrassatis et atrobrunneis compositum. Ascomata disciformia, 120-150 µm lata. Asci circum columnam centralem paraphysum radiatim depositi, bitunicati, octospori, cylindrici vel subclavati 35-50 × 11-14 µm. Ascosporae biseriatae, aseptatae, brunneae, obovoideae, 10-13 × 4-5 µm, cum extravitam supra median hyalinum transversum 1-2 µm latum.

Etymology: Referring to the genus of host plant.

Colonies superficial, epiphyllous, growing in the cuticle. Hyphae ribbon-like, up to 5 µm wide, hyaline to pale brown, septa thickened and dark-brown. Ascomata discoid, 120-150 µm wide. Asci arranged radially around a central column of paraphyses, bitunicate, 8-spored, cylindrical to subclavate 35-50 × 11-14 µm. Ascospores biseriate, aseptate, brown, obovoid, 10-13 × 4-5 µm with a supermedial transverse hyaline band 1-2 µm wide.

TYPUS here designated: On *Philotheca myoporoides* (DC.) M.J.Bayly (*Rutaceae*), Australia: Victoria, Seven Acre Rock, 22 January 1986, *Pascoe, I.G.*, VPRI 13214 (holotype).

Although *Philotheca myoporoides* (=*Eriostemon myoporoides* DC.) is one of the most widely cultivated native Australian shrubs, only one fungus has been described from



Figs. 1–2. Micrographs of *Vizella philothecae*. **1.** Asci and ascospores. **2.** Ascocarp. Scale bar = 20 μm.

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its leaves. *Puccinia eriostemonis* McAlpine was described based on two collections (McAlpine 1906), but has since been found only once (herb. BRIP, DAR and VPRI records).

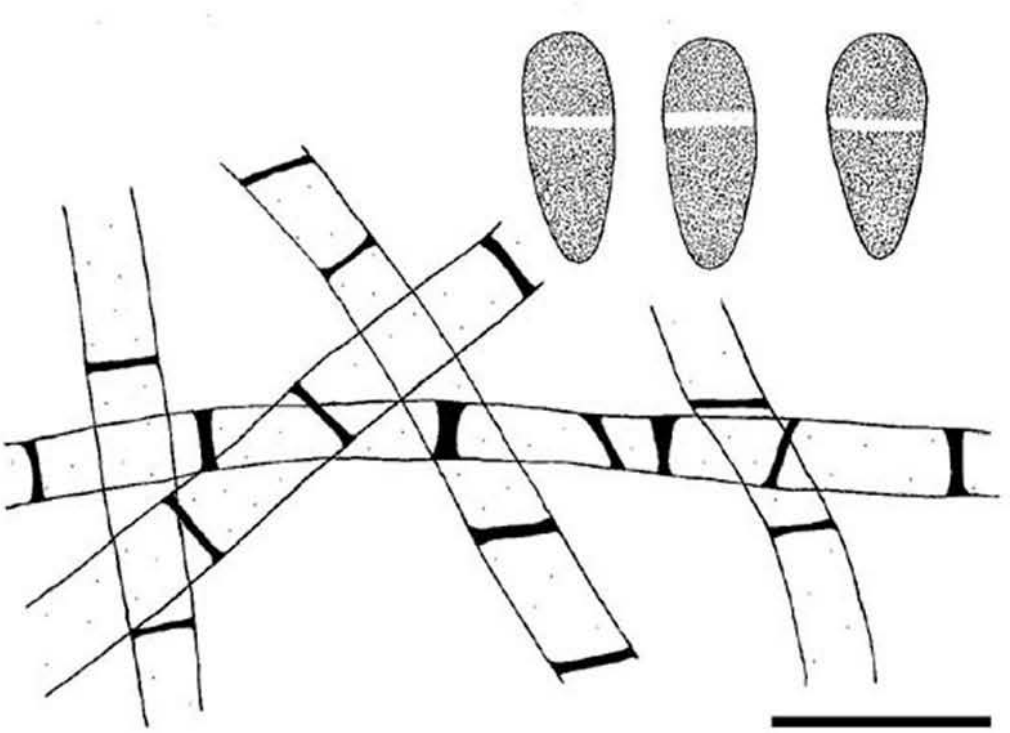

Fig. 3. *Vizella philothecae*. Ascospores and intracuticular hyphae. Scale bar = 10 μm.

Vizella philothecae is the second fungus to be described from the leaves of *P. myoporoides*, and is the only *Vizella* species known on the *Rutaceae*. It differs in a number of respects from other *Vizella* species found in Australia. *Vizella interrupta* (G. Winter) S. Hughes (synonyms include *V. banksiae* H.J. Swart and *V. banksiae* H.J. Swart) on proteaceous plants, differs in its larger ellipsoid ascospores (Taylor & Crous 1998). The ascospores of *V. xanthorrhoeae* Sivan. & B. Sutton are of a similar size to *V. philothecae*, but are also ellipsoid (Sivanesan & Sutton 1985). *Vizella oleariae* H.J. Swart on *Olearia argophylla* is a common species in southeastern Australia, but differs from the species described here by the hyaline basal cell on the ascospores (Swart 1971). *Vizella philothecae* also differs from the above species by forming hyphae that do not have alternating darkly pigmented and pale cells.

Entopeltis Höhn. was synonymised with *Vizella* by Hughes (1953). Most later authors agreed (Swart 1981, Sivanesan & Sutton 1985), however Arx & Müller (1975) maintained that *Entopeltis* should be used for taxa with one-celled ascospores and the absence of a column of sterile tissue in the centre of the ascomata. Those taxa with two-celled ascospores and a column of sterile tissue would be placed in *Vizella*. *Vizella philothecae* has a mixture of these characters, as does the recently described *V. metrosideri* P.R. Johnst. (Johnston 2000). Thus, *Entopeltis* is regarded here as a synonym of *Vizella*.

The combination of ascospore size, obovoid shape and absence of a hyaline basal cell, distinguishes *V. philothecae* from *Vizella* (including *Entopeltis*) species described in other parts of the world.

Key to *Vizella* species in Australia

1. Ascospores with a hyaline basal appendage. On *Olearia argophylla*.. ..... *V. olearíae*
1. Ascospores without a hyaline basal appendage 2

2. Ascospores obovoid. On *Philotheca myoporoides*. ..... *V. philothecae*
2. Ascospores ellipsoid. 3

3. Ascospores 15–16 × 7–11 μm. On *Proteaceae*. ..... *V. interrupta*
3. Ascospores 12–14 × 6–7 μm. On *Xanthorrhoea*. ..... *V. xanthorrhoeae*

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MYCOTAXON

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Sulcatistroma nolinae (*Calosphaeriales*), and its *Phialophora*-like anamorph

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Abstract—Genera in the *Calosphaeriales* have been found on wood or other fungi growing on wood. A new genus, *Sulcatistroma*, is described from leaves of *Nolina*. The *Phialophora*-like anamorph in culture shows phialidic conidiogenous cell proliferation on appressed mycelium or upright conidiophores of various configurations.

Key words—diatrypoid configuration, percurrent, phialidic, sympodial

Introduction

During the past several years, small collections of an unknown fungus were repeatedly made on dead leaves of *Nolina micrantha* I.M.Johnst. (Agavaceae). This fungus consists of erumpent, discrete, pseudoparenchymatous stromata containing a single layer of several globose ascomata disposed in a diatrypoid configuration. Mature ascomata are filled with periphyses, scarcely visible deliquescing paraphyses, and unitunicate, clavate asci that remain attached during forcible discharge of the 8 allantoid ascospores. Several pyrenomycete families have asci with allantoid ascospores, but the presence of a pseudoparenchymatous stroma, true paraphyses, and asci that remain attached at maturity, limits consideration to the families of the *Xylariales* or *Calosphaeriales*.

These traits are typical of *Diatrype* Fr. (*Diatrypaceae, Xylariales*), a well-known genus with nearly 200 representatives listed in Saccardo (Reed & Farr 1993). Some synonymy is cited in this long list, but other species have since been added. Kirk et al (2001) include only 56 species in the genus in agreement with the modern and extensive study of Rappaz (1987) in which 56 species were carefully described, and many additional synonyms discovered and cited. This family and genus with familiar and widespread species seemed the likely place for the fungus from *Nolina*. However, several traits were discordant. One noticeable character separating the *Nolina* fungus from disposition in *Diatrype* is the nature of the paraphyses that are broad at the base and tapering continuously to a more pointed apex, the shape typical of the *Calosphaeriales*. It is a feature easy to overlook unless ascomata are examined prior to maturation of any asci, or phase microscopy is used in viewing somewhat more mature ascomata.

Munk (1957) established the *Calosphaeriaceae* as a separate family for *Calosphaeria* with its unique centrum characteristics—the arrangement of asci at different heights on upright hyphae along with a few long paraphyses. Munk questioned whether a

separate order might be necessary to accommodate this family. Barr (1983) introduced the *Calosphaeriales* with members found on woody substrata, or associated with other fungi on these substrata (Barr 1990). The centrum for the order is described with fasciculate or spicate clusters of asci accompanied by a few paraphyses tapering upward from a broad base. The order includes the *Calosphaeriaceae* and *Graphostromataceae* (Barr et al 1993). As presently constituted, both families contain species previously placed in *Diatrype* or *Valsa*, genera that share allantoid ascospores, stromata, and a woody substratum, but not the unique centrum of the *Calosphaeriales*. The fungus from *Nolina* is not characterized in any existing generic description of fungi included in the order (Barr 1985, Barr et al 1993, Barr 1998). A new genus, *Sulcatistroma*, is therefore proposed.

Materials and Methods

Transverse sections were cut with a sharp razor blade. All measurements were made on fresh material in drops of sterile tap water. Permanent slides were prepared with lactophenol and for some observations, cotton blue was added. Cultures were prepared by suspending a small piece of a stroma containing mature ascomata on the top of a petri plate and allowing ascospore discharge onto potato dextrose agar (PDA, Difco). Cultures were maintained in tubes of PDA. Few ascospores germinated, but isolations of the same description were made from two collections from locations separated by hundreds of miles. To assess growth and appearance of the anamorph Petri plates of malt agar (MA Difco) with added yeast extract, and oatmeal agar (OA Difco) were inoculated and incubated at RT (17–22 C) on a table top with normal daylight fluctuation.

Taxonomy

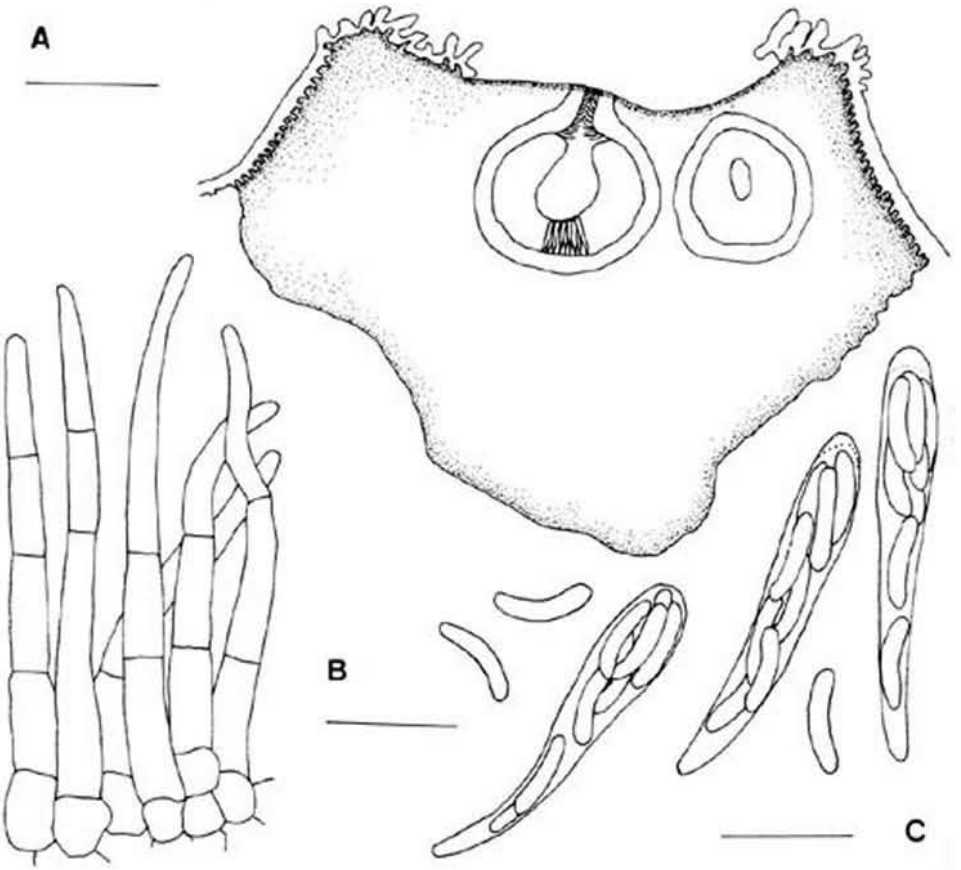
Sulcatistroma A.W. Ramaley, **gen. nov.**

Fructificationes discretae, erumpentes, pseudoparenchymatae, stromaticae. Ascomata in stromatibus inclusa, monostichae, per ostiola brevia aperta, distributio diatrypoidea, periphysibus. Asci breviter stipitati, clavati, unitunicati, octospori. Paraphyses numerosae, bases latae, contractae apices versus. Ascosporae allantoideae, hyalinae. Species typicus hic designatus: S. nolinae.

Fructifications stromata, discrete, erumpent, pseudoparenchymatous. Ascomata in the stromata in diatrypoid configuration, monostichous, short-ostiolate, with periphyses; asci unitunicate, clavate, numerous, short stipitate, octosporous; paraphyses broad at base, tapered upwards; ascospores allantoid, hyaline. Type species *S. nolinae*

Sulcatistroma nolinae A.W. Ramaley, **sp. nov.** **FIGURES A–D**

Stromata 480–1920 x 480–840 µm superficies brunnea, entostroma plerumque hyaline, interdum brunnea diluta. Ascomata 150–250 µm diam, globosae, paries plerumque hyalinus, interdum brunneus dilutus. Asci p.sp. 35–44 (–48) x 6.4–8.8 µm. Paraphyses numerosae, aliquantum longiores quam asci, plerumque 50–60 µm longae, ad bases ca 4–5 µm latae, contractae apices versus. Ascosporae 9.6–15.2 x 2.4 µm, allantoideae, aseptatae, hyalinae, leves.



Figures A-C. *Sulcatistroma nolinae.* Fig. A. Transection of mature, young, moist stroma with diagrammed mature ascoma in mid-longisetion. Toothed epidermis of ruptured stomatal cleft on upper surface. Fig. B. Tapered paraphyses before any asci have been delimited. Fig. C. Asci and ascospores. Scale bar for A = 120 μm; for B, C = 15 μm.

HOLOTYPE here designated: UNITED STATES. NEW MEXICO: Lincoln Co, Valley of Fires, roadside plants, in dead leaves of *Nolina micrantha* IM Johnst., 9 October 2002, Annette Ramaley *0210*, BPI 864276. Culture to CBS, ATCC. Paratype: roadside plants, in dead leaves of *Nolina micrantha* IM Johnst., 27 May 1999, Annette Ramaley *9901*, UC.

Stromata discrete, erumpent through leaf epidermis, rarely nearly circular, mostly ellipsoid, long axis paralleling length of leaf, 480–1920 x 480–840 μm; in transverse section, depending on develpmental stage, more or less sulcate around the stomatal cleft when dry, expanding when wet so surface flat when moist, external cell layer brown on upper surface, lighter brown on outermost cell layer of lateral surface of stromata, entostroma pseudoparenchymatous, completely surrounding ascomata, white, in age becoming unevenly pale brown, ostioles entire, emerging separately, not prominent, mostly nearly the same color as stromatal surface but in some collections nearly black from above, hyphae from mature stromata into subtending substrate parenchyma and through stomata in the stomatal cleft midway between coarse longitudinal leaf fibers. *Ascomata* globose, in one layer, wall of elongate *textura angularis*, mostly hyaline, only

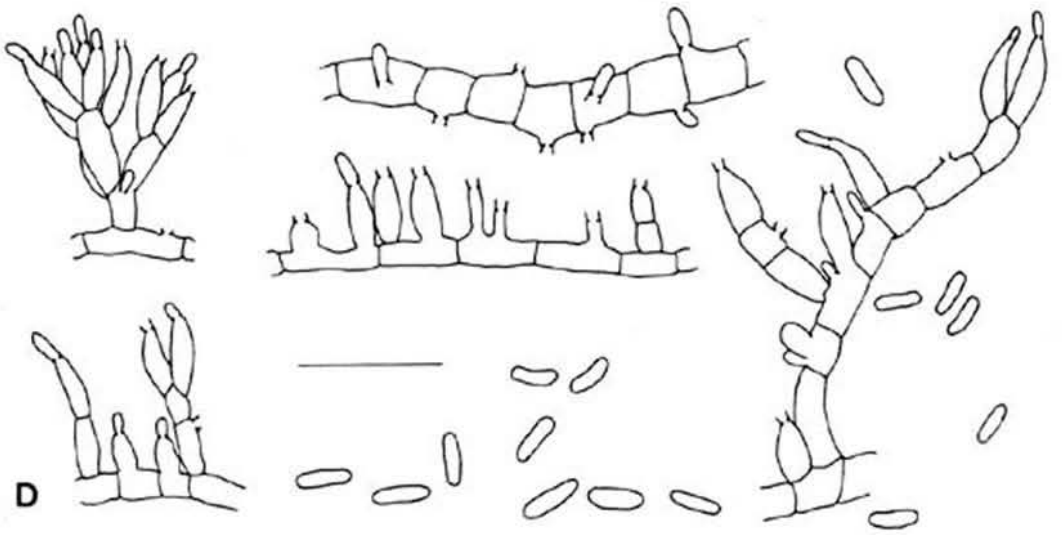


Figure D. *Sulcatistroma nolinae*. Conidia and conidiogenous cell assemblages of cultured *Phialophora*-like anamorph. Scale bar = 15 μm.

occasionally unevenly very pale brown, elongate cells of short neck brown at surface of stroma, 150–250 μm diam, periphyses present, tips brown at surface of stroma, paraphyses tapering from ca 4–5 μm at base, mostly 50–60 μm long, few-(mostly 1–2) septate. *Asci* clavate, 8-spored, p. sp. 35–44 (–48) x 6.4–8.8 μm, stipe short, apical ring not observed. *Ascospores* allantoid with rounded ends, 9.6–15.2 x 2.4 μm, aseptate, hyaline, smooth. Anamorph *Phialophora*-like

Anamorph in culture: Mycelium white, above and reverse, hyphae hyaline, smooth. Colonies cover Petri plates in 10 days, becoming pale orange from inoculum toward periphery from accumulated conidia. Surface mycelium appressed, free aerial hyphae absent. Conidiogenesis phialidic, conidiogenous cells horizontal in a long series with phialidic apertures directly on cells or raised on cylindric to inflated pegs of various heights, or born on upright conidiophores consisting of an upright conidiogenous cell or an axis of 1–4 cells with 1–4 cells at each junction. Axes up to ca 36 μm tall, even complex axes mostly shorter, cells 2.4–4.0 μm broad, cells in axis may have a lateral phialidic aperture. Many crowded upright axes often originating from one horizontal cell when cultures show this sort of conidiogenous cell proliferation. Phialides with 1 conidiogenous aperture, occasional horizontal phialides with 2, hyaline, smooth, with small periclinal thickening and hyaline, nearly cylindric, colorless collarettes ca 0.5–0.8 μm long. Profuse conidia covering colonies in pale orange masses, 3.2–5.6 x 0.8–1.6 μm, some increasing in size after formation to at least 8 x 2.4, nearly cylindric with rounded ends, ellipsoid, or allantoid. This cultured anamorph is designated *Phialophora*-like, but colonies lack the brown coloration of that genus. *Lecythophora* Nannf., cited as the anamorph for *Coniochaeta* (Sacc.) Cooke (Seifert & Gams 2001), has been used for a *Phialophora*-like fungus having numerous conidiogenous cells with simple, lateral, phialidic openings on superficial or submerged hyphae, and lacking the brown pigmentation of *Phialophora*. *Sulcatistroma* cultures show these traits. Although

re-established by Gams & Medlar (1983), *Lecythophora* is often considered a synonym of *Phialophora* (Kirk et al 2001).

Longitudinal fiber bundles bestow rigidity to *Nolina micrantha* leaves that may be up to ca three feet in length. The thick epidermis with stomata restricted to a deep internal epidermal fold, or cleft, between the fiber bundles makes these leaves quite resistant to desiccation in their arid environment. *Sulcatistroma* develops between the longitudinal fiber bundles in parenchyma below and surrounding the stomatal cleft. During dry periods young stromata are deeply sulcate, folded around the stomatal cleft, and firmly attached to the epidermis through stomata. When moist, stromata expand becoming flatter. As stromata grow during moist periods, the stromatal surface is flattened and greatly expanded, the stomatal cleft finally splits at the bottom, and the sides are separated from one another. At maturity, when dry, the upper stromatal surface is still partially or even mostly covered by the flattened sides of the ruptured stomatal cleft. At maturity, when damp, virtually the entire upper surface is exposed via stromatal expansion.

Discussion

Sulcatistroma shares many features with *Diatrype*, but *Diatrype* ascomata are mostly medium sized with colored walls, ostioles are mostly distinguishable from the stromatic surface with short or long beak tips usually more or less sulcate, paraphyses are narrow and cylindric, ascus stipes are generally much extended even before expansion at dehiscence, an ascal ring is generally observable even if small, and ascospores are pale yellow to brown. In addition, cultured anamorphs of the *Diatrypaceae* are quite different from *Sulcatistroma*'s *Phialophora*-like anamorph Conidiogenous cell proliferation in *Diatrype* and its close relatives is sympodial, percurrent, or a mixture of the two. Conidiophores in cultures may be borne in dark, more or less rudimentary, coelomycetous conidiomata, or on masses of subsolid hyphae in a variety of forms depending on the species under study (Glawe 1983, Glawe & Jacobs 1987, Glawe & Jones 1989, Glawe & Rogers 1981, Glawe & Rogers 1984, Glawe & Rogers 1985, Rappaz 1987). In sharp contrast, conidiogenous cell proliferation varies in the few studied *Calosphaeriales*. Hyphomycetous anamorphs with sympodial conidiogenous cell proliferation include that of *Graphostroma* (*Nodulisporum*) which is associated in nature (Pirozynski 1974) and has been cultured (Glawe & Rogers 1985), *Wegelina barbirostris* (Dufour: Fr.) M.E. Barr (*Nodulisporium*-like), and *Pareutypella* (Ju & Rogers 1995) that may or may not be a member of this order. Phialidic conidiogenesis is found in pycnidia of *Pachytrype* (Barr et al 1993), and for two species of *Togninia* (=*Pleurostoma*, Barr et al 1993) that show hyphomycetous growth between *Acremonium* and *Phialophora* (Hausner et al 1992). The phialides of these hyphomycetous anamorphs are more or less upright with slimy drops of conidia accumulating at their tips (Hausner et al 1992). Like these last two species, the *Sulcatistroma* anamorph shows phialidic conidiogenous cell proliferation on variably disposed conidiogenous cells. However, *Sulcatistroma* colonies lack the gray or brown coloration or verruculose hyphae shown in these isolates.

Other stromatic calosphaerialean genera lack the combination of pseudoparenchymatous, discrete stromata with diatrypoid disposition of short-ostiolate ascomata found in

Sulcatistroma. The prosenchymatous stromata of *Graphostroma* and *Pachytrype* are found on wood. In addition, *Graphostroma* stromata are effuse, asci contain a slightly amyloid apical ring, and the anamorph shows sympodial conidiogenous cell proliferation. *Pachytrype* ascomata have colored walls, may be polystichous, are somewhat larger than *Sulcatistroma* ascomata, and the beaks may be extremely long. The anamorph in culture resembles the coelomycete, *Cytospora*. Other members of the order are not truly stromatic.

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Oidium stachytarphetae on *Stachytarpheta*, emended: new from Australia and New Caledonia

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Abstract — Reexamination of *Oidium stachytarphetae*, the only powdery mildew recorded with *Stachytarpheta* as host, supports its placement in *Oidium* subg. *Pseudoidium*. Data from the first reported specimens from Australia and New Caledonia supply additional information for an emended description of *O. stachytarphetae*.

Key words — *Erysiphaceae*

Introduction

Snakeweeds (*Stachytarpheta* spp., *Verbenaceae*) are clumping perennial plants with rather tough, branched stems and woody roots. They are native to the tropical Americas, and eight species have become so common as to be considered weeds in Pacific tropical regions. Four snakeweeds are found in Queensland, Australia (*Stachytarpheta cayennensis* (Rich.) Vahl, *S. jamaicensis* (L.) Vahl, *S. mutabilis* (Jacq.) Vahl, and *S. urticifolia* Sims). They were introduced as garden plants from where they have spread and become serious weeds along coastal Queensland. Snakeweeds are abundant along roadsides, neglected areas, and pastures as well as in sugar cane plantations (Land Protection 2003).

Powdery mildews infecting *Stachytarpheta* spp. from Australia and New Caledonia were sent for identification to the Queensland Department of Primary Industries and Fisheries, Plant Pathology Herbarium in 2004. These specimens, which were found to belong to the genus *Oidium* had "pseudoidium-type" conidiophores with solitary conidia produced at the conidiophore apices.

Only one powdery mildew species, *Oidium stachytarphetae*, has been reported on *Stachytarpheta* (Braun 1987). Yen (1966) described *O. stachytarphetae* as having "euoidium-type" conidiophores in which the conidia are produced in chains. However,

Yen's written description is ambiguous and the associated drawings clearly indicate a *Pseudoidium*. Examination of the *O. stachytarphetae* type specimen (**PC** Yen MS 660) revealed that its "pseudoidium-type" conidiophores place it in *Oidium* subg. *Pseudoidium*. As conidiophore type is a very important feature of powdery mildew taxonomy, we provide an emended description of *O. stachytarphetae* to prevent future taxonomic confusion.

Taxonomic Description

Oidium stachytarphetae J.M. Yen **emended** **Figs. 1-6**

White superficial colonies, with abundant sporulation, developed amphigenously on leaves and shoots. Superficial *hyphae* branched, septate, 3.5-9 µm wide, hyaline, smooth, mycelial appressoria lobed. *Conidiophores* produced from the external mycelium, cylindrical, hyaline, smooth, 44-94 x 6-11 µm, 0-2 septate, foot-cells cylindrical, straight, 19.5-36 x 6-11 µm, followed by 0-2 often shorter cells. *Conidia* produced singly at the apex of the conidiophores, subcylindric to cylindric, or ellipsoid, 24-68 x 10-24 µm, aseptate, hyaline, smooth. Germ tubes, one at an end of the spore, moderately short (up to 1.5 x the length of the conidium), ending in a lobed appressorium. *Teleomorph* not found.

Habitat: on living shoots and leaves of *Stachytarpheta* spp.

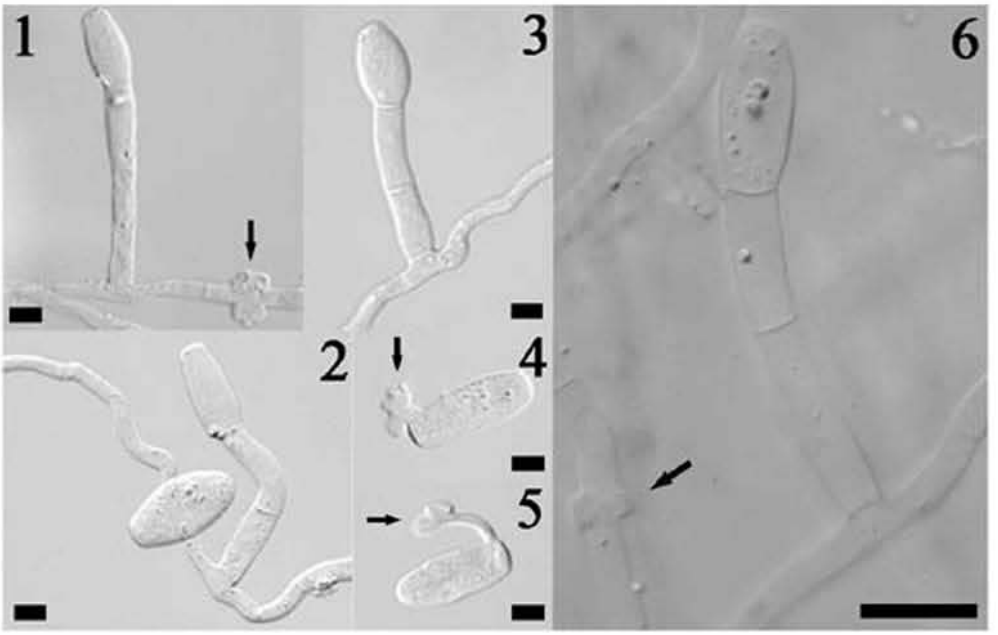
Distribution: Australia, New Caledonia and Singapore.

SPECIMENS EXAMINED – SINGAPORE, Jurong, on *Stachytarpheta indica* (L.) Vahl., 2 Jan 1966, J.M. Yen (**HOLOTYPE**: herbarium PC – Yen MS 660); **AUSTRALIA, Queensland, Townsville**, Bluewater, on *Stachytarpheta jamaicensis* (L.) Vahl, 12 Jul 2004, S. Campbell (BRIP 45027); Thursday Island (10 35'S 142 13'E), on *S. jamaicensis*, 30 May 1999, A.A. Mitchell (BRIP 26464); **Bamaga** (10 53'S 142 23'E), on *S. jamaicensis*, 29 May 1981, J.L. Alcorn (BRIP 10722); Thornton Beach (16 10'S 145 26'E), on *Stachytarpheta* sp., 02 Oct 1979, J.H. Simmonds (BRIP 13086); **Cooktown** (15 28'S 145 15'E), on *S. jamaicensis*, 07 Sep 1977, J.H. Simmonds, (BRIP 12384). **NEW CALEDONIA, Goyetta,** on *Stachytarpheta urticola* Sims, 02 Sep 2003, J.G. Wright (BRIP 45065).

Discussion

The two recently collected specimens (BRIP 45027 and BRIP 45065) of *Oidium* on *Stachytarpheta* from Australia and New Caledonia and four other herbarium specimens were identified as *O. stachytarphetae*. This is the first reported occurrence of *O. stachytarphetae* from New Caledonia. A search of the powdery mildews on *Stachytarpheta* in the Australian Plant Disease Database (http://npdd.nre.vic.gov.au/ihd/nre/research.htm on 03 Aug 2004) yielded 12 records identified as *Oidium* sp. and two as *O. stachytarphetae*. These Australian records have not been published until now.

Erysiphe is the teleomorph name reserved exclusively for the sexual stages of *Oidium* with "pseudoidium-type" conidiophores (Braun 1999, Braun et al. 2002). Although the teleomorph of *O. stachytarphetae* has not been found it is likely to belong to *Erysiphe*.



Figs 1-6. *Oidium stachytarphetae*. **Fig 1-3, 6.** Pseudoidium-type conidiophore with conidium produced singly at the apex and lobed hyphal appressoria (arrowed). **Figs 4-5.** Subcylindric to cylindric conidia with germ tube and multilobed appressoria (arrowed). **Figs 1-5.** BRIP 45065 (Bar = 10 μm) and **Fig 6.** Holotype (Bar = 20 μm).

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Two *Microbotryum* species from the Himalayas

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Abstract– Two smut fungi are noted from the Himalayas: a new species, *Microbotryum bardanense* on *Silene moorcroftiana*, and *Microbotryum violaceum* on *Dianthus jacquemontii*.

Key words– SEM teliospore morphology, hybrid, India

Introduction

Taxonomic and nomenclatural problems of the genus *Microbotryum* Lév. were recently published by Vánky (1998, 2004). According to Almaraz et al. (2002), who investigated the ITS rDNA region of *Microbotryum*, *Sphacelotheca* de Bary and *Ustilago* (Pers.) Roussel, the genus *Microbotryum* is monophyletic and restricted to *Caryophyllaceae*. At present this genus consists of 15 species. However, the taxonomy, nomenclature and problems in species delimitation within the genus are still not resolved satisfactorily (Vánky 2004). During a Himalaya expedition we found smuts similar to *Microbotryum violaceo-irregulare* (Brandenb. & Schwinn) G. Deml & Oberw. on *Silene moorcroftiana* Benth., and *Microbotryum violaceum* (Pers.) G. Deml. & Oberw. s. lato on *Dianthus jacquemontii* Edgew. & Hook.f. So far these plants have not been mentioned in the world literature as hosts for smut fungi. *Microbotryum violaceo-irregulare* was previously reported from Austria, Germany, Slovakia and Switzerland (Brandenburger & Schwinn 1971, Denchev 1994). Our material of *Microbotryum violaceum* belongs to Group 2 of Durrieu and Zambettakis (1973), named *M. violaceum* var. *silenes-nutantis* (DC. ex Liro) Durrieu & Zambett. (nom. inval., Art. 33.2) and placed by Denchev in *M. violaceum* var. *violaceum* (Denchev & Sharkova 1997). To date, only *Microbotryum nepalense* (Liro) Vánky [= *Ustilago nepalensis* Liro, *Melanopsichium nepalense* (Liro) Zundel, *Bauhinus nepalensis* (Liro) Denchev] was mentioned from the Himalayas (Liro 1924). Some information on fungi from this area was published by Mundkur (1944), and Zundel (1953), as well as by Paul and Sharma (2003). Physiological forms

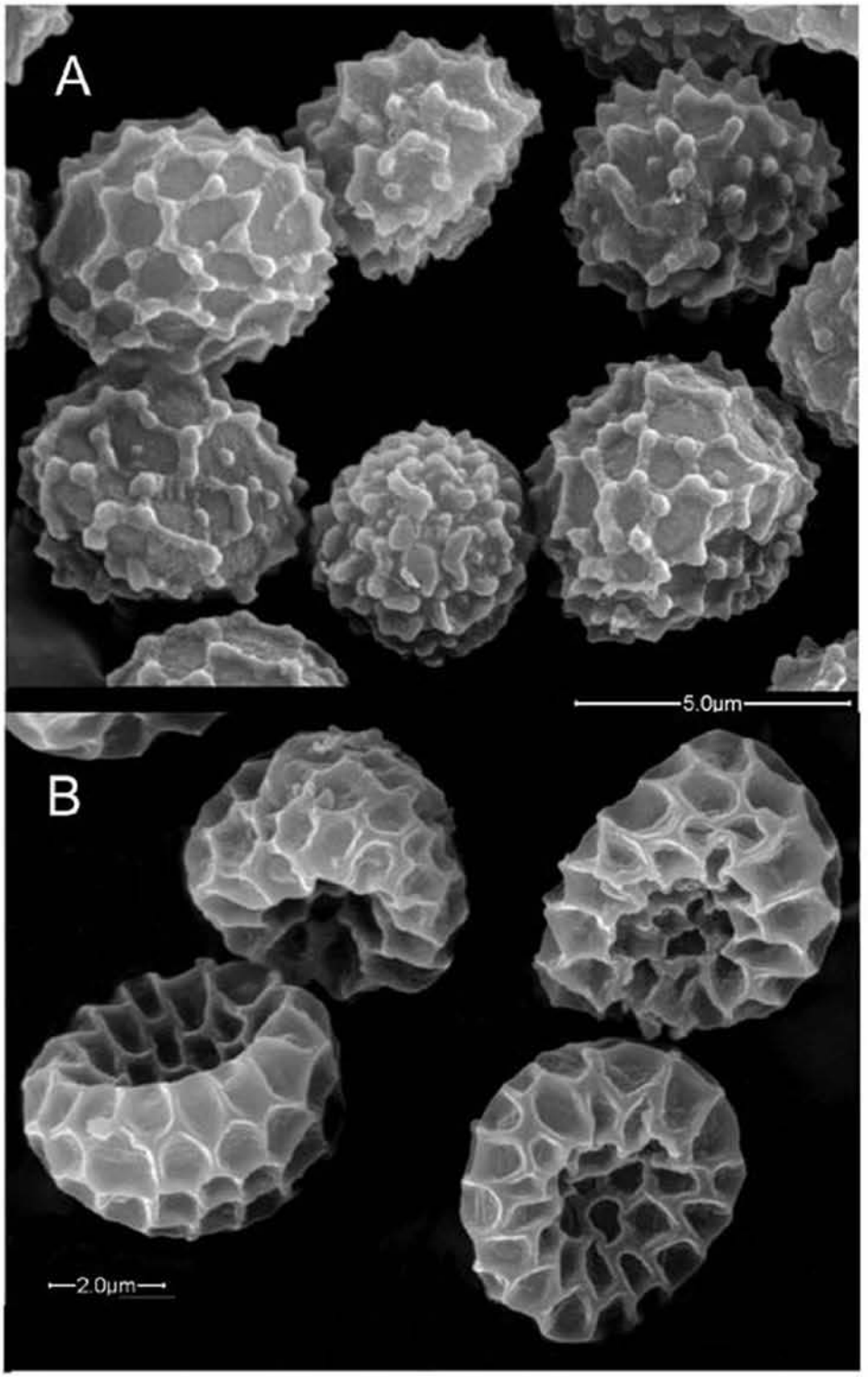


Fig. 1. A - spores of *Microbotryum bardanense* on *Silene moorcroftiana* (type, KRAM F); B - spores of *Microbotryum violaceum* s. lato on *Dianthus jacquemontii* (KRAM F).

Distribution. On *Caryophyllaceae*: *Silene moorcroftiana*, India. Known only from the type locality.

Comments: *Microbotryum bardanense* is similar to *M. violaceo-irregulare* but differs in the shape of warts and smaller number of meshes per spore diameter.

intermingled with the plant hairs, subglobose or globose, rarely conoid, black, 164-230 µm wide and 130-225 µm high, with thick papillate ostiole. Peridium wall with an external layer of textura angularis, brown, completely occluded by the melanin deposits. *Pseudoparaphyses* numerous, filiform, hyaline, septate, 400 µm long and about 1.5 µm wide. *Asci* numerous, 75.0-95.0 x 8.7-12.5 µm, clavate, short-stalked, bitunicate, 8-spores. *Ascospores* fusiform, 17.5-23.7 x 5.0-7.5 µm, 3 septate, with acute to rounded apices, second cell from apex sometimes slightly swollen, yellowish brown, overlapping biseriate in the ascus (Figs. 1-4).

Host species: *Draba aspera* Bertol.

Specimens examined: Montenegro, Maja Kolata (Mauntain Prokletije), 2530 m a.s.l., on leaves of *Draba aspera*, 5 July 1995, Stevanović, V., Lakušić, D., Niketić, M., Bulić, Z., Hadžiablahović, S. 751/95 (BEOU! – Botanical Institute and Garden, Faculty of Biology, University of Belgrade).

Discussion

According to Crane and Shearer (1991), *Leptosphaeria raphani* was reported in Europe on *Raphanus marithimus* in Great Britain. Our results represent the first occurrence of *L. raphani* on Balkan Peninsula on the new host, *Draba aspera*.

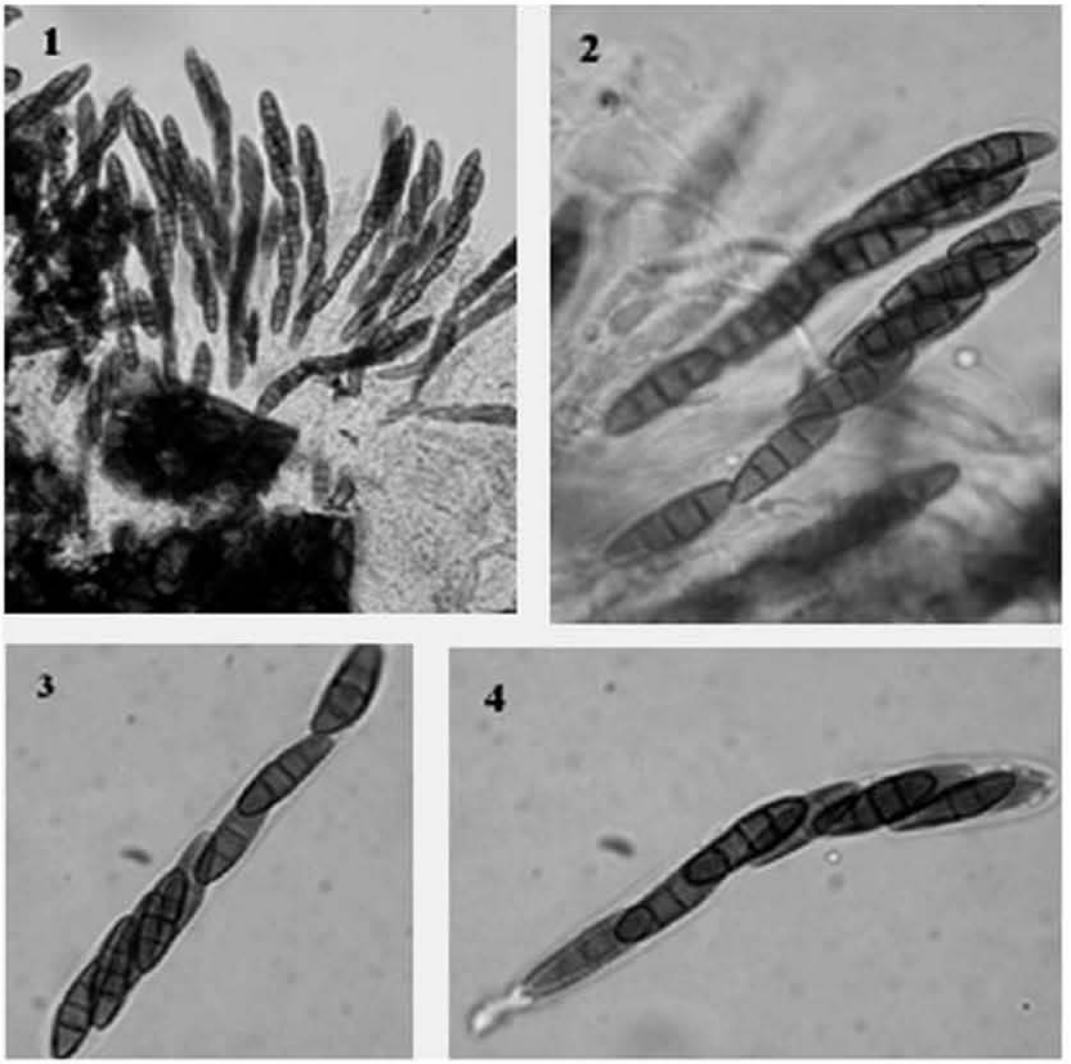
Shoemaker (1984), after the revision of *Leptosphaeria* collections in the National Mycological Herbarium Canada, (DAOM), renamed two previously described specimens of *L. johansonii* E. Müll. on *Arabis alpina* L. and on *Draba oblongata* R. Br. ex DC., as *L. raphani*. However, Canadian materials were not compared with an authentic material and therefore the revision of Shoemaker is provisional, which was also emphasized by him.

There are no considerably morphological differences between the reproductive structures of our isolates and the holotype except in their dimensions which can be a result of development on different hosts and in different environmental conditions (Table 1).

Table 1. Dimensions of the reproductive structures of different isolates of *Leptosphaeria raphani* (in µm).

	Hawksworth & Sivanesan (1975)	**Shoemaker (1984)**	**Our results**
Host	*Raphanus maritimus*	*Arabis alpina* *Draba oblongata*	*Draba aspera*
Ascomata	275-325 × 200-250	200-280 × 200-280	164-230 × 130-225
Asci	70.0-85.0 × 5.0-9.0	60.0-80.0 × 8.0-11.0	75.0-95.0 × 8.7-12.5
Ascospores	20.0-26.0 × 4.0-5.0	15.0-20.0 × 4.5-5.0	17.5-23.7 × 5.0-7.5

Leptosphaeria raphani has some similarities (form and ascospore septation) with *L. viridella* (Peck) Sacc., while it is significantly different from *L. maculans* (Desm.) Ces. & De Not., especially in septate number of ascospores, that is in accordance with results of Hawksworth and Sivaneasan (1975).



Figs 1-4. *Leptosphaeria raphani*: 1. ascomata, 2. asci, 3–4. bitunicate asci with short stalk.

The hosts of *L. raphani* are *R. maritimus, A. alpina, D. oblongata* and *D. aspera* belong to *Brassicaceae* family, but they are phylogenetically distinctive. Thus, *R. maritimus* belongs to the tribe *Brassiceae, A. alpina* to *Arabideae*, and *Draba* species (*D. oblongata* and *D. aspera*) to *Alysseae*. Although these *Draba* species are closely related, they belong to different sections, *Chrysodraba* and *Aizopsis,* respectively (Schulz, 1936).

Pleospora pyrenaica Niessl, which is taxonomically close to the genus *Leptosphaeria* (ordo Pleosporales), was found on the same field samples of *D. aspera* collected from the same locality (Vukojević et al., 2000). *Draba aspera* is found to be a new host both for *L. raphani* and *P. pyrenaica.*

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Myxomycetes of the Western Black Sea Region of Turkey

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Abstract—The distribution and abundance of myxomycetes in parts of the western Black Sea Region of Turkey during 2000–2002 are documented. Seventy-eight species belonging to 25 genera were recorded from field and moist chamber collections. *Badhamia goniospora, B. papaveracea, B. populina, Cribraria confusa, Dianema harveyi, Diderma niveum, Didymium sturgisii, Licea scyphoides, Macbrideola dubia,* and *Physarum globuliferum* are new for Turkey. Climograph and the checklist are available at the website http://biyoloji.uludag.edu.tr/ergul/Checklist_002.pdf.

Key words—slime moulds, new records, flora

Introduction

Turkey, which is located in between 36°–42° north latitude and 26°–45° east longitude, belongs to the Palearctic Biogeographical Realm (Olson & Dinerstein 2002) of the northern hemisphere. The present study was conducted in the Euxine province of the Euro-Siberian floristic region. This phytogeographical region covers an area of 130 000 km^2, nearly 15% of the total area of Turkey, and represents some of the most diverse and distinctive temperate forests in Eurasia (Kutluk & Aytuğ 2001, Olson & Dinerstein 2002). Turkey is influenced by a continental oceanic and mediterranean climate (Akman & Ketenoğlu 1986). The oceanic climate prevails on the northern slopes along the 1500 km Turkish Black Sea coast, but at some points along this coastal belt, especially the southern slopes, a Mediterranean climatic influence is apparent. In the Euxine vegetation areas there is no marked summer drought. High levels of precipitation and moderate temperature have been recorded during the summer months in some cities of the region (Atalay 2002). This area has a variety of special habitats, diverse microclimatic conditions and also includes internationally recognized natural reserves. The Kastamonu-Bartın Küre Mountains, which are protected as a national park, constitute 25% of the forest area of Turkey and are considered to be one of the Conservation International Global Biodiversity Hot Spots.The mountains have been included among 100 hot spots in Europe by the World Wildlife Fund. The Kastamonu-Ilgaz Mts. National Park, the Bolu-Abant Nature Park, and the Bolu- Seven Lakes National Park are also located in this part of Turkey. The forest vegetation of the study

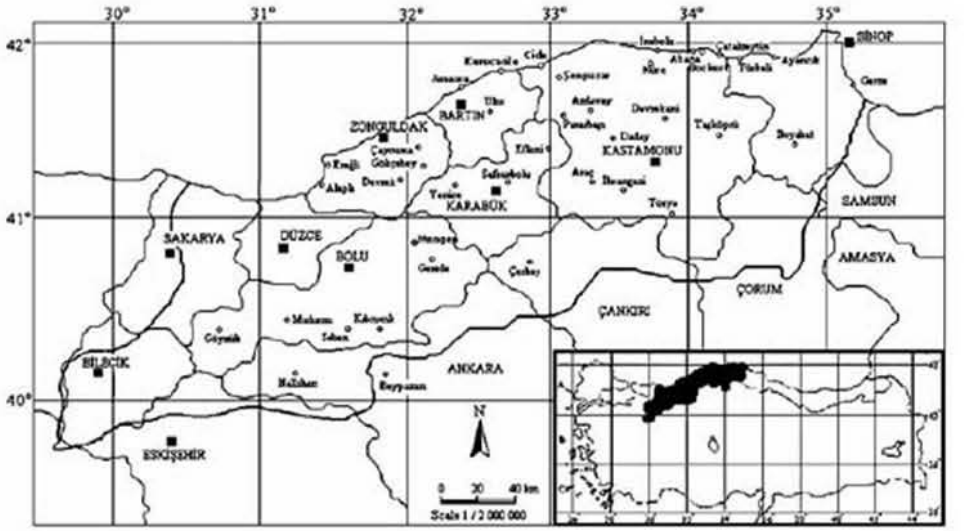

Figure 1. The Western Black Sea Region and selected collecting sites.

area is dominated by the broad-leaved *Fagus orientalis*, *Quercus* spp., *Castanea sativa*, *Carpinus orientalis*, and *C. betulus* in addition to the conifers *Abies bornmuelleriana* and *Pinus* spp. (Akman 1995). In humid stream valleys *Platanus orientalis* and *Salix* spp. are the dominant tree elements. On rural land near the main roadsides illegal agricultural development has resulted in the loss of native vegetation and its replacement with an invasive secondary vegetation that includes *Juglans regia, Malus* spp., *Morus* spp., *Populus* spp., and *Sorbus* spp. Several new myxomycete taxa were identified in previous studies carried out on the western part of the region. Based on these previously published records 20 taxa have been identified as new records for Turkey.

Results

Incubating detrital material in Petri dish moist chambers and collecting sporocarps directly, we identified 78 taxa in the study area. The moist chamber technique yielded the greatest number of samples, 212, whereas only 43 specimens were found sporulating in the field. In total the collections were distributed among 25 genera. Representatives of all known orders of Myxomycetes were found. The *Physarales* was the best represented with 23 species, followed by the *Liceales* (19 species). The most abundant genera were in *Licea* (9 species), *Badhamia* (8), and *Stemonitis* (7). Each of the following genera was represented with 5 species: *Arcyria*, *Cribraria*, *Macbrideola*, *Physarum*. *Diderma*, *Didymium*, and *Perichaena* were represented by 4 species. Three species were found for each of *Echinostelium*, *Trichia*, and *Comatricha*, *Hemitrichia* and *Lycogala* were represented by 2 species each. Only a single species per genus was found for *Badhamiopsis*, *Ceratiomyxa*, *Clastoderma*, *Collaria*, *Dianema*, *Fuligo*, *Lindbladia*, *Reticularia*, *Stemonitopsis*, and *Tubilifera*. The most commonly found species were *A. cinerea*, *Macbrideola cornea*, *Physarum auriscalpum* and *Perichaena corticalis*. While only one sample of *A. cinerea* was found sporulating in nature, fourteen specimens were recovered in moist chambers. All 32 specimens of *Macbrideola cornea* and all 17 of *Physarum auriscalpium* were recovered in moist chambers. *Perichaena corticalis* was represented by 13 specimens, all of which were also recovered in moist chambers.

This high incidence of recovery demonstrates the high germination potential and wide dispersal of the spores of these species in the study region. The forty-three samples collected directly from natural habitat were distributed among 14 genera: *Stemonitis* (7 species), *Arcyria* (5), *Physarum*, *Lycogala* (each with 2), *Badhamia*, *Ceratiomyxa*, *Diderma*, *Didymium*, *Fuligo*, *Hemitrichia*, *Lindbladia*, *Reticularia*, *Stemonitopsis*, and *Tubulifera* (each with 1 species). When the distribution of species was analyzed, it was seen that the most of the *Stemonitis* species sporulating in nature were typically lignicolous; they were found on wood in riparian sites where the wood was decaying and soggy. Some of the other natural specimens and the species that were recovered in moist chambers, were either typically lignicolous or corticolous. The following species were recorded for the first time from Turkey: *Badhamia goniospora*, *B. papaveracea*, *B. populina*, *Cribraria confusa*, *Dianema harveyi*, *Diderma niveum*, *Didymium sturgisii*, *Licea scyphoides*, *Macbrideola dubia*, and *Physarum globuliferum*.

Discussion

The study area was rich in myxomycetes. Previously published studies recorded 20 taxa for the first time in Turkey. According to Lado (1993) the Mediterranean region allows for the development of one of the richest myxomycete biotas in the world. At present 78 species of myxomycetes are recorded from the Anatolian temperate forest ecoregion of the Palearctic biome. Future field work in early spring and late fall is likely to increase the number of myxomycete records for the area and also will reveal species that are new to science (Eliasson et al. 1988). According to Stephenson (1988), most studies dealing with the distribution and ecology of myxomycetes in terrestrial ecosystems have been conducted in temperate forests where these organisms are particularly abundant. Factors that appear to most strongly influence the seasonal production of sporocarps in forests are moisture and the availability of nutrients. Sporocarps generally are scarce during periods of drought, and are often produced two to three weeks after a heavy rainfall (Moore 1996). Diversity of ecological conditions and a wide diversity of substrata found in floristically diverse regions create excellent conditions for rich myxomycete productivity (Eliasson et al. 1988). Bark of *Quercus* species is more productive of myxomycetes (54 specimens) than is the bark of *Salix* spp. (33) and other trees, including *Platanus orientalis* (24), *Malus* spp.(22), *Pyrus* spp.(22), *Populus* spp. (20 specimens), *Creatagus* spp. (10), *Fagus orientalis*, *Abies bornmuelleriana* (8). The appearance of minor myxomycetes on the other vegetation elements of the study region were: *Sorbus* spp. (5 specimens), *Fraxinus* spp., *Pistacia* spp. (4 each), *Castanea sativa*, *Juglans regia*, *Morus* spp., *Robinia* spp. (3 each), *Carpinus* spp. *Vitis* spp. (2 each) and *Ulmus* spp. (1 specimen). The occurrence of different numbers of myxomycete collections on bark of different trees might relate primarily to the bark textures. The deeply furrowed bark of *Quercus* spp., *Salix* spp. and *Platanus* spp. tends to accumulate water and nutritive soil particles essential proliferation of myxomycetes. According to McHugh (1998) and Lado (1993), individual *Quercus* spp and *Quercus* forests are the most productive sources for myxomycetes. Nutrients most likely to influence sporocarp production in nature (Moore 1996). Although *Salix*, *Malus*, *Pyrus* and *Populus* are not native, they provide new substrata for the development of myxomycetes, thus providing the potential for increasing the diversity of myxomycetes

in the region. Ukkola & Rikkinen (2000) noted the increase in myxomycete diversity with an increase in heterogeneity of substratum types, especially in relation to an increase in the availability of angiosperm bark and wood.

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A new *Lepraria* species from Gough Island, South Atlantic Ocean

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Abstract—*Lepraria goughensis* from Gough Island is described as new to science. It is the first species of *Lepraria* known to contain a combination of lecanoric acid, gyrophoric acid, stepsilin, fragilin and 7-chloroemodin.

Key words—lichens, taxonomy

Introduction

Gough Island (40°21' S, 9°53' W) is an uninhabited cool-temperate oceanic island, situated in the South Atlantic Ocean, approximately midway between the southern tip of Africa and South America. It is part of the Tristan-Gough group of islands, and is approximately 300 km removed from the other islands of this group. The island measures *ca.* 6 km by 14 km and is mountainous. The highest peak reaches 910 m above sea level, and much of the island is above 400 m. The island is of volcanic origin, but shows no sign of recent volcanic activity. The climate is cool and wet, with a mean temperature at sea level of *ca.* 11° C, a mean annual precipitation in excess of 3000 mm, and with frequent gale-force winds. So far approximately 100 lichen species have been recorded (Elix & Gremmen 2002, Øvstedal & Gremmen in prep.), and these range from tropical to temperate in origin. During the study of the lichens from this island, some specimens of an unknown *Lepraria* species were discovered, and it is described here.

Materials and Methods

The specimens studied are deposited in BG. The morphology of the lichen specimens were examined using a Zeiss Stemi 2000C stereo microscope, and a Zeiss Axiolab compound microscope. Chemical constituents were identified by thin layer chromatography (Culberson 1972; Culberson et al. 1981; Culberson & Johnson 1982; Elix & Ernst-Russell 1993), high performance liquid chromatography (Elix et al. 2003) and comparison with authentic samples.

Taxonomic Description

Lepraria goughensis Elix & Øvstedal, **sp. nov.**

Thallus leprosus, 1-4 cm latus, griseo-viridis, acidi lecanorica, gyrophorica, strepsilin, fragilin, 7-chloroemodin, et flavo-obscurin C continens.

Etymology: The specific epithet derives from the Latin *ensis* (place of origin) and Gough Island.

Type here designated: **GOUGH ISLAND**. Seal Beach, 40°20'S, 9°52'W, over bryophytes and plant litter on vertical peat surface in shade, *N. Gremmen 99-701*, 22 Sept. 1999; holo: BG.

KEY CHARACTERS — Thallus crustose, entirely leprose, forming rosettes from 1-4 cm wide, thin, 0.2-0.3 mm thick, with a tendency to form poorly defined marginal lobes but with no medulla, upper surface grey-green. Soredia fine, 20-26 μm wide, with numerous protruding hyphal ends. No hypothallus observed. **Chemistry** — K-, C+ red, KC+ red, P-; containing lecanoric acid (major), gyrophoric acid (minor), strepsilin (minor), fragilin (trace), 7-chloroemodin (trace), and flavo-obscurin C (trace).

Distribution — At present this species is only known from two localities on Gough Island.

Ecology — This species grows over bryophytes, plant litter or peat on steep slopes, in shady and humid places.

COMMENTS — The observed combination of secondary metabolites present in *L. goughensis*, namely the lecanoric acid - gyrophoric acid complex, a dibenzofuran and anthraquinones, is unique in the genus *Lepraria*. Two other *Lepraria* species contain lecanoric acid as the major component, namely *L. atrotomentosa* Orange & Wolseley (Orange *et al.* 2001) and *L. lecanorica* Tønsberg (Tønsberg 2004). *Lepraria atrotomentosa* contains additional atranorin and zeorin, whereas *L. lecanorica* contains only additional atranorin. Both of these species lack gyrophoric acid, the anthraquinone pigments and dibenzofuran derivatives present in *L. goughensis*. Like *L. goughensis*, *L. atrotomentosa* has a thin thallus but differs morphologically in having a well-developed layer of dark blue-grey to dark brown hyphae on the lower side. Morphologically *L. lecanorica* differs from *L. goughensis* in having a thicker (0.6 mm cf. 0.2-0.3 mm thick) stratified thallus with a distinct medullary layer. The dibenzofuran strepsilin has recently been detected in *L. multiacida* Aptroot and *L. xerophila* Tønsberg (Elix & Tønsberg 2004; Tønsberg 2004), while anthraquinone derivatives have been found in *L. bergensis* Tønsberg, *L. sipmaniana* (Kümmerl. & Leuckert) Kukwa and a chemotype of *L. incana* (L.) Ach. (Tønsberg 2002).

SPECIMENS EXAMINED — **GOUGH ISLAND.** Seal Beach, 40°20'S, 9°52'W over plant litter, *N. Gremmen 99-316,* 12 Sept 1999; Seal Beach, 40°20'S, 9°52'W, over moss on wet, vertical slope, *N. Gremmen 99-323,* 13 Sept. 1999 (BG); Prion Cave, inland of Standoff Rock, 40°21'S, 9°53'W, on moss on vertical rockwall in *Phylica* forest, *N. Gremmen 2000-0456,* 27 June 2000 (BG).

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Changes and additions to the checklist of North American Lichens — III

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Abstract. – *Lecidea santae-monicae* and *Lecidea violascens* are placed in synonymy with *Lecidea laboriosa*. A new combination is made: *Polysporina oligospora*. *Ramonia gyalectiformis* is considered a species distinct from *R. ablephora*. *Sarcogyne plicata* (currently called *Biatorella plicata*) is placed in synonymy with *Sarcogyne privigna*. A neotype is selected for *Sarcogyne novomexicana*. *Sarcogyne californica* is placed in synonymy with *Sarcogyne similis*. Lectotypes are selected for the following names: *Lecidea santae-monicae*, *Lecidea violascens*, *Sarcogyne californica*, and *Sarcogyne similis*.

1. ***Lecidea laboriosa*** Müll. Arg., Flora, 57: 187-188. 1874.

Syn nov. *Lecidea santae-monicae* H. Magn., Meddelander från Göteborgs Botaniska Trädgård, 10: 49. 1935. TYPE: Santa Monica Range, California, USA, 1909, *H.E. Hasse s.n. in* Hasse-Plitt exs. No. 62 as *Lecidea diducens* (S!, **lectotype, designated here**).

Syn. nov. *Lecidea violascens* H. Magn., Meddelander från Göteborgs Botaniska Trädgård, 10: 48. 1935. TYPE: Santa Monica Range, California, USA., 1909, *H.E. Hasse s.n. in* Hasse-Plitt exs. No. 62 as *Lecidea diducens* (S!, **lectotype, designated here**).

In a continuing study of rare or missing species reported from the Santa Monica Mountains (Knudsen, 2005) the types were examined of two *Lecidea* species named by Magnusson from collections by H. E. Hasse. Magnusson's concept of *Lecidea santae-monicae* is known apparently from a single specimen in hb. Vrang (S) selected from the Hasse-Plitt exs. No. 62 of *Lecidea diducens*. Magnusson's concept of *Lecidea violascens* is known from two syntypes. The first syntype Magnusson selected from the

same Hasse-Plitt exs. No. 62 of *Lecidea diducens* which we select here as the lectotype. The remaining syntype was collected at Eden Hot Springs in Riverside County, California. The lectotypes of both names are on granitic rock which forms the basement rock of the east end of the Santa Monica Mountains, and is only exposed in areas of the range west of Mount Lee (on which the Hollywood sign is located) to Cahuenga Pass (Dibblee 1982).

Both lectotypes are *Lecidea laboriosa* (as described by Hertel and Prinzten 2004). This is the most common species of *Lecidea* in southern California and we have collected it from sandstone outcrops above the Pacific Ocean to high in the San Bernardino and San Jacinto Mountains. It is important to note that Magnusson (1935a) did not recognize *L. laboriosa* as occurring in America. An especially rich concentration of the melaenida-red pigment that often occurs in the exciple is all that really distinguishes *L. violascens* from an average specimen of *L. laboriosa* in southern California. *Lecidea santae-monicae* is an average specimen with a small concentration of melaenida-red pigment in the exciple. Magnusson recognized the species were very close to one another (1935a).

The Hasse-Plitt exsiccati No. 62 *Lecidea diducens*, in many herbaria, may contain *L. diducens*, *L. cinerata*, or *L. laboriosa* (with specimens not necessarily conforming to Magnusson's concepts of *L. santa-monicae* or *L. violascens*.)

2. *Polysporina oligospora* (H. Magn.) K. Knudsen, **comb. nov.**

Sarcogyne oligospora H. Magn., Acta Horti Gotoburgensis, 19(1): 32. 1952. TYPE: On dry exposed sandstone, Ekker's Ranch, Wayne Co., Utah, USA, 6000 ft., *S. Flowers 372* (UPS!, holotype).

In the process of a study of *Polysporina* in the Sonoran area (Knudsen in prep.) number of specimens of *Polysporina cyclocarpa* (Anzi) Vězda were seen determined originally as *Sarcogyne oligospora*. *Polysporina oligospora* has smaller apothecia, 0.5-0-8 mm wide, 0.2-0.3 mm thick with ascospores 7-10 x 4-5 μm. No specimens have been seen other than the holotype.

3. *Ramonia ablephora* (Nyl.) R.C. Harris, Bryologist, 96(3): 474. 1993.

Lecidea ablephora Nyl. *in* Hasse, Lichens of Southern California, p. 15. 1898. TYPE: On clay, Santa Monica Mountains, California, USA. *H.E. Hasse s.n.* (NY!, lectotype).

Harris (1993) placed *Ramonia gyalectiformis* into synonymy with *R. ablephora* on the basis of the figures and description provided by Vězda (1967). When attempting to identify several collections recently made by the authors it was noticed that the published spore sizes for each species differed significantly. Comparison of the lectotype of *R. ablephora* with the recent collections confirmed that two species differing primarily in ascospore size and shape were involved. Further comparison with the data presented by Vězda (1967) lead to the discovery that the new collections represented *R. gyalectiformis*, a species distinct from *R. ablephora*. *Ramonia ablephora* is presently known only from the type collection and differs from the superficially similar *R. gyalectiformis* in having smaller ascomata and broadly ovate-fusiform ascospores, ca. 4-celled, 23-27 x 7-8 μm. It appears to be a narrow endemic of the Santa Monica Mountains.

4. *Ramonia gyalectiformis* (Zahlbr.) Vězda, Folia Geobot. & Phytotax., 2: 312. 1967.

Bilimbia gyalectiformis Zahlbr., Beihefte Bot. Centralbl., 13: 158. 1902. TYPE: "Ad terram nudam, Palm Springs in montibus San Jacinto", California, USA. *H.E. Hasse 824* (W).

Bacidia gyalectiformis (Zahlbr.) Hasse, Contrib. U.S. Nat. Herb., 17(1): 50. 1913.

As is noted above *R. gyalectiformis* is not a synonym of *R. ablephora*. *R. gyalectiformis* is distinguished from the superficially similar *R. ablephora* by the larger ascomata and ca. 4-celled, fusiform ascospores, (17.5)-20-(25) x 5-6 μm. For a full description refer to Vězda (1967). Several recent collections are cited below. It should be noted that the type specimen could not be located at W (O. Breuss, pers. comm.). We presume it is still on loan and has not been lost. *Ramonia gyalectiformis* is only currently known from the San Jacinto Mountains from the two locations below and it may be a narrow endemic.

USA. CALIFORNIA. RIVERSIDE CO.: over steep rock outcrops of decomposing granite and sandstone on hillside, on edge of ravine with dry streambed, on the west side of Bautista Canyon Road, Bautista Canyon, elev. 795 m., 33° 39' 30" N, 116° 46' 20" W, *Lendemer 2876 & Knudsen* (hb. Lendemer); spike moss terraces with desert scrub, on a southwest facing slope, along the north side of CA Route #243, south fork of the San Jacinto River, San Jacinto Mountains, east of Hemet, elev. 857 m., 33° 42' 37" N, 116° 46' 23" W, *Lendemer 2641 & Knudsen* (hb. Lendemer), *Lendemer 3772 & Knudsen* (NY, UCR, hb. Lendemer).

6. *Sarcogyne novomexicana* H. Magn., Ann. Crypt. Exot., 7(3-4): 142. 1934.

TYPE: Las Vegas, Nevada, USA, 1927, *Brouard* No. 19.560 (hb. B. de Lesdain, holotype (destroyed)). NEOTYPE: On west-facing vertical surface of Hcl- boulders in mixed conifer forest, 34° 11' 78" N, 116° 46' 81" W, elev. 2568 meters, steep slope above Wildhorse Meadows, San Bernardino Mountains, San Bernardino County, California, USA. *Knudsen 1601 & Wagner* (UPS!, **neotype selected here**; ASU! MIN! UCR! hb. Lendemer, hb. McCune! duplicates of neotype [isoneotypes]).

Sarcogyne novomexicana was named from a single specimen collected by Brouard in Las Vegas, Nevada in 1927. The type of *S. novomexicana* was presumably destroyed with the herbarium of Bouly Lesdain in Dunkirk. Apparently Magnusson kept no duplicate or fragment. This species is one of the most beautiful *Sarcogyne* and has large reddish-brown discs that turn orange when wet, thick septate paraphyses, and broad spores. A full description will be provided by Knudsen & Standley (in prep.). It is apparently a rare species occurring above 1900 meters in New Mexico and southern California. The neotype is deposited at UPS in honor of Magnusson's contribution to lichenology.

7. *Sarcogyne privigna* (Ach.) A. Massal., Gener. Lich., p.10. 1854

Lecidea privigna Ach., Meth. Lich., p. 49.1803.

Biatorella privigna (Ach.) Sandst., Flecht. Nordwdeutschen Tiefl., p. 138. 1912.

Syn nov. *Sarcogyne plicata* H. Magn., Ann. Crypt. Exot., 7(3-4): 134. 1934. TYPE: On plaster of a wall, Upland, California, USA. 17.February.1917. *I. M. Johnstone* (FH! holotype.)

Biatorella plicata (H. Magn.) Zahlbr., Cat. Lich. Univ., 10: 418. 1939.

Sarcogyne plicata was based on two specimens from southern California (FH!). This is not a stable morphotype of *S. privigna*. Some of the apothecia are elongated and it has a thicker and more prominent parathecium which usually splits and curls obscuring the disc. The following specimens collected from above the type locality, which is now a suburb, are good examples of the *S. plicata* form intergrading with typical *S. privigna*.

USA. CALIFORNIA. SAN BERNARDINO CO.: On granite boulders in flood plain, San Antonio Wash behind San Antonio Dam, San Gabriel Mountains, elev. 761 m., 34° 10.537' N 117° 40.474' W, *Knudsen 1230, Knudsen 1231* (ASU, NY, MIN, UCR, hb. Ketzner, hb. Lendemer)

8. *Sarcogyne similis* H. Magn., Ann. Crypt. Exot., 7(3-4): p.135. 1934. TYPE: On sandstone, Devil's Cañon, Santa Cruz Mountains, California, USA. elev. 2300 ft. 8.August.1906. *A.W.C.T. Herre 948* (FH!, **lectotype, designated here**).

Syn. nov. *Sarcogyne californica* H. Magn., Ann. Crypt. Exot., 7(3-4): 138. 1934. TYPE: Topanga Canyon, California, USA. 1908. *H.E. Hasse 1102* (FH!, **lectotype, designated here**).

Sarcogyne similis occurs across North America on acid rocks and is particularly common in the west.

Sarcogyne californica is a synonym of *S. similis*, differing only in being described as always immarginate and pulvinate. The pulvinate form is caused by the multiple division of an apothecium and is very striking when seen but intermediates are numerous with the apothecium dividing into a lesser number of apothecia and being less convex to plane. Divisions forming pulvinate clusters were observed on hard granite boulders, which may stimulate it by restricting the spread of endolithic hyphae; on crumbling granite, sandstone, pebbles and small rocks, or on soil, convex and immarginate discs are usually rare.

Acknowledgements

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MYCOTAXON

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Taxonomic studies of *Alternaria* 9: two new species and two new records from China

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Abstract—Two new species, *Alternaria impatientis* on *Balsaminaceae*, *A. pharbitidicola* on *Convolvulaceae*, are described. *Alternaria impatientis* is large-spored species and is the first species described from the *Balsaminaceae*. *A. pharbitidicola* is characterized by producing single conidium with filiform and unbranched beak. *A. mouchaccae* and *A. crotonicola* are reported as new records from China.

Key words— *Acalypha*, *Agropyron*, *Impatiens*, *Pharbitis*

Since the publication of Flora Fungorum Sinicorum Vol. 16: *Alternaria* (Zhang 2003), which includes 123 species, varieties and 2 forma speciales, a number of new taxa in the genus have been found from China. In this paper, two new species and two new records for China are reported.

Alternaria impatientis X. Sun & T.Y. Zhang, **sp. nov.** **Fig. 1**

Maculae orbiculares vel suborbiculares, flavo-brunneae, 5-10mm diam. concentrice zonatae. Caespituli amphigeni. Conidiophora solitaria vel fasciculata, erecta, recta vel curvata, non ramosa vel ramosa, septata, 76.5~115.5×4.5~6.0μm. Conidia solitaria vel interdum 2 catenulata, obclavata, flavo-brunnea, 5-9 transverse septata, 1-4 longitudinaliter vel oblique septata, centro 1-2 septa incrassata. 49.5~72.0×14.0~22.0 μm(av.59.8×17.9μm). Rostra filiformia, infuscata vel subhyalina, septata, 32.5 ~ 95.5 (~153.0)×2.0~3.0μm (av. 73.8×2.6μm).

Habitatio typi in foliis maculis Impatientis sp., Balsaminaceae, Mohe, Heilongjiang Provincia, 2003, Leg. T.Y. Zhang, HSAUP$_{03}$0148 (=ZTY$_{03}$0148).

Holotypus hic designatus: Specimen et pars ex cultura (isol. X. Sun, 2003) in PCA et in PCA-charta filtra desiccatae in HSAUP$_{03}$0148 (=ZTY$_{03}$0148) conservatae.

Leaf spots circular or subcircular with concentric rings, yellowish brown, 5-10 mm in diam. Fruiting amphigenous. Conidiophores solitary or fasciculate, simple or branched,

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erect, straight to curved, septate, light brown, 76.5~115.5×4.5~6.0μm. Conidia solitary or occasionally in chains of two, spore body obclavate, yellowish brown, with 5-9 transverse septa, 1-4 longitudinal or oblique septa, slightly constricted at septa, the central 1-2 septa occasionally thicker and darker than the others, 49.5~72.0×14.0~22.0μm (av. 59.8×17.9μm). Rostra filiform, very pale brown or subhyaline, septate, 32.5~95.5(~15 3.0)×2.0~3.0μm (av. 73.8×2.6μm).

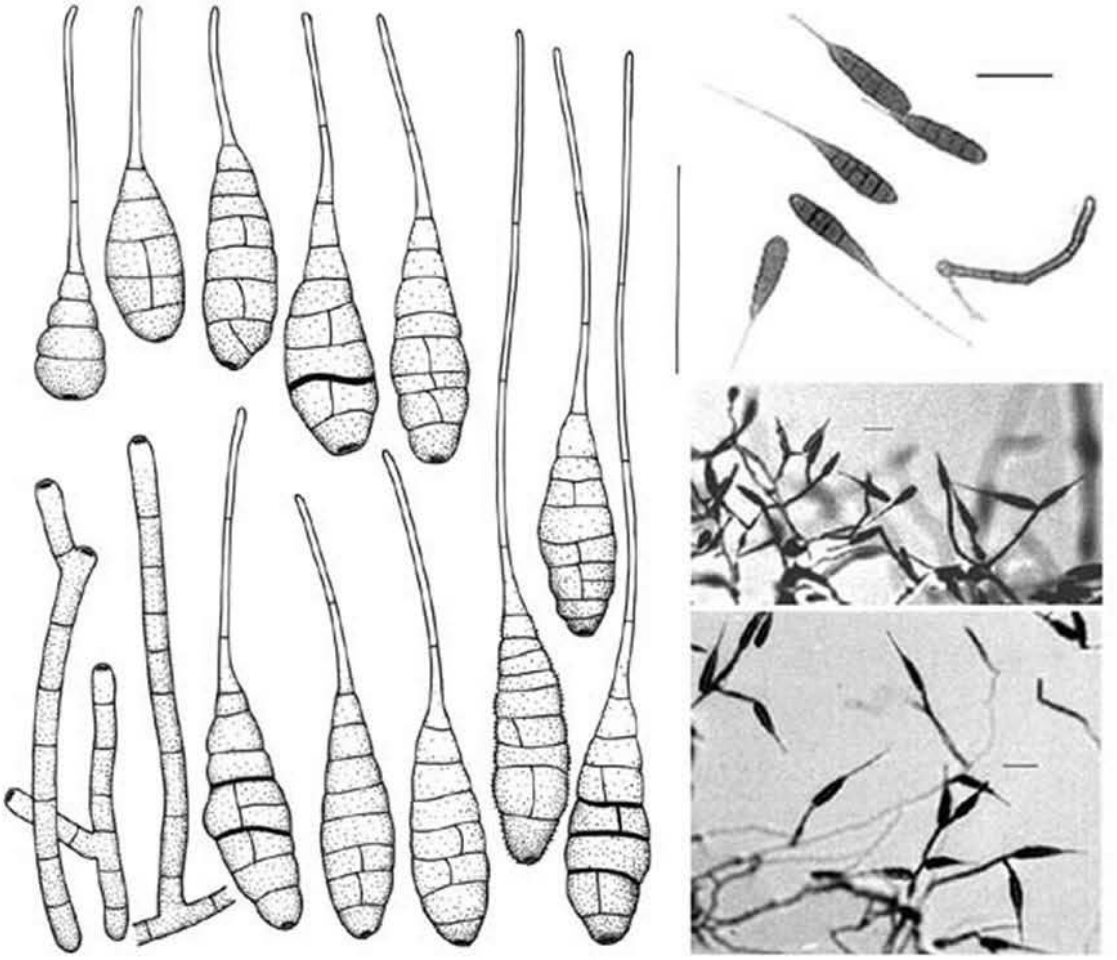

Fig.1 *Alternaria impatientis*. Left: Conidia and conidiophores ex natural substrate. Upper right: Conidia and conidiophores ex culture on PCA, Middle and lower right: Sporulation pattern (PCA 7d.). (All above ex HSAUP$_{03}$0148, Bars=50μm)

Colonies on PCA circular, effuse, pale brown, reaching about 7.0 cm diam. in10 days at room temperature, a light red pigment often diffusing into the medium, sporulation sparse and mostly in the outer half of the colony, on PCA-filter paper, sporulation abundant. Conidia single or in chains of two, size and shape are similar in both the field type specimen and in PCA culture.

Holotype: on leaf spots of *Impatiens* sp., Mohe, Heilongjiang Province, 2003, Coll. T.Y. Zhang, *HSAUP$_{03}$0148 (=ZTY$_{03}$0148)*. And dried ex-type cultures on PCA and PCA-filter paper in *HSAUP$_{03}$0148*.

This is the first report of an *Alternaria* species on a member of the *Balsaminaceae*.

Alternaria pharbitidicola X. Sun, Meng Zhang & T.Y. Zhang, **sp. nov.** **Fig. 2**

Maculae suborbiculares, atro-brunneae, margine griseae, concentrice zonatae, 3-8mm diam. Caespituli imprimis epiphylli. Conidiophora solitaria vel fasciculata, brunnea, recta vel leviter curvata, non ramosa vel raro ramosa, septata, 62.5~109.5×6.0~8.0μm. Conidia solitaria, (raro 2 catenulata), brunnea vel atro-brunnea, obclavata vel obpyriformia, 6-10 transverse septata, 1-4 longitudinaliter vel oblique septata, constricta, 37.5~59.5×10.5~22.0μm (av. 48.9×14.2μm). Rostra filiformia, pallide brunnea vel subhyalina, septata, 65.5~234.0×2.0~3.0μm (av. 152.1×2.5μm).

Habitatio typi in foliis maculis Pharbitidis purpureae (L.) Voight, Dali, Yunnan Provincia, 2003, Leg. T.Y. Zhang, HSAUP$_{03}$0081 (=ZTY$_{03}$0081).

Holotypus hic designatus: Specimen et pars ex cultura (isol. X. Sun, 2003) in PCA et in PCA-charta filtra desiccata in HSAUP$_{03}$0081 conservata.

Leaf spots circular or subcircular, dark brown with greyish margin, usually 3-8 mm in diam. Fruiting mainly epiphyllous. Conidiophores solitary or fasciculate, rarely branched, straight or slightly curved, septate, brown, 62.5~109.5×6.0~8.0μm. Conidia solitary or occasionally in chains of two, brown or dark brown, obclavate or obpyriform, with 6-10 transverse septa, 1-4 longitudinal and oblique septa, constricted at septa, the central 1-2 septa often slightly darker than the others, 37.5~59.5×10.5~22.0μm (av. 48.9×14.2μm) excluding beaks; rostra filiform, up to 2-4 times the length of the spore body, very light brown or subhyaline, septate, 65.5~234.0×2.0~3.0μm (av.152.1×2.5μm).

Colonies on PCA grow rapidly, attaining a diameter of about 8.3 cm in 10 days at room temperature, appearing circular, effuse, greyish brown. Sporulation on PCA moderate, mostly near the periphery of the colony. On PCA-filter paper, sporulation abundant, conidiophores straight or slightly curved, unbranched or occasionally branched. Conidia solitary or rarely in chains of two. Conidium body in culture (av. 60.0×19.0μm) is a little larger and darker than that in field specimen.

Holotype: *HSAUP$_{03}$0081 (=ZTY$_{03}$0081)*, on leaf spots of *Pharbitis purpurea* (L.) Voight, Dali, Yunnan Province, Coll. T.Y. Zhang, 2003 and dried ex-type cultures on PCA and PCA-filter paper in *HSAUP$_{03}$0081*.

Six species of *Alternaria* have been described so far on plants of *Convolvulaceae*. *A. pharbitidicola* is very different from *A. destruens* E.G. Simmons, *A. pharbitidis* T.Y. Zhang & W.Q. Chen and *A. calystegiae* Nelen, because conidia of the last three species are often catenulate and short beaked. *A. cuscutacidae* Rudakov, according to Simmons, appears in a few publications but never with a description or other validating information, and the isolates labeled *A. cuscutacidae* do not establish the relation with the original source, so it is an illegitimate species name. Among the previously described large-spored species, *A. pharbitidicola* somewhat resembles *A. bataticola* Ikata ex W.Yamam. and *A. dichondrae* Gambogi, Vannacci et Triolo in having long conidium beaks. However, the new taxon is different from *A. bataticola* in that conidia of the latter are cylindrically beaked and thicker- and darker-walled. The new species can be separated from *A. dichondrae* in that the conidium beak of the latter is always branched 2-4 times.

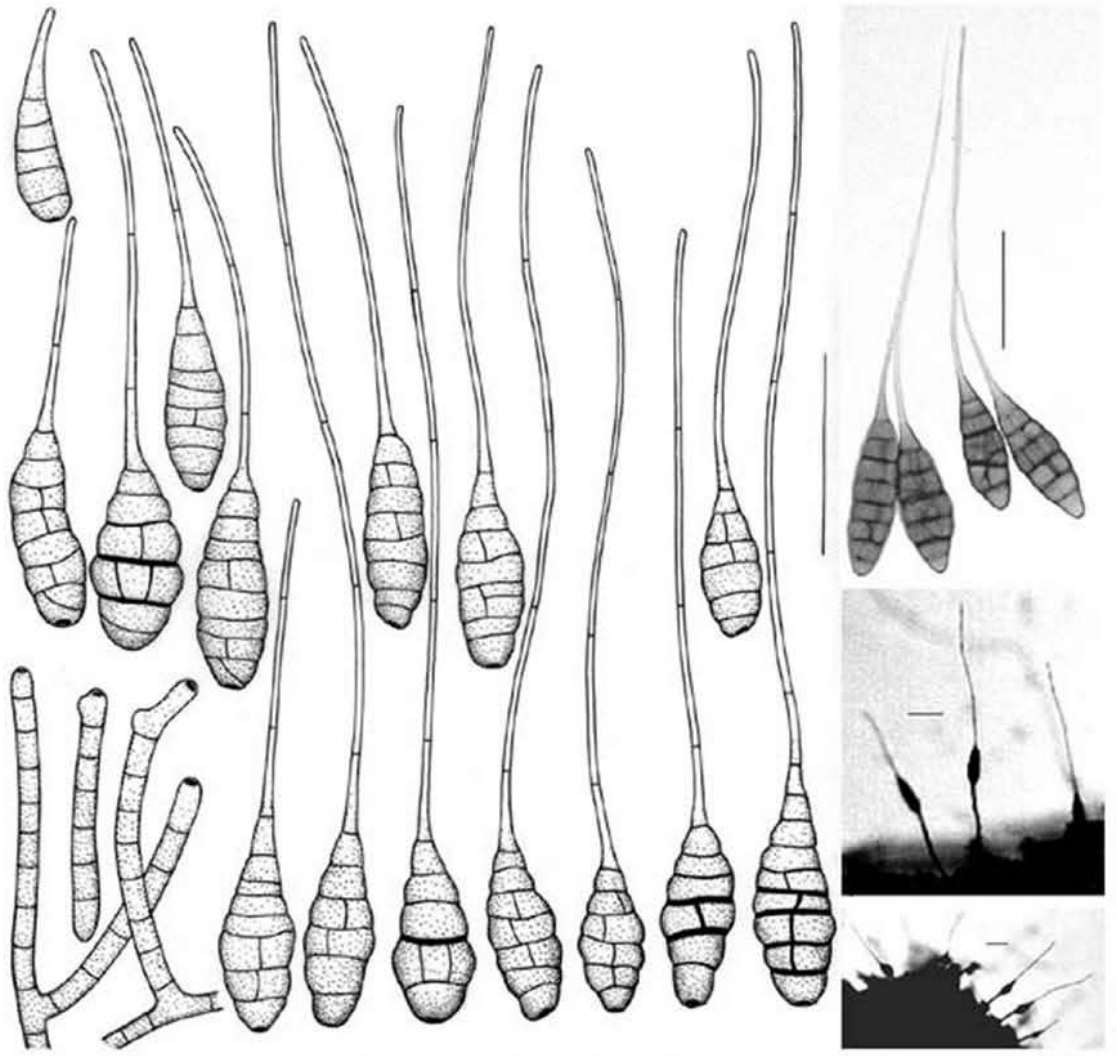

Fig.2 *Alternaria pharbitidicola*. Left: Conidia and conidiophores ex natural substrate, Upper right: Conidia ex culture on PCA, Middle and lower right: Sporulation pattern (PCA 7d.), (All above ex HSAUP$_{03}$0081, Bars=50μm)

Alternaria mouchaccae E.G. Simmons, Mycotaxon 13: 18-21, 1981. **Fig. 3**

=*Ulocladium chlamydosporum* Mouch., Revue de Mycologie 36(2): 120, 1971.

Specimen examined: *HSAUPII$_0$0138 (=ZTYII$_0$0138)*, on leaf spots of *Agropyron sp.*, Kashi, Xinjiang Uygur Autonomous Region; T.Y. Zhang, Aug. 2000.

This species is a new record for China.

Alternaria crotonicola T.Y. Zhang & J.C. David, Mycosystema, 8-9: 130, 1995-1996.

Specimen examined: *HSAUP$_{03}$1032 (=ZM$_{03}$0532)*, on leaf spots of *Acalypha australis* L., Jinan, Shandong Province, Coll. Meng Zhang, 2003.

This is a new record for China.

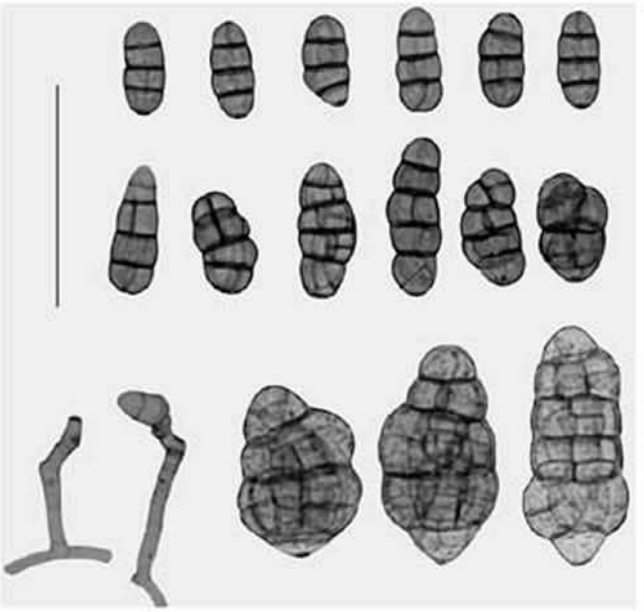

Fig.3 Conidia and conidiophores of *Alternaria mouchaccae*. (ex HSAUP II $_0$0138. Bar=50μm)

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中国链格孢属的分类研究 IX.

两个新种及两个中国新记录种

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摘要：报道生于凤仙花科植物上的一个新种，*Alternaria impatientis*，生于旋花科植物上的一个新种，*A. pharbitidicola*，和二个中国新记录种，*A. mouchaccae* 及 *A. crotonicola* 。 新分类单位的模式标本（田间标本和干制培养物）保存在山东农业大学植物病理学标本室（HSAUP）。

关键词：苋菜，冰草，凤仙花，牵牛

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Changes and additions to the North American lichen flora. – IV.

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Abstract. – *Acarospora intercedens* and *A. radicata* are placed in synonymy with *A. socialis*. *A. peltastica* and *A. utahensis* are placed in synonymy with *A. strigata*. *Thelocarpon albomarginatum* is placed in synonymy with *A. washingtonensis*. A neotype is selected for *A. peltastica*. A lectotype is selected for *A. strigata*. *Hypotrachyna afrorevoluta* is reported as new to North America.

1. *Acarospora socialis* H. Magn., Mycologia, 21: 252. 1929. TYPE: USA, California, Los Angeles Co., Santa Catalina Island, on mountain tops, *L.W. Nuttall 478* (FH!, holotype).

Syn. nov. *Acarospora intercedens* H. Magn., Goteborgs Kungl. Vetensk. & Vitterhets. Samhalles Handl., sjatte foljden ser. B, 6(17): 15. 1956. TYPE: USA, California, Ventura Co., 3.5 miles up Matilija Canyon, Los Padres National Forst, W. of Matilija Hot Springs, elev. 450 m., *W.A. Weber. S-1040* (UPS!, holotype).

Syn. nov. *Acarospora radicata* H. Magn., Goteborgs Kungl. Vetensk. & Vitterhets. Samhalles Handl., sjatte foljden ser. B, 6(17): 14. 1956. TYPE: USA, Arizona, Pinal Co., Desert Mountains, SW of Superior, NW slope, just S of Picketpost Mountains, near Southwestern Arboretum, elev. 825 m., *W. A. Weber & J.B. McCleary* (UPS! holotype).

The major characteristics of *Acarospora socialis* H. Magn. are the formation of well-developed squamules, a stipe, and hyaline, simple spores that are usually broadly ellipsoid, 2.0-2.5 μm wide. For a current description of *A. socialis* refer to the first author's treatment in Vol. 3 of the Sonoran lichen flora (Knudsen in prep.)

Acarospora socialis is the most common yellow *Acarospora* in western North America, occurring in southern and central California and the Channel Islands, in the Mojave Desert, and from the Colorado Desert in California to New Mexico, and south into Mexico. The full range of its distribution in North America is not known, in great

part due to collections being referred to as *A. schleicheri sensu* Weber or *Pleopsidium*. Before Magnusson (1929a), Tuckerman (1882) and Hasse (1913) determined western North American specimens as *A. xanthophana*, a South American *Acarospora* that does not occur in North America. Also the current use of *A. socialis* in the Midwest by some lichenologists may be misapplied to specimens of *A. chrysops* (Tuck.) H. Magn., which appears to replace *A. socialis* from Texas and the Rocky Mountains east to Kansas and the Ozarks. Clauzade et al. (1981) indiscriminately lumped the yellow *Acarospora* of North American into *A. bella* (Nyl.) Jatta.

Individual specimens of *A. socialis* from different parts of its range can look quite different. This has led to a number of synonyms, only those which have been studied so far are made official here. Examination of numerous collections, combined with the field studies, turns up many intergrading forms and none of the morphotypes are stable. But one should be careful in assigning yellow *Acarospora* to *A. socialis* even within its current known range, as rarer *Acarospora* species often occur within the range of more common and successful species. One example is *A. epilutescens* with just a few reports from southern California, Arizona, and Texas (Knudsen 2005).

Herre (1910) applied his combination *Acarospora bella* (Nyl.) Herre to all yellow *Acarospora* in north and south America, including *A. socialis* occurring in the Santa Cruz Mountains of central California. Knudsen (2004) suggested that the name *A. bella* could be used by lichenologists in central California ad interim during the process of revision of the group, as being preferable to *Pleopsidium* or *A. schleicheri sensu* Weber and the name was included in Esslinger (1997). But with new data available it is best to shed the use of this name. The basionym of *A. bella*, is *Lecanora bella* Nyl., an illegitimate homonym of *Lecanora bella* Ach., and the correct name *A. xanthophana* (Nyl.) Jatta, in our opinion, should be used only for members of a group of high elevation South American yellow *Acarospora* that is in need of revision.

Magnusson's synonyms are based on a species concept that did not take into account the variability of this taxon. He segregated his species based on narrow differences in hymenium height, cortical thickness, apothecia color or width, and pruina. In this wide-ranging and successful taxon, there is considerable variation in these measurements and characteristics which make Magnusson's concepts impossible to apply. *Acarospora subalbida* auct. was applied to heavily pruinose specimens common in Topanga Canyon in the Santa Monica Mountains but specimens with varying amounts of pruina are common throughout the range of *A. socialis* (Knudsen 2005). *Acarospora interecedens* was applied to specimens from Matilija Canyon in Ventura County, California, which are reduced in size. Such reduced specimens, probably caused by stress through environmental factors, are common in *Acarospora* in western North America and in *A. socialis*. *Acarospora radicata*, which Magnusson (1956) himself recognized as close to *A. socialis*, are specimens with interascal plectenchyma in the apothecia caused by the retarded development of fertile apothecia in mature squamules, often in desert populations, where extended conidia production of infertile squamules appears to be a successful strategy for pioneering habitats.

Magnusson (1929a) originally selected the collection by L.W. Nuttall as the holotype of *A. socialis*. The later citation of a different collection as the type (Magnusson 1929b) is erroneous.

2. *Acarospora strigata* (Nyl.) Jatta, Malpighia, 20: 10. 1906.

Lecanora strigata Nyl., Annal. Sci Nat., 3: 155. 1855. TYPE: Chile, Coquimbo, ad saxa calcaea. *Gay s.n.* (H-Nyl #24898!, lectotype, **designated here**).

Syn. nov. *Acarospora peltastica* Zahlbr., *Beih. Bot. Centralbl.*, 13: 161. 1902. TYPE: USA, California, Riverside Co., Palm Springs, ad saxa granitica, *H.E. Hasse s.n.* = *Lichenes Rariores Exsiccati 75* (W!, neotype, **designated here**). (see discussion below).

Syn. nov. *Acarospora utahensis* H. Magn., Acta Horti Gotoburgensis, 19(1): 32. 1952. TYPE: USA, Utah, Wayne Co., sine loc., *S. Flowers 364* (UPS!, holotype).

Acarospora strigata (Nyl.) Jatta occurs mainly throughout the deserts of western North America and in the mountains of South America on both acid and carbonate rock. The differences between substrates, slope aspect, humidity, wind, and access to water can cause extreme differences in specimens collected within sight of each other. Specimens may be epruinose, have different fissuring patterns with different ontogenies, several apothecia or a single dilated one, and even have the thallus blown away leaving only the blackened true exciple. The broadly attached areoles may be very reduced or in mesic situations with shade and high humidity up to 3 mm. across and 1 mm. high or more. The differences are not quite as bewildering as they appear and the one constant throughout the species is the occurrence of broadly ellipsoid spores (3.0-)4.0-6.5(-7.0) x (2.0-)2.5-3.0(-3.7) μm. If mature spores average less than 2.5 μm in width in a specimen, you usually have one of several other possible pruinose species.

Acarospora peltastica Zahlbr., was placed in division *Subglobosae* (Magnusson 1929b) and was delimited from other North American species as having spores globose or subglobose, and furrowed areoles from 2-4 mm. in diameter (Magnusson 1956). These characteristics are all within the normal range of variation in *A. strigata*. The immature spores of *A. strigata* are often clearly globose and become 4x2 μm, broadly ellipsoid, in the neotype of *A. peltastica*. In many Hasse specimens of *A. peltastica* from the Palm Springs area on the east slope of the San Jacinto Mountains spores can be found as large as 7 x 3 μm. It should also be kept in mind that broadly ellipsoid spores viewed in the ascus or loose at a wrong angle appear globose. The normal range of areoles in *A. strigata* is 0.3-4.0(-5.0) mm. in diameter. The sizes of areoles apparently depend on environmental conditions. The largest squamules on the east side of San Jacinto Mountains occur in shaded drainages on north slopes with spring-fed water and can easily get to 3-4 mm. in diameter. Furrows occur in the upper syncortex and cut down to the upper pigmented layer of the eucortex. In many specimens this furrowing is well-developed in a cross-hatched pattern that is 70-100 μm deep, especially in large areoles. In these cases furrowing appears to be caused by differential expansion of medulla and eucortex to the syncortex. Zahlbruckner (1902) cited the type of *A. peltastica* as *H.E. Hasse 662* however, that collection could not be located. Thus, an exsiccate collection from the same locality, without number or date, and also collected by Hasse is here selected as the neotype.

Acarospora utahensis was segregated from *A. strigata* on basis of larger spores 9-13 x 5-6 μm (Magnusson 1956). Herre himself, who sent the specimens to Magnusson, annotated the holotype packet with the spore size "4-6.5 x 2-4 μm." The examination

of the spores of the holotype agree with Herre's observation except no width was seen above 3.4 μm and the specimen falls easily within the normal range of variation in *A. strigata*. We have no explanation for Magnusson's observation.

Specimens of *A. strigata* should be carefully determined since several taxa are superficially similar and easily misidentified as this taxon. Pruinose specimens with a C+ red cortex and broadly ellipsoid spores are the rare and usually epruinose *A. nevadensis* H. Magn. Pruinose specimens with spores that are narrowly ellipsoid are usually *A. veronensis* (C-, lacking gyrophoric acid) or *A. obpallens* (C+ red, gyrophoric acid).

The collections of *A. strigata* we have seen have been haphazard. More careful and intense collections in various regions may reveal other species. Morphological variation may also be due partly to different lineages within the taxon that have not speciated due to the success of *A. strigata* in adapting to varying harsh habitats. In some locations these lineages may re-converge.

3. *Acarospora washingtonensis* H. Magn., Ann. Crypt. Exot., 6: 46 (1933).
TYPE: USA, Washington, Roslyn, 1931, *I.E. Howard s.n.*, (UPS!, holotype)

Syn. nov. *Thelocarpon albomarginatum* Herre, J. Wash. Acad. Sci., 2: 384. 1912. TYPE: USA, California, Santa Cruz Mountains, Devil's Cañon, on a loose rock lying on earth, elev. 2400 ft., 1906, *A.W.C.T. Herre s.n.* (F!, holotype)

Acarospora albomarginata (Herre) G. Salis., Lichenologist: 3: 191. 1966. comb. illeg. non *Acarospora albomarginata* B. de Lesd. (1911).

Acarospora washingtonensis H. Magn., is a rare lichen known from Arizona (Magnusson 1937), California (Herre 1912), and Washington (Magnusson 1933). Herre first collected this species in 1906 in the Santa Cruz Mountains of central California.

The same lichen was collected by I.E. Howard in Washington in 1931 and he sent a specimen to Magnusson who described it as *A. washingtonensis* (Magnusson 1933). In 1937 Magnusson reported it as being collected by K. Bartlett in Arizona near Oraibi. The taxon is in need of further study especially its relation to *A. elevata* H. Magn.

4. *Hypotrachyna afrorevoluta* (Krog & Swinscow) Krog & Swinscow, Lichenologist, 19: 420. 1987.

Parmelia afrorevoluta Krog & Swinscow, Norweg. J. Bot., 26: 22. 1979. TYPE: Kenya, Central Province, Nyeri District, Aberdare Mts., 10 km W Tusha, on trees in ericaceous zone, *H. Krog 3k 31/188* (O!, holotype).

Parmelinopsis afrorevoluta (Krog & Swinscow) Elix & Hale, Mycotaxon, 29: 242. 1987.

While attempting to resolve the material referred with question to *Parmelinopsis spumosa* (Asah.) Elix & Hale by Harris & Lendemer (2005) and Lendemer & Harris (2004) the second author examined a large number of pustulose *Hypotrachyna*/*Parmelinopsis* specimens from eastern North America. It became clear that several taxa were involved, one of which was *H. afrorevoluta*.

Originally described from Africa by Krog & Swinscow (1979) the species was separated from *H. revoluta* (Flot.) Hale by the presence of submarginal sorediate

pustules and marginal cilia. Subsequent to its description the species has been widely reported from other regions including China (Chen et al. 2003), Norway (Santesson 1993), and South America (Adler & Elix 1992). The presence of the species in North America is not unexpected considering the records from Norway as well as its generally widespread distribution. The correct generic placement of *H. afrorevoluta* is somewhat problematic (see synonymy above and various regional checklists not cited here), we follow Krog & Swinscow (1987) and retain the species in *Hypotrachyna* pending further study.

In eastern North America *H. afrorevoluta* has previously been confused with *Parmelinopsis spumosa* from which it differs chemically in containing the hiascic acid complex in addition to gyrophoric acid and lacking a UV+ blue-white unknown, geographically in being absent from the southeastern coastal plain, and morphologically in having revolute lobe margins and a larger thallus. *Hypotrachyna afrorevoluta* differs from the superficially similar *H. showmanii* in having emaculate lobe tips, sorediate pustules, a more loosely adnate thallus, and revolute lobe margins. It is also more densely rhizinate with long, occasionally branching rhizines.

The status of *Hypotrachyna showmanii* in eastern North America will be re-revaluated by Lendemer & Harris (in prep.). In *H. showmanii* the pustules do not become sorediate but are easily broken following collection and subsequently mistaken for schizidia or soredia. *Hypotrachyna showmanii* also has conspicuously maculate lobe tips, unlike *H. afrorevoluta*.

Hypotrachyna afrorevoluta is widespread in north/central North America and we have seen material from coastal Maine, USA and throughout the southern Appalachians. The species is likely uncommon, and the identification of some specimens can be problematic, especially if they are old or fragmentary.

Selected Specimens Examined. - USA. Maine. Hancock Co.: Acadia National Park, Mount Desert Island, to the east of Gilley Field Trail descending Bernard Mt., in conifer dominated forest, on *Acer rubrum*, 125 m., UTM 19 4906061.7N 550554.3E, *N. Cleavitt 1611 & D. Werier* (hb. Cleavitt!, hb. Lendemer!). North Carolina. Macon Co.: Nantahala National Forest, N slope of Wayah Bald along Appalachian Trail, moist mixed hardwoods, on *Quercus*, ca. 1535 m., 35° 11'N 83° 34'W, *R.C. Harris 42822* (NY!). Transylvania Co.: Gorges State Park, Bearwallow Fields, mixed forest along banks of Toxaway River, on *Alnus*, 1475 ft, 35° 04'N 82° 54'W, *J.C. Lendemer 4602 & E. Tripp* (hb. Lendemer!); Gorges State Park, east facing slope below Grassy Ridge, ca. ½ mi. N of Ray Fisher Farm, acid cover forest, on *Acer*, ca. 2500 ft., 35° 05'N 82° 56'W, *J.C. Lendemer 4713 & E. Tripp* (NY!, hb. Lendemer!). West Virginia. Pendleton Co.: Monongahela National Forest, Spruce Knob National Recreation Area, trunk of tree on dry, steep slope, along Forest Service Road #112, ca. 4400 ft., *W.R. Buck B-996* (NY!).

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A new species and its phylogenetic placement in the *Didymella/Phoma* complex (*Phaeosphaeriaceae, Pleosporales*)

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Abstract - A proposed new species, *Phoma billsii* sp. nov., was obtained from soil samples from Hawaii. The features of this new species are described and it is distinguished from other species to which it is similar. Large subunit 28S rDNA sequences are employed to place this new species phylogenetically. *Phoma billsii* is placed in a *Didymella/Phoma* complex in family *Phaeosphaeriaceae* of the *Pleosporales*. Sequence similarity of ITS1 rDNA was used to evaluate distinctness from similar species in *Didymella* and *Phoma*. A phylogenetic approach for classification of phomoid fungi is advocated.

Key words - *Phoma billsii, Pleosporales*, taxonomy

Introduction

The form genus *Phoma* Sacc. was proposed in 1880 by Saccardo (1880). Since establishment of the genus, thousands of species have been described and separated by host substrate and by morphological differences (Sutton 1980; Boerema et al. 2004). Most fungi referred to *Phoma* pertain to the *Pleosporales* (Wehmeyer 1961; Sutton 1980; Grondona et al. 1997; Boerema et al. 2004). Historically, *Phoma* has been a repository for any pycnidial coelomycete with colorless and one to two-celled conidia (Grove 1935; Sutton 1980). Recently Boerema and colleagues have published a comprehensive identification manual for cultural identification of *Phoma* (Boerema et al., 2004). This work was the culmination of decades of taxonomic study of *Phoma* and *Phoma*-like species by an international suite of mycologists (e.g., Grove 1935; Morgan-Jones 1988a,b; Punithalingam 1990; Rai 1998; de Gruyter 2002; Boerema

et al. 2004). The monograph facilitates identification of numerous *Phoma* isolates; however, classification of many species in *Phoma* still carries with it uncertainty as to precise phylogenetic affinity. One of the challenges for mycologists is the development of a phylogenetic base for classification of fungal species in groups like *Phoma* where classification lacks phylogenetic clarity and teleomorphs are rarely observed (Alexopoulos, Mims, Blackwell 1996).

In this study, we document morphological and cultural features of a new species of *Phoma* and place it in a phylogenetic context.

Materials and Methods

Fungal Material: Isolates of *Phoma billsii*, *Phoma cucurbitacearum* (Fr.:Fr.) Sacc. (GSB10), and *Phoma pomorum* Thüm. (GSB12) were obtained from soil collected by Gerald Bills in 1988 from a sugarcane field near Olowalu, Maui, Hawaii. Isolations from soil samples were made using the ethanol pasteurization technique (Bills et al., 2004). Once isolated, cultures were grown on potato dextrose agar (PDA). Specimens obtained from the American Type Culture Collection (ATCC) (Table 1) were revived in potato dextrose broth and subsequently plated on PDA. Cultures were maintained at approximately 23 °C in an irregular light (fluorescent room lighting)/dark cycle. Specimens of all collections were submitted to the Rutgers University Plant Pathology Herbarium (RUTPP) and representative cultures were sent to the ATCC in Manassas, Virginia.

Microscopy: Specimens of all isolates were examined by simple squash mounting and *P. billsii* was further examined by embedding and sectioning pycnidia (Figs. 1-4; 6-9). For sectioning, blocks of agar with pycnidia were fixed in FAA (five parts stock formalin: five parts glacial acetic acid: 90 parts 50% ethyl alcohol) for approximately 5 days. Tissue was then dehydrated and embedded in L. R. White® acrylic embedding medium (Polysciences, Inc., Warrington, PA) and 1 µm sections were obtained using glass knives (Figs. 6-9). Sections were stained on a slide warmer for 30 s in toluidine blue stain (0.1% aqueous) and examined with a phase contrast microscope. Conidial, pycnidial, and mycelial examinations were made in squash mounts in aniline blue stain (0.1% aqueous) (Figs. 1-4). Size measurements are an average of at least 20 individual measurements.

Cultural studies: Isolates were cultured on oatmeal agar (OA; Fig. 5), malt-extract agar (MEA), and PDA, prepared as outlined by Boerema et al. (2004). In addition we employed Czapek cellulose agar (CCA) to stimulate pycnidial production. CCA medium contained the following: fibrous cellulose powder (Whatman) 10 g, sodium nitrate 2 g, dipotassium phosphate 1 g, magnesium sulfate 0.5 g, potassium cloride 0.5 g, ferrous sulfate 0.01 g, bacto-agar 15 g, distilled water 1 litre. All media were inoculated using 7 mm plugs cut from margins of colonies growing on CCA plates. Plates were maintained at 23 °C in an alternating light/dark cycle and examined after 5 and 7 days of growth. Descriptions represent observations after 5 days. For the sodium hydroxide spot test one drop of 10% sodium hydroxide solution was placed on mycelium at the margins of 7-day-old colonies growing on OA and MEA media after Boerema et al. (2004).

Identifications of Isolates: Isolates from soil and leaf litter were identified using

a combination of sequence homology, morphology, and cultural characteristics. For *Phoma cucurbitacearum* (GSB10) an exact sequence match in LSU sequences was obtained with *Didymella bryoniae* (Auersw.) Rehm (isolated from cantaloupe in Arizona in 1997; IMI 373225) and cultural and morphological characteristics corresponded to the *Phoma cucurbitacearum* state of that species (Boerema et al 2004). *Phoma pomorum* (GSB12) was identified through examination of cultural and morphological features (White, Morgan-Jones 1986; Boerema et al. 2004).

Sequencing and Analyses: Amplification and sequencing of 18S small subunit (SSU) rDNA, 28S large subunit (LSU) rDNA, and internal transcribed spacer sequence 1 (ITS1) was done as previously described (White et al. 1990; Sullivan et al. 2001) and voucher accession numbers are provided in Table 1.

Table 1. Taxa used in ITS and LSU analyses

Taxa	GenBank #	Culture/Voucher #
Aureobasidium pullulans	AF050239	ATCC 62921
Clathrospora diplospora	U43481	IMI 68086
Cochliobolus heterostrophus	AF163992	---
Delphinella strobiligena	AY016358	CBS 735.71
Didymella bryoniae	AY293792/AF046014	IMI 373225
Didymella lycopersici	AF046015	AUAM1431
Dothidea ribesia	AY016360	CBS 195.58
Dothidea sambuci	AF382387	CBS 198.58
Lewia infectoria	U43482	IMI 303186
Leptosphaeria doliolum 1	U43475	ATCC 32815
Leptosphaeria doliolum 2	U43474	ATCC 32814
Melanomma radicans	U43479	ATCC 48522
Mycosphaerella mycopappi	U43480	ATCC 64711
Phoma americana	AF046017	AUAM3376[2]
Phoma billsii	AY293789	ATCC MYA3680
Phoma cucurbitacearum (GSB10)	AY293786	ATCC MYA3681
Phoma glomerata (South River)	AF126819	ATCC MYA2373
Phoma herbarum	AY293791	ATCC 12569
Phoma macrostoma	AF046020	PD68/1014[2]
Phoma multirostrata	AF046019	AUAM2409[2]
Phoma pomorum (GSB12)	AY293787	ATCC MYA3682
Phoma sp. (*Westerdykella*)	AY293790	ATCC 22167
Phoma sp.	AY293788	ATCC 26648
Phoma sp. (Turkey Swamp)	AY293785	ATCC MYA3683
Pleomassaria siparia	AY004341	---
Pleospora betae	U43483	IMI 156653
Pleospora herbarum 1	U43476	ATCC 11681
Pleospora herbarum 2	AF382386	CBS 191.86
Pyrenophora trichostoma	U43477	ATCC 44111
Trematosphaeria heterospora	AY016369	CBS 644.86
Westerdykella cylindrica	AY004343	CBS 454.72

[1]--- indicates that voucher accession not available.

[2]Sequences were obtained directly from dried herbarium specimens from the Auburn University Mycological Herbarium (AUAM) in Auburn, Alabama or Plantenziektenkundige Dienst (PD) in Wageningen, The Netherlands.

In a few instances sequences were obtained directly from dried herbarium specimens (Reddy et al. 1998). The GCG programs Gap, Pileup and the SeqLab interface for the Wisconsin Package Version 9.1 (Genetics Computer Group, Madison, WI) were used to analyse sequences, generate alignments and make manual adjustments. PAUP version 4b10 (Swofford 1999) was used for sequence similarity analysis of ITS1 data and for phylogenetic analysis of LSU and SSU sequences. PAUP's Base Frequency program was used to get the expected base frequency for each taxon and to do a Chi-square test for homogeneity of base frequencies across taxa. Preliminary analyses were conducted on all sequence regions using parsimony and distance options. Because of the lack of sufficient variability in SSU rDNA sequences and its failure to distinguish families *Phaeosphaeriaceae* and *Leptosphaeriaceae* (Rossman et al. 2002), the SSU region was not employed in further analyses to place *P. billsii* phylogenetically. MODELTEST (Posada, Crandall 1998) was used to establish the model of DNA evolution that best fit the data model for the LSU data (Treebase submission ID number SN2485; Akaike Information Criterion) and maximum likelihood analysis with 1000 replicates was performed (using PAUP) with the resulting model. The model used was TrNef+I+G; -lnL = 3679.6941, AIC = 7373.3882; base frequencies A = 0.2492, C = 0.2148, G = 0.2928; substitution model with rate matrix R (a) [A-C] = 1.0000, R (b) [A-G] = 2.2880, R(c) [A-T] = 1.0000, R (d) [C-G] = 1.0000, R (e) [C-T] = 7.0409, R (f) [G-T] = 1.0000; Among-site rate variation (I) = 0.4267, Variable sites (G) with gamma distribution = 0.8191.

MrBayes 3.0, a Bayesian phylogenetic inference program (Huelsenbeck, Ronquist 2001), was used to determine branch support (posterior probabilities). Bayesian analysis was run with four Markov chains Monte Carlo (three cold, one heated) for 1,000,000 generations, sampling every 100 generations (including the first generation). The trees that were not asymptotic (the first 50 trees) were discarded ("burn-in"; Huelsenbeck 2000). Bayesian analysis was done three times with a total of 29850 trees resulting. These trees were imported into PAUP and a 50% majority-rule consensus tree was produced to determine posterior probabilities. Support values are reported on the maximum likelihood tree (Fig. 10).

Taxonomy

Phoma billsii was found to be distinct from previously described species. Its features are outlined in the taxonomic description below.

Phoma billsii J. F. White **sp. nov.** **Figs. 1-9.**

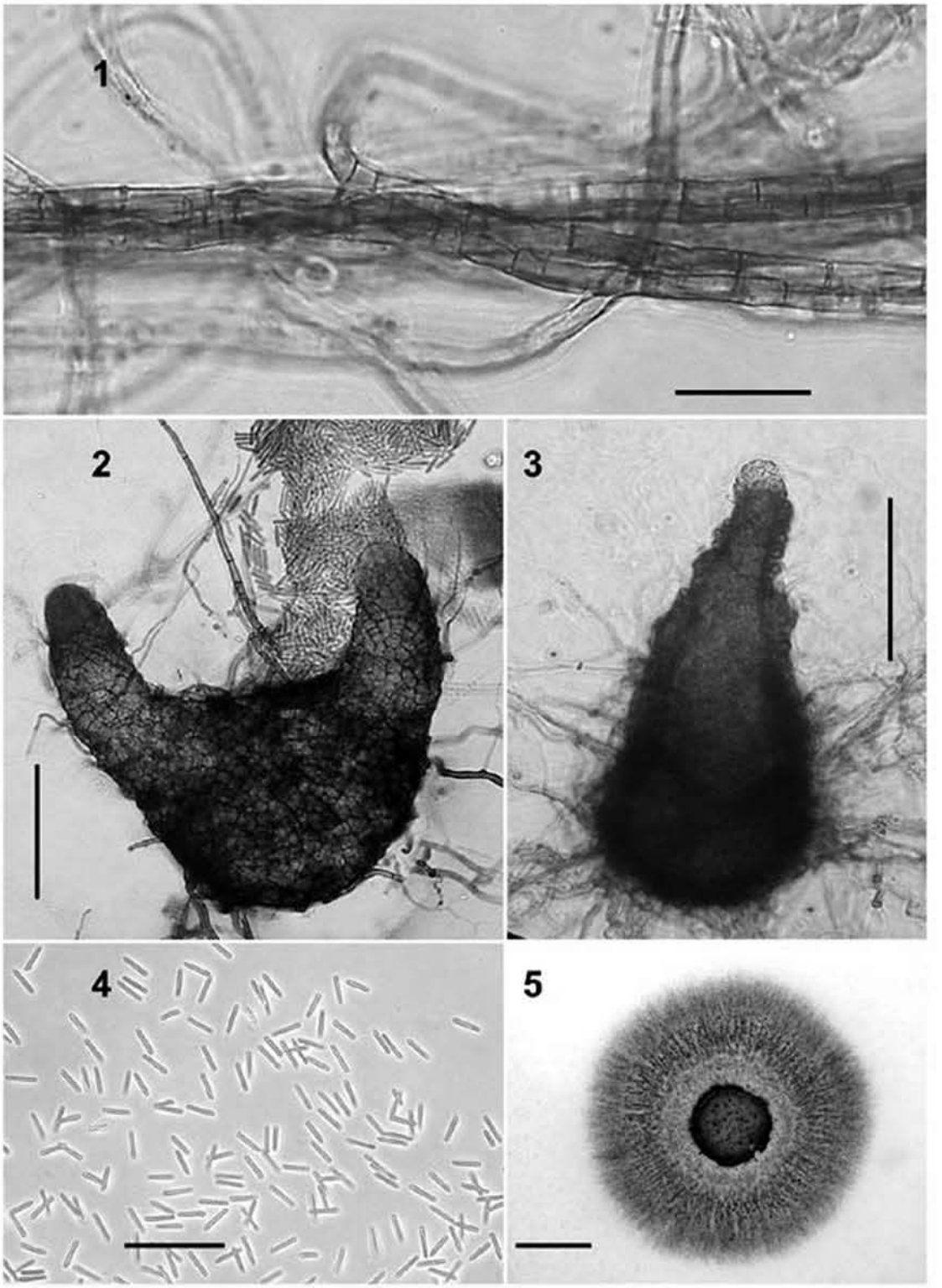
[Etym. *Phoma billsii* is named for the mycologist Dr. Gerald F. Bills]

Coloniae in agaro decocto tuberorum olivaceae, lanosae, margine sparsae, post 5 dies 23 °C ad 39 mm diametro, reverso negro. Mycelium ex hyphis septatis, ramosis, subhyalinis vel pallide brunneis, 1-8 µm crassis compositum. Pycnidia solitaria, ampulliformae, 1-2 rostrata, brunnea, partim immersa, pseudoparenchymatica, 1-2 ostiolata, 60-100 X 80-200 µm; paries cellularum isodiametricarum compositum. Cellulae conidiogenae hyalinae, simplices, ex cellulis interioribus parietis pycnidii, ampuliformes, 3-5 µm. Conidia enteroblastica, hyalina, simplicia, cylindrica, 3-4 X 11-14 µm. Holotypus hic designatus: Phoma billsii (RUTPP); ex-typus ATCC MYA3680.

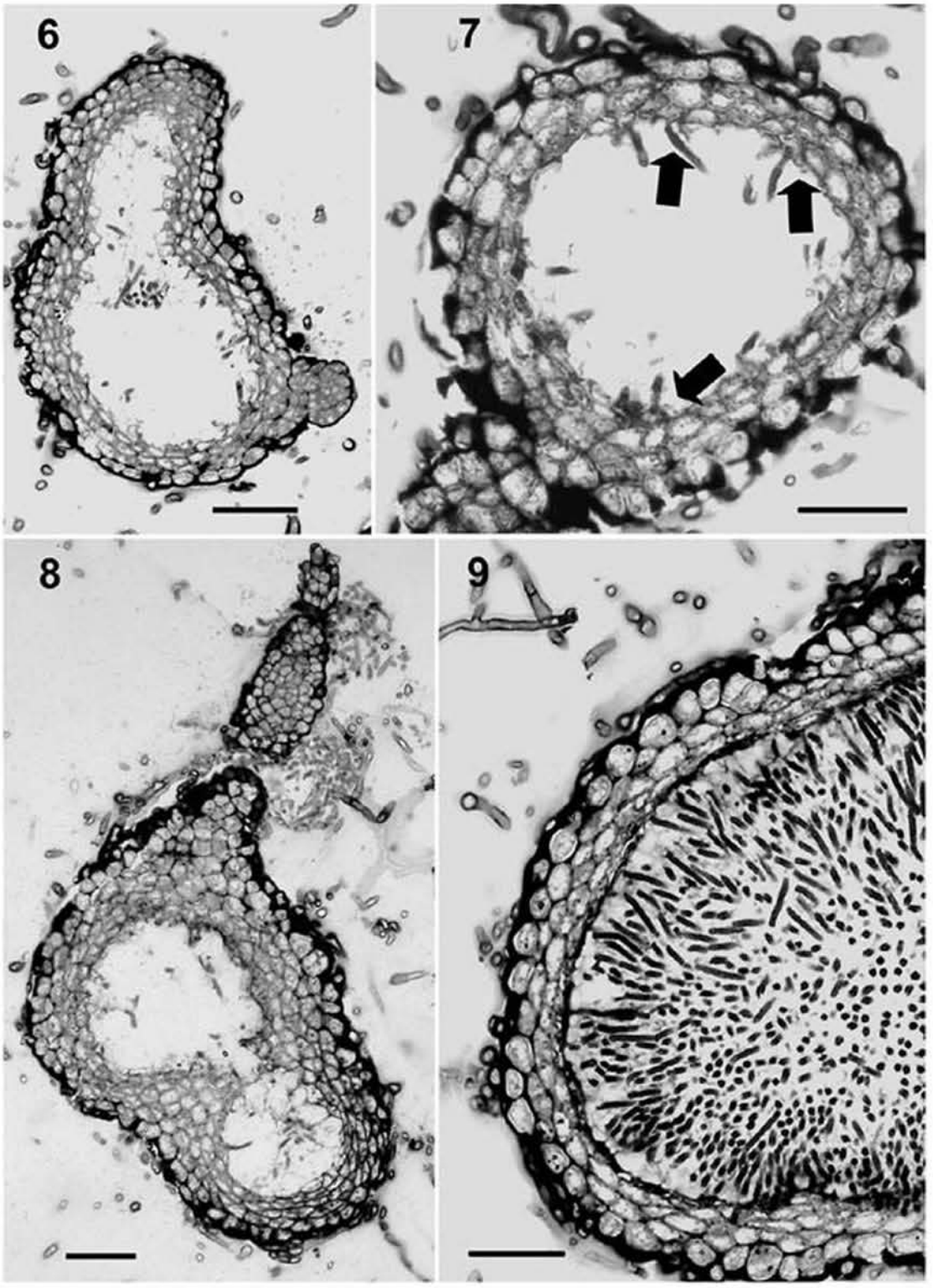
Technical Description: Colonies on MEA dark olivaceous, with sparse aerial mycelium, particularly in a wide marginal zone, attaining a diameter after 5 days of 37mm at 23 °C, reverse olivaceous; on PDA dark olivaceous, lanose aerial mycelium, black and stromatic beneath surface, margin thin and cream colored, attaining a diameter after 5 days of 39 mm, reverse black; on CCA colonies not pigmented, with sparse mycelium and almost no aerial mycelium, attaining a diameter after 5 days of 13 mm (after 30 days diameter 70 mm with abundant pycnidia), reverse not pigmented; on OA light olivaceous to brown, with sparse aerial mycelium, attaining 39 mm after 5 days (52 mm after 7 days), zonate, with inner zone 3-4 mm across and brown, middle zone 4-5 mm across and darker brown with abundant pycnidia, outer zone 4-5 mm across and light olivaceous with sparse pycnidia (Fig. 5), reverse zonate and similar to above but obscured by medium. On all media pycnidia produced abundantly through a meristogenous process, partly immersed in the agar, except in CCA where pycnidia were both deeply immersed and partially immersed in medium and formed along strands of roping melanized mycelium (Fig. 1) that tended to radiate from centers of colonies. Mycelium composed of septate, branched, subhyaline to pale brown, smooth 1-8 µm wide hyphae, sometimes aggregated into closely appressed strands (Fig. 1). Pycnidia solitary, flask-shaped, light brown to blackish brown, often partly immersed, pseudoparenchymatous, with 1 or 2 ostioles that when immature appeared to contain isodiametric multicellular occlusions (Figs. 2, 3), bearing necks ranging 80-100 µm long and 30-40 µm wide at the extreme tip, 60-100 X 180-200 µm; pycnidial wall composed of isodiametric to ellipsoidal cells 3-6 µm, 3-6 layers, 7-10 µm thick (Figs. 2, 6-9). Conidiogenous cells phialidic, hyaline, simple, smooth-walled, borne on the innermost cells of the pycnidial wall, subglobose to broadly flask-shaped, isodiametric in size, 3-5 µm (Fig. 7). Conidia enteroblastic, hyaline, simple, eguttulate to guttulate with 4-6 large guttules in a line through the length of conidia, cylindrical, obtuse at each end, smooth, aseptate, 3-4 µm wide by 11-14 µm long (Figs. 4, 9). No chlamydospores were observed on any medium although simple hyphal swellings were present. Teleomorph unknown. The sodium hydroxide spot test (Boerema et al. 2004) gave an immediate orange-rust pigment that faded after 15 min on OA cultures; but no color reaction on MEA. Holotype: *Phoma billsii*, isolated from a soil sample from Olowalu, Maui, Hawaii (RUTPP); ex-type ATCC MYA3680.

Discussion

Comparisons to similar species: This species is distinguished from other species classified in *Phoma* due to its cultural, morphological, and rDNA sequence differences. *Phoma billsii* bears similarity to *Phoma zeae-maydis* Punith. in conidial size and sodium hydroxide reaction (Punithalingam 1990; Boerema et al. 2004). However, *P. billsii* may be distinguished from it by: 1) pycnidia of *P. zeae-maydis* are not bi-rostrate; and 2) colonies of *P. zeae-maydis* on OA are colorless to grey with black sectors rather than concentrically zonate with brown and olivaceous green zones as observed in *P. billsii*. In addition, the teleomorph of *P. zeae-maydis* is *Mycosphaerella zeae-maydis* Mukunya & Boothr. Sequence analyses using LSU (Fig. 10) and ITS1 (Table 2) rDNA placed *P. billsii* in the *Didymella* group of *Phoma* species (100% branch support) rather



Phoma billsii. Figs. 1-5. Morphological and cultural features. 1. Hyphae from CCA showing roping mycelium (bar = 23 μm). 2. Bi-rostrate pycnidium from CCA medium (bar = 80 μm). 3. Pycnidium with a single ostiole showing the multicellular ostiolar plug (arrow; bar = 90 μm). 4. Conidia from CCA (bar = 60 μm). 5. Five-day-old colony on OA showing zonate character (bar = 8 mm).



Phoma billsii. Figs. 6-9. Pycnidial sections. 6. Section showing a uni-locular pycnidium (bar = 10 μm). 7. Section of pycnidium showing conidiogenous cells (arrows; bar = 10 μm). 8. Section showing bi-locular pycnidium (bar = 10 μm). 9. Section of pycnidium showing ventor filled with conidia (bar = 10 μm).

than in the *Mycosphaerella* clade. Using ITS1 rDNA, *Phoma americana* Morgan-Jones & J. F White was found to be most similar with a 98.5% sequence similarity (Table 2). *Phoma billsii* differs from this species in that *P. americana* possesses multicellular chlamydospores and conidia that are somewhat shorter 5-8 µm, although it is similar in other cultural features. None of the previously treated species of *Phoma* possess the suite of features exhibited by *P. billsii* (Boerema et al. 2004).

***Phoma* Section Placement:** Boerema (1997) and de Gruyter (2002) divided *Phoma* into nine sections: *Phoma* section *Phoma* Sacc. including species with ellipsoidal to cylindrical conidia and pycnidia that are pseudoparenchymatous; section *Heterospora* Boerema et al. that includes species characterized by possession of both large and small conidial sizes; section *Paraphoma* (Morgan-Jones & J. F. White) Boerema including species with pycnidia that bear seta-like appendages; section *Peyronellaea* (Goid. ex Togliani) Boerema including species with multicellular chlamydospores; section *Phyllostictoides* Žeberle ex Boerema including species where a minority of conidia develop septa; section *Sclerophomella* (Höhn.) Boerema et al. including species where pycnidia become thick-walled and sclerenchymatous; section *Plenodomus* (Preuss) Boerema et al. including species with thick-walled pycnidia; section *Macrospora* Boerema et al. including species with conidia that are notably elongated; and section *Pilosa* Boerema et al. including species with pilose pycnidia (Boerema 1997; Boerema et al. 2004). The species of the first six sections have teleomorphs, where known, in *Didymella* Sacc. (*Phaeosphaeriaceae*). Section *Plenodomus* has teleomorphs, where known, in the *Leptosphaeriaceae*. Section *Macrospora* teleomorphs, where known, are in *Mycosphaerella* Johanson (*Mycosphaerellaceae*). Section *Pilosa* has teleomorphs in *Pleospora* Rabenh. ex Ces. & de Not. (*Pleosporaceae*).

Based strictly on morphology *P. billsii* is placed in *Phoma* section *Macrospora* due to its elongate conidia. The type of section *Macrospora* is *P. zeae-maydis* with teleomorph *Mycosphaerella zeae-maydis*. However, the LSU analysis places *P. billsii* in a clade that contains *Didymella bryoniae* (100% branch support) (Fig. 10). *Phoma billsii* did not group with the *Mycosphaerellaceae* in any analysis. Further, the *P. billsii* ITS1 sequence was 96-98.5% similar to *Didymella lycopersici* Kleb., *P. americana*, *P. glomerata* (Corda) Wollenw. & Hochapfel, *P. macrostoma* Mont., and *P. multirostrata* (P.N.Mathur et al.) Dorenb. & Boerema (Table 2). This similarity is in line with species in the same genus. *Didymella bryoniae* and *D. lycopersici* were themselves only 96.3% similar to one another. These results suggest that *P. billsii* is likely derived from a *Didymella* sp. (*Phaeosphaeriaceae*), although without an observed teleomorph we cannot be certain. We propose that *P. billsii* should be classified as a large conidial species in section *Phoma* since its features and phylogenetic affinities most closely match this section (Fig. 10; Table 2). *Phoma herbarum* Westend. is the type of genus *Phoma* and section *Phoma* (Boerema et al. (2004).

Development of a Phylogenetic Context for Phoma: The genus *Phoma* is generally considered by most modern mycologists to be taxonomically problematical due to difficulties in distinguishing species from one another and uncertain phylogenetic affinities (Boerema 1970; Sutton 1980; Morgan-Jones 1988a; Reddy et al. 1998; Boerema et al. 2004; Hawksworth 2004). *Phoma*, as morphologically defined, is not a

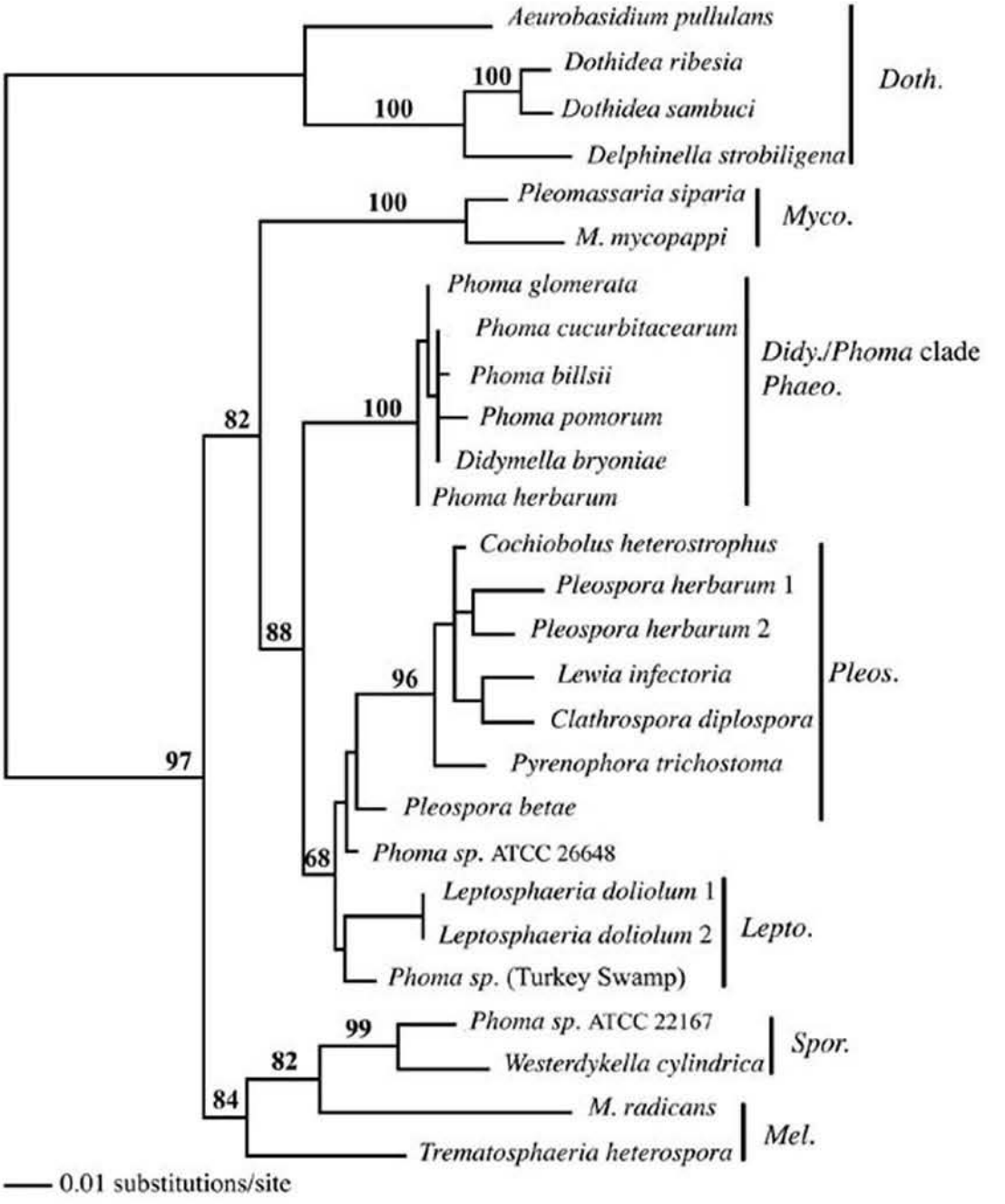


Fig. 10. Tree resulting from likelihood analysis of LSU region (best tree score = 2521.31987; hit 772 times of 1000 reps) with Bayesian branch support values mapped onto tree. The *Dothideales* were defined as outgroup. Families or orders are indicated on the tree to the right of species (*.Doth.=Dothideales; Myco.=Mycosphaerellaceae; Phaeo.=Phaeosph aeriaceae; Pleos.=Pleosporaceae; Lepto.=Leptosphaeriaceae; Spor.=Sporormiaceae; Mel.=Melanommataceae*). This analysis illustrates placement of *Phoma billsii* in a *Didymella/ Phoma* clade with 100% Bayesian support for the clade.

monophyletic genus, but instead consists of species that are distributed throughout the *Pleosporales* (Boerema et al. 2004; Fig. 10). It is possible that the *Phoma* anamorphic state was a feature of fungi in the lineage that gave rise to the *Pleosporales*. This would explain why *Phoma* anamorphs occur sporadically in several families of the *Pleosporales* (Boerema et al. 2004). Reliance on the *Phoma* anamorph to define the genus *Phoma* has resulted in a situation where classification in the genus carries little evolutionary information.

Table 2. Similarity matrix derived from the sequence data of the ITS1 region in seven species of *Didymella* and *Phoma*.

Taxa	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) *P. billsii*	---						
(2) *P. americana*	98.5	---					
(3) *P. macrostoma*	98	99.2	---				
(4) *P. glomerata*	98	98.8	99.2	---			
(5) *P. multirostrata*	97.1	98	97.1	96.7	---		
(6) *D. lycopersici*	96.1	96.7	96.7	95.9	96	---	
(7) *D. bryoniae*	93.5	94.6	95.4	94.6	94.6	96.3	---

Culture collections and sequence databases worldwide contain numerous representatives of fungi identified to genus *Phoma* (Bridge et al. 2003). These collections of *Phoma* are phylogenetically heterogenous. The system of classification of *Phoma* anamorphs could be improved by further evaluating all known species for their phylogenetic placement and establishing monophyletic groups. A very thorough sampling of taxa and phylogenetic analysis of *Phoma* species throughout the *Pleosporales* is needed to accomplish this end. It is our conviction that much can be added to the present framework of classification of *Phoma* and *Phoma*-like states by continuing to develop an understanding of the evolutionary history of *Phoma* and related groups.

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Hypoderma qinlingense sp. nov. on *Sabina squamata* from China*

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Abstract—Specimens of *Hypoderma* on *Sabina squamata* were collected during the survey of plant parasitic fungi at Mt. Qinling, Shaanxi Province, Northwest of China. Based on their morphological examinations, a new species, *H. qinlingense*, is described. This species is characterized by ascospores without gelatinous sheaths.

Key words—Ascomycete, *Rhytismatales*, taxonomy

Introduction

Since 1985, we have been investigating plant parasitic fungi on shrubs and trees at Mt. Qinling in Shaanxi Province, China. More than 5000 specimens of fungi were collected from more than 50 families of host plants, and about 480 species of fungi have been recorded from Qinling Mountains (Tian et al. 1991; Cao & Li 1999; Yang et al. 2000). Among them four specimens of an ascomycetous fungus on *Sabina squamata* (Buch.-Ham.) Antoine were collected and their morphological examinations showed that these specimens had immersed ascomata covered by the clypeus and opening by a single longitudinal split. Based on these morphological characteristics, we considered this fungus a member of *Hypoderma* De Not. (Darker 1967; Johnston 1989, 1990, 1994). When we compared the morphology of this fungus with the thirty other known *Hypoderma* species (Johnston 1990, 1991; Kirk et al. 2001; Lin et al. 2004), we found that this fungus has significant differences from previously reported species in morphological characteristics of ascomata and ascospores. Therefore, we described it as a new species.

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Description

Hypoderma qinlingense Y.M. Liang & C.M. Tian, **sp. nov.** **Fig. 1**

Ascocarpis sparsis in maculis griseo-brunneis, subcuticularibus, elevates, extus ellipsoideis, atris, 800 × 300 μm, fissura longitudinali dehisentibus, labiis brunneis; clypeis fere carbonaceis, extensis ad murum inferiorem bene evolutum; ascis clavatis, stipitatis, apice subtruncatis, cum poro vel obturamento non amyloideo, 52.5-92.0 × 10.5-13.0 μm; paraphysibus apice non aut leviter inflatis, rectis vel curvatis; ascosporis ellipsoideis usque oblongo-ellipticis, paulo curvulis, hyalinis, 0-1-septatis, non constrictis, sine vaginis gelatinis, 12.0-18.5 × 4.5-6.0μm; anamorphose ad Leptostroma sp., conidiis unicellularibus, hyalinis, bacillaribus, 4-5 × 1 μm.

Holotype here designated: on *Sabina squamata*, Mt. Taibai, alt. 3000-3300 m, Shaanxi, China, Aug 21, 1986, J. X. Yang, HMNWFC-86TB094, deposited in the Mycological Herbarium of the College of Forestry, Northwest Sci-Tech University of Agriculture and Forestry, China (HMNWFC). Isotype in the Mycological Herbarium of Beijing Forestry University (HMBFU-T0105).

Other specimens examined: on *Sabina squamata*, Mt. Taibai, Shaanxi, China, Sept 21, 1989, Tian and Yang, HMBFU-T0106, HMBFU-T0107.

Ascomata and conidiomata developing on the needle-leaves of host, in discrete scorched pale areas. These pale areas often not associated with black zone lines. In surface view ascomata 0.4-1.3 × 0.3-0.6 mm, elliptic in outline with rounded ends. Unopened ascomata with uniformly black walls. Ascomata opening by a single, longitudinal split, which is lined with a narrow, often indistinct yellow, brown, or dark brown zone. Conidiomata 0.1-0.3 mm diam., circular in outline, brown to dark brown, pustulate. Ascomata subcuticular. In vertical section, upper wall of the unopened ascomata up to 30-60 μm thick, narrower toward the edges. Wall comprising mostly brown to dark brown, angular cells, with a group of paler, thinner walled cells in the inside edges, along the fissure line of opening. In opened ascomata the upper walls up to 40-90 μm thick near the ascomatal opening, becoming either gradually or abruptly thinner towards the outer edge. Upper walls comprising dark tissue with no obvious cellular structure; cylindric, 30-50 μm long, thin-walled, hyaline to dark brown cells developing across exposed face of broken upper walls. Lower walls 15-25 μm wide, of dark brown, thick-walled cells. Paraphyses 1.5 μm diam., undifferentiated at apex, barely extending beyond asci. Asci 52.5-92.0 × 10.5-13.0 μm, clavate with basal stalk, tapering gradually to the rounded apex, walls at the apex sometimes slightly thickened and with indistinct central pore, 8-spored, spores extending two-thirds down the ascus, maturing successively. Ascospores 12.0-18.5 × 4.5-6.0 μm, slightly tapering towards rounded both ends, in side view slightly curved, 0-1septate, without gelatinous sheath.

Anamorph: conidiomata subcuticular, 0.2-0.3 mm diam., round in outline, dark brown to black, pustulate, subcuticular. Conidia 4-5 × 1 μm, oblong with rounded ends, or short-clavate, hyaline, 0-septate.

Discussion

Hypoderma are similar in many ways to some species of *Lophodermium* (Johnston 1989, 1990), but traditionally the two genera have been distinguished by the shape

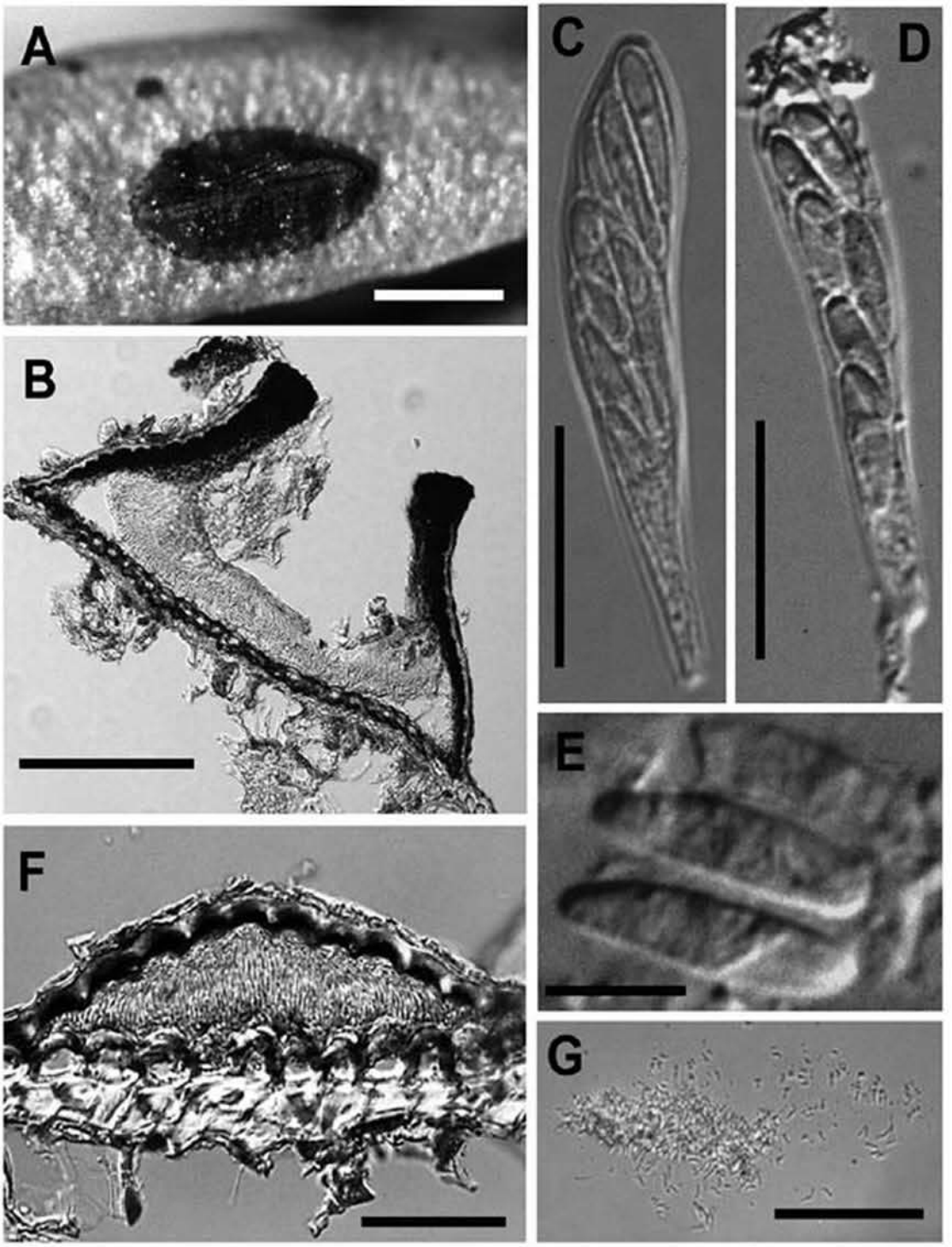

Fig.1. *Hypoderma qinlingense*. A. Ascoma on needle-leaf of *sabina squamata* (bar= 0.5 mm); B. Vertical section of ascoma (bar=150 μm); C-D. Asci (bar=30 μm); E. Ascospores (bar=8 μm); F. Vertical section of conidioma (bar=80 μm); G. Conidia (bar=35 μm).

of ascospores which are ellipsoidal to cylindrical in the former and long filiform in the latter genus (Cannon et al. 1986). In addition, species of *Hypoderma* have clavate asci with long stalks, while those of *Lophodermium* usually have cylindrical asci with relatively short stalks (Darker 1932, 1967; Minter et al. 1984; Powell 1974; Cannon

et al. 1983, 1986). However, Johnston (1990, 1991) redefined the genus *Hypoderma*, based on nine characters associated with ascomatal development and morphology and reported 13 species from New Zealand. We considered that *H. qinlingense* was identical with these characteristics.

Hypoderma qinlingense can be distinguished from other *Hypoderma* species by ascospores without gelatinous sheaths surrounding the entire spores when they were mounted in 3-5% KOH.

In the shape of ascospores, *H. qinlingense* is very similar to *H. rubi* (Pers.) DC. ex Chevall., *H. bihospitum* P.R. Johnst., and *H. cordylines* P.R. Johnst. However, *H. qinlingense* can be distinguished from above three species by size of its asci and ascospores. Asci of *H. qinlingense* (52.5-92.0 × 10.5-13.0 μm) are smaller than those of *H. rubi* (110-160 × 11-14 μm), and ascospores of *H. qinlingense* (12.0-18.5 × 4.5-6.0 μm) are also smaller than those of *H. rubi* (15-28 × 2.5-5.5 μm). Furthermore, the ascospores of *H. qinlingense* are uniform in shape at both ends, and elliptic or oblong-elliptic. The ascospores of *H. rubi* (Johnston, 1990) are wide near the center, tapering slightly to the rounded apex, and more markedly to the acute base than those of *H. qinlingense*.

Hypoderma bihospitum and *H. cordylines* can be distinguished from *H. qinlingense* in size of asci. These species have bigger asci (80-130 × 11-16 μm, and 90-140 × 11-16 μm, respectively) than those of *H. qinlingense*. In addition, the asci of *H. bihospitum* has no basal stalk and *H. cordylines* has bigger conidia (5-9 × 1μm) (Johnston, 1990) than those of *H. qinlingense* (4-5 × 1 μm).

In addition, *H. qinlingense* is parasitic on the needle-leaves of a conifer, though above mentioned three species are saprotrophic on the fallen leaves and dead stems of broad-leaved trees.

On the other hand, *Lophodermium juniperinum* (Fr.) De Not. [=*H. juniperinum* (Fr.) Kuntze] has been reported on *Sabina squamata* by Hou and Wang (1995) in China. However, *L. juniperinum* is different from this species, which has long stalks of asci and filiform ascospores. Furthermore, asci of *H. qinlingense* are smaller than those of *L. juniperinum* (110-130 × 15-17 μm), and ascospores of *H. qinlingense* are also smaller than those of *L. juniperinum* (70-90 × 2-3 μm). *Lophodermium juniperinum* was found on the fallen needle-leaves of *S. squamata*.

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MYCOTAXON

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Melanogaster utriculatus sp. nov. from Japan

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Abstract—A new *Melanogaster* species is described and illustrated: *M. utriculatus* from Japan. The relationship of the new species to other closely related species is discussed. A key to *Melanogaster* species from Asia is presented.

Keywords—Basidiomycetes, *Boletales*, taxonomy

Years ago the senior author visited the Forestry Sciences Laboratory, Corvallis, Oregon, USA to work on taxonomy of *Melanogaster* under the tutelage of Dr. J. M. Trappe. Examination of all available *Melanogaster* specimens in numerous herbaria from around the world revealed five new *Melanogaster* species from Asia. The senior author has described three of them with Chinese colleagues (Wang et al. 1995), these being *Melanogaster spinisporus* and *M. ovoidisporus* from China and *M. fusisporus* from China and Japan. A new species, *M. utriculatus* from Japan is described and illustrated in this paper. The type collection is deposited in OSC (Holmgren & Keuken 1974).

Melanogaster utriculatus Y. Wang, Castellano & Trappe **sp. nov.** **Figs 1-2**

Basidiomata dessicata usque ad 3 cm in diam, subglobosa, irregularia vel rugosa. Peridium brunneum, 300-400 µm crassum, minute tomentosum, basi rhizomorphis appressis, stratis duobus: epicutis hyphis intertextis croceis, 2-4 µm crassis; subcutis hyphis armeniacis, 5 µm crassis, cellulis inflatis usque ad 10-15 µm. Gleba atra venis avellaneis. Sporae laeves, (9-) 11-15 (-17) x (7-) 8-11 µm, late ellipsoideae

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vel obovoideae, utriculo hyalino, rugoso inclusae, singulatim obscure brunneae, aggregatae atrobrunneae.

Holotypus hic designatus: leg. N. Sagara (OSC Yoshimi #2237), Honshu, Kyoto, Iwakara, Japan, 24 October 1970.

Etymology: Latin, referring to the utriculate spores.

Sporocarp up to 3 cm in diam, subglobose, irregular to wrinkled, deep brown, minutely tomentose when dried; rhizomorphs concolorous, abundant and appressed at base. **Gleba** black, firm, hard when dried, marbled with pale brown trama; the locules rounded or irregular, filled with spores embedded in gelatinous matrix at maturity. **Peridium** up to 300-400 μm thick, two-layered: epicutis exuding a brown pigment in KOH, 15-20 μm thick of pale yellow-brown, thin-walled, compactly interwoven hyphae, 2-5 μm in diam; clamp connections abundant; subcutis 280-380 μm thick, of deep orange-yellow, thin-walled, interwoven hyphae, 2-5 μm in diam with many cells inflated 10-15 μm; clamp connections present. **Trama** of pale orange-yellow, interwoven hyphae, 4 μm in diam, with round inflated cells up to 10 μm in diam. **Spores** smooth, bilaterally symmetric, enclosed in a smooth to wrinkled, slightly inflated, or partially ephemeral utricle, (9-) 11-15 (-17) x (7-) 8-11 μm, broadly ellipsoid to obovoid, pyriform or subglobose; the base truncate-cupped, 2-2.5 μm in diam; walls 1-1.5 μm thick; in KOH dark brown singly, black-brown in mass; not distinctive in Melzer's reagent; utricle 0.5 μm thick but appearing thicker or inflated; **Basidia**: rehydrating poorly, hyaline, sphaeropedunculate, 4-spored, gelatinized at maturity.

On most spores of the holotype the utricle is smooth and tightly appressed to the spore wall, thus appearing to be the outer layer of a double wall. On some spores, however, it becomes wrinkled or inflated away from the spore wall, being revealed thereby as a true utricle. On apparently older spores the utricle flakes away. No other *Melanogaster* species has been described as having utriculate spores.

Key to species of *Melanogaster* from Asia

1. Spores spiny or with utricle 2
1. Spores smooth 3

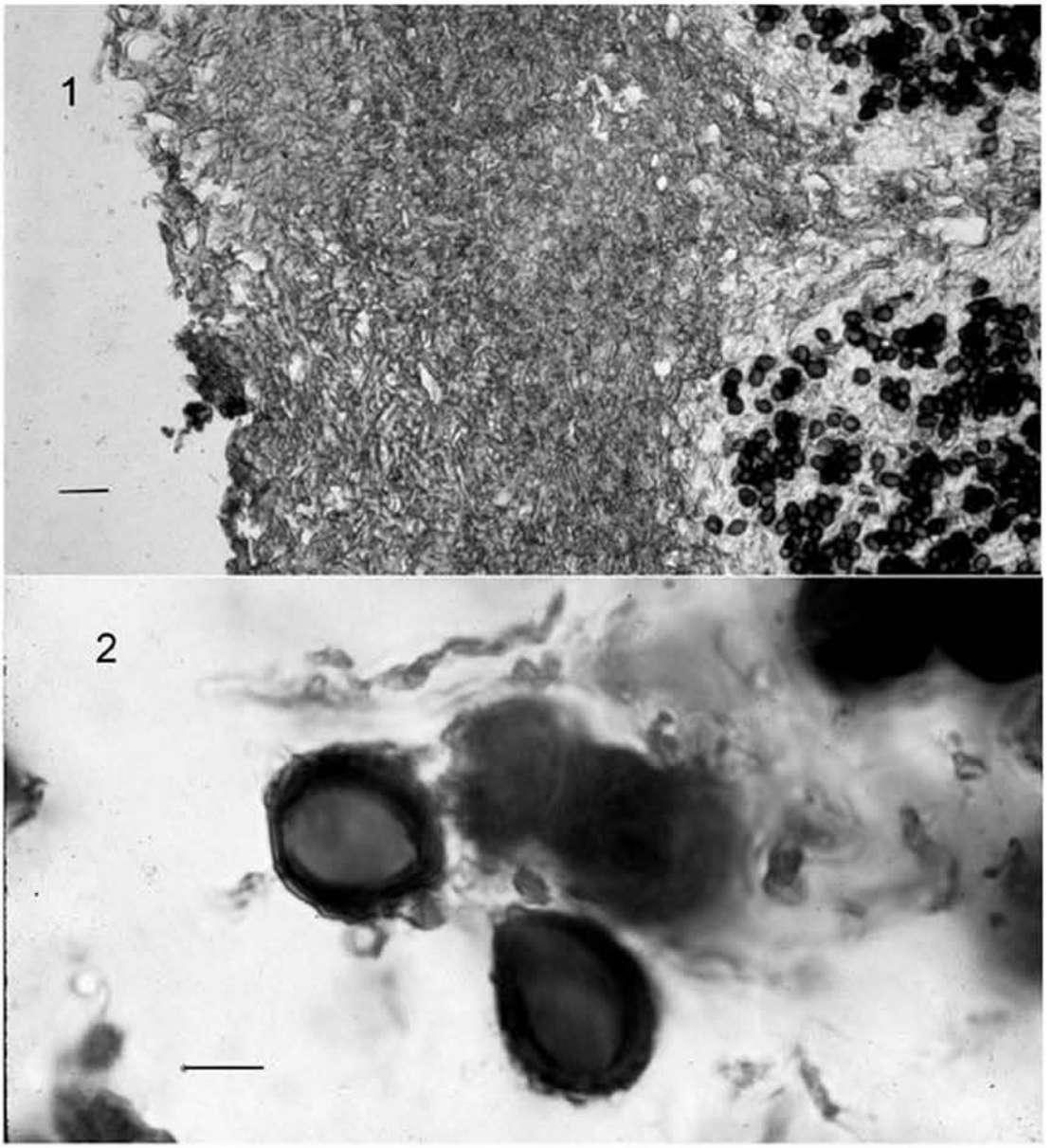
2. Spores minutely spiny ..... ***M. spinisporus***
2. Spores with appressed or inflated utricle ..... ***M. utriculatus***

3. Spores fusoid; basidia with 2-4 spores 4
3. Spores not fusoid; basidia with 4-8 spores 6

4. Spores longer than 13 μm long ..... ***M. trappei***
4. Spores shorter than 13 μm long 5

5. Peridium prosenchymatic, spores (8-) 10-11 (-15) x 6.5-7 (-9) μm ..... ***M. natsii***
5. Epicutis prosenchymatic, subcutis pseudoparenchymatous, spores (10-) 11.5-13(-15) x (5-) 5.5-6 (-6.5) μm ..... ***M. fusisporus***

6. Spores subglobose to globose, 8-10 (-11) x 7-8 (-9) μm ..... ***M. subglobosporus***
6. Spores ovoid, (5-) 5.5-6.5 (-7) x (3.5) 4-5 (-5.8) μm ..... ***M. ovoidisporus***



Figs. 1-2. *Melanogaster utriculatus* (Yoshimi #2237). **Fig. 1.** Peridial section, bar = 32 μm. **Fig. 2.** Spores, bar = 6 μm.

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A study of wood decaying macrofungi of the western Black Sea Region, Turkey

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Abstract — This study was based on specimens of macrofungi collected on field trips to the region between 1998 and 2000. A list of 80 species belonging to *Ascomycotina* and *Basidiomycotina* has been compiled and 7 species were added to the Turkish mycoflora as new records. The complete checklist to species can be viewed on the RBGE website : http://rbg-web2.rbge.org.uk/mycotaxon/50428.pdf.

Key words — lignicolous, saprophytic, parasitic

Introduction

Since the western Black Sea Region has a mild oceanic climate, wood-decaying fungi can be found throughout the year. Coniferous broad leaf forests cover large areas of the region, providing good growing conditions and substrate for wood rotting fungi. Trees growing in sheltered valleys and near streams are particularly suitable habitats for these fungi. A list of wood decaying fungi from Turkey has been published by Baytop (1994). Other studies were carried out by a number of workers in various parts of Turkey (Pilat 1932, 1933; Lohwag 1957, 1964; Selik 1973; Kotlaba 1976; Sümer 1977, 1982; Abatay 1983, 1985). One of these studies (Sümer 1982) also covered parts of the western Black Sea Region, especially Bolu district. Because of the ecological properties of the area and the scarcity of data, especially in respect of wood decaying macrofungi, we decided to carry out a detailed study to determine the occurrence and distribution of these organisms in the entire western Black Sea Region. The area consists of seven provinces (Bolu, Düzce, Karabük, Kastamonu, Sinop, Zonguldak, and Bartın; see fig. 1), and represents the largest study area of this kind in Turkey to date. It was also intended to make a contribution to the mycoflora of Turkey as a whole.

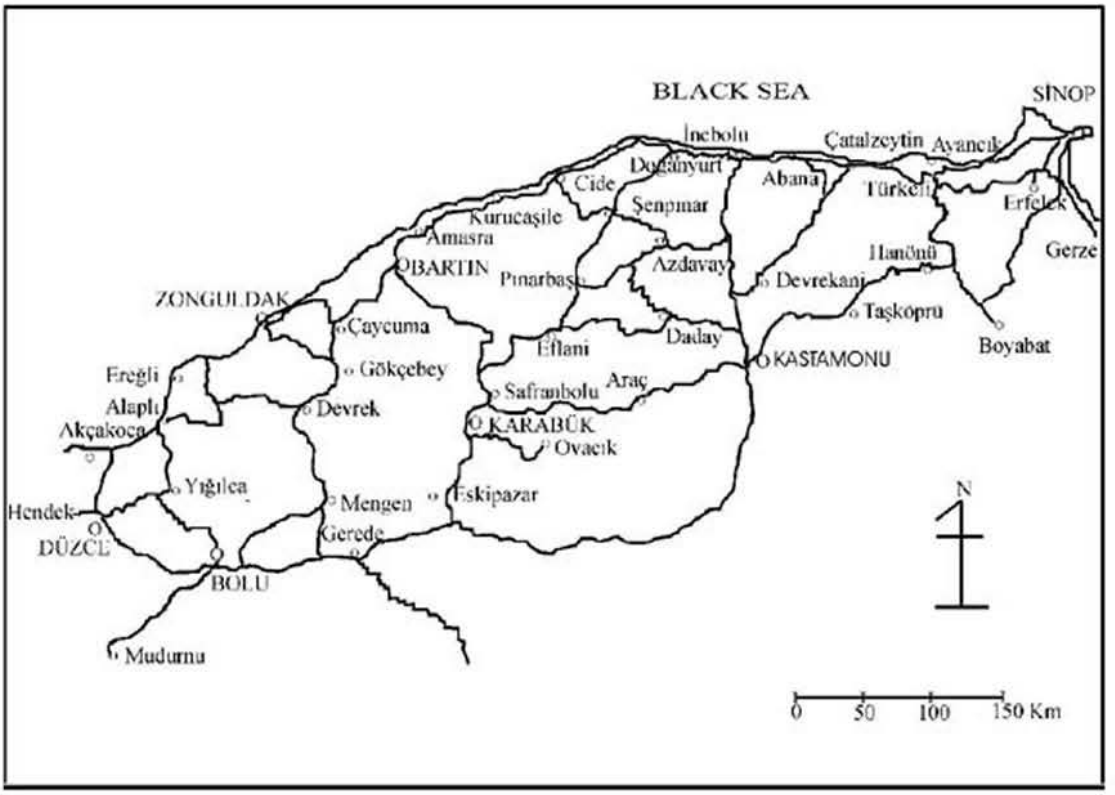

Figure 1: Map of the study area.

Materials and Methods

Specimens were collected during field work 1998-2000. The morphological properties and ecological conditions of the specimens were recorded in the field, and samples were taken to the laboratory for microscopical examination and the preparation of herbarium voucher specimens. We used the following literature for identification: Phillips (1981), Marchand (1971-1986), Breitenbach & Kränzlin (1984–1991), Michael et al. (1983–1988), and Dähncke (1993). Voucher specimens are kept at Selçuk University, Education Faculty Herbarium (KNYA).

Results

Our study recovered 80 species of wood decaying fungi. Of these 25 were recovered from coniferous trees, 51 from broadleaved trees, and 3 from either broadleaved or coniferous trees and one from litter. A total of 11 species were identified as primary parasites. Particularly rare and unusual findings were: *Hericium erinaceus*, *Trametes gibbosa*, *Crucibulum laeve*. Conversely, *Schizophyllum commune* was the most common species. *Armillaria borealis*, *Lentaria delicata*, *Pholiota lenta*, *Pluteus tricuspidatus*, *Pl. umbrosus*, *Tremella encephala* and *Xerula pudens* are new records for the Turkish mycoflora.

Discussion

This study recovered 80 species of wood decaying macrofungi from the western Black Sea Region of Turkey. They belong to the two divisions Ascomycotina (2 species) and

Basidiomycotina (78 species). Several species were living on dead tree-stumps, trunks, branches, leaf or needle litter and are decaying them. This contributes significantly to nutrient recycling in nature. Some live as parasites on live trees and cause organic product loss and structural damage to host trees. *Armillaria mellea*, *A. ostoyae*, *A. tabescens*, *Fomes fomentarius*, *Ganoderma lucidum*, *Fomitopsis pinicola*, and *Lenzites betulina* are particularly important as parasitic species. Similar studies in neighbouring regions have shown comparable findings with the data obtained in this study. Previous to this study the following species had been reported from the area and neighbouring regions: Lohwag (1964) reported *Stereum*, *Ganoderma* and *Phellinus* species from Belgrad forest. Sümer (1982) reported *Stereum*, *Ganoderma*, *Polyporus*, *Trametes* and *Mycena* species from the western Black Sea Region as wood decaying species. Abatay (1983) recorded *Trametes*, *Polyporus*, and *Stereum* species as wood parasites from the eastern Black Sea Region. He (1988) also reported some other species such as *Armillaria*, *Pholiota* and *Polyporus* species growing in different ecological conditions. Niemelä and Uotila (1977) reported some lignicolous fungi on wood in Turkey. Allı and Işıloğlu (2000) reported 34 parasitic macrofungi in Muğla province. Although previous reports agree with our findings, they were not as detailed as our research. Furthermore, our research area is larger than that of other researchers, consequently contributing more records.

The wood decay fungi *Pleurotus ostreatus* and *P. pulmonarius* are known as edible mushrooms that are collected and consumed by local people. The other edible wood-decay fungi are not recognised or valued locally.

With this study, seven wood-decay species are added to the Turkish mycoflora as new records.

Acknowledgments

The authors wish to thank TUBITAK (Turkish Scientific and Technical Research Council) for supporting this project (TBAG-1659) financially and Prof Işıloğlu for reviewing this article.

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The species of *Entyloma* (Ustilaginomycetes) on *Convolvulaceae*

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Abstract—The species of *Entyloma* on *Convolvulaceae* are reviewed. *Entyloma convolvuli* on *Calystegia soldanella* is known only from type locality in Portugal, Europe. *Entyloma martindalei* is proposed as a new combination based on *Protomyces martindalei* described from hypertrophied clusters of flowers and enlarged stems of *Cuscuta gronovii* in North America. The name *Protomyces martindalei* is lectotypified. A key to *Entyloma* species on *Convolvulaceae* is provided.

Key words—smut fungi, taxonomy, *Protomycetaceae*

Introduction

The species of the genus *Entyloma* de Bary are characterized by sori that form spots, rarely swellings, in various vegetative parts of dicotyledonous host plants such as leaves and stems. The hyaline, yellow or pale brown spores are arranged singularly or agglutinated in irregular groups, and usually have smooth walls of various thickness. Nearly half of the known *Entyloma* species occur on representatives of *Asteraceae*. The remaining families are parasitized by fewer species, respectively (Begerow et al. 2002).

The sole known species of *Entyloma* on *Convolvulaceae* was *Entyloma convolvuli* on *Calystegia soldanella*. However, recent examination of type specimens of *Protomyces martindalei* Peck on *Cuscuta gronovii* revealed characters of the genus *Entyloma*. It is not surprising because in the past many species described as *Protomyces* Unger turned out to be smut fungi, some examples follow: *P. ari* Cooke is *Melanustilospora ari* (Cooke) Denchev, *P. endogenus* Unger is *Melanotaenium endogenum* (Unger) de Bary, *P. calendulae* Oudem. is *Entyloma calendulae* (Oudem.) de Bary, *P. fergussonii* Berk. & Broome is *E. fergussonii* (Berk. & Broome) Plowr. and *P. microsporus* Unger is *E. microsporum* (Unger) J. Schröt.

The genus *Cuscuta* L. is sometimes included in the separate family *Cuscutaceae* but usually it is treated as member of the *Convolvulaceae*. The two currently known *Entyloma* species on the *Convolvulaceae* are described as follows:

Taxonomy

Entyloma convolvuli Bres.
in Torrend, Broteria 4: 211. 1905.

Type on *Convolvulus soldanella* L. [=*Calystegia soldanella* (L.) Roem. & Schult.], Portugal, near Setubal, Serra da Arrabida, Vale de Pixaleiro, *C. Torrend* (type ubi?).

Sori in leaves as orbicular to oblong spots, reddish on the lower surface and paler red on the upper surface, reddish-brown on the margins. Spores intercellular, globose, yellowish, mostly 14–15 μm in diameter; wall thin, brownish, not layered. Mycelial hyphae hyaline to straw-yellow, ramified, 1.5 μm wide. Anamorph not seen.

On *Convolvulaceae*: *Calystegia soldanella* (=*Convolvulus soldanella*). Known only from the type locality in Portugal.

COMMENTS — Vánky (1994: 88) did not find the type specimen in any of the major herbaria in Portugal, and he composed the description of this species from the original description by Bresadola (in Torrend 1905) and from the description by Zundel (1953: 244). The description of Vánky (1994: 88) is given here.

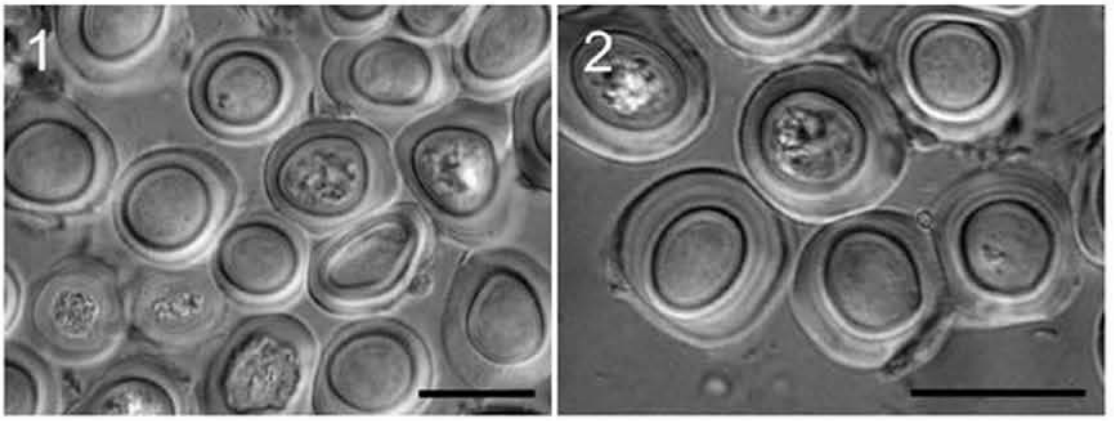
Entyloma martindalei (Peck) Piątek, **comb. nov.** **FIGURES 1–2**
Basionym: *Protomyces martindalei* Peck, Bull. Torrey Bot. Club 5: 2-3. 1874.

Type on *Cuscuta gronovii* Willd. ex Roem. & Schult., U.S.A., New Jersey, near Camden, autumn, *J. C. Martindale* [lectotype (***hic designatus***): NYS!; isolectotypes: NYS!, BPI n.v.].

Sori in much hypertrophied, pale clusters of flowers and also in much enlarged parts of the stems, filled by whitish coloured mass of spores. Spores numerous, intercellular, globose, subglobose, commonly irregular, (17–)18–20(–24) × (15–)17–19(–22) μm, hyaline or yellowish, adhering in irregular groups, sometimes covered by hyaline gelatinous layer; wall smooth, thick, often unequal, 3–5 μm wide, thickest at the angles, even up to 10 μm wide, sometimes with short hyphal remains. Anamorph not seen.

On *Convolvulaceae*: *Cuscuta gronovii*. Known only from the type collections in the U.S.A.

COMMENTS — This species has been described by Peck (1874) as *Protomyces martindalei* based on specimens collected by J. C. Martindale near Camden in New Jersey, U.S.A. Reddy and Kramer (1975) in their monograph of *Protomycetales* excluded this species from this group because "spores are too small (18 μ) for *Protomyces*, and the host, *Cuscuta gronovii* appears unlikely for *Protomycetaceae*". Nevertheless, they did not propose any other genus for this species. The morphological features of spores, they shape and size are characteristic for the genus *Entyloma*. Accordingly, its transfer to this genus is proposed. It should be noted that the spores of *E. martindalei* are large in comparison with most other species of *Entyloma*, which have smaller spores, usually no more than 15 μm in diameter. However, there are several species in *Entyloma*, which have at least some percentage of spores exceeding 20 μm in diameter, some examples are *Entyloma magnusii* (Ule) Woronin, *E. microsporum* and *E. sonchi* Vánky (Vánky 1994).



Figs 1–2. Spores of *Entyloma martindalei* on *Cuscuta gronovii*, in LM (lectotype: NYS). Bars = 20 μm.

In his protologue for *Protomyces martindalei*, Peck (1874) did not select a type specimen. Charles H. Peck's collection is preserved in NYS where there are two specimens of *Protomyces martindalei*, bearing almost identical labels. One of them is marked as "type" and the other as "?isotype" but the handwriting and shade of pencil differ from the remaining part of the labels, and it appears that these words were written later. The former specimen is here chosen as the lectotype since it is more abundant and marked as "type", and the latter specimen as an isolectotype. The other isolectotype is probably preserved in BPI because the specimen identified as *Protomyces martindalei* is included in the "specimens database" of this herbarium (http://nt.ars-grin.gov/fungaldatabases/specimens/specimens.cfm) with almost identical data as in the protologue (the only exception is presence of the date in the collection in BPI: September 1873), but this specimen was not seen during the present study.

Key to the *Entyloma* species on *Convolvulaceae*

1. Spores about 14–15 μm in diameter, wall thin. On *Calystegia* ..... ***E. convolvuli***
1* Spores about 17–20 μm in diameter, wall thick. On *Cuscuta* ..... ***E. martindalei***

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Three new rust species (*Uredinales*) from Turkey

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Abstract— This paper describes and illustrates three new rust species, *Phragmidium hendersonii* on *Potentilla*, *Puccinia gjaerumii* on *Bellardiochloa polychroa* and *Puccinia asyneumatis* on *Asyneuma amplexicaule*.

Keywords—microfungi, new taxa, parasite

Introduction

Approximately three hundred and twenty rust fungi are known in Turkey (Bahçecioğlu 1998, 2001; Bahçecioğlu & Isıloglu 1995; Bahçecioğlu & Gjærum 2003, 2004; Kabaktepe & Bahçecioğlu 2005; Bahçecioğlu & Yıldız 1996, 2005; Henderson 1959, 1961, 1964; Tamer et al. 1998). With this new study, three new rusts have been added to the Turkish rust flora.

Materials and methods

Specimens cited here were collected in the years 2002-2004 in Kahramanmaras and Ordu provinces. Spores were mounted in lactophenol. Host names follow the "Flora of Turkey and Aegean Islands" by Davis (1968–1985) and Davis et al. (1988). The specimens are preserved in the herbarium of Inönü University.

Phragmidium hendersonii Bahç. & Kabaktepe, **sp. nov.** **Fig. 1**

Etymology: in honour of Prof. Dr. D.M. Henderson.

Pycnia et aecia ign1ota. Uredinia hypophylla, dispersa, brunnea. Urediniosporae 18-30 x 16-20 µm, globoideae, ellipsoideae, vel ovoideae, pariete 1-2 µm crasso, luteolo, verruculoso, cum 3 poris germinationis dispersis. Telia urediniis similia, sed atra, cum paraphysibus clavatis, pariete 1-1.5 µm crasso, hyalino. Teliosporae 44-110 x 20-26 µm, 3-7 cellulares (raro 1-2), cylindraceae, ad septum leviter constrictae, basim versus rotundatae, quoque cellula aequalis, ad apicem dilatatae, generaliter praecipue apice

obtuse papillatae, pariete laevi, 2-3 µm crasso, castaneo-brunneo, quoque cellula poro 1 (raro 2), pedicello persistenti, usque ad 220 µm longo, deorsum incrassato vel non, hyalino vel dimidius colorato.

Pycnia and aecia not seen. Uredinia hypophyllous, scattered, brown. Urediniospores 18-30 x 16-20 µm, globoid, ellipsoid, ovoid, wall 1-2 µm thick, yellow, verruculose with 3 scattered pores. Telia similar to uredinia, but black, with clavate paraphyses, walls 1 µm thick, hyaline. Teliospores 44-110 x 20-26 µm, 3-7 (rarely 1-2) celled, cylindric, slightly constricted at the septa, rounded at base, cells almost equal in size except for the larger uppermost one, generally bluntly papillate at apex, rarely absent, wall smooth, 2-3 µm thick, chestnut brown, with 1 (rarely 2) pore upper part of each cell. Pedicel up to 220 µm long, of equal thickness or swelling at base, upper part pigmented, at base hyaline or slightly pigmented.

Holotype here designated: Z. Bahçecioğlu 3830 (Inönü), Turkey, Kahramanmaras, 2-3 km from Andırın to Cıgsar, 1300 m, 20. Aug. 2004, on *Potentilla* sp. (*Rosaceae*). Isotype in NCRI.

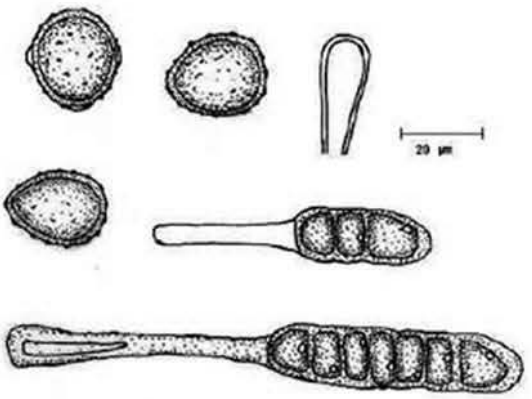

Fig. 1. *Phragmidium hendersonii*. Telio-, urediniospores and paraphysis from type.

The teliospores in the present specimen differ from those in *Phr. potentillae* (Pers.) P. Karst. by having 7 cells, each with 1 pore (rarely 2), by being slightly constricted at septum and the bigger size.

Phr. potentillae has been reported on the present host from America, Finland, Germany, Great Britain, Italy and Turkey.

Puccinia asyneumatis Bahç. & Kabaktepe, **sp. nov.** **Fig. 2**

Etymology: from *Asyneuma*, a genus in Campanulaceae.

Pycnia et aecia ignota. Uredinia hypophylla, rariter epiphylla, dispersa, pulverulenta, brunnea. Urediniosporae 20-28 x 18-22 µm, globoideae, ellipsoideae, pariete 1.5-2.5 µm crasso, cinnamomeo-brunneo echinulato, cum 2-4 poris germinationis dispersis. Telia urediniis similia. Teliosporae 26-34 x 16-20 µm, ellipsoideae, oblongus, rariter basim versus attenuatae, ad septum leviter constrictae, pariete 1-2 µm crasso, brunneo, leviter verruculoso, poro superiore apicali, poro inferiore prope septum, poris hyalinis papillis tectis, pedicello hyalino, fragili.

Pycnia, aecia not seen. Uredinia hypophyllous, rarely epiphyllous scattered, pulverulent, brown. Urediniospores 20-28 x 18-22 μm, globoid, ellipsoid, wall 1.5-2.5 μm. thick, cinnamon brown, echinulate with 2-4 scattered pores. Telia similar to uredinia. Teliospores 26-34 x 16-20 μm, ellipsoid, oblong, rounded at both ends or rarely attenuate at base, slightly constricted at septa, wall 1-2 μm thick, brown, slightly verruculose, upper pore apical, lower pore at septa, with a minute hyaline papilla at apex, pedicel hyaline, fragile.

Holotype here designated: Sanli Kabaktepe 2441 (Inönü), Turkey, Ordu, 10 km. from Mesudiye to Golkoy, 1150 m, 05. Jul. 2003, on *Asyneuma amplexicaule* (Willd.) Hand.-Mazz. (*Campanulaceae*). Isotype in NCRI.

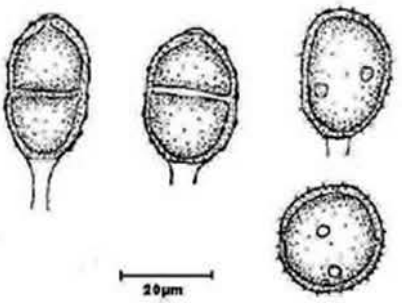

Fig. 2. *Puccinia asyneumatis*. Telio- and urediniospores from type.

To our knowledge no *Puccinia* has previously been described on this host genus. The teliospores of the present species are smilar to those in *P. campanulae* Carmich. but have a dark coloured teliospore wall and urediniospores.

Puccinia gjaerumii Bahç. & Kabaktepe**, sp. nov.** **Fig. 3**

Etymology: in honour of Dr. Halvor B. Gjærum.

Pycnia et aecia ignota. Uredinia hypophylla, rariter epiphylla dispersa, pulverulenta, aparaphysata, brunnea. Urediniosporae 22-26 x 18-22 µm, globoideae vel subgloboideae, pariete 2-4 µm crasso, luteolo, verruculoso, cum 2-3 poris germinationis aequatorialibus vel subaequatorialibus. Telia urediniis similia sed atro-brunnea. Teliosporae 28-40 x 18-24 µm, ellipsoideae, basim versus rariter attenuatae, ad septum leniter vel non constrictae, pariete 1.5-3 µm crasso, apice usque ad 6 µm, luteolobrunneo, laevi, poro superiore apicali, poro inferiore prope septum, apicaliter inconspicue papillato pedicello hyalino vel luteolo, persitenti, usque ad 90 µm longo, sporae unicellulares 20-24 x 16-20 µm, subgloboideae, pedicello usque ad 34 µm longo, hyalino.

Pycnia, aecia not seen. Uredinia hypophyllous, rarely epiphyllous, scattered, pulverulent, lacking paraphyses, brown. Urediniospores 22-26 x 18-22 μm, globoid or subgloboid, wall 2-4 μm thick, yellowish, verruculose, with 2-3 equatorial or subequatorial pores. Telia similar to uredinia but dark brown, teliospores 28-40 x 18-24 μm, ellipsoid, oblongrounded at both ends or rarely attenuate at base, slightly constricted at septa or not wall 1.5-3 μm thick, at apex up to 6 μm, yellowish brown, smooth, upper pore apical, lower pore at septa, slightly papillate. Pedicel hyaline or yellowish, persistent, up to 90 μm. One-celled spores 20-24 x 16-20 μm, subgloboid, pedicel up to 34 μm, hyaline.

Holotype here designated: S. Kabaktepe 2028 (Inönü), Turkey, Ordu, 8 km. from Kabatas to Catalpinar, 550 m, 18. Sep. 2002, on *Bellardiochloa polychroa* (Trautv.) Roshev. (*Poaceae*). Isotype in NCRI.

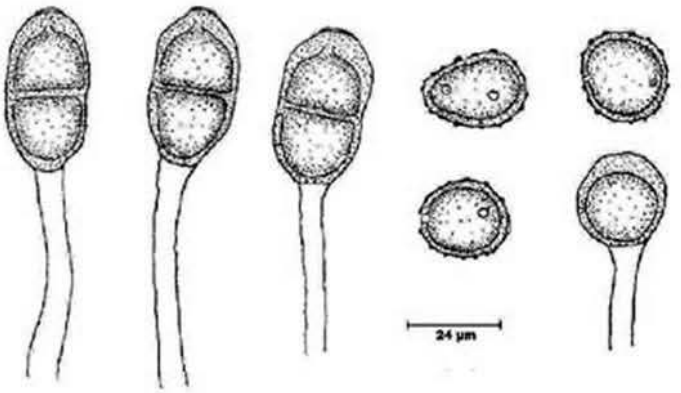

Fig. 3. *Puccinia gjaerumii*. Telio- urediniospores and mesospore from type.

To our knowledge, no rust has previously been described on this genus. The teliospores differ from those of *Puccinia moliniae* Tul. by teliospores slightly constricted and with hyaline apical papillae.

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Plenodomus morganjonesii sp. nov. and a discussion of the genus *Plenodomus*

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Abstract—*Plenodomus morganjonesii* was obtained from partially degraded leaves from New Jersey. It is described as a new species based on morphological, cultural and molecular characters that differ from other species to which it is similar. Analysis of the large subunit 28S rDNA sequences suggested that this new species is related to members of the family *Leptosphaeriaceae* in the *Pleosporales*. Separation of *Plenodomus* from *Phoma* is advocated in order to produce monophyletic genera of coelomycetes.

Key words—*Phoma, Pleosporales*, scleroplectenchyma, taxonomy

Introduction

The phylogenetically based classification of anamorphic forms of fungi for which no teleomorph is known has been a problem since the beginnings of systematic mycology (Fries 1828; Saccardo 1880; Grove 1935; Alexopoulos et al., 1996). The difficulty is compounded in groups of fungi such as *Phoma* Sacc. where there are limited morphological characters and they are associated with teleomorphs in different families, including *Leptosphaeriaceae, Melanommataceae, Phaeosporaceae*, and *Pleosporaceae* (Sutton 1980). The current system of classification of phomoid anamorphs places them in a single genus *Phoma* which is divided into different sections based on morphology and teleomorph connections (Boerema 1997; Boerema et al., 2004; Grondona et al., 1997; Rai 1998). This morphologically-based system is functional but requires considerable expertise to use and results in a highly polyphyletic genus *Phoma* (Bridge et al., 2003; Hawksworth 2004). The use of morphological and molecular characters to develop a phylogenetic basis for defining genera of phomoid fungi will further the establishment of monophyletic anamorph genera. Identification of phomoid fungi could be enhanced by the development of a largely DNA sequence-based system.

In a phylogenetic and developmental study of *Phoma lingam* (Tode:Fr.) Desm. and *P. wasabiae* Yokogi, Reddy, Patel, and White (1998) proposed segregation of phomoid species with teleomorphs in the *Leptosphaeriaceae* into genus *Plenodomus* Preuss. This separation was based on molecular analysis and developmental and morphological features of the pycnidia. Reddy et al., (1998) further proposed that *Phoma* should be restricted to species that grouped in the *Didymella/Phoma* clade in the *Phaeosphaeriaceae*.

In this study we studied the morphological, developmental, and cultural features of a phomoid species and evaluated its phylogenetic placement using large subunit rDNA sequences. Based on our results we have determined that this is a new species and we describe it in the genus *Plenodomus*.

Materials and Methods

Fungal Material: Isolates of *Plenodomus morganjonesii* were obtained from decaying leaves collected by J. F. White and Gerald Bills in 1998 in a swamp in Turkey Swamp Park, in Monmouth County, New Jersey. The isolation was made using the particle filtration technique (Bills et al., 2004). For this study cultures were grown on potato dextrose agar (PDA). Specimens were obtained from the American Type Culture Collection (ATCC) (Table 1) for comparison. They were revived in potato dextrose broth and subsequently plated on PDA. Cultures were maintained at approximately 23 °C in an irregular light (florescent room lighting)/dark cycle. Dried cultures of all collections were submitted to the Rutgers University Plant Pathology Herbarium (RUTPP) and representative cultures were sent to the ATCC in Manassas, Virginia.

Cultural studies: Isolates of the new species were grown on oatmeal agar (OA), malt-extract agar (MEA), and PDA, prepared as outlined by Boerema et al. (2004). In addition we grew them on czapek cellulose agar (CCA) to stimulate pycnidial production. The CCA medium contained the following: fibrous cellulose powder (Watman) 10g, sodium nitrate 2g, dipotassium phosphate 1g, magnesium sulfate 0.5g, potassium cloride 0.5g, ferrous sulfate 0.01g, bacto-agar 15g, distilled water 1 liter. All media were inoculated with 7mm plugs taken from the margins of colonies growing on CCA plates. Plates were maintained at 23 °C in an alternating light/dark cycle and examined after 5 and 7 days of growth. Descriptions represent observations after 5 days (but all of the colony diameters in the description are at 7 days). Seven-day-old colonies growing on OA, PDA, and MEA were tested for reaction with sodium hydroxide by placing one drop of 10% sodium hydroxide solution on the colony margin after Boerema et al. (2004).

Developmental and morphological studies: Developmental characters of the pycnidia were determined by sectioning blocks of CCA with pycnidia. Blocks were fixed in FAA (five parts stock formalin: five parts glacial acetic acid: 90 parts 50% ethyl alcohol) for approximately 5 days. They were then dehydrated and embedded in L. R. White® acrylic embedding medium (Polysciences, Inc., Warrington, PA) and 1µ sections were obtained using glass knives. Sections were stained on a slide warmer for 30 s in toluidine blue (0.1% aqueous) and examined with a phase contrast microscope. Conidial, pycnidial, and mycelial characters were observed in squash mounts in aniline blue (0.1% aqueous) (Figs. 2-11). Sizes are an average of at least 20 individual measurements.

Sequencing and Analyses: Amplification and sequencing of 18S small subunit (SSU) rDNA, 28S large subunit (LSU) rDNA, and internal transcribed spacer sequence 1 (ITS1) was done as previously described (Sullivan et al., 2001; White et al., 1990). In a few instances sequences were obtained directly from dried herbarium specimens (Reddy, Patel, White 1998). Voucher accession numbers are provided in Table 1.

The GCG programs Gap, Pileup and the SeqLab interface for the Wisconsin Package Version 9.1 (Genetics Computer Group, Madison, WI) were used to analyse sequences, generate alignments and make manual adjustments. PAUP version 4b10 (Swofford, 1999) was used for sequence similarity analysis of ITS1 data and for phylogenetic analysis of LSU and SSU sequences. PAUP's Base Frequency program was used to get the expected base frequency for each taxon and to do a Chi-square test for homogeneity of base frequencies across taxa. Preliminary analyses were conducted on all sequence regions (LSU, ITS and SSU) using parsimony and distance options. Because of the lack of sufficient variability in SSU rDNA sequences and its failure to separate the families *Phaeosphaeriaceae* and *Leptosphaeriaceae* (Rossman et al., 2002), the SSU region was not employed to place *P. morganjonesii* phylogenetically. In addition, ITS region was not employed in the analysis because of very high variability among the sequences included.

Maximum parsimony analyses were performed using heuristic search options with 2000 random sequence additions, tree bisection reconnection branch swapping algorithm and treating gaps as missing data. Consistency Index (CI) and Retention Index (RI) were calculated using PAUP. Jackknife analysis was performed to estimate support for the internal branches. This analysis used 1000 replicates with 37% deletion (Farris et al., 1996). The data set included 494 characters in which 90 (18%) were parsimony informative. Analysis resulted in two most parsimonious trees (Length = 197; Consistency index = 0.817; Retention index = 0.908; Fig. 12)

MODELTEST (Posada, Crandall 1998) was used to establish the model of DNA evolution that best fit the data model for the LSU data (Akaike Information Criterion) and maximum likelihood analysis with 1000 replicates was performed (using PAUP) with the resulting model. The model used was TrNef+I+G; -lnL = 3679.6941, AIC = 7373.3882; base frequencies A = 0.2492, C = 0.2148, G = 0.2928; substitution model with rate matrix R (a) [A-C] = 1.0000, R (b) [A-G] = 2.2880, R(c) [A-T] = 1.0000, R (d) [C-G] = 1.0000, R (e) [C-T] = 7.0409, R (f) [G-T] = 1.0000; Among-site rate variation (I) = 0.4267, Variable sites (G) with gamma distribution = 0.8191. MrBayes 3.0, a Bayesian phylogenetic inference program (Huelsenbeck and Ronquist, 2001), was used to determine branch support (posterior probabilities). Bayesian analysis was run with four Markov chains Monte Carlo (three cold, one heated) for 1,000,000 generations, sampling every 100 generations (including the first generation). The trees that were not asymptotic (the first 50 trees) were discarded ("burn-in"; Huelsenbeck, 2000). Bayesian analysis was done three times with a total of 29850 trees resulting. These trees were imported into PAUP and a 50% majority-rule consensus tree was produced to determine posterior probabilities. Support values are reported on the maximum likelihood tree (Fig. 12).

Table 1. Taxa used in LSU analyses

Taxa	GenBank #	Culture/Voucher#
Aureobasidium pullulans	AF050239	ATCC 62921
Clathrospora diplospora	U43481	IMI 68086
Cochliobolus ellisii	AF163993	[1]—
Delphinella strobiligena	AY016358	CBS 735.71
Didymella bryoniae	AY293792/ AF046014	IMI 373225
Dothidea ribesia	AY016360	CBS 195.58
Dothidea sambuci	AF382387	CBS 198.58
Lewia infectoria	U43482	IMI 303186
Leptosphaeria doliolum 1	U43475	ATCC 32815
Leptosphaeria doliolum 2	U43474	ATCC 32814
Phoma billsii	AY293789	ATCC MYA-3680
Phoma cucurbitacearum (GSB10)	AY293786	ATCC MYA-3681
Phoma glomerata (South River)	AF126819	ATCC MYA-2373
Phoma herbarum	AY293791	ATCC 12569
Phoma pomorum (GSB12)	AY293787	ATCC MYA-3682
Phoma morganjonesii n.sp.	AY293785	ATCC MYA-3683
Pleospora betae	U43483	IMI 156653
Pleospora herbarum 1	U43476	ATCC 11681
Pleospora herbarum 2	AF382386	CBS 191.86
Pyrenophora trichostoma	U43477	ATCC 44111

[1]— indicates that voucher accession not available

Taxonomy

Plenodomus morganjonesii was found to be distinct from previously described species (Boerema et al., 2004) based on morphological and molecular characteristics and is described as a new species.

Plenodomus morganjonesii M. S. Torres & J. F. White **sp. nov.** **Figs. 1-11**

Etym. *Plenodomus morganjonesii* is named for the mycologist Dr. Gareth Morgan-Jones

Coloniae in agaro decocto tuberorum zonatae, olivaceae-brunneae, lanosae, post 7 dies 23 °C ad 18-20 mm diam. Mycelium ex hyphis septatis, ramosis, subhyalinis, 1-3μ crassis compositum. Pycnidia solitaria, globosae vel fusiformae-cordatae, 1 ostiolata, brunnea, immersa et superficia, pseudoparenchymatica, 30-60 X 50-80μ; paries cellularum isodiametricarum compositum. Cellulae conidiogenae hyalinae, simplices, ex cellulis interioribus parietis pycnidii, 1.5-2.5μ. Conidia enteroblastica, hyalina, simplicia, cylindrica, 1-2 X 3-5μ.

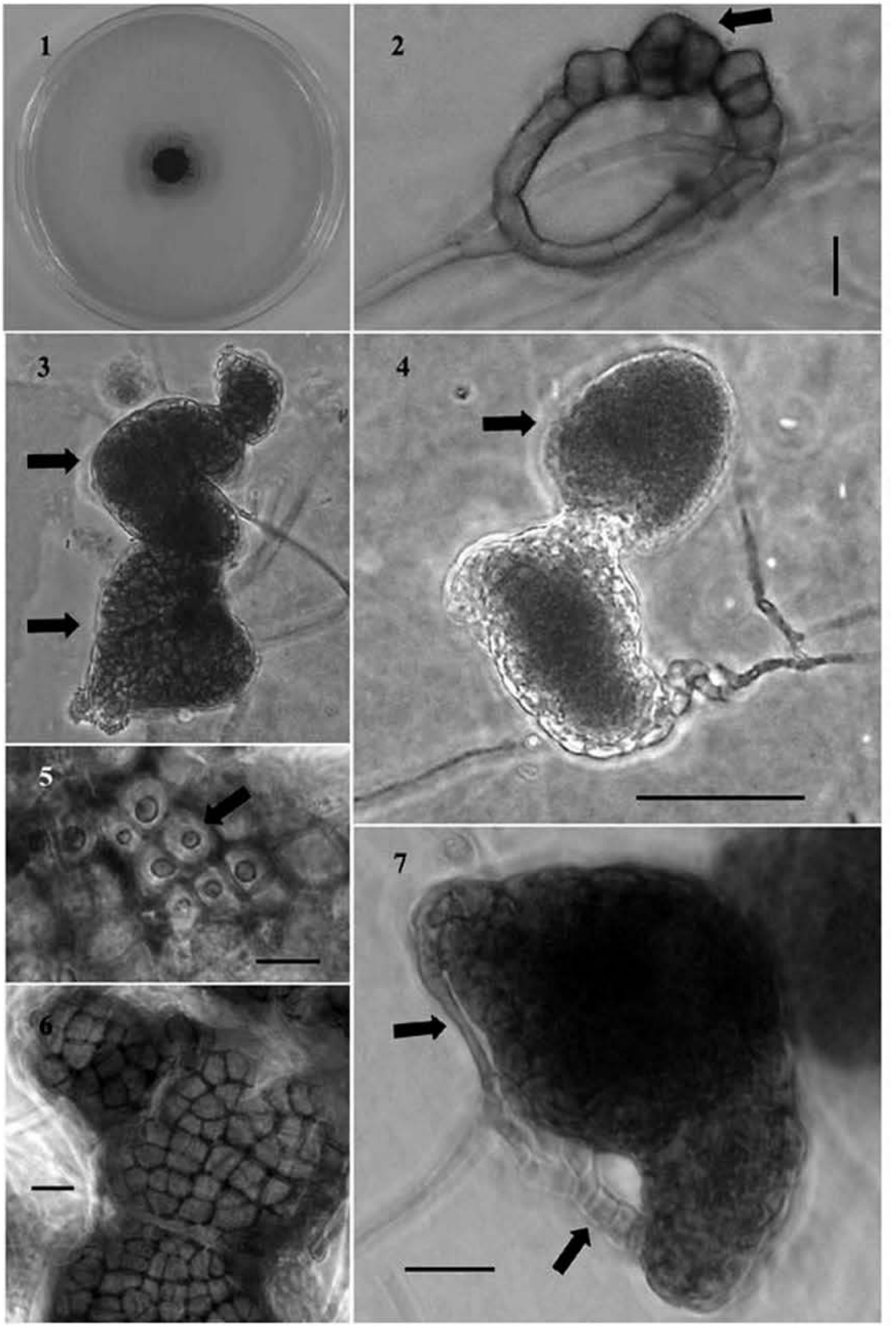
Colonies on MEA (Fig. 1) tan-yellowish, with sparse aerial mycelium, 18-20 mm diam after 7 days at 23 °C; pycnidia (Figs. 3, 4, 7-9) solitary and in clusters of up to eight, reverse yellow, developing yellow mycelial clusters in media beneath colony. On PDA

gray to light olive green with irregular lighter patches, aerial mycelium lanose, zonate with pycnidia in concentric zones, 18-20mm diam after 7 days, reverse tan centrally with black beneath pycnidial zones, with a yellow diffusible pigment in medium. On OA brown to olivaceous-gray, zonate, aerial mycelium brown to black in zones where pycnidia formed abundantly, with lanose aerial mycelium centrally, 18-20mm diam after 7 days, sectoring with abundant pycnidia in sectors and at margins but less aerial mycelium, reverse dark green-black, becoming yellowed due to diffusible pigment. Pink reaction in medium in sodium hydroxide spot test after five minutes where formerly the yellow pigment had been visible on MEA, OA, and PDA. On CCA not pigmented, with sparse mycelium and almost no aerial mycelium, 17 mm diam after 7 days, reverse not pigmented, pycnidia not fully developed. After 15 days pycnidia were immersed at various depths in medium and in concentric zones on the surface. Mycelium of septate, branched, subhyaline smooth 1-3 µm wide hyphae. Pycnidia solitary, sometimes globose, frequently arcuate-fusiform (Figs. 4, 8, 9) to cordate (Fig. 3, arrows) with two acute lateral sides bearing hyphal initial attachments (Figs. 2, 4, 7), light brown, mostly immersed, mostly pseudoparenchymatous (Fig. 6) with some scleroplectenchmous cells (Fig. 5), papillate, 30-60 wide X 50-80 µm high, with one ostiole that opens after conidia fill pycnidium (Fig. 4), ostiole neck short (Figs. 3, 4, 8-10), 10-20 µm long and 10-20 µm wide, pycnidial wall in median, vertical section composed of most 1-4 layers of ellipsoidal cells (Fig. 9) measuring 2-3 X 4-10 µm, irregularly thickened (Fig. 9) and 3-7 µm thick, wall cells in squash mounts (Figs. 5, 6) brown, isodiametric, 5-15 µm diam., sometimes with narrowed lumens (Fig. 5). Conidiogenous cells obscure, phialidic, hyaline, simple, smooth-walled, borne on the innermost cells of the pycnidial wall, doliiform, isodiametric, 1.5-2.5 µm diam. Conidia (Fig. 11) enteroblastic, hyaline, simple, eguttulate or with 2-3 large guttules, cylindrical, often slightly curved, frequently narrower on one end, smooth, aseptate, 3-5 x 1-2 µm, en masse off-white. No chlamydospores were observed on any medium although simple hyphal swellings were sometimes present in older cultures. Teleomorph not observed.

Holotype here designated: *Plenodomus morganjonesii* (RUTPP), dried culture on PDA, Turkey Swamp Park, Monmouth County, New Jersey; cultotype ATCC MYA-3683.

Discussion

Plenodomus morganjonesii is similar to the cosmopolitan saprophytic species *Phoma fimeti* Brunaud in colony characteristics (Boerema et al., 2004; Sutton, 1980). It may be readily distinguished from *P. fimeti* because the latter does not show a color change in the sodium hydroxide spot test and the conidia are ellipsoidal rather than cylindrical as in *P. morganjonesii*. Additionally, pycnidia of *P. fimeti* are frequently globose and the pycnidial walls in median vertical section are more regular in thickness and are composed of cells that are isodiametric and squared rather than ellipsoidal (White, 1983). *Phoma fimeti* is known to bear affinity to teleomorphic genus *Didymella* Sacc. and its pycnidial development and structure are consistent with species grouped therein (Boerema et al., 2004).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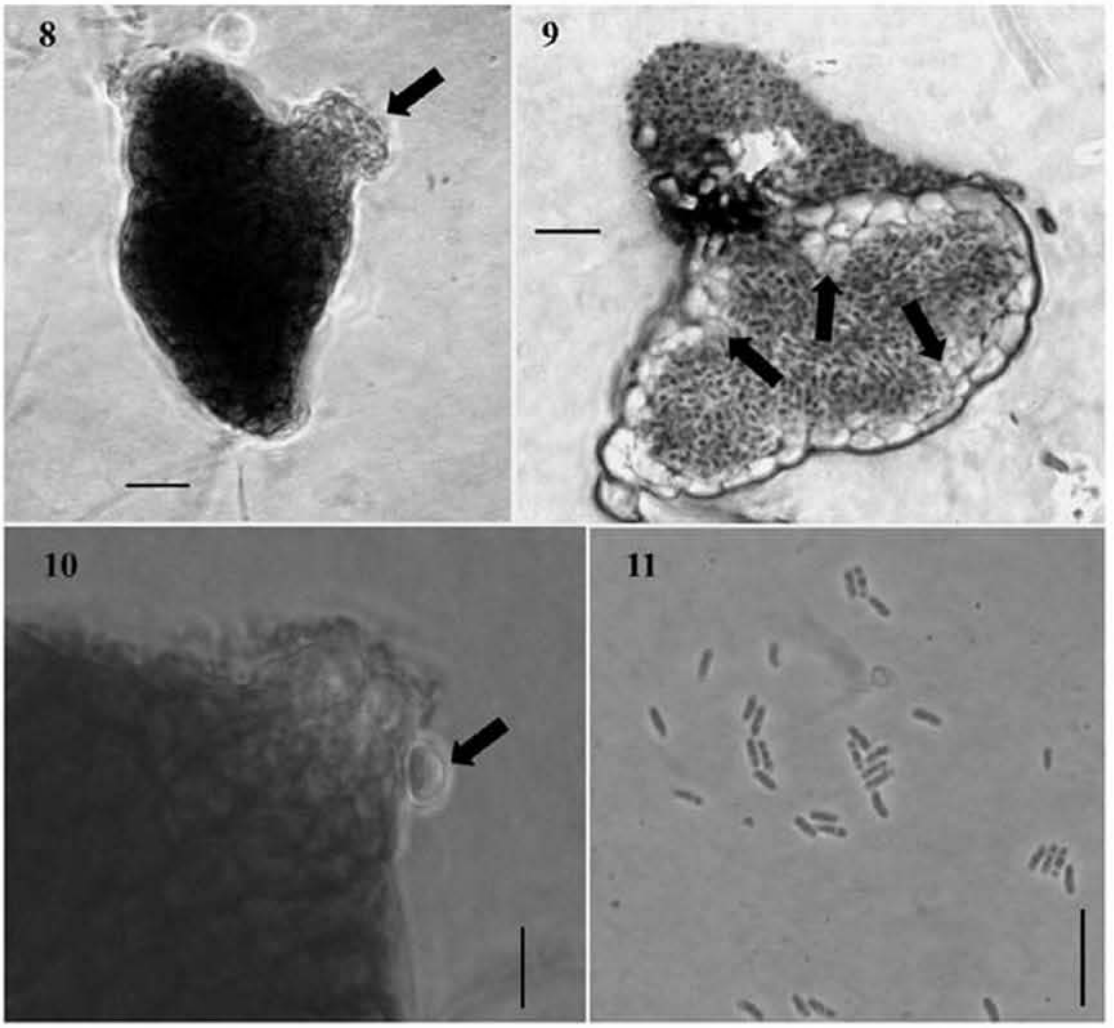

Plenodomus morganjonesii. **Figs. 1-11.** Morphological and cultural features.

(Figs. 1-7, **left**). 1. Culture on MEA medium after 7 days. 2. Symphogenous pycnidial primordium (arrow) showing typical ring form of initial with primordial pycnidium developing from fusion of hyphae (suspensors) arising from a common hyphal strand (bar = 5μm). 3. Cordate pycnidia (arrows; bar = 50μm). 4. Solitary pycnidium showing irregular fusiform shape and globose mass of conidia (arrow) emerging from lateral ostiole (bar = 50μm). 5. Developing pycnidial wall (surface view) showing narrowed lumens (arrow) in sclerenchyma cells (bar = 5μm). 6. Pycnidial wall with pseudoparenchyma cells (bar = 5μm). 7. Pycnidium showing two lateral suspensors (arrows; bar = 10μm).

(Figs. 8–11, **above**). 8. Pycnidium showing papillate ostiole (arrow; bar = 10μm). 9. Vertical section of pycnidium showing wall with irregularly thickened areas (arrows) and sclerified cells around apical ostiolar region (bar = 10μm). 10. Surface view of ostiolar papilla showing sloughed sclerenchyma cell (arrow; bar = 10μm). 11. Conidia stained with aniline blue (bar = 10μm).

The genus *Plenodomus* is typified by *Plenodomus lingam* (Tode : Fr.) Höhn (teleomorph: *Leptosphaeria maculans* (Desm.) Ces. & De Not.). Boerema (1982) placed *Plenodomus* as a section of the genus *Phoma* and Boerema et al. (2004) include in that section approximately 30 species with validly published binomials in *Plenodomus*.

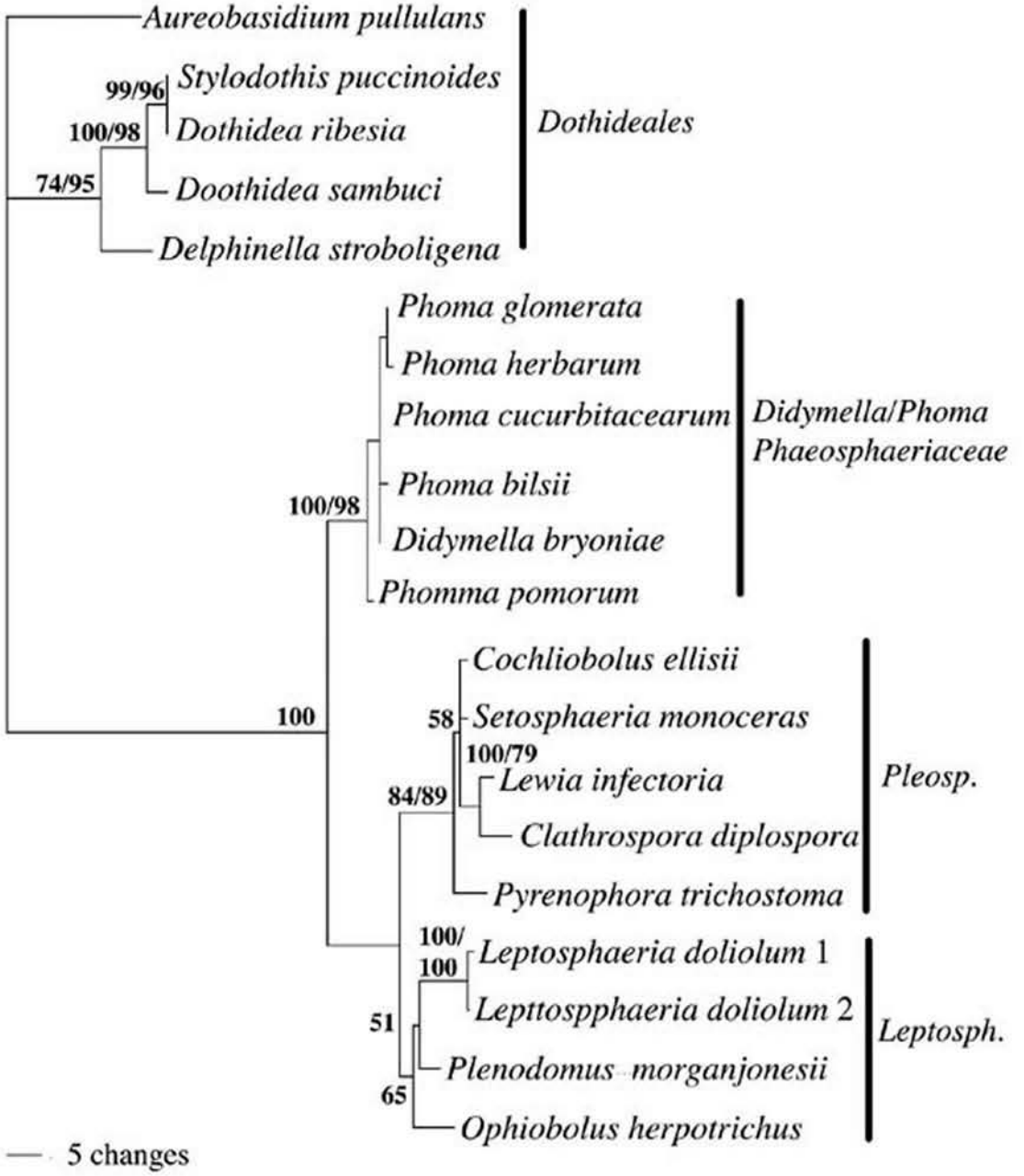

Fig. 12. Tree resulting from parsimony analysis of LSU region (tree length =197) with Jackkniffing support and Bayesian branch support values mapped onto tree. The Dothideales were defined as outgroup. Families are indicated on the tree to the right of species, Pleosp= *Pleosporaceae*, Leptosph.=*Leptosphaeriaceae*. This analysis illustrates placement of *Plenodomus morganjonesii* in a *Leptosphaeriaceae* clade.

Most species in *Plenodomus* produce pycnidia composed of at least some scleroplectychmatous cells in which the inner cell wall is irregularly thickened. Additionally the walls in the interior of the pycnidia bear irregular files of cells that extend into the pycnidial cavity (Reddy, Patel, White, 1998). Generally the ostiole in pycnidia of species of *Plenodomus* does not develop until the pycnidium is fully developed (Boerema et al, 2004; Reddy et al. 1998). Most species referred to *Plenodomus* (Boerema et al., 2004) have known teleomorphs in genus *Leptosphaeria* Ces. & De Not. In contrast, the genus *Phoma*, as typified by *Phoma herbarum* Westend., is characterized by species which produce pycnidia with minimally sclerifeid walls, evenly thickened inner wall layers, and teleomorphs in *Didymella* (Morgan-Jones 1988a,b; Morgan-Jones, White, 1983; White, Morgan-Jones, 1986).

Although no teleomorph was observed for *P. morganjonesii*, it grouped in the *Leptosphaeriaceae* clade (51% Jackknife support) along with *L. doliolum* (Pers.:Fr.) Ces. & De Not. (anamorph = *Plenodomus doliolum* (Höhn.) Höhn.) and *Ophiobolus herpotrichus*. In culture the fungus has some features that are consistent with *Plenodomus*. The mode of pycnidial formation is symphogenous with pycnidial formation being initiated by the fusion of two separate hyphal strands often arising from the same hypha (Fig. 2). This leads to the characteristic arcuated-fusiform to cordate appearance of many of the mature pycnidia (Figs. 3, 4, 7-9). Frequently the original hyphal initials are visible attached to the lateral ends of the arcuate to cordate pycnidia (Figs. 4, 7). The symphogenous method of pycnidial development is often found in species referred to *Plenodomus* (Boerema et al., 2004). The early pycnidial wall is unevenly thickened on the inner surface (Fig. 9) as is evident in many species of *Plenodomus* (Boerema et al., 2004). As the pycnidium develops, the outer surface layer, especially near the ostiolar pore, becomes sclerifeid with narrowed lumens (Fig. 5). Sclerenchyma is another feature of many species in *Plenodomus* (Boerema et al., 2004). The ostiolar pore does not appear to develop until later in pycnidial formation although the entire development process is only a few days in duration. The cells forming the ostiole are highly sclerified (appearing refractive under phase-contrast) and are sloughed off to reveal the ostiolar pores (Figs. 8-10). Typically in *Plenodomus* ostiolar pores do not form in the pycnidial primordium but develop late in maturation (Boerema et al., 2004). The thin-walled pseudoparenchymatous pycnidia of *P. morganjonesii* are consistent with the thin-walled type-I pycnidia of some species of *Plenodomus* but no thick-walled plectosclerenchymatious type-II pycnidia have been observed in our cultures. It is possible that type-II pycnidia are produced on natural substrates. Separation of monophyletic units of phomoid fungi into distinct genera will improve the precision of our system of classifying phomoid fungi. Along these lines more extensive phylogenetic studies must be conducted with a broad spectrum of phomoid fungi in distinct families of the *Pleosporales*. It is likely that phylogenetic work in phomoid fungi would result in a system of classification and tools for identification that are more accessible to a broad spectrum of mycologists.

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NATS truffle and truffle-like fungi 12: *Rhizopogon ater* sp. nov. and *R. brunsii* sp. nov. (*Rhizopogonaceae*, Basidiomycota)

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Abstract—Two new species of *Rhizopogon* are described as *R. ater* from western Oregon and southwestern Washington and *R. brunsii* from southern California. *R. ater* is placed in *Rhizopogon* subgenus *Villosuli* and associates with *Pseudotsuga menziesii*, whereas *R. brunsii* belongs to *Rhizopogon* subgenus *Amylopogon* and associates with two- to five-needle pines in southern California.

Key words—hypogeous, *Boletales*, ectomycorrhizal fungi, taxonomy

Introduction

Rhizopogon is a hypogeous, ectomycorrhizal genus that associates with members of the *Pinaceae*. It reaches its greatest abundance and diversity in western North America (Smith and Zeller 1966, Molina et al. 1999). Many habitats of that region have not been explored for hypogeous fungi, so discovery of undescribed species is not surprising. Here we describe two new species associated with Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) and pines (*Pinus muricata* D. Don, *P. radiata* D. Don and *P. torreyana* Carrière), respectively.

Methods and materials

Notes were recorded on characters of fresh specimens that were then dried on a food dehydrator with forced air at 35 °C (95 °F). Colors are in general terms. Microscopic characters were determined from hand sections mounted in 5% KOH or Melzer's reagent as indicated.

Placement of *R. ater* within *R.* subgenus *Villosuli* and *R. brunsii* within *R.* subgenus *Amylopogon* was tested through phylogenetic analysis of DNA sequences. Grubisha et al. (2002) previously confirmed that *R. ater* is part of *R.* subgenus *Villosuli*. Genomic DNA was extracted from small pieces of *R. brunsii* basidiocarps following Kjøller and Bruns (2003). Polymerase chain reaction (PCR) conditions for amplification of the nuclear ribosomal internal transcribed spacer region (ITS) were previously described (Gardes and Bruns 1993). Sequencing of both strands was performed using a BigDye Terminator Cycle Sequencing Ready Reaction Kit (Applied Biosystems Co.) and an ABI PRISM 3100 Genetic Analyzer. Sequences were edited using Sequencher 4.2.2 (Gene Codes Corp.) and have been deposited in GenBank as accession numbers AY971813-AY971841. Sequence alignment and phylogenetic analyses using maximum parsimony as the optimality criterion followed Grubisha et al. (2002). Sequences from holotype and paratype collections of species in *R.* subgenus *Amylopogon* were obtained from GenBank (Bidartondo and Bruns 2002, Grubisha et al. 2002). ITS sequences from two species in *R.* subgenus *Roseoli*, *R. vulgaris* (Vittad.) M. Lange (GenBank no. AF062934) and *R. roseolus* (Corda) Th. Fr. (AF058315), were used as the outgroup.

Phylogenetic results

Analysis of ITS sequences of *R. ater* and other *Rhizopogon* species placed it in *Rhizopogon* subgenus *Villosuli* in close relationship to *R. vinicolor* A. H. Sm. (Grubisha et al. 2002, as "*R. sp. nov.* JMT 17466", GenBank accession no. AF071438; Kretzer et al. 2003).

Sequences of *R. brunsii* formed a strongly supported monophyletic clade within *R.* subgenus *Amylopogon* and a sister-group to the *R. arctostaphyli* A. H. Sm. clade (Fig. 1). An alignment of 634 nucleotide characters from 28 ITS sequences from *R. brunsii* collections and 20 sequences from *Rhizopogon* species in *R.* subgenus *Amylopogon* plus the two outgroup sequences contained 72 parsimony informative characters. Phylogenetic analyses resulted in 216 equally parsimonious trees, each of 167 steps, CI=0.886, RI=0.964. Bootstrap values strongly supported the *R. brunsii* clade as distinct from the *R. archtostaphyli* clade.

Taxonomic description

Rhizopogon ater Trappe & Grubisha **sp. nov.** **Fig. 2 a–c**

Basidiomata 7-20 x 9-32 mm. Peridium juventute sordide album vel griseum sub suprapelle tenui hypharum brunnearum, ubi contusa saepe erubescens, vinascens vel brunnescens, maturitate rubroatrum, violaceoatrum vel olivaceoatrum. Rhizomorphae basi singulatae vel fasciculatae. Gleba juventute grisea vel sordide olivacea, mox olivaceoater, cyanater vel viridiater. Hymenium et peridium in aqua vel solutione Melzeri granulis atris abundis quibus in KOH in pigmento viridi dissolvescens. Basidia 13-23 x 7.5-10 µm. Subhymenium cellulis isodiametris 7-10 µm latis. Fibulae absentes. Sporae obtusae vel ellipsoideae, laeves, 6-7 (-10) x (2.5-) 3-3.5 (-4), hyalinae, nonamyloideae, interdum in aqua vel solutione Melzeri granulis atris adhaerentibus. Holotypus hic designatus: Trappe 17466, leg. D. Wheeler in OSC.

Etymology — Latin, *ater*, (black) in reference to the black or near black colors of peridium and gleba of mature specimens.

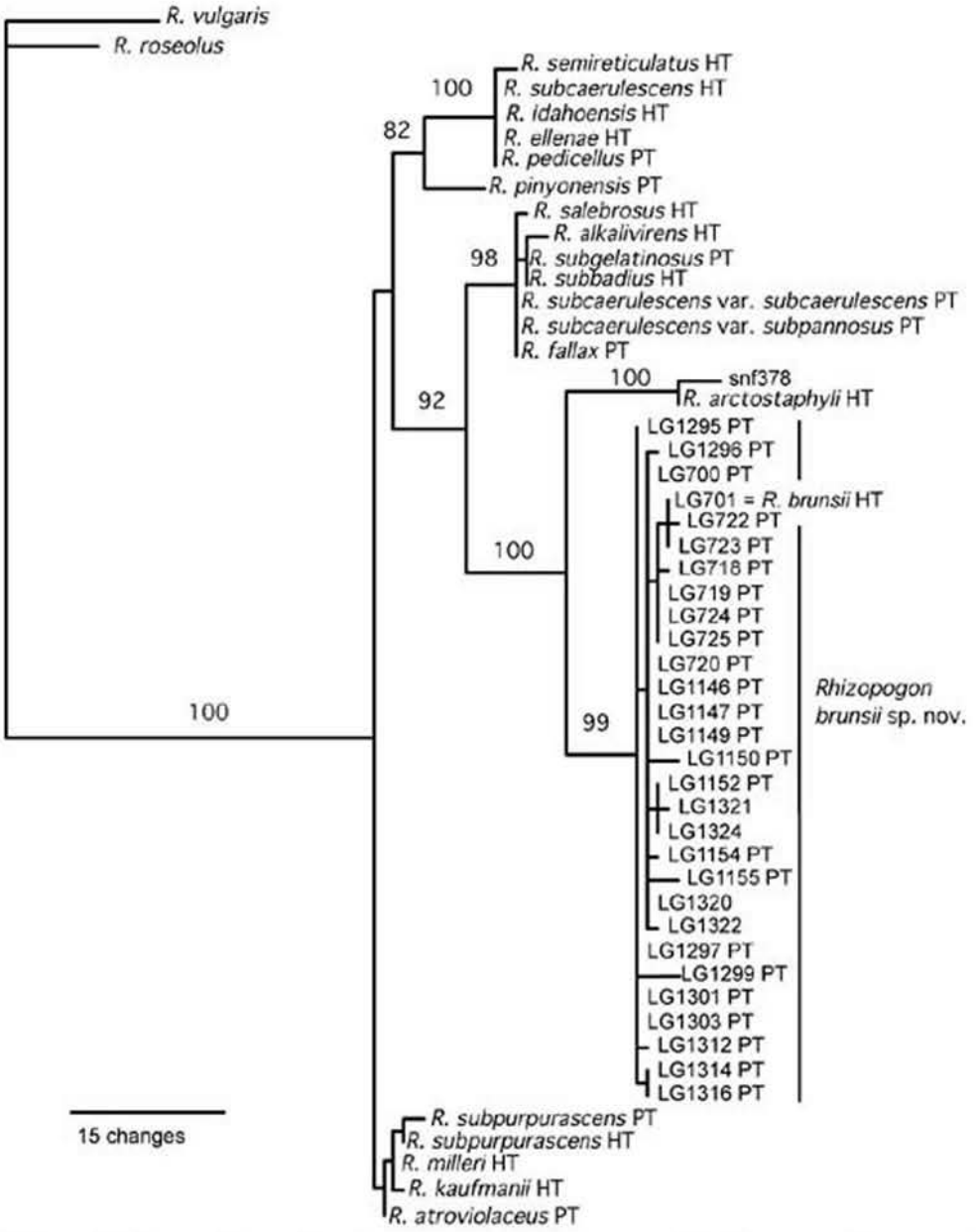


Fig. 1. One of 216 equally parsimonious trees of 167 steps resulting from an alignment of 634 nucleotide characters from ITS sequences from *R. brunsii* collections and species in *R.* subgenus *Amylopogon*. Sequence alignment contained 72 parsimony informative characters. CI=0.886, RI=0.964; Bootstrap values greater than 70 are shown. HT=Holotype collection; PT=Paratype collection. *R. vulgaris* and *R. roseolus* were chosen as the outgroup.

Basidiomata 7–20 x 9–32 mm broad, globose to subglobose, in youth sordid white to gray under a thin suprapellis of brown hyphae, often staining pink to vinaceous or brown where cut or bruised, by maturity becoming reddish black to violaceous black or olivaceous black over all, drying dull black to brownish black or blackish olive but often with vinaceous areas, the inner peridium sometimes pink. **Rhizomorphs** appressed at and emanating from the base singly or in clusters of a few, up to 2 mm thick at place of attachment, dark brown and much branched, often breaking off when the specimen

is unearthed. **Gleba** in youth gray to dirty olive, soon becoming olive black to bluish black or greenish black, when moist and cut open often with a metallic luster, drying dark olive to olive black; columellae rare, when present percurrent or inserted into the gleba only a few mm, sordid yellow when fresh, staining pink, drying pink. **Chemical reactions**: KOH on fresh, white peridium immediately olive, soon black, on fresh or dry gleba instantly black. **Odor** not distinctive or sometimes sweet or onion-like.

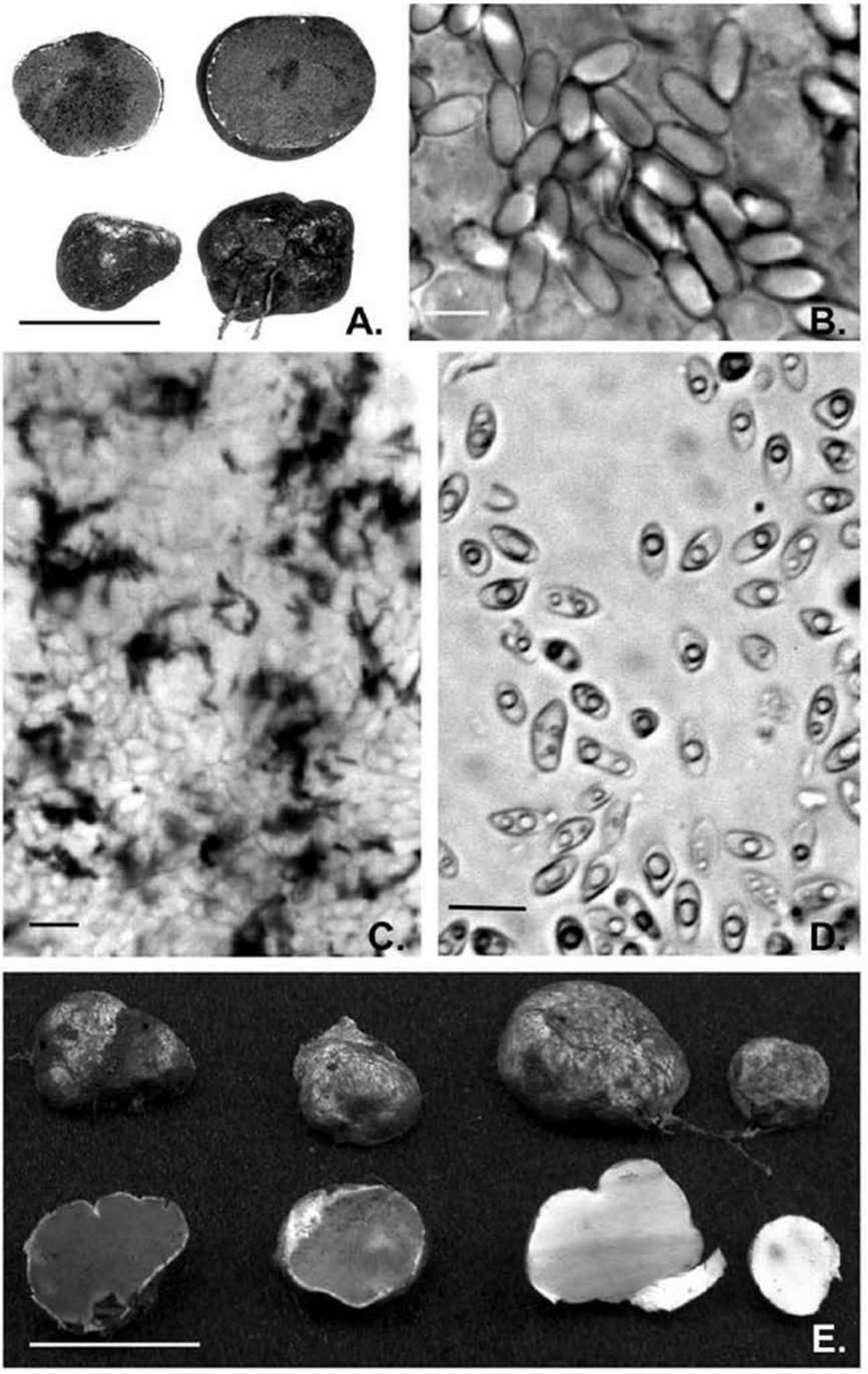
Black granules present in water or Melzer's reagent, scattered in the peridium and glebal trama but profuse in the subhymenium and hymenium, in KOH dissolving into a green pigment. **Peridium** 270-440 μm thick; suprapellis of scattered to thinly layered hyphae 3-6 μm broad and with thin to thick brown walls; pellis of hyaline hyphae 1-6 μm broad, obscured by massive deposits of amorphous, yellowish brown pigment that form brown pigment balls in Melzer's reagent; subpellis of hyphae similar to those of the pellis, in KOH with a diffuse pink to red color. **Glebal trama** of interwoven, gelatinized hyphae 2-5 μm broad. **Hymenium** with abundant, KOH-soluble, black granules as in the peridium. **Basidia** clavate to clavate-cylindrical, 13-23 x 7.5-10 μm, by maturity with gelatinous-thickened walls. **Subhymenium** of isodiametric cells 7-10 μm broad, by maturity with gelatinous-thickened walls. **Clamp connections** absent.

Spores obtuse to ellipsoid, smooth, 6.0-7.0 (-10.0) x (2.5-) 3-3.5 (-4) μm, in youth with 1-2 guttules and often appearing false septate, hyaline to brown in mass in KOH, nonamyloid, in Melzer's reagent brown in mass, sometimes in water or Melzer's reagent with black granules adherent to the surface.

Habit, habitat, mycorrhizal hosts, distribution and season — Solitary to gregarious in natural forests or plantations of *Pseudotsuga menziesii* in pure or mixed stands from near sea level to ca 600 m elevation in the northern Oregon Coast Ranges and rarely in the southern Washington Cascades. October through December.

Collections examined: HOLOTYPE here designated: **Oregon**, *Polk Co.*—Black Rock (Lackiamute Tree Farm), T85N, R7W, Rd. 1300 out of Falls City, col. Dan Wheeler, Trappe 17466, 4 Nov. 1995 (OSC 80942; isotypes BPI, UC). PARATYPES: **Oregon**: *Benton Co.*—near Blodgett, Starker Forests Tree Farm, col. B. Winn, Trappe 7703, 28 Oct. 1983 (OSC 80937) and L. Schramm, Trappe 30517, 6 Nov. 2004 (OSC 111363). *Lincoln Co.*—3.2 km E of Cape Perpetua, col. A. B. Walters, Trappe 5624A, 18 Nov. 1979 (OSC 80936, UC). *Polk Co.*—Black Rock Rd., Luckiamute Tree Farm, 4–4.5 miles from Falls City, Col. W. Bushnell, Trappe 8934, 6 Sept. 1986 (OSC 80938), R. & N. Nett, Trappe 13351, 5 Nov. 1994 (OSC 111292), Z. Carter, Trappe 13353, 5 Nov. 1994 (OSC 80939, BPI, FH, K, NY, UC), A. Beyerle, Trappe 17419, 7 Oct. 1995 (OSC 80940, CANB), L. Schramm, Trappe 17428, 7 Oct. 1995 (BPI), A. Beyerle, Trappe 17423, 13 Oct. 1995 (NY), A. Beyerle, Trappe 17436, 27 Oct. 1995 (OSC 80941), A. Beyerle, Trappe 17488, 9 Nov. 1995 (FH, UC), A. Beyerle, Trappe 25879, 14 Nov. 2000 (OSC 80945), A. Beyerle, Trappe 17623, 20 Dec. 1995 (OSC 80943), A. Beyerle, Trappe 22797, 11 Dec. 1997 (OSC 111294), A. Beyerle, Trappe 25853, 26 Dec. 2000 (OSC 80944) and Trappe 25855 (BPI, K, UC), A. Beyerle, Trappe 27157, 21 Nov.

Fig. 2. Basidiomes and light microscopy of *Rhizopogon ater* and *R. brunsii*. A. *R. ater* showing dark gleba and rhizomorphs. B. *R. ater* basidiospores. C. Black granules that are abundant in the subhymenium and hymenium. D. *R. brunsii* basidiospores. E. *R. brunsii* showing rhizomorphs and different colors of the gleba. Scale bars: A =2.5 cm; B, C, D = 10 μm; E = 4 cm.


A.
B.
C.
D.
E.

2001 (OSC 80946), A. Beyerle, Trappe 28265, 25 Nov. 2002 (OSC 111295). *Tillamook Co.*—Cedar Cr., T2N, R7W, Sec 30, SW 1/4, M. Layes, Trappe 22770 17 June 1996 (OSC 111293). *Yamhill Co.*— Siuslaw National Forest, Hebo Ranger District, Agency Creek, T4S, R8W, Sec 32, S. McDowell, Trappe 28031, 5 Oct. 2000 (OSC 80934). **Washington**, *Skamania Co.*—Gifford Pinchot National Forest, Panther Creek, ca 0.5 mi N of Eight-mile Cr., Perkins, Trappe 27184, 14 Nov. 2000 (OSC 80935).

Comments — The black peridium and gleba of both fresh and dry, mature specimens of *R. ater* are distinctive for the genus. This color comes from the black granules that are deposited throughout the basidiomata, most profusely in the subhymenium and hymenium of mature specimens. The effect of microscope mounts in KOH, with the gleba flushed green from dissolved granules and the peridial subpellis red, is startling and pleasing to the eye. Such granules are common in several other species of *R.* subgen. *Villosuli*, e.g. *R. villosulus* Zeller, but usually only in the peridium and sometimes the immediately adjacent gleba. In no other species do the granules occur in such profusion throughout the gleba as in *R. ater*. These granules do not occur in *R. vinicolor*, the species with the closest molecular relationship to *R. ater* of those studied by Grubisha et al. (2002).

The granule deposits occur only in members of subgen. *Villosuli*, so they appear to be phylogenetically meaningful at the subgenus level but not among sections within the *Villosuli*. Alexander H. Smith was the first to discover these granules in members of *R.* subgen. *Villosuli* and originally regarded them as amyloid, because he saw them in mounts in Melzer's reagent but not KOH (Smith and Zeller 1966). Later, at the suggestion of Dr. Robert Shaffer, Smith made water mounts of members of the *Villosuli* and discovered that the granules can be seen in water mounts and hence are not amyloid (Smith & Harrison 1968).

The relationship between *R. ater*, with its abundant granules, and *R. vinicolor*, which lacks granules, was unexpected on morphological grounds. However, other characters relate them morphologically, especially the strong pink staining of the peridial subpellis when bruised or mounted in KOH, and the very scanty suprapellis of brown-walled hyphae compared to the well developed suprapellis of other species in the *Villosuli*. We do not know if *R. ater* forms the tuberculate mycorrhizae similar to those of Douglas-fir + *R. vinicolor* and related species (Trappe 1965, Zak 1971, Molina et al. 1999).

Rhizopogon brunsii Grubisha & Trappe, **sp. nov.** **Fig. 2 d–e**

Basidiomata 7-45 mm lata, subglobosa, ellipsoidea vel irregularia. Peridium filis intertextis, juventute album areis luteis, avellaneis vel auranteobrunneis, maturitate pallide vinaceum vel sordidum, 0.3-2.5 mm crassa. Rhizomorphae basi fasciculatae et ubique appressae, albae vel sordidae, maturitate interdum subnigrae. Gleba firma, juventute alba, maturitate olivaceobrunnea vel fusco-olivacea. Basidia 8.5-11.5 (-19) x (3-) 4.5-6 µm. Subhymenium cellulis isodiametris. Fibulae absentes. Sporae obtusae vel ellipsoideae, laeves, 7-9.5 (-12) x (3-) 4-6 (-7) µm, hyalinae, nonamyloideae. Holotypus hic designatus: LCG 701, leg. J.M. Trappe in UC, isotypus in OSC.

Etymology — In honor of Dr. Thomas D. Bruns, who has made important contributions to our understanding of the life history and ecology of *Rhizopogon* in California pine forests, to the field of mycorrhizal ecology, and for collecting some of the collections cited below.

Basidiomata 7-45 mm broad, subglobose to ellipsoid or irregular, white in youth, developing yellow to yellow-brown or orange-brown streaks and patches where pressed against needles or sticks, at maturity pale gray to pale vinaceous or dingy, in cross-section white, unchanging where cut or bruised, the surface netted by minute, interwoven strands, 0.3 – 2.5 mm thick and varying that much on a single specimen, thickest at the basidiome base, drying brown. **Rhizomorphs** loosely clustered at base and appressed overall, white to dingy, the larger ones darkening to almost black with age. **Gleba** firm, white in youth, at maturity yellowish-olive to olive and finally olive-brown to dark grayish olive, exuding moisture when cut, the locules 3-5 per mm^2 and spore-filled at maturity; columella lacking, except in one specimen with two columns 2-3 mm wide of white sterile tissue intruding to the center. **Chemical reactions:** KOH on fresh white peridium instantly pink, occasionally with a blue fringe at the edge of the drop, soon blue overall and finally blue black to olive black; on brown peridium instantly dark brown and soon brownish black; on white peridial cross-sections quickly pink to blue, then black; on brown cross-sections instantly dark brown, quickly brownish black. Melzer's reagent non-reactive on fresh white gleba, purplish gray on light olive gleba, dark purplish gray on dark olive gleba. No obvious reaction on dried gleba from KOH or Melzer's reagent. **Odor** not distinctive.

Peridium of appressed, interwoven hyphal strands, the hyphae hyaline, thin-walled, 3.9-10.8 μm broad, in KOH with abundant, pink to gray or faintly olive extracellular pigment deposits, in Melzer's reagent with orange-brown pigment balls. **Glebal trama** with a narrow center of subparallel hyphae 4.6-6.2 μm broad surrounded by interwoven gelatinized hyphae, often with extracellular purple to black particles in water, KOH and Melzer's reagent. **Basidia** thin-walled, clavate to cylindrical, 8.5-11.5 (-19) x (3-) 4.5-6 μm. **Clamp connections** absent.

Spores 7-9.5 (-12) x (3-) 4-6 (-7) μm, ellipsoid to broadly ellipsoid, often irregular to reniform, subtriangular, smooth, in youth with 1-2 guttules, in KOH hyaline singly, brownish yellow in mass, in Melzer's reagent hyaline to faintly amyloid in youth, at maturity pale yellow singly to brownish yellow in mass.

Habit, habitat, mycorrhizal hosts, distribution and season — Gregarious to caespitose mostly 1-3 cm deep in mineral soil in natural forests or under individually planted trees of *Pinus muricata*, *P. radiata*, and *P. torreyana* in pure or mixed stands in southern California (Santa Barbara, San Diego, and San Luis Obispo Counties); January and February.

Collections examined: HOLOTYPE here designated: **California:** *Santa Barbara Co*—along Harris Grade Rd, north of Lompoc 34° 44.06N, 120° 26.44W, col. J. M. Trappe, LCG 701, 11 Jan. 2002 in UC, isotype in OSC. PARATYPES — **California:** *San Diego Co.*—Torrey Pines State Reserve, 32° 54 N, 117° 14 W, along North Torrey Pines Road, col. L. C. Grubisha, LCG 1312-1316, 21 Jan 2003(UC); Torrey Pines State Reserve Extension, 32° 56 N, 117° 14 W, along Red Ridge trail, col. L. C. Grubisha LCG 1295-1303, 21 Jan 2003 (UC). *San Luis Obispo Co.*—University of California Kenneth B. Norris Rancho Marino Natural Reserve, 35° 32 N, 121° 05 W, col. L. C. Grubisha, LCG 1146, 1147, 1149, 1150, 1152, 1154, 1155, 5 Feb. 2002 (UC). *Santa Barbara Co.*—along Harris Grade Rd, N of Lompoc 34° 44.06N, 120° 26.44W, col. T. D. Bruns and L. C. Grubisha, LCG 720, 11 Jan 2002 (UC). Rucker Rd. N of Lompoc

near Mission La Purisma, 34° 44 N, 120° 26 W, col. T. D. Bruns, LCG 718, 722, 725, 11 Jan 2002 (UC), col. L. C. Grubisha, LCG 700, 723, 11 Jan 2002 (UC), col. J. M. Trappe, LCG 719, 724, 11 Jan 2002 (UC, OSC). All specimens deposited in UC and isotypes in OSC.

Comments — DNA sequence data (Fig. 1) indicate *Rhizopogon brunsii* is most closely related to *R. arctostaphyli*, but these species are not similar morphologically. Spores of *R. brunsii* are larger and wider, nonamyloid, and the fresh peridium does not bruise red. *Rhizopogon arctostaphyli* is best characterized by yellow tones overlaid by gray in the peridium and amyloid spores in mature specimens (Smith and Zeller 1966). These characters are absent in *R. brunsii*. *R. brunsii* has the broadest spores in *R.* subgenus *Amylopogon*, up to 7 μm; *R. kauffmanii* A. H. Sm. and Zeller has the next broadest spores (up to 5 μm) but is not closely related to *R. brunsii* (Fig. 1). The taxonomy and phylogeny of species of *R.* subgenus *Amylopogon*, to which these species belong, is beset with difficulties that remain to be resolved. The morphological characters originally used to differentiate its species are often inadequate for that purpose (Bidartondo and Bruns 2002), so the entire subgenus needs reworking with the help of molecular tools.

Kjøller and Bruns (2003) initially detected what we describe here as *R. brunsii* from spore bank bioassays. They compared ITS sequences from *Rhizopogon* mycorrhizae of bishop pine soil bioassay samples to known sequences of *Rhizopogon* basidiocarps, including holotype and paratype sequences (see *Amylopogon* clade II in Kjøller and Bruns 2003). At the writing of Kjøller and Bruns (2003) there was no ITS sequence match for the clade identified as *Rhizopogon* subgen. *Amylopogon* clade II. We found basidiocarp matches to the bioassay sequences at the location in Santa Barbara Co. where the soil for the bioassays was collected (data not shown) and subsequently at other locations in southern California.

Acknowledgments

Members of the North American Truffling Society found most of the collections of *Rhizopogon ater;* the enthusiastic participation of NATS members in individual and group forays has contributed significantly to knowledge of North American hypogeous fungi. We thank Dr. Zoltán Bratek and Dr. Jason Hoeksema for reviewing the manuscript and whose comments increased the quality of the manuscript; Dr. Else Vellinga for valuable comments on an earlier version of the manuscript; Don Canestro for help as a guide at the University of California Rancho Marino Natural Reserve, and the Torrey Pines State Reserve and the UC Rancho Marino Natural Reserve for permission to collect fungal specimens. This study was funded in part from a University of California Natural Reserve System Mildred E. Mathias Graduate Student Research Grant and Mycological Society of San Francisco Esther Colton Whited-Harry D. Thiers Scholarship to LCG. Trappe's participation in the research was supported in part by the U. S. Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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Coprophilous Mycobiota of Oman

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Abstract—The coprophilous fungal mycobiota of the Sultanate of Oman was surveyed. Its distribution among the different sites and dung types was investigated. Forty-five species belonging to 25 genera are reported. The genera belong to the Discomycetes, Loculoascomycetes, Pyrenomycetes, Plectomycetes, Zygomycetes, Basidiomycetes and Myxomycetes. Most of the genera and species are new records for Oman. Twenty-one species are new records for the Arabian Peninsula and four are new records for Asia. The full text is included on the online database. http://www.mycotaxon.com/resources/weblists.html

Key Words—camels, cattle, goats, coprophilous fungi, survey

Introduction

Little is known about the coprophilous fungi of the Arabian Peninsula (Ahmed et.al. 1971a,b; Abdullah et al. 1976, 1978; Abdullah 1982; Bokhary 1985, 1986, 1987; Bokhary & Parvez 1986). No thorough study has been carried out on the coprophilous fungi of Oman.

The purpose of this online database is to document the coprophilous mycobiota of an arid environment and compare its distribution among the sites and dung types of Oman. The database will serve as a nucleus for the mycobiota of Oman and the Arabian Peninsula.

Materials and Methods

One hundred and ten dung samples were collected from different sites in the Sultanate of Oman. Each sample was soaked in distilled water for a few minutes and placed in a sterile glass dish containing sterilized moistened absorbent cotton lined with wet filter papers. The dishes were incubated at 24 ± 2°C. Fungi that developed on the dung were examined and identified.

Results and Discussion

The incidence of occurrence, distribution of 45 species belonging to 25 genera are reported and displayed on the online database. Most of the genera and species are new

Fig.1 Distibution of coprophilous fungi in different sites in Oman

records for Oman. The genera are distributed as follows: Discomycetes (8 genera, 19 species); Loculoascomycetes (3 genera, 6 species); Pyrenomycetes (9 genera, 15 species); Plectomycetes (2 genera, 2 species); Myxomycetes, Basidiomycetes, and Zygomycetes (one genus, one species). Species of Discomycetes and Pyrenomycetes are the most common (75.5%).

Most of the fungal species were very rare and were found in less than 5% of dung examined. The species that were extremely common (≥31%) were *Sporormiella minima* and *Iodophanus carneus*.

The distributions of the fungal species among the sites are displayed on the online database. Some fungi were found only in one site while others were distributed in all sites.

The distribution of the fungal species among the dung types of animals is also displayed on the online database. Twenty-seven species were found on camel dung, 24 on goat dung, 16 on cattle dung and 1-7 species on the dung of other animals. Some fungi were found only on one dung type while others were found on more than one. Some species are new records to the Arabian Peninsula and/or to Asia. Some dung types are new substrates.

Some of the seven genera of Discomycetes found on different dung types in this study are cosmopolitan and were also found in temperate and tropical habitats.

The most abundant fungi we found in our study were *Sporormiella minima, Iodophanus carneus, Coprotus disculus, C. granuliformis, C. leucopocillum* and *Chaetomium globosum*. The majority of these species are common and have been reported in East Africa. (Khan & Cain 1972, 1979; Caretta et al., 1998; Carter & Khan 1982).

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MYCOTAXON

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Six new lichen records from Turkey

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Abstract—Six species of lichenized fungi, *Acarospora modenensis*, *Aspicilia recedens*, *Echinoplaca epiphylla*, *Lecanora graeca*, *Lepraria cacuminum* and *Parmotrema austrosinense* are reported as new to the lichen flora of Turkey. For each a short description is presented.

Keywords—Ascomycetes, flora, Giresun, MustafaKemalpaşa, Trabzon

Interest in the lichen flora of Turkey has greatly increased in recent years (Aslan 2000, Aslan et al. 2002a, 2002 b, John & Breuss 2004, Yazıcı 1999a, Yazıcı & Aslan 2002, Yazıcı & Aslan 2003, Yazıcı et al. 2004). In previous studies on the Northeastern region, John and Breuss (2004) and Steiner (1909) reported 42 species for Giresun, Yazıcı (1999b) reported 78 species for Karacabey (Bursa), and Yazıcı et al. (2004) 4 species for MustafaKemalpaşa (Bursa). So far in the whole of Trabzon 502 species have been reported (John 1995 and references therein, John & Breuss 2004, Szatala 1960, Yazıcı 1999a).

The present report is based on samples collected on three different stations in Bursa, Giresun and Trabzon provinces between 26 August 2003 and 16 August 2004. A stereo microscope, a compound microscope and the standard spot tests were used in the identification of the samples, together with the following references: Clauzade & Roux (1985), Louwhoff & Elix (2002), Lohtander (1995), Lucking (1992), Poelt (1974), Purvis et al. (1992) and Wirth (1995). *Echinoplaca epiphylla* has been stored in the herbarium of Kazım Karabekir Faculty of Education, Atatürk University, Erzurum, Biology Department and the other samples in the herbarium of Biology Department, Giresun Sience and Art Faculty, Karadeniz Technical University.

Acarospora modenensis H. Magn.

Thallus indeterminate, areolate; areoles dispersed or subcontiguous among the unevennesses of the stone, pallid or obscure red-grey brown, round, convex or

subplane or rarely a few grouped, 0.5–0.7(–1) mm wide, 0.3–0.4 mm thick, smooth, widely attached to the stone. Upper cortex 25–35(–60) µm thick, varying in thickness, translucid, exterior 5–7 µm dark brown, amorphous stratum rarely reaching 15 µm in thickness. Cells rather distinct in water, 2–3 µm in diam., irregularly arranged, with somewhat thickened walls, apices at the surface swollen, 3–4 µm broad, forming a dark brown line. Gonidia 6–9 µm in diam., forming a 60–85(–165) µm thick stratum with uneven surface, sometimes ± distinctly interrupted. Medulla white, 100–200 µm thick, hyphae rather lax, 3–5 µm in diam., rather thin walled, with ± round or elongate, distinct lumina. Lower side pale, ± thinly corticated. Apothecia rarely 2–4 in one areole, usually impressed, disc 0.3–0.6(–0.7) mm broad, quite smooth, often irregular in shape, surrounded by the usually prominent margin of the areole as a thick wall. Excipulum ± distinct, 15–20 µm thick, at the surface poorly or not developed, I–. Hypothecium ca. 50 µm thick with subhymenium 100-130µm, I+ blue. Hymenium 70–80(–90) µm high, I+ dark blue, upper 15µm gradually dark brown. Paraphyses in water not well discrete, coherent, 2–2.5 µm thick, with distinct septa in water, the apices in K swollen, brown, 3–4 µm thick. Asci rarely well developed. Spores about 4–5.5 x (1.8–)2–2.5 µm, ellipsoid, partly somewhat broadly ellipsoid. Pycnidia not found. Medulla K–, P–, C–.

Grows on sandstone without accompanying species. Known from Sweden, England, Italy and Australia.

Trabzon: Düzköy, Beypınar high plateau, on siliceous rock, at 700 m, 40° 48' N, 39° 20' E, 15 August 2004, Yazici 1255.

Aspicilia recedens (Taylor) Arnold

Thallus thick, loosely warted to cracked-areolate, dark grey, without isidia or soralia. Apothecia 0.3–1.0 mm diam., round, numerous, crowded; thalline exciple thin, persistent; true exciple pseudoparenchymatous, cells 5–8 x 3–5 µm; disc dark brown-black, matt, flat, not pruinose; hypothecium with an algal layer below, hymenium colourless, epithecium olive green. Spores (9–)12–14 x 7–9µm. Cortex and medulla P–, K–.

Grows on rocks by the seashore; found only once. Known in Europe from Sweden, Norway, Finland, Ireland, UK, Portugal, Germany, Poland, Ukraine, Romania and Denmark.

Trabzon: Düzköy, Beypınar high plateau, on siliceous rock, at 1700 m, 40° 48' N, 39° 20' E, 15 August 2004, Yazici 1257.

Echinoplaca epiphylla Fée

Thallus foliicolous, usually 5–10 mm diam., sometimes up to 15 mm diam., rounded, continuous or dispersed, verrucose to rugose, greyish-green to whitish grey, usually slightly nitid, 15–30 µm thick, encrusted with colourless crystals, usually furnished with white, tapering hairs, 0.3–0.8 mm long; corticiform layer 3–4 µm thick. Verrucae 0.05–0.1 mm across, irregular, often ± confluent, low, whitish. Hypothallus indistinct. Apothecia adnate, 0.2–0.4 mm diam., emarginate; disc pale to dark yellow or pale brown, non-pruinose, plane; excipulum sometimes faintly apparent around the

hymenium, resembling that of *Echinoplaca leucotrichoides*, but its lateral part usually not more than 100–150 μm broad and 40 μm thick. Algiferous thallus tissue below most of the apothecium. Hypothecium 5–10 μm thick, uncoloured. Hymenium 55–75 μm high, uncoloured or yellowish, K+ pale yellowish to intensely yellow; epithecium pale yellowish, 2–4 μm thick. Paraphyses 1μm thick, richly branched and anastomosing. Asci clavate to clavate, 40–75 x 24–52 μm. Spores single (rarely 2 per ascus), muriform, with numerous cells, broadly ellipsoid, 36–70 x 20–48 μm. Symbiotic alga a species of *Chlorococcaceae*, cells globose, 5–10 μm diam.

This species is pantropic, with an isolated outpost on the East coast of the Black Sea. Known from Honduras, Guatamala, Costa Rica, British Guiana, French Guiana Ecuador, Peru, Brasil, Tanzania, East Africa (Kenya), Java, The Philipines, New Guinea, New Caledonia, The Fiji Islands, Thailand, Japan, China, Australia, Sweden and North America.

Giresun: Center, Çatak Area of Mesudiye village, on Buxus colchica leaves, at 150 m, 40° 25' N, 38° 28' E, 10 September 2004, Aslan 1260.

Lecanora graeca J. Steiner

Thallus crustose, grey to yellow-green, distinct, cracked areolate, without soredia, marginal lobes rigid, 2–3(–5) mm long, thickish, at first often curved later ± cross-cracked, frequently some what recurved at the front, margins especially of the central areoles often blue-black bordered. Apothecia large, irregularly rounded, sunken to somewhat projecting, often areole-like, one per areola. Spores 9–13 x 5–8 μm. Medulla K+ red, C–, P+ yellow, Cortex K–.

Grows mostly on calcareous rock on level or sloping faces, in the Mediterranean region, above all in the east, very scattered. Known from Greece. Tunisia, Sweden and Italy.

Trabzon: Düzköy, Beypınar high plateau, on siliceous rock, at 1700 m, 40° 48' N, 39° 20' E, 15 August 2004, Yazici 1263.

Lepraria cacuminum (A.Massal.) Kümerl. & Leukert

Thallus crustose-leprose, diffuse, forming a thick, compactly packed, irregular patches; or a non-areolate crust, yellowish-white to grey; surface not corticate, a mass of coarse, spherical granules to 0.4 mm diam., or eroded to leave a leprose membrane; soredia with or without short projecting hyphae; margin effuse, rarely sublobed; medulla white, not distinct; lowerside with a weft of loosely entanged hyphae forming a thin, brown hypothallus. Thallus P– or + yellow, K+ yellow, C– (atranorin, ± porphyrilic acid, roccellic acid and fatty acids).

Grows on acid, mossy rocks, also on acid bark, soil and other lichens. Known from temperate-arctic zones of both Hemispheres, in Europe from the UK, France, Estonia, Finland and Russia.

Bursa: MustafaKemalpaşa, near Suuçtu Cascade, on mosses, at 600 m, 39° 03' N, 28° 19' E, 26 August 2003, Yazici 1244.

Parmotrema austrosinense (Zahlbr.) Hale

Thallus foliose with broad lobes, loosely adnate, 5–8 cm wide, lobes rounded, 10–30 mm wide, margins often ascending, eciliate; upper surface pale grey to grey-green, emaculate to faintly maculate sorediate; soralia marginal to submarginal, capitate to wavy, linear or rounded, ± diffuse, occasionally produced on pustules. No isidial initials present. Medulla white (sometimes with patches of orange-red skyrin or other anthraquinones near the lower cortex), lower surface black in the center, with a brown or partly white, erhizinate marginal zone, sparsely rhizinate, rhizines simple, black. Apothecia and pycnidia not seen. Cortex K+ yellow; medulla K–, P–, C+ red, KC+ red.

Grows on tree trunks in well lit sites. Known from Argentina, Brazil, Thailand, Mexico, Australia, England, Japan, South and North America, Africa (Sudan, Ethiopia, Tanzania) and China.

Trabzon: Düzköy, Beypınar high plateau, on Picea orientalis, at 1700 m, 40° 48' N, 39° 20' E, 15 August 2004, Yazici 1252.

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Five trans-septate species of *Hemithecium* from India

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Abstract–Five species of the lichen genus *Hemithecium* have been recorded from India, including the three new species *H. amboliense, H. consociatum,* and *H. norsticticum* and the new combination *H. nakanishianum*. A key to all species of *Hemithecium* thus far known from India is also provided.

Keywords–ascomycetes, taxonomy, *Graphidaceae*

Introduction

Staiger (2002) in her recent treatment of the lichen family *Graphidaceae* reintroduced the genus *Hemithecium* Trevis. *Hemithecium* is distinguished from the closely related new genus *Platythecium* Staiger (2002) and the other members of this family by: labia well developed, convergent; exciple uncarbonized, mostly distinctly crenate and with internal striae; disc not visible; the hyphae forming the lateral exciple/the labia are puffy/swollen and turn I+ brown/reddish-brown while *Platythecium* is characterized by: exciple uncarbonized, divergent, carbonization restricted to the base, lateral exciple only poorly developed forming a narrow brownish layer; disc visible in surface view, disc brown, yellowish, flesh-coloured or transparent, without or with little pruina. So far eight species of *Hemithecium* have been recorded from India (Adawadkar & Makhija, 2005; Makhija & Adawadkar, 2005).

As a result of our continuing investigations in the lichen family *Graphidaceae*, based on the examination of over 500 specimens collected from the Maharashtra state of India, we have recorded five species of the genus *Hemithecium*, three of them are new, namely *H. amboliense, H. consociatum,* and *H. norsticticum,* and a new combination, namely *H. nakanishianum*. *Hemithecium aphanes* was earlier recorded as *Graphis aphanes* (Patwardhan & Kulkarni 1976). A key to all hyaline, trans-septate species of *Hemithecium* so far known from India has also been given.

Materials and Methods

In the present work chemical constituents were identified by thin-layer chromatography using methods standardized for lichen products (Culberson & Kristinsson 1970; Culberson 1972; White & James 1985) with the solvent systems benzene-dioxane-acetic

acid (180:45:5), toluene-ethylacetate-formic acid (139:83:8) and toluene-acetic acid (200:30). All specimens were examined under UV light (365 nm). All the specimens examined are deposited in Ajrekar Mycological Herbarium (AMH).

Key to all known trans-septate species of *Hemithecium* from India

1a. Ascomata immersed in elevated wart-like structures, (not in stroma). *(Thallus creamish to buff; ascomata 0.3–1.5 mm long; exciple entire to striate, non carbonized, present below; ascospores 21–53 x 6–9 µm; constictic, norstictic and stictic acids present.)* ..... ***H. consociatum***

1b. Ascomata not in wart-like structures **2**

2a. Ascospores more than 100 µm long **3**

2b. Ascospores less than 100 µm long **4**

3a. Ascomata 6–15 mm long, robust, branched; exciple colourless to yellowish-brown throughout, with subverrucose margin, heavily crenate, heavy deposition of crystals in crenation; ascospores 10–25-trans-septate, (45-) 52–122 x 8–12 µm; constictic, norstictic and stictic acids present ..... ***H. nagalandicum***

3b. Ascomata 2–9 (-12) mm long, emergent, sparsely branched; exciple 3-4 striate on each side, present below, apically carbonized; ascospores 13–21-trans-septate, 49–112 x 7–14 µm; constictic, norstictic and stictic acids present ..... ***H. amboliense***

4a. Protocetraric acid present. *(Thallus dull yellow; ascomata 0.5–6 mm long, simple to branched, immersed; exciple entire; ascospores 9–12-trans-septate, 29–42 x 4–6 µm; protocetraric, stictic and constictic acids present)* ..... ***H. fulvescens***

4b. Protocetraric acid absent **5**

5a. Ascospores more than 50 µm long **6**

5b. Ascospores less than 50 µm long **9**

6a. Ascomata less than 5 mm long. *(Thallus greenish stramineous, rough; ascomata 1–4 mm long, immersed to slightly raised; exciple entire, woody brown, present below; ascospores 15–22-trans-septate, 63–88 x 6–8 µm; constictic, salazinic, and stictic acids present)* ..... ***H. scariosum***

6b. Ascomata more than 5 mm long **7**

7a. Only norstictic acid present. *(Thallus grayish-white; ascomata 1–9 mm long, concolorous; exciple internally striate, present below, occasionally slightly carbonized at the apex; ascospores 25–56 x 7–8 µm; norstictic acid present)* ..... ***H. norsticticum***

7b. Norstictic and other acids present **8**

8a. Thallus buff to whitish-green; ascomata 0.5–10 mm long, simple or rarely branched, immersed to semi-emergent; exciple with 2-4 internal striae, present at the base; ascospores 10-14-transeptate, 25–67(-80) x 11–12 µm (upto 100 µm long in holotype); constictic, norstictic and stictic acids present. ..... ***H. aphanes***

8b. Thallus greenish glaucous to pale olivaceous buff; ascomata 2–7 mm long, simple to dendroidly branched; exciple entire to indistinctly striate, present at the base; ascospores 8–10 (-15)-transeptate, 30–40(-60) x 6–9 μm; constictic, norstictic (trace), and stictic acids present ..... ***H. nakanishianum***

9a. Norstictic acid present **10**
9b. Norstictic acid absent **11**

10a. Thallus off-white, pale beige; ascomata 0.5–1.5 mm long, delicate, simple to radially to irregularly branched, scattered; disc dark reddish-brown, epruinose; exciple entire; ascospores 8–9-transeptate, 17–25 x 3–4 μm; stictic, consalazinic and norstictic (trace) acids present ..... ***H. pulchellum***

10b. Thallus greenish gray; ascomata 0.2–2 mm long, simple, triradiate or irregularly branched; disc black, pruinose; exciple entire; ascospores 10–14-trans-septate, 33–46 x 6–8 μm; norstictic and stictic acids present. ..... ***H. balaghatense***

11a. Ascomata short less than 5 mm long; testacein present. (*Thallus whitish, distinctly warty, farinaceous; ascomata 0.5–3 mm long, simple to branched, immersed; exciple entire, orange brown, internal striae, present at the base; ascospores 5–7-trans-septate, 21–29 x 4–5 μm; consalazinic acid, testacein A and testacein B present.*) ..... ***H. staigerae***

11b. Ascomata more than 5 mm long; testacein absent **12**

12a. Thallus brownish-yellow, olivaceous, glossy; ascomata 1-13 mm long, simple to branched, immersed, acute ends; disc pale brown; exciple entire, present at the base; ascospores 7-9-trans-septate, 21-33 x 3-4 μm; constictic and stictic acids present ..... ***H. aphaneomicrosporum***

12b. Thallus whitish-green, rough; ascomata 3-7 mm long, light brown, mostly simple; disc reddish-orange; exciple entire, present at the base; ascospores 6-7-trans-septate, 16-21 x 4-5 μm; stictic acid present ..... ***H. croceum***

Taxonomic descriptions

Hemithecium amboliense Makhija & Dube **sp. nov.** **Figure 1**

Similis Hemithecium nakanishianum, *sed ascosporis majoribus differt.*

Etymology: From the latin *ensis*, a place of origin, and Amboli, the type locality.

Holotype here designated–Maharashtra State: Sindhudurg District, Amboli, 28.9.1976, *P.G. Patwardhan & U.V. Makhija, 76.1260*; holotype: AMH.

Thallus greenish-gray, glaucous, continuous, smooth, cracked, thick, delimited by black hypothalloidal region at the periphery. **Ascomata** lirelline, semi-emergent to distinctly emergent, concolorous with the thallus or pale woody brown, straight or curved, flexuose, simple to sparsely branched, 2–9 (-12 mm) long, 0.2–0.7 mm broad, terminally subobtuse. **Disc** narrow, slit-like. **Exciple** entire or indistinctly 3–4 striate, convergent, reddish-brown to blackish-brown, complete, present at the base; completely non-carbonized, dark blackish brown or slightly carbonized at the tips. **Epithecium**

colourless to greenish-brown or brown. **Hymenium** hyaline, not inspersed, 53–49 μm high, 98–213 μm broad, I-, KI-. **Hypothecium** hyaline 35–49 μm. **Paraphyses** simple, thin. **Asci** 4–8 sporate, cylindrical. **Ascospores** hyaline, 13–21-trans-septate, 49–112 x 7–14 μm, I+ blue violet.

Chemistry–stictic, constictic, norstictic (trace) present.

Remarks–*Hemithecium amboliense* is distinguished from the closely related *H. nakanishianum* (*vide infra*) especially by its larger ascospores of 49–112 x 7–14 μm. In *H. nakanishianum* the ascospores are 30–40(-60) x 6–9 μm. The specimens examined were previously identified as *Graphis nakanishiana* (Patwardhan & Kulkarni 1979).

Hemithecium nagalandicum (Kr. P. Singh & G. P. Sinha) Adaw. & Makhija (Adawadkar & Makhija, 2005), a species from Nagaland, India resembles the new species in chemistry, but has larger, 6–15 mm long ascomata, exciple with verrucose, heavily crenate margin and slightly larger ascospores (52–122 x 8–12 μm).

The species was collected on *Mangifera indica* from Amboli in tropical semi-evergreen forest in open places on the road sides and is named after its locality. *H. amboliense* has been found associated with *H. nakanishianum*. The species seems to be restricted to Amboli.

Specimens examined–Maharashtra State: Sindhudurg District, Amboli, *P.G. Patwardhan & U.V. Makhija*, 76.1234B, 76.1235, 76.1256B, 76.160, 76.1261, 76.1263 (AMH).

Hemithecium aphanes (Mont. & Bosch) M. Nakan. & Kashiw. **Figure 3**

Bull. Natn. Sci. Mus. Tokyo ser. B., **29(2):** 85, 2003.

= *Graphis aphanes* Mont. & Bosch *Jungh. Plant. Junghuhn.* **4:** 474, 1855.

Remarks–The species was earlier recorded from Maharashtra as *Graphis aphanes* (Patwardhan & Kulkarni 1976). The species has been collected in semi-evergreen forest in open places on the road sides.

Specimens examined–Maharashtra State: Sindhudurg District, Amboli, *U. V. Makhija*, 76.1230; Kolhapur District, Vishalgad, Amba to Gajapur Road, *C.R. Kulkarni & M.B. Nagarkar*, 74.2204, 74.2205, 74.2207 (AMH).

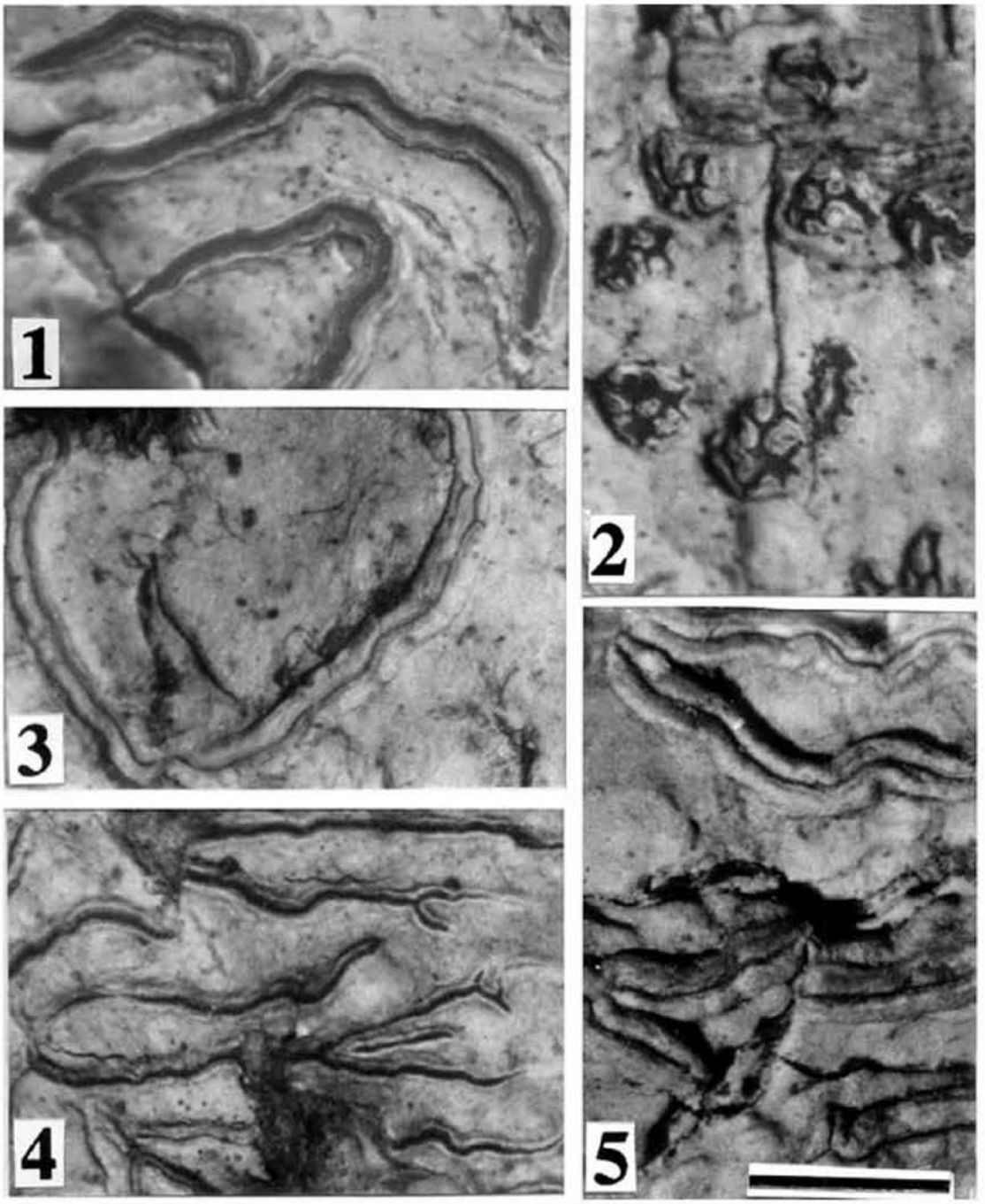
Hemithecium consociatum Makhija & Dube **sp. nov.** **Figure 2**

Species insignis ascomatis consociatis et immersis structura thallo verruciformis; ascosporis incolores, 7–13-trans-septatis, 21–53 x 7–10 μm; acida constictícum, norstictícum et stictícum continens.

Etymology: from the latin *consociatus*, closely associated, connected, a reference to the ascomata immersed in a wart like structure.

Holotype here designated–Maharashtra State: Kolhapur District, on the way to Phonda ghat from Radhanagari, 12.10.2000, *U.V. Makhija & V. A. Mantri, 00.262;* holotype: AMH.

Thallus creamish to buff, smooth, cracked, moderately thick, surrounded by a thin black hypothallus. **Ascomata** lirelline, 0.3–1.5 mm long and 0.1–0.4 mm broad, simple to branched, 2-3 lirellae immersed in an elevated, linear, round or elongate, 0.7–2 mm long



Figures—1-5. Habit (Holotypes) 1. *Hemithecium amboliense*; **2.** *H. consociatum*; **3.** *H. aphanes*; **4.** *H. nakanishianum*; **5.** *H. norsticticum*. Bar = 2mm

and 0.5–0.7 mm broad, non-stromatic, wart like structure. **Disc** narrow to moderately broad, reddish black. **Exciple** orange brown, present at the base, non carbonized, rarely carbonized at the tips, and converging at the apical portion, entire to sometimes striate, covered by a thick thalline margin till the top. **Epithecium** greenish- black, 14–18 μm thick. **Hymenium** hyaline, not inspersed, 74–112 μm high and 70–245 μm broad, I-, K/I-. **Hypothecium** hyaline, 11–21 μm thick. **Paraphyses** simple, septate, thickened

and branched at the apices. **Asci** 8 sporate. **Ascospores** hyaline, fusiform to oblong, 7–13-trans-septate, 21–53 x 7–10 μm, I+ blue.

Chemistry–constictic, norstictic (trace) and stictic acids present.

Remarks–*Hemithecium consociatum* is characterized by its short, simple to branched lirellate ascomata immersed in elevated, linear, round or elongate, non-stromatic, wart like structures, trans-septate ascospores of 21–53 μm long and the presence of constictic, stictic and norstictic (in trace) acids in its thallus.

Thus the new species stands distinct among all species of *Hemithecium* and is not comparable with any other known species of this genus by virtue of its ascomata immersed in non-stromatic, wart like structures.

Hemithecium consociatum was collected in moist place on the road side trees.

Hemithecium nakanishianum (Patw. & C.R. Kulk.) Makhija & Dube **comb. nov.**
Figure 4

= *Graphis nakanishiana* Patw. & C.R. Kulk., *Norw. J. Bot.* **26**: 46 (1979)

Type–India, Karnataka, South Canara, Sringeri, *C.R. Kulkarni & A.V. Prabhu, 74.3288;* holotype: AMH (!)

Thallus greenish glaucous to pale olivaceous buff, continuous or cracked, smooth. **Ascomata** semi-emergent to emergent, concolorous with the thallus or pale woody brown, flexuose to dendroidly branched, 2.0–7.0 mm long, ends subobtuse to acute. **Disc** narrow, slit-like. **Exciple** entire or indistinctly striate, convergent, crimson red to slaty, completely non-carbonized. **Epithecium** hyaline, thin. **Hymenium** hyaline, not inspersed, 120–180 μm high and 150–200 μm broad, I-, K/I- **Paraphyses** simple, thin, unbranched. **Asci** cylindrical, 4–8 sporate. **Ascospores** hyaline, 8–10 (-15)-trans-septate, 30–40(-60) x 6–9 μm I+ blue.

Chemistry–constictic, norstictic (trace) and stictic acids present.

Remarks–In the protologue to *Graphis nakanishiana* a large number of specimens were cited under this name by Patwardhan & Kulkarni (1979). The authors reported a "great range of variation in thallus colour, lirellae morphology (length, branching, and colour, nature of disc and labia) and size and number of locules of ascospores" and suggested that this was "possibly due to incomplete segregation of species by hybridization in a complex of two or more taxa". Careful examination of these specimens, and additional specimens cited below, has resulted into the segregation of three distinct species namely *Hemithecium amboliense, H. aphanes, H norsticticum* and the new combination *H. nakanishianum* which are described in this work. All the additional specimens cited are in AMH.

Hemithecium nakanishianum seems to be one of the most predominant and widely distributed species in Maharashtra. The species has been collected on road side trees in both moist and dry conditions.

Specimens examined–Maharashtra State: Kolhapur District, on the way to Kumbhi from Gaganbavda, *B.C. Behera & B.A. Adawadkar,* 00.344, *B.C. Behera & V. A. Mantri,* 00.346; Phonda to Vaibhavwadi, *B.A. Adawadkar & K.R. Randive,* 00.331; Radhanagari to Phonda, *U.V. Makhija & V.A. Mantri,* 00.265, 00.270; on the way to Phonda from Radhanagari, *U.V. Makhija & V.A. Mantri,* 00.264, 0.266, 00.280; Panhala,

U.V. Makhija & V.A. Mantri, 00.381, 00.384, 00.389, 00.481; Panhala, *U.V. Makhija & V.A. Mantri* 00.391, 00.477, 00. 478; Dongarwadi, *V.A. Mantri & K.R. Randive*, 00.134, 00.136; Dongarwadi,, *U.V. Makhija & B.C. Behera*, 00.131; Purandar fort, *C.R. Kulkarni*, 73.157; Lonavala, 00.86; Sinhagad, *U.V. Makhija*, 00.53; Shirgaonkar Point, *U.V. Makhija & B.A. Adawadkar*, 00.224, 00.229, 00.230; Amboli to Shirgaonkar point, *U.V. Makhija & V.A. Mantri*, 00.225, 00.241; on the way from Amboli to Ajra, *U.V. Makhija*, 00.210; on the way to Sawantawadi from Amboli, *U.V. Makhija & B.A. Adawadkar*, 00.238, 00.239 (AMH).

Hemithecium norsticticum Makhija & Dube **sp. nov.** **Figure 5**

Similis Hemithecium aphanes *sed acidum norsticticum continens vice acidum consticticum, norsticticum et sticticum differt.*

Etymology: from the name of the lichen substance norstictic acid.

Holotype here designated–India, Maharashtra State, Bhimashankar, 29.9.1974, *M.B. Nagarkar & C.R. Kulkarni, 74.784*; holotype: AMH.

Thallus grayish-white to buff, glaucous, thin, smooth to cracked, sometimes warty, surrounded by thin, black, hypothallus. **Ascomata** lirelline, 1–9 mm long and 0.5 mm broad, simple to rarely branched, immersed to semi-emergent, straight to irregularly curved, flexuose, scattered, concolorous with the thallus, tapering, terminally acute to obtuse. **Disc** narrow, dark brown, 0.1–0.2 mm broad, epruinose. **Exciple** complete, present at the base, converging at the apical portion, internally striate, non carbonized, to rarely carbonized at tips. **Epithecium** dark brown to greenish-brown, 14–18 μm thick. **Hymenium** hyaline, not inspersed, 53–81 μm high and 158–210 μm broad, I-, K/I-. **Hypothecium** hyaline,10–18 μm thick. **Paraphyses** simple, long, thin, filiform, septate. **Asci** 2-8 sporate. **Ascospores** hyaline, 7–14-trans-septate, 25–56 x 7–8 μm, I+ blue.

Chemistry–norstictic acid present.

Remarks–*Hemithecium norsticticum* is similar to *H. aphanes* in its morphology and anatomy but differs from *H. aphanes* in containing norstictic acid in contrast to *H. aphanes* which contains constictic, norstictic and stictic acid in its thallus. *Hemithecium nakanishianum*, another species from India is very similar to *H. norsticticum* in exciple characters, ascospores size, but contains stictic and constictic acids with only traces of norstictic acid. The new species is distinguished from the chemically similar *H. oshioi* (M. Nakan.) M. Nakan. & Kashiw (Nakanishi *et al.* 2003) by the larger ascospores; in *H. oshioi* the ascospores are 20-30 x 7-9 μm. The new species is found in dry deciduous forest as well as in semi evergreen forests and seems to be restricted to Maharashtra only.

Specimens examined–Maharashtra State: Pune District, Bhimashankar, *M.B. Nagarkar & C.R. Kulkarni*, 74.773, 74.778, 74.784, 74.786, 74.815; Dongarwadi, *U.V. Makhija & B.A. Adawadkar*, 00.137; Sinhagad, *U.V. Makhija & B.A. Adawadkar*, 00.52; Malshej Ghat, Neemgiri, *U.V. Makhija & A.V. Bhosale*, 02.16, 02.20, 02.21, 02.22, 02.29, 02.30; Satara District, Mahabaleshwar, Dhobighat, *M.B. Nagarkar*, 74.76; Bombay point, *M.B. Nagarkar & P.G. Patwardhan*, 75A, 85.1855, 85.1856, 85.2937; Sindhudurg District, Amba, *C.R. Kulkarni & A.V. Prabhu*, 74.1336, 74.1644 (AMH).

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Leptogium diffractum in Slovakia and Czech Republic (lichenized Ascomycota)

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Abstract—Specimens assigned to *Leptogium diffractum* originating in Slovakia and Czech Republic were located and revised. The occurrence of the species in Slovakia is supported by one historic collection and one new finding, presented here. The rest of the material as well as Czech material represent *Collema parvum*. *L. diffractum* and its synonym *L. placodiellum* are lectotypified. Overall distribution and aspects of conservation evaluation are discussed.

Key words—*Collemataceae*, *Leptogium placodiellum*, cyanophilic lichens, types

Introduction

Leptogium diffractum is a tiny crustose cyanolichen. The minute placodioid thallus (1–1.5 cm diam.) is rimose-cracked, composed of rosette-like or irregularly arranged areoles and lobules ± 1 mm long. Dorsiventral areoles often ascend and subsequently die away. Their surface is delicately wrinkled. Apothecia are rarely produced. Coppins & Purvis (1992) give the following details: apothecial disc 0.2–0.5 mm diam., size of ellipsoid, muriform spores 15–30 × 8–12 µm. Production of vegetative diaspores has not been observed.

L. diffractum is currently regarded a European geoelement. It has been reported from Austria (Hafellner & Türk 2001), Benelux (Diederich et al. 2000), Bosnia-Hercegovina and Croatia (Kušan 1953), Estonia (Martin et al. 2000, Anonymous 2004), France (Degelius 1954, Ozenda & Clauzade 1970), Great Britain (Coppins & Purvis 1992), Hungary (Verseghy 1994), Italy (Nimis 2003), Germany (Scholz 2000), Slovakia (Bielczyk et al. 2004), Spain (Aragón & Otálora 2004), Sweden (Santesson et al. 2004) and Ukraine (Coppins et al. 2001).

The species is confined to basic rock substrates. Aragón & Otálora (2004) are more specific, explaining that the rock is preferably dry and perpendicular, and they list further accompanying cyanolichens viz. *Collema cristatum*, *Leptogium massiliense*, *Placynthium hungaricum*, *P. subradiatum*, *P. tremniacum* or *Zahlbrucknerella calcarea*.

In Slovakia the species was considered *Vulnerable* (see IUCN Red List categories and criteria) due to scattered records. After the ongoing field research, it was placed into the category covering the taxa with deficient data (DD) in the latest version of the Red List of lichens (Pišút et al. 2001). It is also listed as *Vulnerable* in the Red List of Sweden (Gärdenfors 2005); in Great Britain, referring to post-1960 records, it is classified as nationally rare (Woods & Coppins 2003).

Materials and Methods

Specimens labelled as *Leptogium diffractum*, *Collema diffractum* or *Leptogium placodiellum* kept in the collections of the following institutions were studied: BM, BP, BRA, BR, BUC, BUCA, CL, GZU, H-NYL, KRAM, L, M, PAV, PRC, PRM, SAV, SLO, TNP, UPS, VBI, W, as well as private collections of A. Lackovičová (Bratislava, Slovakia), I. Pišút (Bratislava, Slovakia), A. Vězda (Brno, Czech Republic). Acronyms follow Index Herbariorum by Holmgren et al. (1990).

Morphological and anatomical characters of the specimens were investigated using light microscope and preparations in 10% aqueous KOH. Localities are fully cited. Alpha-numberic codes associated with localities refer to the UTM coordinates used in Slovakia. Nomenclature of the cited lichen names conforms Bielczyk et al. (2004).

Results

The species was reported from Slovakia from two orographic units. The collection from Belianske Tatry Mts. (Lojka 1869, Szatala 1930) is in poor condition (broken apart into pieces of ca 1 mm). Examination of the other specimen from Biele Karpaty Mts (Pišút 1981) showed that it represents another gelatinous lichen, *Collema parvum*, a species at first sight closely resembling *L. diffractum*. The dark grey to black colour of the *Collema* species, rounded lobes, widening towards the tips, abundant spherical isidia as well as the absence of a paraplectenchymatous cortex unambiguously differ from that of *L. diffractum*. The collection labelled as *L. diffractum* from the Czech Republic also belongs to *Collema parvum*.

Simultaneously, field research was carried out to determine whether the species is as rare as herbarium records indicate. In Slovakia the authors concentrated on limestone areas such as the southwest, north central, and central karst regions and the Jurassic-Early Cretaceous klippen belt. This belt initiates in Austria (north of Vienna), breaks the surface in southwest Slovakia (Podbranč), and then follows the Váh river northeast to Orava, near southern Poland. It then turns south, back into Slovakia in Červený

Kláštor (Pieniny Mts). Further in the east it sinks under the volcanic rocks of Vihorlat Mts, crossing the Ukrainian border before ending in Romania. In the Czech Republic, the main limestone islands were studied: Czech karst (Central), Moravian Karst and the Pavlovské vrchy hills in the southeast. Despite the number of localities with favourable conditions in both the countries, *L. diffractum* was recorded only once. In addition to this several tiny epilithic cyanolichens (from the genera *Lemmopsis*, *Psorotichia*, *Anema*), either new records for Slovakia, or previously undercollected, were found (cf. Guttová & Palice 2002, Guttová 2004). This fieldwork shows that *L. diffractum* is rare although it has not been possible to ascertain the cause of this. The species currently grows on perpendicular rock faces of the cliffs above the gorge Manínska tiesňava. The site features temperature inversion due to local geomorphology.

SELECTED SPECIMENS EXAMINED. *Leptogium diffractum*, An Kalkfelsen bei Lofer in Pinzgau, Krempelhuber, (L 0194179); *Leptogium placodiellum*, ad lapides calcareos, Cher, Châteauneuf, dans les vignes, 1863 Dr. Ripart (H-NYL P.M. 340); *Leptogium placodiellum*, Gallia, Châteauneuf, Ripart, (H-NYL P.M. 341); *Leptogium placodiellum*, ad lapides calcareous, Châteauneuf, 1863 Ripart (M 0059941). Crypt. Vind. 2448 (BP, BR, CL, GZU, W). **SLOVAKIA. Belianske Tatry Mts.**, Faixová (ut Feigsblösse), am Kalkfelsen, 1868 Lojka (W, Lojka 1869, Szatala 1930, Lisická 2005); **Biele Karpaty Mts.**, ad saxa calcarea aprica in monte Chmeľová supra pag. Vršatecké Podhradie, alt. 800 m, 1971 Pišút (BRA, Pišút 1981) = *Collema parvum*, rev. A. Guttová; **Strážovské vrchy Mts.**, Manín, NNR Manínska tiesňava, Malý Manín, limestone ridge Jašteričí hrebeň, S exposed limestone walls, ca 500 m a. s. l., 10. 5. 2003 leg. A. Guttová, K. Kresáňová & J. Smatanová (SAV) (6877/c). **CZECH REPUBLIC. Drahanská vrchovina hills**, Blansko, „Rudické propadání" prope Jedovnice, ad saxa calcarea, alt. 480 m s. m., 1973 Vězda (BRA, hb. Vězda) = *Collema parvum*, rev. A. Guttová.

The species and nomenclatural notes

Leptogium diffractum Kremp. ex Körb. – Parerga Lichenologica 1859–65: 424.
Type: Auf Kalkgerölle unter Buchen bei Prunn unweit Riedenburg im Altmühlthale. – August 1863, Arnold (L 0194178), lectotype *designated here.*

= *Leptogium placodiellum* Nyl. ex Ripart – Bull. Soc. Bot. France 23: 269 (1876).
Type: Châteauneuf – pierre, d´un vieu mur au ruines dans des vignes, du côté du nord. 13 août 1863 Dr. Ripart (H-NYL 41135), lectotype designated here.

The species has been misunderstood and renamed throughout its history. *Leptogium diffractum* appeared first as a nomen nudum in Arnold (1861) who took up an unpublished Krempelhuber´s name. However it was not validly published until Körber (1859–65: 424) who based his description on Arnold´s sterile specimens (Lichenes exsiccati/ Lichenes Jurae 156b) (Arnold 1861) and those of Krempelhuber from Pinzgau.

We located and studied original material cited in the protologue. The specimen in Lichenes exsiccati/Lichenes Jurae 156b (L) contains well-developed, typical thalli both in initial (1–2 mm diam.) and adult phases (5–6 mm diam.). Apothecia are not developed. Cortical layer is continuous, covering upper and lower surface, where, sporadic rhizinae help to fix the areoles to the substrate. We select this specimen

0194178 (L) as a lectotype of the taxon according to ICBN, Art. 9.2. Krempelhuber's collection from Pinzgau (L) is a little piece of stone with 2 sterile thalli (3 and 4 mm diam.).

Leptogium diffractum is currently synonymized with *L. placodiellum* (e.g. Nimis 2003) and was linked with it since its introduction in the past. *L. placodiellum* was first used as a nomen nudum by Nylander in a footnote to the presumably related species *Pyrenidium actinellum* Nyl. (Nylander 1865, Crombie 1870) – "*Leptogium placodiellum dixi L. diffractum Kphb. (Flora 1861, p. 258), quod nomen jam affini Collemati adhibitum fuit; a Dre. Ripart in Gallia centrali lectum est.*" Ripart formally described the species (Ripart 1876). It was also him who pointed out that the newly described species might be identical with *L. diffractum*: "*M. Krempelhuber a publié, sous le nom de L. diffractum, une espèce trouvée par lui en Allemagne, également à l'état stérile, et qui est probablement la même que la nôtre*". In his description he referred to the collection from Châteauneuf-sur-Cher "*sur les pierres du calcaire jurassique*". We studied Ripart's material kept in H-NYL (3 specimens) and one duplicate kept in M comprising well developed, sterile thalli. It is identical with the above selected lectotype of *L. diffractum*. *L. placodiellum* accordingly is a younger synonym of *L. diffractum*. We designate the specimen 41135 as a lectotype of the name *L. placodiellum* following ICBN, Art. 9.2.

Interestingly, in his descriptive catalogue, Crombie (1894) chose the name *L. placodiellum* over *L. diffractum*. His argument was that even though the epithet *diffractum* has priority, it was already used in the combination *Collema diffractum* (Nylander 1857). Forssell (1885) however, and then Degelius (1954) or Moreno & Egea (1994) showed, that this combination denotes the crustose cyanolichen *Psorotichia diffracta* (Nyl.) Forssell.

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Taxonomic revision of the myxomycetes from Cuba deposited in the Farlow Herbarium (USA)

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Abstract—A critical revision of the myxomycetes from Cuba deposited presently in the Farlow Herbarium (FH) is presented. The total number of examined specimens is 83, of which 13 could not be determined to species. These specimens were gathered mainly during the 19th century by Charles Wright in the course of expeditions he made to this island. All the species are discussed and, in the case of records of taxonomic or chorological interest, they are described. The determinations are reinforced by studies of the spore ornamentation by SEM, using the critical point method. Micrographs of the spore ornamentation of species little studied by SEM or that are of particular interest for the island biota are included.

Key words—chorology, Myxomycota, taxonomy, Neotropical myxobiota, SEM

Introduction

We consider that the revision of historic material as a necessary part of a detailed study of the Myxobiota of a country, representing a basic aspect in the compilation of existing information in herbaria and from the literature.

There are a few references to Cuban Myxomycetes prior to 1980 (Montagne 1845, Berkeley 1869, Masse 1892, Farr 1976), and most of these refer to specimens deposited in the Farlow Herbarium (FH) and in the National Fungus Collections (BPI) in the 19th century.

Most of the specimens deposited in the Gray Herbarium of Farlow Herbarium were collected by Charles Wright.

Asa Gray (1810-1888) could be regarded as the person who established systematic botany at Harvard and, to some extent, in the United States because he was well-known as the "Father of American Botany" and champion of Darwin's theory of Natural Selection. As a result of Gray's ties with European botanists, developed through correspondence, exchange of specimens and visits to Europe, combined with his network of collectors in North America, he was able to build a major herbarium, which became the nucleus of the current Gray Herbarium at Harvard University in Cambridge, Massachusetts.

Among the collectors was Charles Wright (1811-1885). Wright corresponded with Asa Gray, beginning in 1837 following his move to Texas. He traveled around the world in 1851 and collected numerous specimens from Texas, New Mexico, Arizona, Australia, Hong Kong, Japan, islands of the Bering Straits and Nicaragua.

From 1856 to 1867, Wright made many trips to Cuba. His work was described by the botanist August Grisebach in his work *Plantae Wrightianae e Cuba Orientali,* published in two parts from 1860-1862. Rarely did Wright publish his own finding, for it appears that he was much more interested in collecting than in writing.

Wright's return from Cuba in 1867 marked the end of his epic travels. In his later years he spent much time in Cambridge, working at the Gray Herbarium.

Locating the material was not easy because herbarium references were not always indicated. In other cases, neither the herbarium number nor the particular collection number is cited; therefore, thus it is difficult to know the precise origin of some specimens.

Another difficulty is that the material is sometimes poorly conserved or is very sparse and sometimes non-existent. Information on the specimen labels is generally incomplete or the collection date is illegible.

For this study, bibliographical references from specialized literature have been compiled and a taxonomic revision of the collections in the FH herbarium has been carried out.

Materials and Methods

The Cuban material we studied comes from the Harvard University, Farlow Herbarium (FH). Depending on their conservation state, they were studied macro- and microscopically.

Samples for light microscopy were mounted in Hoyer's medium and PVA according to Schnittler & Novozhilov (1996) and Koske & Tessier (1983). Spore measurements were made under an oil immersion objective and include surface structures such as spines or warts.

Scanning electron microscopy (SEM) images were prepared using the critical point method (Castillo et al. 1997) and the micrographs were produced at the University of Alcalá using a Zeiss DSM-950. This technique allows using very little material (one sporocarp, a part of it or only a small portion of spores).

In some cases, where the sample is scarce, is not well conserved or presents some taxonomic problem, it was compared with other Cuban material deposited in the Herbarium of the Cuba National Botanical Garden (HAJB).

In the list given below, we have used a question mark to indicate places where we had a problem in interpretation of data labels caused by such factors as faded hand-writing and where localities seem no longer to exist. The beginning of data for each sample studied is indicated by "CUBA" in bold type.

The terminology used for the spore-producing stages follows Dörfelt & Marx (1990) and Lado & Pando (1997). The spore wall ornamentation as seen by SEM is described according to the terminology proposed by Rammeloo (1975a, b) and abbreviations for author citations follow Kirk & Ansell (1992).

Taxonomic Description

Arcyria cinerea (Bull.) Pers., Syn. Meth. Fung.: 184. 1801.

= *Arcyria albida* Pers., Neues Mag. Bot. 1: 90. 1794

= *A. bicolor* Berk. & M.A. Curtis in Berkeley, Grevillea 2: 67. 1873

SPECIMENS EXAMINED — CUBA: Retiro, on rotten wood, June 19, *leg.* C. Wright (672), Fungi Cubenses Wrightiani n° 542 (Gray Herbarium) FH, as *Arcyria bicolor* var. *albida*. **CUBA:** ad ram: deject, *leg.* C. Wright (672), ex folder 192, Curtis Fungus Herbarium n° 542, FH, as *Arcyria bicolor*.

COMMENTS — Berkeley (1869) mentions the collection "Wright 672" (Curtis Herbarium) as *Arcyria bicolor*, and Massee (1892) also mentions *A. bicolor* with the collection "Fung. Cub. Wrightian. 542" (Gray Herbarium). Both authors refer to the same collection (Wright 672) in two different herbaria: Gray Herbarium and Curtis Herbarium. The specimen from the Gray Herbarium has a hand-written label with the collection data and the substrate is "rotten wood". However, in the material of the Curtis Herbarium appears: "ad ram: deject" and there is also another label written by Sturgis: "the digitate form of *A. cinerea*".

Berkeley (1869) also cites *Arcyria cinerea* Fr. as "Wright 502", but subsequently he says "With n° 502 is an abortive *Marasmius*". Furthermore, *Arcyria cinerea* Fr. is a later homonym of *A. cinerea* (Bull.) Pers., according to Lado (2001).

Farr (1976) also refers to BPI material that has not been examined by us. There is also material of Wrightiani 542 in BM.

Arcyria denudata (L.) Wettst., Verh. Zool.-Bot. Ges. Wien 35: Abh. 535. 1886

= *Clathrus denudatus* L., Sp. Pl.: 1179. 1753

SPECIMENS EXAMINED — CUBA ORIENTALI: 1856-7, *leg.* C. Wright, Plantae Cubenses Wrightianae (Gray Herbarium) FH, as *A. incarnata*. **CUBA:** *leg.* C. Wright (801), ex folder 192, Curtis Fungus Herbarium, FH, as *A. punicea* Fr. **CUBA:** Cienfuegos, Botanical Woods, August 16-1933, *leg.* A. G. Kevorkian (30), *det.* G. D. Darke, FH. **CUBA:** rotten wood, April 1857, *leg.* C. Wright, Curtis folder 192, Curtis Fungus Herbarium, FH as *A. incarnata* Pers. **CUBA:** Santa Clara, San Blas, foothill of Trinidad Mountains, on dead "snag" 6 above ground, June 20-21-1941, *leg.* W.L. White (337), *det.* D.H. Linder, FH.

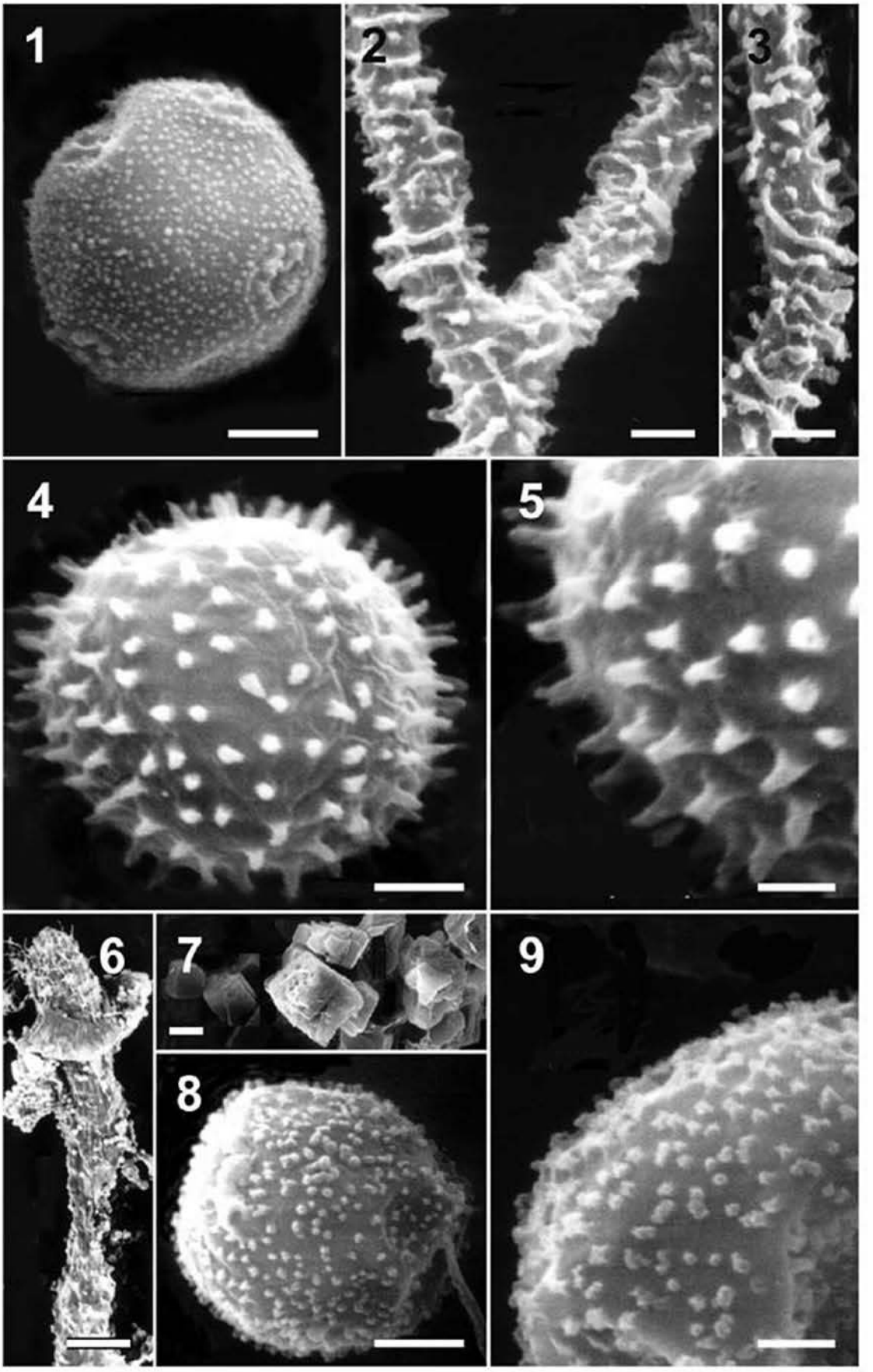
COMMENTS — There are two specimens identified as *Arcyria incarnata* Pers. and another as *A. punicea* Fr. but both correspond to *A. denudata* in agreement with the determinations made by Darke (Kevorkian 30) and Linder (White 337).

Arcyria magna Rex, Proc. Acad. Nat. Sci. Philadelphia 45: 364. 1893 **FIGURES 1-3**

SPECIMENS EXAMINED — CUBA: Baracoa, Maravi, 9-30-1910, FH, as *Arcyria incarnata*, revisado por M.L. Farr 7-XII-1972, *Arcyria oerstedtii*. *Ibidem*, FH, as *A. incarnata*.

COMMENTS — M.L. Farr determined this material (7-12-1972) as *Arcyria oerstedtii* Rost. and she mentions in *Flora Neotropica* (1976): "two specimens labelled *A. incarnata* from Baracoa, Cuba, 1910 (FH) have spinose capillitium and belong in *A. oerstedtii*."

In this study we place both these specimens in *Arcyria magna* due to their pink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sporothecae which are drooping at maturity, with a lax capillitium that is extremely elastic, flaccid, deciduous and sculptured with cogs and half-rings and small spines.

Arcyria obvelata (Oeder) Onsberg, Mycologia 70 (6): 1286. 1979 ["1978"]

≡ *Embolus obvelatus* Oeder, Fl. Dan. 3(9): 8, tab. 536 (1770)

= *Arcyria nutans* (Bull.) Grev., Fl. Edin.: 455 (1824)

SPECIMENS EXAMINED — CUBA ORIENTALI: 1856-7, *leg.* C. Wright, Plantae Cubenses Wrightianae n° 543 (Gray Herbarium) FH as *A. nutans* Grev. **CUBA:** April 1857, *leg.* C. Wright, Curtis 192, Fungus Herbarium, FH as *A. nutans* Grev.

COMMENTS — Farr (1976) comments on this species "the Cuban record is doubtful, since the apparent voucher collections (FH) no longer contains any myxomycete; however, this common species undoubtedly is present on the island".

The material examined of "Plantae Cubenses Wrightianae 543" and in "Curtis 192" it is not well conserved, and only capillitium was observed in the first, stalks and calyculus separated from the capillitium in later. The capillitium of samples studied exhibits pink tones. The lack of yellowish coloration makes us doubt the identity of these samples. However, this species is present in Cuba and is cited by Camino & Pérez (2000).

Berkeley (1869) mentions *Arcyria nutans* Fr. based on the collections of Wright 258, 262 (Fungi Cubenses Wrightiani 543). In the material received from FH, Wright's numbers do not appear but, as at least one refers to "Fungi Cubenses Wrightiani 543", we presume that it is the one mentioned by Berkeley (1869). Also, this species does not appear in Lado (2001) with Fries as the author.

Cribraria intricata Schrad., Nov. Gen. Pl.: 7. 1797

≡ *Trichia intricata* (Schrad.) Poir. in Lamarck, Encycl. 8: 56. 1808

SPECIMEN EXAMINED — CUBA: Santa Clara, Cienfuegos, Soledad, Blanco's Woods, July 1-1941, *leg.* W.L. White (581), *det.* D.H. Linder, FH.

COMMENTS — This species is mentioned for Cuba by Farr (1976) as FH without indication of the herbarium number. We examined the material of FH (White 581) and we agree with Linder's determination.

Diachea bulbillosa (Berk. & Broome) Lister in Penzig, Myxomyc. Fl. Buitenzorg: 45. 1898 **FIGURES 4-7**

SPECIMENS EXAMINED — CUBA ORIENTALI: 1856-7, *leg.* C. Wright, Plantae Cubenses Wrightianae (Gray Herbarium) FH, as *D. elegans* Fr. **CUBA:** whitout locality, woods, Dec. 14, *leg.* C. Wright (665), Fungi Cubenses Wrightiani n° 537 (Gray Herbarium) FH, as *D. elegans* Fr. **CUBA:** ad Filicem, *leg.* C. Wright (665), ex folder

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FIGURES 1-3. ***Arcyria magna*** (Baracoa, Maravi, 9-30-1910). 1. Spore (bar = 2 μm). 2-3. Detail of capillitium (bar = 2 μm). **FIGURES 4-7.** ***Diachea bulbillosa*** (C. Wright 665, Fungi Cubenses Wrightiani n° 537 as *D. elegans*). 4. Spore (bar = 2 μm). 5. Detail of spore ornamentation (bar = 1 μm). 6. Detail of columella (bar = 100 μm). 7. Detail of cubical crystals of peridium (bar = 5 μm). **FIGURES 8-9.** ***Diderma effusum*** (C. Wright 797, Fungi Cubenses Wrightiani 526 type as *Diderma cubense*). 8. Spore (bar = 2 μm). 9. Detail of spore ornamentation (bar = 1 μm).

187, Curtis Fungus Herbarium n° 537, FH, as *D. elegans* Fr., Rev. W.C.S. and M.L. Farr, 28-XI-1972, as *D. bulbillosa*.

COMMENTS — Of the six samples received and determined as *Diachea elegans*, after our revision, three specimens were considered to belong to *D. bulbillosa* and the other three to *D. leucopodia*.

Berkeley (1869) cites from the genus *Diachea* only *D. elegans* and mentions four specimens of Wright (268, 271, 495, 665), "Fungi Cubenses 537". Of these specimens we have been able to examine the samples Wright 268 and 665.

With the number Wright 665 (Fungi Cubenses 537) there are two exsiccatae, one of them placed inside an envelope and developed on fern fronds and another held inside a cardboard box, also on the same substrate. The latter was identified by W.C. Sturgis as *Diachea bulbillosa* and confirmed by Farr (28-XI-1972). We agree with these determinations. We think that the sample kept in the envelope is the original material because a hand-written note appears inside and the substrate is more abundant and complete. The other revised specimen of "Plantae Cubenses Wrightianae" has no number and the substrate appears to be grass.

By SEM, a short cylindrical columella with an obtuse apex is present. Spores are strongly spinose and the crystals of calcium carbonate are cubic.

Diachea leucopodia (Bull.) Rostaf., Sluzowce Monogr.: 190. 1874

= *D. elegans* (Trentep.)Fr., Syst. Mycol. 3: 156. 1829

SPECIMENS EXAMINED — **CUBA:** sides of Loma del Gaso?, on grasses, *leg.* C. Wright (268), Fungi Cubenses Wrightiani n° 537 (Gray Herbarium) FH, as *D. elegans* Fr. **CUBA ORIENTALI:** 1856-7, *leg.* C. Wright, Plantae Cubenses Wrightianae (Gray Herbarium) FH, as *D. elegans* Fr. **CUBA:** on gram. & fol. dej., Jan. 1857, *leg.* C. Wright, ex folder 187, Curtis Fungus Herbarium n° 537, FH, as *D. elegans* Fr.

COMMENTS — Farr (1976) questions the presence of *D. leucopodia* in Cuba, as although originally the Cuban specimens were determined as *D. elegans*, synonym of *D. leucopodia*, some specimens of FH are indeterminate and another, (Wright 665), belongs to *D. bulbillosa*.

The material "Wright 228" (Fungi Cubenses Wrightiani 537), is mentioned by Berkeley (1869) and the other two specimens do not bear numbers. In one of them, there appears on the border the hand-written note "Curtis 187", and we suppose that this belongs to Curtis Fungus Herbarium.

We confirmed that *Diachea leucopodia* is cited for Cuba by Berkeley (1869) and Massee (1892). This species has been mentioned later by Camino & Perez (2001).

Diderma effusum (Schwein.) Morgan, J. Cincinnati Soc. Nat. Hist. 16: 155. 1894

FIGURES 8-9

= *D. cubense* Berk. & M.A. Curtis in Berkeley, J. Linn. Soc. Bot. 10: 347. 1868

SPECIMENS EXAMINED — **CUBA:** on leaves? among coffee plants, July, *leg.* C. Wright (797), Fungi Cubenses Wrightiani 526 Gray Herbarium, FH type as *Diderma cubense*. **CUBA:** ad fol. mort, July, *leg.* C. Wright (797), ex folder 177, No. 526, Curtis Fungus Herbarium, FH as *Diderma cubense*.

COMMENTS — The first sample is kept inside a paper envelope with a red label that

indicates "TYPE". Inside this are numerous pieces of leaves and some stems that are fragmented. We have been able to separate two pieces of leaves with at least one complete sporocarp and other open ones that have been deposited in an Eppendorf tube for their protection. We have been able to observe remains of spores.

The sporocarps are whitish, sessile, with a marked line of dehiscence, the columella is pale ochraceous to ochraceous whitish and flat. The spores are globose, pale violaceous, (5-)6-8(-9) μm in diam, warted, with groups of darker, more prominent warts. The capillitium has not been observed in order to conserve the complete sporocarp. Spore ornamentation by SEM consists of small, irregularly distributed baculae.

In the second sample (a duplicate of the first) the material is kept in a cardboard box but only the hypothallus, some pseudocolumellae and a few spores are conserved. It was revised by M.L. Farr (28-XI-1972) who indicates that "This is the type of *Diderma cubense* B & C, which is listed by Martin & Alexopoulos (1969), as syn. of *D. testaceum*. We would prefer to place this specimen in *D. effusum* (Schw.) Morgan".

After studying the type material of *Diderma cubense*, we agree with Farr (1976) that it is a synonym of *D. effusum* and not of *D. testaceum* (Schrad.) Pers., as Martin & Alexopoulos (1969) had indicated.

Didymium squamulosum (Alb. & Schwein.) Fr., Symb. Gasteromyc.: 19. 1818
= *D. costatum* Fr., Syst. Mycol. 3: 118. 1829
= *D. herbarum* Fr., Syst. Mycol. 3: 120. 1829

SPECIMENS EXAMINED — CUBA: Stalks & leaves of Congo Bean, Jan. 1857, *leg.* C. Wright, ex folder 179, Curtis Fungus Herbarium, FH as *Didymium herbarum* Fr. **CUBA:** ad folia deject, *leg.* C. Wright (667), ex folder 179, n° 527 Curtis Fungus Herbarium, FH as *Didymium costatum* Fr. **CUBA:** *leg.* C. Wright, Fungi Cubenses Wrightiani n° 527 (Gray Herbarium) FH as *Didymium costatum* Fr.

COMMENTS — In the sample originally identified as *Didymium herbarum*, there is a hand-written label that says "*D. squamulosum*" but without any signature. This sample consists only of one complete, loose sporocarp. In the sample "Wright 667", one typical stalk, one sporocarp and very few spores are conserved. The sample without number of Wright (Fungi Cubenses Wrightiani n° 527) consists of several complete sporocarps that are typical for this species.

Berkeley (1869) mentions *Didymium costatum* as "Wright 667" (Fungi Cubenses Wrightiani 527), growing on a leaf. We examined two specimens with this number but one has no indication of Wright's collection number. However, it is very evident that it belongs to the same collection (Wright 667) because it is clear that the leaf was cut to make a duplicate. We confirm the presence of *D. squamulosum* in Cuba.

Massee (1892) also mentions *Didymium squamulosum* but he does not indicate exsiccatae.

Fuligo septica (L.) F.H. Wrigg., Prim. Fl. Holsat.: 112. 1780
= *Aethalium septicum* (L.) Fr., Syst. Mycol. 3: 93. 1829

SPECIMENS EXAMINED — CUBA ORIENTALI: 1856-7, *leg.* C. Wright, Plantae Cubenses Wrightianae (Gray Herbarium) FH, as *Aethalium septicum*. **CUBA:** Monte Verde, on rotten wood in field, *leg.* C. Wright, Plantae Cubenses Wrightianae n° 525,

FH, as *Aethalium septicum*. **CUBA:** Cienfuegos, Soledad, growing on trash heap at edge of cane field on road to Limonos, Sept. 12-1933, *leg.* A. G. Kevorkian (51), *det.* G. D. Darke, FH.

COMMENTS — Wright 525 is the only sample recorded by Berkeley (1869).

Massee (1892) also mentions *Fuligo septica* as *Fuligo varians* Rostaf., but does not indicate exsiccatae.

Hemitrichia calyculata (Speg.) M.L. Farr, Mycologia 66 (5): 887. 1974

FIGURES 10-12

SPECIMENS EXAMINED — CUBA ORIENTALI: 1856-7, *leg.* C. Wright, Plantae Cubenses Wrightiani n° 547 (Gray Herbarium) FH, as *Trichia serotina*.

COMMENTS — Berkeley (1869) mentions *Trichia clavata* Pers. as collection "Wright 259". It is probable that the material we revised coincides with that mentioned by Berkeley (1869), because the label bears the epithet "*clavata*" together with the number "547" (Plantae Cubenses Wrightianae). This number coincides with the reference of Fungi Cubensis Wrighttiani in Berkeley (1869).

Massee (1892) reported *Arcyria clavata* without indicating exsiccatae. Farr (1976) indicates: "this species appears to be confined to temperate habitats; collections reported from tropical areas generally prove, upon reexamination, to be *Hemitrichia calyculata*". We suppose that this might be the case with records from Cuba and we can confirm this thesis with numerous Cuban specimens in the herbarium (HAJB) collected more recently.

By SEM the peridium has small irregular crests, the capillitium has spiral bands with very small warts on the outside and spores are reticulate with meshes of varying diameters.

Hemitrichia serpula (Scop.) Rostaf. ex Lister, Monogr. Mycetozoa: 179. 1894

= *Mucor serpula* Scop., Fl. Carniol., ed. 2, 2: 493. 1772

= *Trichia serpula* (Scop.) Pers., Neues Mag. Bot. 1: 90. 1794

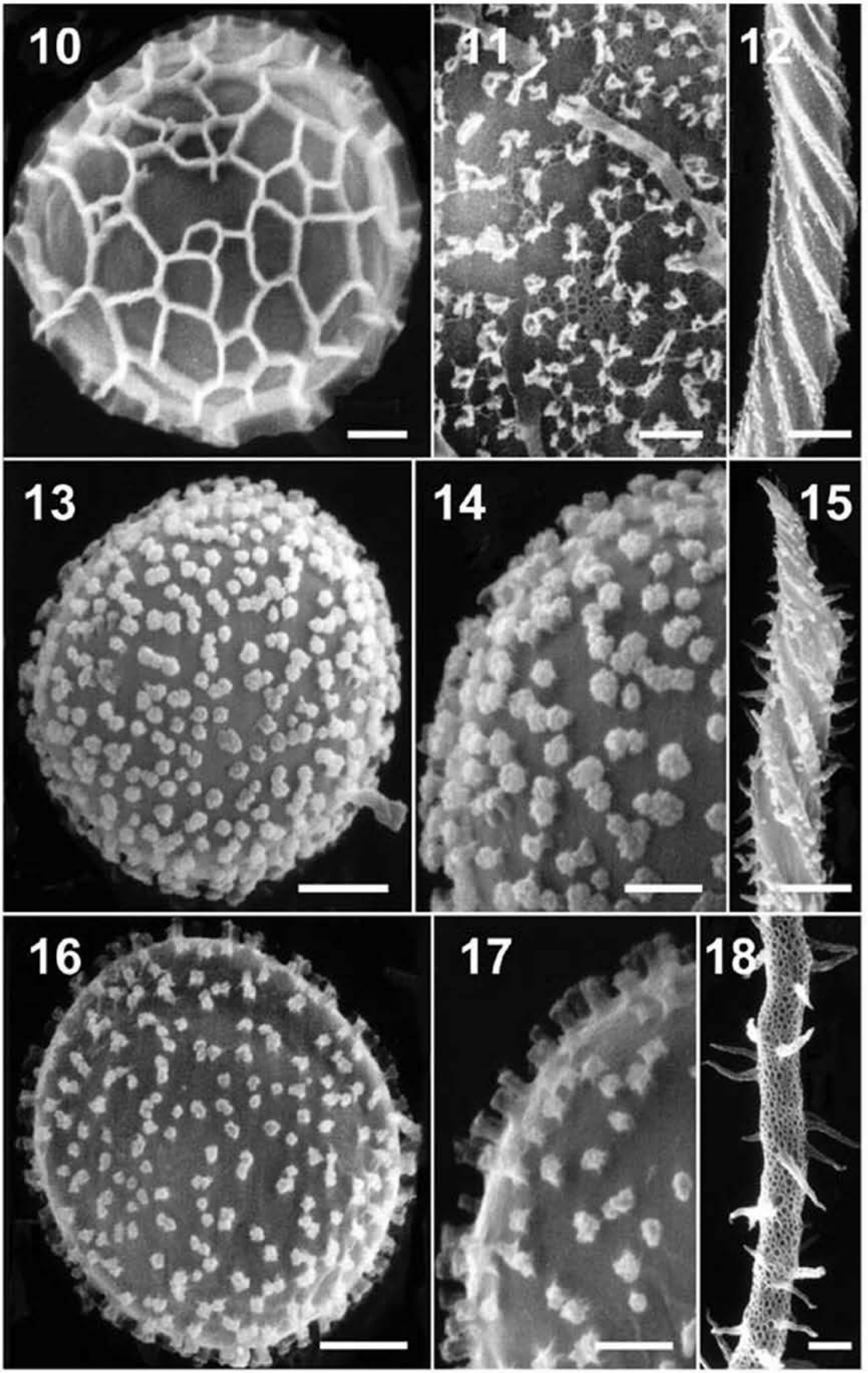
= *Arcyria serpula* (Scop.) Massee, Monogr. Myxogastr.: 164. 1892

SPECIMENS EXAMINED — CUBA: on logs, 1857, *leg.* C. Wright (265), ex folder 193, n° 550 Curtis Fungus Herbarium, FH, as *Trichia serpula*. **CUBA:** Cienfuegos, Soledad, Government Road near Bot. Wood, August 25-1933, *leg.* A. G. Kevorkian (45), *det.* G. D. Darke, FH.

COMMENTS — The collection Wright 265 is mentioned by Berkeley (1869) as *Trichia serpula* Pers. In the border of the label there is a note: "to 260 similar, but threads hisfrid ?" (see observations of *Trichia persimilis*).

In the other material we agree with the determination of Darker (Kevorkian 45).

FIGURES 10-12. ***Hemitrichia calyculata*** (Plantae Cubenses Wrightiani n° 547 as *Trichia serotina*). 10. Spore (bar = 2 μm). 11. Inner side of peridium (bar = 2 μm). 12. Detail of capillitium (bar = 5 μm). **FIGURES 13-15.** ***Metatrichia horrida*** (1856-7 C. Wright, Fungi Cubenses Wrightiani as *Trichia rubiformis*). 13. Spore (bar = 2 μm). 14. Detail of spore ornamentation (bar = 1 μm). 15. Detail of capillitium (bar = 5 μm). **FIGURES 16-18.** ***Perichaena chrysosperma*** (C. Wright 673, type as *Ophiotheca wightii* Berk. & M.A. Curtis). 16. Spore (bar = 2 μm). 17. Detail of spore ornamentation (bar = 1 μm). 18. Detail of capillitium (bar = 2 μm).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Massee (1892) mentions *Arcyria serpula*, but he does not indicate exsiccatae.

Hemitrichia parviverrucospora (Lizárraga, G. Moreno & Illana) G. Moreno & Illana is a closely related species that shares the same macroscopy but which possesses a capillitium with a very spiny ornamentation, with spines frequently 4-7 μm long, reticulate spores with small warts within the meshes which are visible only by SEM. Up to the present time, this species has been recorded only from Central Africa and Mexico (Baja California Sur and Sinaloa) according to Pérez-Silva et al. (2001).

Lycogala epidendrum (L.) Fr., Syst. Mycol. 3: 80. 1829

SPECIMENS EXAMINED — CUBA: *leg.* C. Wright (882, 911), ex folder 173, Curtis Fungus Herbarium No. 520, FH.

COMMENTS — This species is one of the first six records of Myxomycetes from Cuba by Montagne (1845) (material not seen).

It is also mentioned by Berkeley (1869) as collection "Wright 316" (Fungi Cubenses Wrightiani n° 520). In the material we received (Wright 882 and 911) appears hand written on the label the number "520", which does not coincide with the original reference of Berkeley (1869).

The number 882 of Wright's collection was collected from wood and the number 911 had developed on bryophytes.

Massee (1892) also mentions *Lycogala epidendrum* but no exsiccatae were indicated.

Metatrichia horrida Ing, Trans. Brit. Mycol. Soc. 47 (1): 51. 1964 **FIGURES 13-15**

SPECIMENS EXAMINED — CUBA: rotten wood, Jan. 1857, *leg.* C. Wright, ex folder 193, Curtis Fungus Herbarium, FH, as *Trichia rubiformis* Pers. **CUBA:** lign. carios?, *leg.* C. Wright 681, ex folder 193, n° 545 Curtis Fungus Herbarium, FH. **CUBA:** *leg.* C. Wright , Fungi Cubenses Wrightiani n° 555 (Gray Herbarium) FH, as *Trichia rubiformis*. **CUBA ORIENTALI:** 1856-7, *leg.* C. Wright, Fungi Cubenses Wrightiani (Gray Herbarium) FH, as *Trichia rubiformis*.

COMMENTS — The four revised specimens were identified as *Trichia rubiformis* and one of these (Wright 681) is mentioned by Berkeley (1869).

Until very recently, the identification of Cuban specimens as *Metatrichia vesparium* has been erroneous. The present species in the tropics is *M. horrida* and it is characterized mainly by the group of threads in hair-spring disposition when the peridium opens and the strongly spinulose capillitium (Moreno et al. 1997), that we confirm in tropical and temperate specimens from HAJB and AH herbarium.

Metatrichia horrida was described originally from Nigeria (Africa) by Ing (1964) and later it was found in several African countries. The first references of this species for the American continent are from Baja California (Mexico) and their differences from *M. vesparium* has been discussed thoroughly by Moreno et al. (1997).

Mucilago crustacea F.H. Wigg., Prim. Fl. Holsat.: 112. 1780

SPECIMENS EXAMINED — CUBA: Mina Carlota, Sierra de San Juan, Trinidad Mountains, on log, July 1-1941, *leg.* W.L. White (758), *det.* D.H. Linder, FH, as *Fuligo septica* var. *candida*.

COMMENTS — A new record for Cuba. This cosmopolitan species occurs in Neotropical latitudes Farr (1976).

Perichaena chrysosperma (Curr.) Lister, Monogr. Mycetozoa 196. 1894

FIGURES **16-18**

= *Ophiotheca wrightii* Berk. & M.A. Curtis in Berkeley, J. Linn. Soc, Bot. 10: 349 (1868)

ORIGINAL DIAGNOSIS — ***Ophiotheca wrightii***: Peridio annulari firmo badio; floccis aculeatis; sporis luteis subangularibus (673).

SPECIMENS EXAMINED — **CUBA:** dead wood, *leg.* C. Wright (673), ex folder 185, Curtis Fungus Herbarium nº 544, FH, as *Ophiotheca wrightii* Berk. & M.A. Curtis. **CUBA:** *leg.* C. Wright (673), Gray Herbarium, FH, type as *Ophiotheca wightii* Berk. & M.A. Curtis.

COMMENTS — The material is well preserved, mainly the labelled one to be regarded as the typus, and considering the second as the isotype, both with abundant well-developed sporocarps. Macroscopic and microscopic features agree with *Perichaena chrysosperma* and by SEM we observed globose spores of 10-11 μm in diam., with a sparse irregular ornamentation formed by pila. The capillitium has abundant long thorns and the surface has numerous perforations of different diameters, resembling a sponge (Fig. 18). For this reason, we think that *Ophiotheca wrightii* is synonymous with *P. chrysosperma* which was studied by SEM of material from Baja California (México) by Lizárraga et al. (1999), agreeing totally with Cuban material.

Massee (1892) describes *Ophiotheca wrightii*, and indicates that the type is deposited in Kew herbarium (K 10888). Rammeloo (1984) also studied part of the type material kept in Kew (Wright, 673) and which agrees with our observations: Nevertheless, this author did not incorporate SEM images of sporal ornamentation.

Physarella oblonga (Berk. & M.A. Curtis) Morgan, J. Cincinnati Soc. Nat. Hist. 19: 7. 1896

SPECIMENS EXAMINED — **CUBA:** Cienfuegos, Soledad, on decayed *Ceiba pentandra*, Sept. 12-1933, *leg.* A.G. Kevorkian (59), *det.* G. D. Darke, FH.

COMMENTS — The material consists of opened sporocarps with typical orange fusiform nodules. This species is mentioned for Cuba by Farr (1976) of FH without indicating exsiccatae. We examined the material of FH (Kevorkian 59) and we agree with Darke's determination.

Physarum cinereum (Batsch) Pers., Neues Mag. Bot. 1: 89. 1794

= *Didymium cinereum* (Batsch.) Fr., Syst. Mycol. 3:126. 1829

SPECIMENS EXAMINED — **CUBA:** Cienfuegos, on lawn in yard of Harvard House, Sept. 4-1933, *leg.* A. G. Kevorkian (50), *det.* F.L. Howard, FH.

COMMENTS — The sample "Kevorkian" (50) is in good conditions, very abundant, well-developed and displays the typical characters of this species. We agree with the determination by F.L. Howard.

In the sample "Wright 679" the number appears to be written by hand, beside a not very readable note "M.V. Ap. 27 spreading over leaves chip & coffee chaff". This specimen is cited by Berkeley (1869) as *Didymium cinereum*.

Massee (1892) cited *Physarum cinereum* (Fungi Cubenses Wrightiani, 535).

Physarum compressum Alb. & Schwein., Consp. Fung. Lusat.: 97. 1805

SPECIMENS EXAMINED — CUBA ORIENTALI: 1856-7, *leg.* C. Wright (42), Plantae Cubenses Wrightianae (Gray Herbarium) General Fungi Herb. 42. FH. as *Didymium sp.* rev M.L. Farr (30-XI-1972) as *Physarum compressum*. **CUBA:** *leg.* C. Wright (907), ex folder 179, Curtis Fungus Herbarium, FH as *Didymium furfuraceum*, rev. M.L. Farr (28-XI-1972) as *Physarum compressum*. **CUBA:** Rangel, on sticks & leaves, June 10, *leg.* C. Wright (907) FH as *Physarum polycephalum* Schw. var *obrusseum* (B. & C.)

COMMENTS — The specimen "Wright 907" is kept in a round cardboard box and several complete sporocarps are present. The box lid bears a hand-written note: "exceptionally calcareous lime white". This sample represents *Physarum compressum*.

We agree with Farr's determination (30-XI-1972) of the specimen "Wright 42" and the comment that she makes in the label "unidentificable (only stipes left) perhaps *Physarum compressum* Alb. & Schw". It is impossible to make a good study of the material because the few sporotheca are imperfectly developed, although their compressed form and stout stipes maintain their characteristics, being furrowed, cylindrical or tapered near the union with the sporotheca, dark brown mostly toward the base and coated with white lime toward the apex. These characters indicate that the material corresponds with *Physarum compressum*.

Two other specimens appear with the same collection number (Wright 907) but with different identifications. One of these as *Didymium furfuraceum* without locality and substrate information. We agree with Farr (28-XI-1972) who identified this material "as probably *Physarum compressum*". The other material is named *Physarum polycephalum* Schw. var. *obrusseum* and on the cover of the box is written "exceptionally calcareous, lime white"; a hand-written note inside the box gives number, locality data and type of substrate. This collection (Wright 907) is referred to neither in Berkeley (1869) nor Massee (1892).

Physarum didermoides (Pers.) Rostaf., Sluzowce Monogr.: 97. 1874

SPECIMENS EXAMINED — CUBA: *leg.* Guba, *det.* F.L. Howard. FH. **CUBA:** Baracoa, on leaves, *leg.* Mm. Roren?, April-1904, FH.

COMMENTS — The sample determined by Howard is conserved in a cardboard box and although it is very broken and some sporocarps are sclerotized, the whitish hypothallus, elongated, cylindrical sporocarps with a double peridium and a whitish stipe can be observed. The spores are spinulose, dark and polygonal, 12-14 μm in diam.

The specimen from Baracoa is also conserved in a cardboard box, with typical, abundant and well fructified sporocarps.

Physarum didermoides is mentioned for Cuba by Farr (1976) in FH without indicating exsiccatae. We examined two specimens from this herbarium and we agree with the determination of *P. didermoides*.

Physarum licheniforme (Schwein.) Lado, Nomenmyx 16: 70. 2001

= *Physarum lividum* Rostaf., Sluzowce Monogr.: 95. 1874

= *Physarum didermoides* var. *lividum* (Rostaf.) Lister, J. Bot. 36: 161. 1898

SPECIMENS EXAMINED — CUBA: spreading over leaves chips & coffee chaff, *leg.* C. Wright (679), Fungi Cubenses Wrightiani n° 535 (Gray Herbarium) FH as *Didymium cinereum.*

COMMENTS — The specimen "Wright 679" is well conserved and it contains groups of subglobose, pyriform and cylindrical sporocarps. Frequently short, white-cinereous plasmodiocarps forming extensive groups, without stipes, bearing a single peridium with few calcium carbonate deposits are observed. The capillitium is formed by large, white, angular to elongated nodes, with badhamioid appearance, but always with hyaline filaments; nodes sometimes fused in the centre to form a pseudocolumella. Spores 12-14 μm in diam., homogeneously spinulose, brown violaceous by the light microscope.

We consider *Physarum lividum* to be an independent species, different from *P. didermoides*, characterized by sessile and globose sporocarps with a single peridium with few calcium carbonate, agreeing with Nannenga-Bremekamp (1974).

We have examined the material "Wright 679" (Fungi Cubenses Wrightiani n° 535) indicated by Berkeley (1869) as *Didymium cinereum* Fr. and verified that it corresponds with *Physarum licheniforme*. With the number "Wright 679" there are two specimens and they probably correspond with the Curtis and Gray Herbarium respectively. We suppose that material from the Gray Herbarium is the original one, due to the hand written text giving more information than the other specimen.

Physarum polycephalum Schwein., Schriften Naturf. Ges. Leipzig 1: 63. 1822

= *Didymium obrusseum* Berk. & M.A. Curtis in Berkeley, J. Linn. Soc. Bot. 10: 348. 1868

= *Physarum obrusseum* (Berk. & M.A. Curtis) Rostaf., Sluzowce Monogr. Suppl.: 11. 1876

= *Physarum polycephalum* var. *obrusseum* (Berk. & M.A. Curtis) Lister, Monogr. Mycetozoa: 48. 1894

= *Physarum polymorphum* Mont., Ann. Sci. Nat. Bot. sér. 2, 8: 361. 1837

= *Didymium tenerrimum* Berk. & M.A. Curtis in Berkeley, J. Linn. Soc. Bot. 10: 348. 1868

SPECIMENS EXAMINED — CUBA: fol. *Tillandsia*, June 1857, *leg.* C. Wright (267), ex folder 179, n° 533, Curtis Fungus Herbarium, FH as "*Didymium tenerrimum* B. & C.". A large envelope as "*Didymium sp.*" with three samples, two of them: **CUBA ORIENTALI:** 1856-7, *leg.* C. Wright (41), Plantae Cubenses Wrightianae (Gray Herbarium) FH, rev. M.L. Farr 30-XI-1972 as *Physarum polycephalum* and **CUBA ORIENTALI:** 1856-7, *leg.* C. Wright (44), Plantae Cubenses Wrightianae (Gray Herbarium) FH, rev. M.L. Farr 30-XI-1972 as *Physarum polycephalum*. **CUBA:** on rotten wood, Mar 29, *leg.* C. Wright (664), Fungi Cubenses Wrightiani n° 532 (Gray Herbarium) FH. as *Didymium obrusseum*. **CUBA:** ad folia, *leg.* C. Wright (799), ex folder 179, n° 532 Curtis Fungus Herbarium, FH. as "*Didymium obrusseum* B. & C.". **CUBA:** Retiro, on dead leaves & sticks in woods, Dec. 4, *leg.* C. Wright (868), Fungi Cubenses Wrightiani FH. as "*Physarum polycephalum* Schw. var. *obrusseum*

(B. & C.)". **CUBA:** *leg.* C. Wright (532), Fungi Cubenses Wrightiani n° 539 FH. as "*Didymium obruseum* B. & C." but inside the lid of the box also appears "*Physarum polymorphum*", **CUBA:** Wright. 532, see Lister's letter of Mar. 1893", and inside the box "*Didymium obrusseum*, Fungi Cubenses Wrightiani n° 539". **CUBA:** on trunk: dej: corrupt, *leg.* C. Wright (868, 919), ex folder 182, Curtis Fungus Herbarium, FH. as *Physarum utriculare* Fr.

COMMENTS — The Cuban specimens are mostly conserved in envelopes. For this reason, they contain crushed, flattened sporocarps and the (more or less discoid) sporotheca are broken. We are able to observe only parts of the whitish membranous peridium, sparse whitish capillitial nodes and a brown violaceous spore-mass. The stipes are yellow, straw-coloured, translucent, wider at the base, flattened, without remains of calcium carbonate, with an abundant growth which is sometimes caespitose.

The presence of solitary sporothecae characterizes *Physarum polycephalum* var. *obrusseum* that very frequently fructifies in the tropics. However, this character has been demonstrated to have no taxonomic value (Alexopoulos 1969), a conclusion that we also support.

Physarum polycephalum macroscopically resembles *P. pezizoideum* (Jungh.) Pavill. & Lagarde, as Farr (1976) suggests, but the latter species differs by its more pronounced spore ornamentation and its stipe morphology.

The specimen "Wright 532" is conserved in a cardboard box, and on the lid of which is written "*Physarum polymorphum* see Lister's letter of Mar. 1893" and a label inside "*Didymium obrusseum*". These species are considered to be synonyms of *P. polycephalum* (Lado, 2001).

This species has been frequently cited from Cuba with other epithets. The first record was made by Montagne (1845) as *Didymium polymorphum* (material not seen). This species was also referred by Berkeley (1869) and Massee (1892) as "Fungi Cubenses Wrightiani n° 532" (Wright 664 y 799) as "*Didymium obruseum* B. & C." and it was mentioned as "*D. tenerrimum* B. & C." by Berkeley (1869) of the collection "Wright 267" and by Massee (1892) without exsiccatae and he says "... .no specimen exists in Berkeley's Herbarium...."

Lister (1894) reported this species as *Physarum polymorphum* (Cuba, BM 440) on the label of which appears "Cuba, leg. C. Wright n° 532". It therefore corresponds with "Fungi Cubenses Wrightiani n° 532", Wright's collections 664 and 799. We examined specimens bearing this number deposited in FH and determined them as *Physarum polycephalum*.

Stemonaria longa (Peck) Nann.-Bremek., R. Sharma & Y. Yamam., in Nannenga-Bremekamp, Yamamoto & Sharma, Proc. Kon. Ned. Akad. Wetensch., C 87 (4): 453. 1984

≡ *Comatricha longa* Peck, *Annual Rep. New York State Mus.* 43: 70. 1890

SPECIMENS EXAMINED — CUBA ORIENTALI: 1856-7, *leg.* C. Wright, Plantae Cubenses Wrightianae (Gray Herbarium) FH, as *Stemonitis fusca*.

COMMENTS — Camino et al. (2003) indicates: "This species was reported for Cuba by Lister (1894) as *Comatricha longa*, based on a specimen that was deposited in Kew Herbarium (K. 1606, C. Wright 261). We studied this material, which corresponds with

Stemonitis splendens,. For this reason, the record by Camino (1998) represents the first record of *Stemonaria longa* for Cuba". It is clear that the number "Wright 261 (K)" mentioned by Berkeley (1869) as *Stemonitis fusca* and by Lister (1894) as *Comatricha longa* corresponds with *Stemonitis splendens*. However, when examining the material "Wright s/n" (Plantae Cubenses Wrightianae) which was erroneously identified as *Stemonitis fusca* Roth, we find that it corresponds with *Stemonaria longa*. Thus, this material is the first collection of this species in Cuba, although it does not appear as such in previous papers.

Stemonitis fusca Roth, Bot. Mag. (Römer & Usteri) 1 (2): 26. 1787

SPECIMENS EXAMINED — CUBA: without locality, ad cortices *leg.* C. Wight (668), ex folder 188, n° 539, Curtis Fungus Herbarium, as *S. ferruginea*. **CUBA:** without locality, *leg.* C. Wright (667), Fungi Cubenses Wrightiani n° 539 (Gray Herbarium) FH, as *S. ferruginea*. **CUBA ORIENTALI:** 1856-7, *leg.* C. Wright, Plantae Cubenses Wrightianae (Gray Herbarium) FH, as *S. typhoides*. **CUBA:** without locality, on logs, 1857, *leg.* C. Wight, ex folder 188, n° 540?, Curtis Fungus Herbarium, as *S. typhoides*, *rev.* M.L. Farr, 28-XI-1972, "not as determined; very moldy, but probably *S. fusca*; spores verr.-reticulate". **CUBA:** Cienfuegos, Seboruco, Botanical Wood, on dead wood, 17-VIII-1933, *leg.* A.G. Kevorkian (35), *det.* G. D. Darke, FH.

COMMENTS — The revision of the material "Wright 668", mentioned by Berkeley as *Stemonitis ferruginea* belongs to *S. fusca* and we agree with the determination made by Sturgis and Farr (28-XI-1972). We also agree with Farr (28-XI-1972) and Darke in the identification of the material "Wright s/n" (Curtis 540 ex folder 188) and (Kevorkian 35) respectively.

The identification of the specimen "Wright 667" (Fungi Cubenses Wrightiani n° 539) as *Stemonitis ferruginea* is erroneous and it belongs to *S. fusca*.

The material of the collection "Wright (s/n)" identified as *Stemonitis typhoides* (Plantae Cubenses Wrightianae) is contaminated with fungi and it appears covered with white filaments that may have caused its incorrect identification.

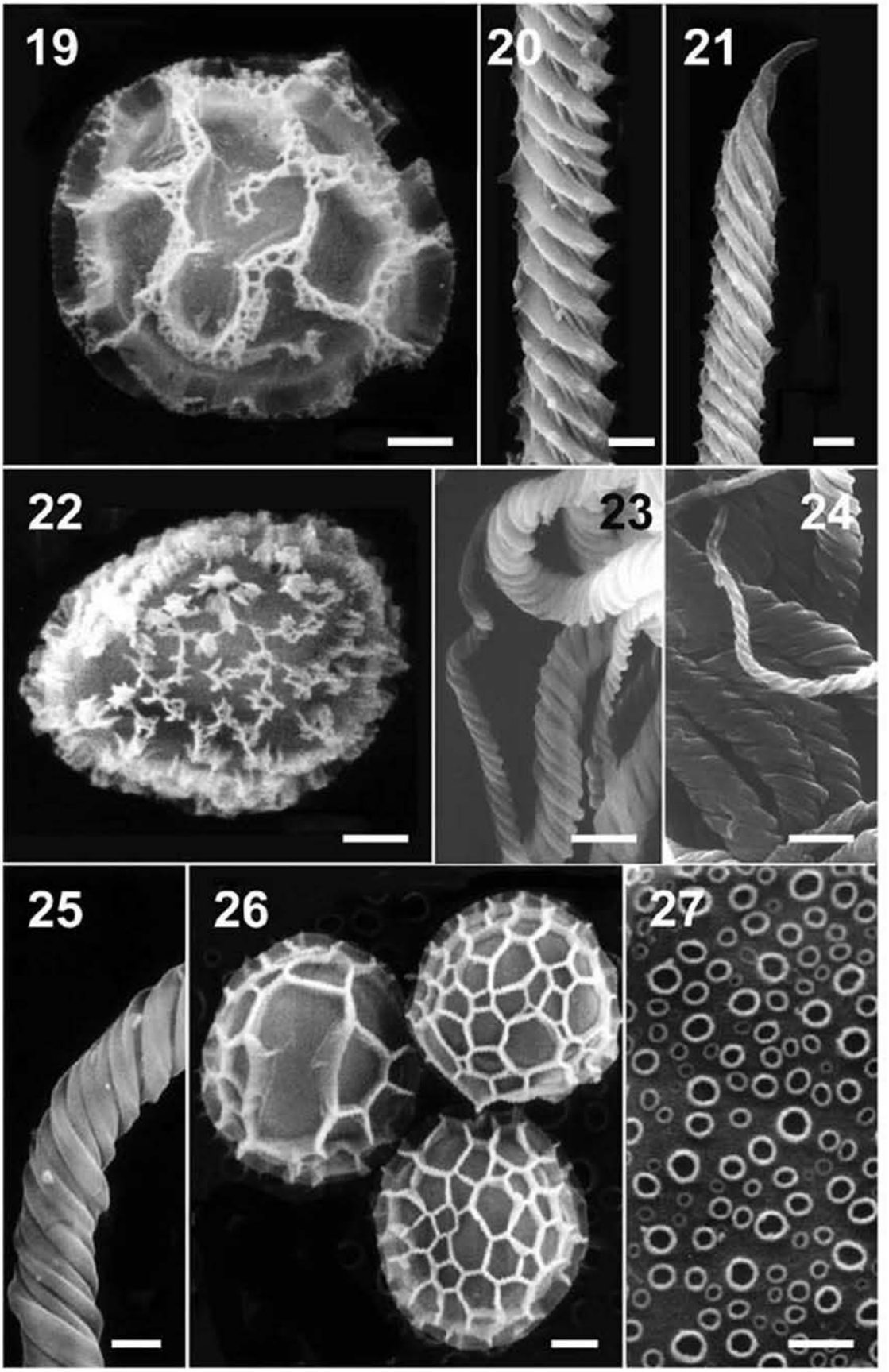
Stemonitis splendens Rostaf., Sluzowce Monogr.: 195. 1874

SPECIMENS EXAMINED — CUBA: in truck of twis? in wood, April 9, *leg.* C. Wright (671), Fungi Cubenses Wrightiani n° 538, (Gray Herbarium) FH, as *S. fusca*, *rev.* M.L. Farr, 28-XI-1972 as *S. splendens*; **CUBA:** ad cortices, *leg.* C. Wright (671), ex folder 188, n° 538 Curtis Fungus Herbarium, FH. as *S. fusca*, *rev.* M.L. Farr, 28-XI-1972 as *S. splendens*.

COMMENTS — Both of the specimens we examined correspond with "Wright 671" (Fungi Cubenses Wrightiani 538), previously mentioned by Camino et al. (2003) and originally cited as *Stemonitis fusca*. We agree with the revision of M.L. Farr (28-XI-1972).

Trichia affinis de Bary in Fuckel, Jahrb. Nassauischen Vereins Naturk. 23-24: 336. 1870 **FIGURES 19-22**

SPECIMENS EXAMINED — CUBA ORIENTALI: 1856-7 *leg.* C. Wright, Plantae Cubenses Wrightianae (Gray Herbarium) FH. **CUBA ORIENTALI:** 1856-7, *leg.* C.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Wright, Plantae Cubenses Wrightianae (Gray Herbarium) FH. **CUBA:** on logs, 1857, *leg.* C. Wright (260), ex folder 193, n° 549 Curtis Fungus Herbarium, FH, as *Trichia turbinata* With.

COMMENTS — In one of the studied specimens that appear with the same typography, the epithet "*persimilis*", the reviewer's initials (W.C.S.) and the date (XII.13.13) was recorded. Comparing this typography with that of other labels, this determination was made by W.C. Sturgis which we were able to confirm.

Farr (1976) considered *Trichia persimilis* and *T. affinis* de Bary to be synonyms of *T. favoginea* (Batsch) Pers. Farr (1958) cites Cuba material of T. favoginea from BPI, FH and Massee (1892).

According to our experience, the diameter of the capillitium is a good character to separate *Trichia favoginea* (8-10 μm) from *T. affinis* and *T. persimilis* (4-6 μm). However, the separation of these latter two species is not so easy. The presence of a capillitium with smooth spiral bands and spores with a broken reticulum characterizes *T. affinis* and the presence of a capillitium with spiny spiral bands and spores with a reticulum in the form of islets or patches of reticulum is typical of *T. persimilis*. In the case of the Cuban specimens kept in FH, they all present a capillitium with spiny spiral bands and spores with a broken reticulum. Thus, the capillitium is from *T. persimilis* and the spores match those of *T. affinis*. We give preference to the spore ornamentation and determined these specimens as *T. affinis* (Fig. 19).

The typical sporal ornamentation of *Trichia persimilis* has recently been studied in material from Mexico (Chihuahua) by Lizarraga et. al. (2003).

When revising the collection "Wright 260" mentioned by Berkeley (1869) as *Trichia turbinata*, following the concept of the authors, it corresponds with *T. affinis* and it presents a capillitium with very small spines and spores with incomplete reticulum.

Trichia decipiens* var. *olivacea (Meyl.) Meyl., Bull. Soc. Vaud. Sci. Nat. 55: 244. 1924 **FIGURES 22-24**

≡ *Arcyria decipiens* Pers., Ann. Bot. (Usteri) 15: 35. 1795

= *Trichia fallax* Pers., Observ. Mycol. 1: 59. 1796

SPECIMENS EXAMINED — **CUBA:** on logs, 1857, *leg.* C. Wright, ex folder 193, n° 546 Curtis Fungus Herbarium, FH, as *T. varia*.

COMMENTS — The material was originally identified as *Trichia varia*, but was subsequently revised by M.L. Farr (28-XI-1972) and re-identified as *T. verrucosa* with the note "see slide". We disagree with M.L. Farr's determination because when examining the material, the threads of the capillitium were found to bear very elongated ends and the spores are 11-13 μm in diam. and have a crested ornamentation. These

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FIGURES 19-21. ***Trichia affinis*** (n° 549 Curtis Fungus Herbarium, as *Trichia turbinata*). 19. Spore (bar = 2 μm). 20. Detail of capillitium (bar = 2 μm). 21. Detail of termination of capillitium (bar = 2.5 μm). **FIGURES 22-24.** ***Trichia decipiens* var. *olivacea*** (n° 546 Curtis Fungus Herbarium, as *T. varia*). 22. Spore (bar = 2 μm). 23. Detail of capillitium (bar = 5 μm). 24. Detail of capillitium (bar = 2.5 μm). **FIGURES 25-26.** ***Tubulifera microsperma*** (Fung. Cub. 551, as *Licea stipitata*). 25. Spores (bar = 1 μm). 26. Inner side of peridium (bar = 2 μm).

features match those of *T. decipiens* var. *olivacea*. Although the olivaceous colour of the sporotheca is not so evident, the spore ornamentation and capillitium that characterizes this variety are present.

In another envelope, the slide with M.L. Farr's label reading *Trichia verrucosa* appears to match that of *Trichia affinis* due to the spore ornamentation with a broken reticulum, az capillitium that is is smooth or has very short spines (visible only in oil inmersion), and elaters with short free ends (Figs. 23-24). But this slide does not correspond (possibly by mistake) with the present sporocarps in the specimen cited above, because we find the capillitium to have long, narrow free ends and a subreticulate spore ornamentation typical of *Trichia decipiens* var. *olivacea*.

In the Cuban reference to *Trichia verrucosa*, Farr (1976) mentions material from FH, but she does not indicate exsiccatae, neither does she comment. We suppose that her records for Cuba are based on her personal identification.

Farr (1976) noted the Cuban records of *Trichia varia* referred to by Berkeley (1869) and commented that "the Cuban record is marked with "?" because the Wright collections in FH were misidentified. Undoubtedly, however, this common and cosmopolitan species occurs on the island".

Massee (1892) mentions *Trichia fallax* Rost., which is currently considered to be a synonym of *T. decipiens*, but he did not indicate exsiccatae. Farr (1976) has not made observations on this material.

Tubulifera microsperma (Berk. & M.A. Curtis) Lado, Nomenmyx 16: 87. 2001

FIGURES 25-26

≡ *Licea microsperma* Berk. & M.A. Curtis in Berkeley, Grevillea 2: 68. 1873

≡ *Tubifera microsperma* (Berk. & M.A. Curtis) G. W. Martin, Mycologia 39 (4): 461. 1947

–*Licea stipitata* Berk. & Ravenel in Berkeley & Curtis, Proc. Amer. Acad. Arts 4: 125. 1860 [Nom. illeg., non *L. stipitata* DC., 1815]

= *Tubulina stipitata* Berk. & Ravenel ex Rostaf., Sluzowce Monogr.:223. 1875

= *Tubifera stipitata* (Berk. & Ravenel ex Rostaf.) T. Macbr., N. Amer. Slime-Moulds: 157. 1899

SPECIMENS EXAMINED — **CUBA:** ad lign: cariosum, *leg.* C. Wright (678), ex folder 193, B. & C. Fung. Cub. 551, FH as *Licea stipitata* Berk. & Ravenel. **CUBA:** on rotting wood, Jun 19, *leg.* C. Wright (677), Fungi Cubenses Wrightiani n° 551 (Gray Herbarium) FH as *Licea stipitata* Berk. & Ravenel. **CUBA:** *leg.* C. Wright (s/n), FH as *Tubifera stipitata* (Berk. & Ravenel) Macbr.

COMMENTS — Farr (1976) mentions *Tubifera microsperma* for Cuba based on Berkeley (1869), Massee (1892) and FH material. The collections "Wright 677" and "678" were cited by Berkeley (1869) as *Licea stipitata* Berk. & Ravenel. Later, Massee (1892) mentions the collection "Wright 677" as *Tubulina stipitata* Rost. We have not been able to find references of "Wright (s/n)" as *Tubifera stipitata*.

This species is easy to identify due to its small spores with a hemisphere completely reticulate and the internal part of the peridium with protuberances in the form of short tubes that resemble the suckers of octopus tentacles, easily visible by LM and SEM (Fig. 26).

Doubtful material:

Fourteen specimens examined in this study are doubtful, due in most cases to the scantiness of stored material or its absence.

Ceratiomyxa fruticulosa* f. *aurea (Link) Y. Yamam., The Myxomycete Biota of Japan (Tokyo): 40. 1998

= *Ceratium aureum* Link, Magazin Ges. naturf. Freunde, Berlin 7: 39 (1816)

SPECIMENS EXAMINED — CUBA: without locality, on the roots of the coffee, 1865, *leg.* C. Wright 670, Plantae Cubenses Wrightianae (Gray Herbarium) FH as *Ceratium aureum*.

COMMENTS — There is no material conserved, only imperfect fungi are present.

Craterium leucocephalum (Pers. ex J.F. Gmel.) Ditmar in Sturm, Deutschl. Fl. Pilze 1 (1): 21. 1812

= *Stemonitis leucocephala* Pers. ex J.F. Gmel., Syst. Nat. 2: 1467. 1792

= *Craterium minimum* Berk. & M. A. Curtis in Berkeley, Grevillea 2: 67. 1873

SPECIMENS EXAMINED — CUBA: 1857, *leg.* C. Wright (s/n), ex folder 186, Curtis Fungus Herbarium, FH as *Craterium minimum* Berk. & M. A. Curtis.

COMMENTS — Farr (1976) mentions *Craterium leucocephalum* for Cuba based on Berkeley (1869) and FH material without indicating exsiccatae. We could not examine FH material because there are no sporocarps.

Berkeley (1869) cites *Craterium leucocephalum* as "Wright 455", but this collection number also appears to be given as *Didymium farinaceum* Fr. (see *D. farinaceum* in doubtful material). We cannot confirm the reference.

Craterium minimum Berk. & M.A. Curtis in Berkeley, Grevillea 2: 67. 1873

SPECIMENS EXAMINED — CUBA: 1857, *leg.* C. Wright, ex folder 186, Curtis Fungus Herbarium, FH.

COMMENTS — Only remains of a leaf without fructifications are conserved.

***Didymium* sp.**

SPECIMENS EXAMINED — CUBA: *leg.* C. Wright (674), ex folder 179, Curtis Fungus Herbarium, FH. **CUBA:** *leg.* C. Wright (898) ex folder 179, Curtis Fungus Herbarium, FH. **CUBA:** on Cacao shells, on leaves & sticks among, Jan. 1857, *leg.* C. Wright (455), ex folder 179, No. 528 Curtis Fungus Herbarium, FH. Note: prematurely dried.

COMMENTS — In the specimens Wright 674 and 455 no material is conserved. In the specimen Wright 898 two very badly conserved sporocarps are present. Because of the very limited material no analysis was possible.

Didymium cinereum (Batsch) Fr., Syst. Mycol. 3: 126. 1829

SPECIMENS EXAMINED — CUBA: ad folia deject, *leg.* C. Wright (679), ex folder 179, n° 535 Curtis Fungus Herbarium, FH.

COMMENTS — No material is conserved.

Didymium farinaceum Schrad., Nov. Gen. Pl.: 22. 1797

SPECIMENS EXAMINED — CUBA: on old bark rope, Feb. 1857, *leg.* C. Wright (483), ex folder 179, n° 528 Curtis Fungus Herbarium, FH. Note: prematurely dried.

COMMENTS — The material is sclerotized, but the stalks are similar to the specimens "General Fungi Herb. 42" that correspond with *Physarum compressum* are observed.

Didymium furfuraceum (Schumach.) Fr., Syst. Mycol. 3: 116. 1829

SPECIMENS EXAMINED — CUBA: *leg.* C. Wright (907), ex folder 179, Curtis Fungus Herbarium, FH, revised by M.L. Farr 28-XI-1972, probably *Physarum compressum*.

COMMENTS — There is no material conserved.

Didymium herbarum Fr., Syst. Mycol. 3: 120. 1829

SPECIMENS EXAMINED — CUBA ORIENTALI: 1856-7, *leg.* C. Wright, Plantae Cubenses Wrightianae (Gray Herbarium) General Fungi Herb. 43. FH.

COMMENTS — The specimen lacks any material of the species in question.

Didymium polymorphum Mont., Ann. Sci. Nat. Bot., sér. 2. 8: 362. 1837

SPECIMENS EXAMINED — CUBA: old logs, Jan. 1857, *leg.* C. Wright (270), ex folder 179, n° 531 Curtis Fungus Herbarium, FH.

COMMENTS — Only some stalks are present, and these may represent *Physarum polycephalum*.

Didymium pruinosum Berk. & M.A. Curtis in Berkeley, J. Linn. Soc. Bot. 10: 348. 1868

SPECIMENS EXAMINED — CUBA: on sticks, Jan. 1857, *leg.* C. Wright (269), ex folder 179, n° 530 Curtis Fungus Herbarium, FH.

COMMENTS — Along with the identification "This is *Phys. nephroideum* Rost" there appear the initials "W.C.S." in reference to Sturgis. This specimen was cited by Massee, Monogr. Myxogastr.:288 (1892)

There are only three fragments of stalks conserved. Because of the limited nature of the material no analysis it was possible.

Didymium squamulosum (Alb. & Schwein.) Fr., Symb. Gasteromyc.: 19. 1818

SPECIMENS EXAMINED — CUBA: *leg.* C. Wright (733) , Plantae Cubenses Wrightianae n° 529 (Gray Herbarium) FH as "*Didymium radiatum* B. & C.".

COMMENTS — In the specimen Wright (733) no sporocarps are conserved and only hypothalli and some stalks similar to those of *Didymium squamulosum* are present.

Trichia verrucosa Berk. in Hooker, Fl. Tasman. 2(9): 269. 1859

SPECIMENS EXAMINED — CUBA: Anana, *leg.* C. Wright, FH, only one slide as *T. varia* (Pers. ex J.F. Gmel.) Pers.

COMMENTS — This microscope slide was examined by M.L. Farr at 28-XI-1972 and identified as *T. verrucosa* (see the observations of *Trichia decipiens* var. *olivacea*).

After our study we think it may be *Trichia affinis* but, because of the limited material, we are unable to be certain.

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A new species of *Leptosphaeria* (Ascomycotina, *Pleosporales*) on *Rosaceae* from Bolivia

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Abstract—*Leptosphaeria polylepidis* is described as a new species on *Polylepis tarapacana* from Sajama National Park in the Bolivian Andes at more than 4,000 m elevation. Diagnostic features are the long asci and the large, brown, 3-septate ascospores.

Key words— biogeography, conservation, rDNA, taxonomy

Introduction

The species of the genus *Polylepis* Ruiz & Pav. (*Rosaceae*: tribe *Sanguisorbeae*) grow naturally at high elevations, usually higher than any other arborescent plant, and occur in South America with the highest number of species in Bolivia, Ecuador, and Peru. It is an important plant in preventing soil erosion and land degradation as well as providing a good source of fuel and building supplies for local communities. Species of this genus are endangered in the Andean high regions and are listed as a primary genus to use in reforestation projects in the Andes (Brandbyge & Holm-Nielsen 1986). However, the regeneration of *Polylepis* largely has been unsuccessful due to cultural and biological factors, and forests continue to disappear at an alarming rate (Kessler & Driesch 1993). Thus, it is important to determine the regenerative needs of this genus as well as to identify pathogens that might reduce vigor and complicate regeneration efforts.

The Sajama National Park is located in the Bolivian Andes (Sajama Province, Oruro Department) and is a small reserve (1002 km^2) created in 1939 to protect the *Polylepis tarapacana* Phil. vegetation formation. This small to medium sized tree or shrub, which is 1-3 m tall and popularly called keñua, is the main component of the world's highest woody plant formation at 5100 m (Jordan 1980; Kessler 1995). The mean annual temperature in the Sajama village is around 10 °C (range between –30 to 22 °C) and the mean annual precipitation is near 280 mm (range between 90-400 mm). In the Bosque de Keñua (18°08'S; 68°57'W), at 4300 m and likely with the highest

density of *P. tarapacana* in the region, some of the shrubs had black knots in both the apical and basal parts of branches (Fig. 1a). During a study of the systematics of *Polylepis* in Bolivia many branches were observed that were malformed due to black, irregular growths (Kessler, personal communication). It is likely that this disease killed a number of *P. tarapacana* trees but no published reports of these malformations or disease were found.

The growths on *Polylepis* resemble the black knot on plums and cherries caused by *Apiosporina morbosa* (Schwein.) Arx (≡*Dibotryon morbosum* (Schwein.) Theiss. & Syd) (Ellis 2002). These growths also resemble those caused on the same host by *Grandigallia dictyospora* Barr et al. (1987). However, *Gr. dictyospora* produces very large galls, from 3-14 cm diam, and has larger ascospores that become densely muriform and break down internally, eventually producing numerous conidia inside the ascospore. In this paper, the probable casual agent of black knot on *P. taracapana* is described as a new species and relationships discussed based on molecular analyses.

Materials and methods

Morphological characters were observed macroscopically and microscopically. All measurements of microscopic structures were made on material mounted in water. Light micrographs were captured using a QImaging MicroPublisher digital camara (QImaging, Burnaby, BC, Canada) that was mounted on an Olympus BX51 compound microscope as described in Díeguez-Uribeondo et al. (2003). All material is deposited in the herbarium MA-Fungi (Real Jardín Botánico de Madrid, Spain). Efforts to obtain this species into pure culture were unsuccessful.

The internal transcribed spacer regions of nrDNA (ITS1 and ITS2), including the 5.8S, were amplified using the primer pair ITS 1F (Gardes & Bruns 1993) and ITS 4 (White et al. 1990). All protocols are described in Martín, Raidl & Tellería (2004). Nucleotide BLAST searches with the option Standard nucleotide-nucleotide BLAST of BLASTN 2.26 were used to compare the sequence obtained in this study against other sequences in the National Center for Biotechnology Information (NCBI) nucleotide databases (Altschul et al. 1997). The new consensus sequence has been accessioned in the EMBL database with the Accession Number AJ786644.

Results

Leptosphaeria polylepidis M.J. Macía, M.E. Palm & M.P. Martín **sp.nov.**

Figs. 1-2

Asci cylindrical-clavate, 8 spori, 185–200 x 28–35 µm. Ascosporae fusiformes, brunneae, 3-septatae, 50–55 x 12–14 µm. Parasitatur in Polylepis tarapacana *Phil., loco dicto Parque Nacional Sajama, Bolivia, supra 4300 m, IV/2002, M.J. Macía (Holotypus MA-Fungi 57843).*

Etymology: from the name of the host *Polylepis tarapacana*

Ascomata aggregated, botryose, on well-developed, black stroma intermixed with plant tissue, superficial, black, surface cracked, 310–360 µm diam, 230–320 µm high,

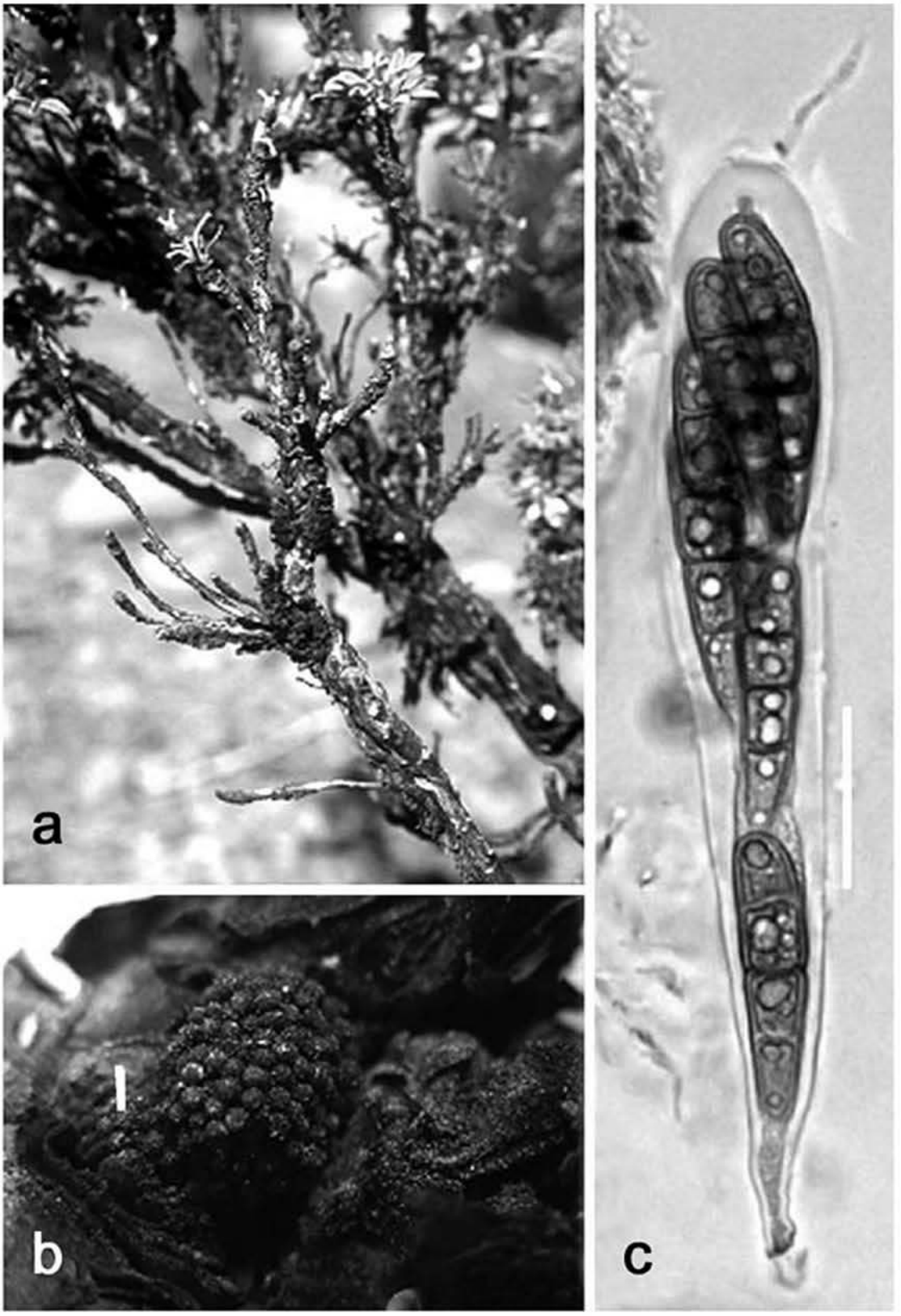

Fig. 1 *Leptosphaeria polylepidis*. a) Stromatic black knots on branches of *Polylepis tarapacana*. b) Papillate ascocarps (MA-Fungi 57843) (Bar=2 mm). c) Mature ascus (MA-Fungi 57843) (Bar=20 μm).

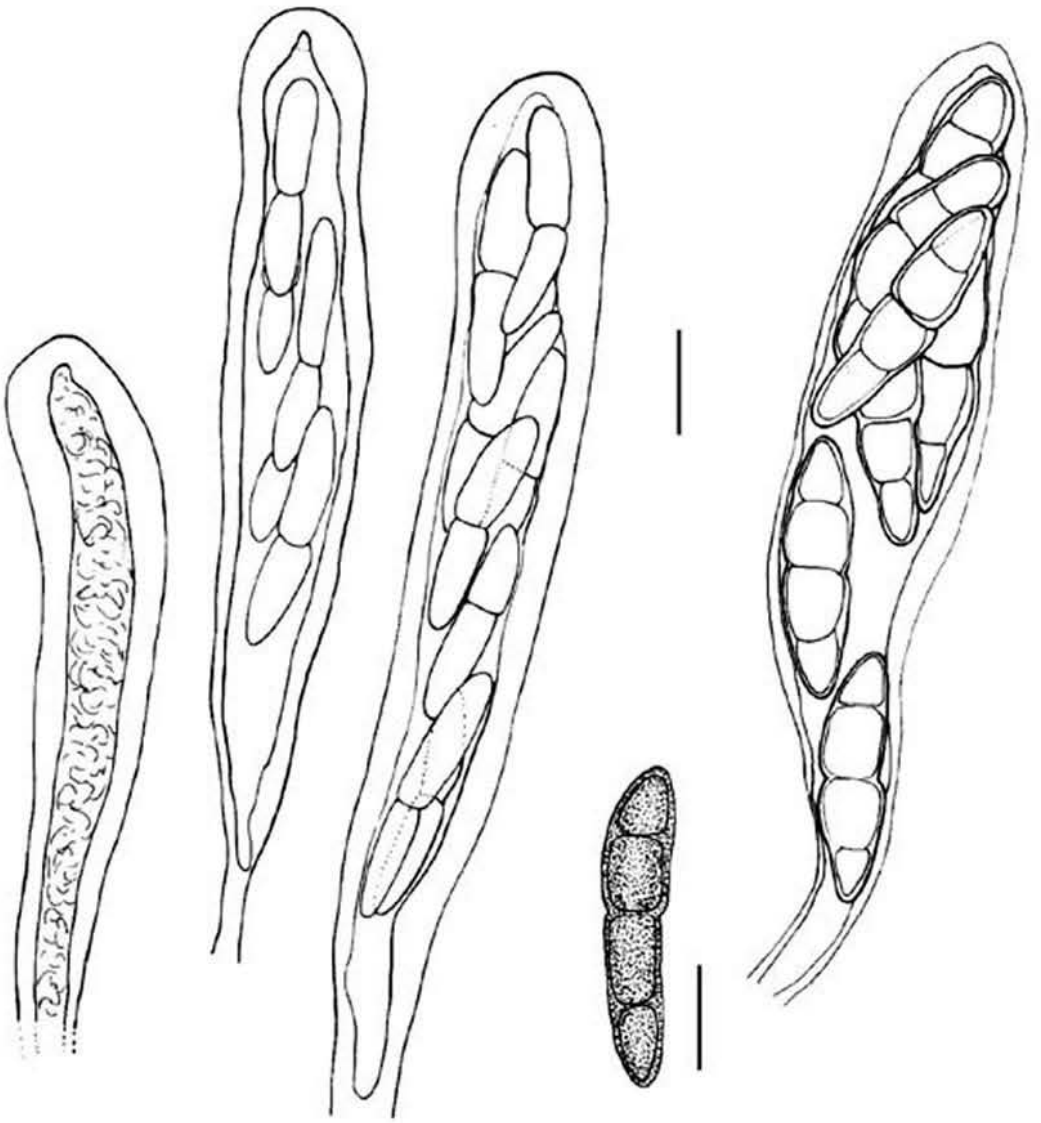

Fig. 2 Line drawings of *Leptosphaeria polylepidis*. a) Asci. b) Ascospore (Bar= 20 μm).

with broadly rounded papilla. Ascomatal wall of *textura angularis* in surface view; in longitudinal section 60–72 μm thick, of 4–5 layers of polygonal, isodiametric to slightly elongate cells, 18–20 x 9–11 μm, all layers with brown-melanized cells of scleroplectenchyma. Pseudoparaphyses 190-210 x 3.0–4.5 μm wide, numerous, narrowly cellular, without gelatinous coating. Asci 185–200 x 28–35 μm, numerous, basal, cylindrical-clavate, with 8 overlapping, uniseriate ascospores. Ascospores when immature 41–50 x 9–10 μm, hyaline to subhyaline, at maturity 50–55 x 12–14 μm, brown, narrowly fusiform, end cells acute, transversely 3-septate.

Material examined: Bolivia, Parque Nacional Sajama, on *Polylepis tarapacana*, 4300 m elev., IV/2002, leg. M.J. Macía 7507 (MA-Fungi 57843) (HOLOTYPE); 4800 m elev., IV/2002, leg. M.J. Macía 7508 (MA-Fungi 57842).

The Blast search of the sequence AJ786644 of *L. polylepidis* shows 92% similarity (392/426) to the sequence AF439461 of *Leptosphaeria dryadis* Rostr. (CBS 643.86) (Câmara et al. 2002).

Discussion

Huhndorf (1992) examined 28 species on *Rosaceae* with names in *Leptosphaeria* and found that five of those species belonged to *Leptosphaeria* Ces. & De Not. sensu Huhndorf. *Leptosphaeria polylepidis* differs from the species treated by Huhndorf (1992) namely *L. cercocarpi* Syd. & P. Syd., *L. doliolum* (Pers.) Ces. & De Not., *L. dryadis* (as *L. dryadophila* Huhndorf), *L. praetermissa* (P. Karst.) Sacc. and *L. umbrosa* Niessl, in the long asci and large, dark brown, 3-septate ascospores that are characteristic of this new species.

Based on comparison of the ITS sequence from this organism with the sequences in Genbank (EMBL), this species is most similar to *Leptosphaeria dryadis*. Chen et al. (2002) pointed out that *L. dryadis* is the correct name for *L. dryadophila* (basionym: *Melanomma dryadis* Johanson). *Leptosphaeria dryadis* occurs on *Dryas octopetala* L. at high latitudes mainly in Europe and is more common in arctic and subarctic areas than alpine zones according to Chlebicki and Suková (2004). *Leptosphaeria polylepidis* is ecologically similar to *L. dryadis* in that it grows at high altitudes.

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Reinventing taxonomy: a curmudgeon's view of 250 years of fungal taxonomy, the crisis in biodiversity, and the pitfalls of the phylogenetic age[1]

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Abstract — Biological taxonomy is bleeding. The fungi are but one example. There is an almost ignored crisis of impending loss in biodiversity, while the funding—necessary to provide basic inventories and monographic studies—is simultaneously siphoned away by the misuse of the great potentials of molecular biology. One disturbing result has been frequent support of needless, repetitive phylogenetic studies. A seminal paper, "Taxonomic triage and the poverty of phylogeny," by entomologist Quentin D. Wheeler, is cited as required reading for all biologists. His theses are that "Taxonomy, already weakened by decades of neglect, now suffers the loss of positions and funding," and that "Considering what is at stake for human and environmental welfare in the biodiversity crisis, it is time to triage and move descriptive taxonomy to the forefront of science funding priorities." Reinventing taxonomy may provide answers.

Key words — collecting, monographs, inventories, PhyloCode, DNA

Introduction

The title of this paper refers to this as "a curmudgeon's view." I have intentionally used the phrase that was also part of the title of an address I gave at the Seventh International Mycological Congress (Korf, 2002), in which I noted: "The noun curmudgeon is defined and used here in two, not necessarily exclusive, ways: *n.* 1. *archaic:* a crusty, ill-tempered, churlish old man. 2. *modern:* (i) anyone who hates hypocrisy and pretense and has the temerity to say so; (ii) anyone with the habit of pointing out unpleasant facts in an engaging and humorous manner." Let us hope that I succeed here to fit one or both of those modern options.

I intend to look here at taxonomy as practiced for the past 250 years in the field of mycology, to trace its roots and highpoints, and to point to the inescapable truth that

[1]Based on an invitational paper delivered at the meetings celebrating the 100th Anniversary of the Danish Mycological Society, Copenhagen, Denmark, on October 1, 2005.

all taxonomy must now reinvent itself and regain its *primary function* in biology. To these ends I shall briefly review the mycological terrain from the days of Linnaeus to the golden explosion at the time of Persoon and Fries in the early 19th century, through the comparative morphological studies of the next century, through the dark days of the New Systematics, and the fortunate birth of Hennig's *Phylogenetic Systematics*. In the last 30 years the decline in taxonomic work has been catastrophic, to the point that taxonomy is today potentially bleeding to death.

Much of what I have to say has recently been covered in great depth by a former colleague of mine at Cornell University, Quentin D. Wheeler, a brilliant taxonomist and entomologist and now Keeper of the insect collection at the British Museum, in a seminal paper entitled *Taxonomic triage and the poverty of phylogeny* (Wheeler, 2004), a paper I consider required reading for all biologists. Throughout my remarks I shall cite this paper frequently, and if all anyone remembers of my analysis is his paper, I shall be satisfied.

Following the introductory historical view, I shall discuss critical areas of what we must now reemphasize: the crisis in biodiversity and the need for collecting, the production and the importance of monographs and of inventories; as well as of what we need to deemphasize: DNA Taxonomy and the PhyloCode, plus much of the unproductive phylogenetic biology now so bandwagon popular; of how funding must be redirected for the good not only of taxonomy but of phylogenetic systematics; and of how taxonomic renaissance must be mounted.

A brief history of 250 years of mycological taxonomy and its technologies

Though Linnaeus' work (1753) is now the official starting point for all mycological taxonomy, he was by no means the earliest to record fungi, nor indeed is he considered to have been well-versed in fungi. His major contribution was the development of the system of binomial nomenclature that has stood the test of time as adaptive to advancing knowledge and allowing the proposal of hypotheses of relationships at all levels. The preeminence of two mycologists, Christiaan Hendrick Persoon [1761–1836] and Elias Magnus Fries [1794–1878], aptly called the "fathers of mycology," overshadows many others of the early 19th century. They and the others of this exciting time of discovery based their species, genera, and higher ranks on comparative morphology, often aided by developments in microscopy. The intent was almost always to provide a classification that reflected relationships, deduced from comparative morphology. A few systems were proposed that attempted to replace such phylogenetic hypotheses by numerical arrangements, and a major compiler of descriptions, Pier Andrea Saccardo [1845-1920], was wedded to the idea that spore septation, shape, and coloration were dominant features by which fungi should be catalogued. His thinking adversely affected generations of mycologists, and one can justly refer to "the dead hand of Saccardo on the advancement of fungal taxonomy."

The use of chemotaxonomy began early, with a few chemicals, and expanded primarily with lichenized fungi to a degree astounding to most non-lichenologists. The

reliance on the presence or absence of specialized lichen-substances as diagnostic tools for species (and generic) identification still remains an anachronism for many of us. Genetics as a tool in taxonomy began in the early 1930's, and mating systems rightfully remain one of the tools some taxonomists still use for species distinction. Reproductive isolation does not always, however, precede speciation, especially in allopatry (Coyne & Orr, 2004). Mycological taxonomists anxious to develop systems of classification that reflect phylogeny have exploited each and every tool that seemed to promise *predictive value*.

The largest blow to taxonomy came with The New Systematics, in which, in Wheeler's (2004) words, "Mayr (1942. p. 7) belittled traditional taxonomy.... Since that time, the goals of taxonomy have been confounded with those of related areas of science whether population biology, tropical biology or molecular biology and few individual or institutional voices have made unapologetic assertions of the importance and credibility of taxonomy for its own sake.... Although Hennig (1966) returned respectability to studies at and above the species level, taxonomy has never fully recovered from being thus tainted as non-scientific (even non-biological!)." We have seen many new tools, have their brief day in the sun, each in turn touted as "cutting edge." These include technologies, *e.g.*, electron microscopy (first TEM, then SEM), isozymes, RFLPs—then RAPDs and cognate approaches such as AFLPs, and now DNA sequence polymorphisms particularly in the nuclear ribosomal DNA repeat. These tools include schools of analysis, such as phenetics, cladistics, and recently Bayesian statistics. DNA sequence data have facilitated the inference of phylogenetic trees resulting in proposals for realignment of many taxa, (sometimes generating nomenclatural consequences that have yet to be proven correct). New combinations and new arrangements have been proposed on the basis of a study of far too few genes and consideration of far too few taxa.

There is a balance to be found between the quantity and the quality of informative characters and the number and distribution of taxa sampled. Higher standards are required. One of the reviewers of this paper believes that we will look back on the recent era of the molecular-phylogeny bandwagon as quaint and not very enduring. He points to some serious and excellent phylogenetic studies, including the exceptional one by Rokas et al. (2003) on a 100+ gene phylogeny of *Saccharomyces* species, which advocates 20-or-more simultaneous gene analyses.

Single-gene phylogenies have often been confused with species phylogenies. This is the sorry state in which we find mycological taxonomy today, forty years since Hennig and the promises his work provided. Molecular biologists have criticized taxonomists for conducting descriptive work, yet much of molecular biology is descriptive and *not* hypothesis-driven. Good science is, unequivocally, hypothesis-driven.[2]

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[2]One may wonder what a hypothesis is in a taxonomic study. Implicit in a phylogenetic study is the hypothesis of monophyly - for any taxon in the hierarchy. Other hypotheses would be associations with morphology or ultrastructure (the dolipore septum was acquired once in Phylum X), or nutritional mode (the lichen symbiosis has evolved once in Family Y), or physiology (members of Genus Z all degrade cellulose by one common enzymatic pathway) or pathogenicity (species of Genus Q have co-speciated with their hosts).

Taxonomists today are almost afraid to label themselves as that. Once more I quote from Wheeler (2004): "Mayr's (1942) "population thinking" led thinkers in systematics to coin the term "biosystematists" to distinguish themselves from traditional taxonomists. Today, ""tree thinking" has led to a segregated study of phylogeny that may, according to O'Hara (1997), be the beginning of another new splinter science. Once again a new name, phylogenetic biologist, distances these tree thinkers from taxonomy."

The crisis in biodiversity

Surely all taxonomists are aware of the crisis that we face in biodiversity. An oft-quoted estimate for fungi is that we have described only 4 to 5% of the world's species, leaving 95% or more yet to be recorded. The loss of habitats is proceeding so swiftly that the problem is critical. Unless these habitats are sampled now we will have lost forever our chance to document the world's living biodiversity, to save that in museum specimens and, in the case of fungi, often in culture collections. To do that documentation requires an immense increase in the number of taxonomists and parataxonomists able to collect and identify the taxa. With the number of taxonomists dwindling each year, and with many of these now engaged only in *studies of known taxa* and who display no interest in the undescribed ones, we have little chance to survive the crisis with honor. Those who follow us will bemoan our lack of foresight in documenting the very diversity that could yield the answers to life on earth, past and future.

The answer is so simple it is easy to overlook. We *must* collect, collect, and collect. We need to spend our monies collecting, and to train our students to leave the air-conditioned laboratory and to go out into the field, from the frozen arctic to the humid tropics. Without documented specimens no assay of biodiversity has meaning. In Wheeler's (2004) words, "Although the most visible products of alpha taxonomy are specimens, their associated data will be increasingly valuable as the biodiversity crisis progresses." Specimens typically carry with them immense amounts of data on ecology, geography, and the environment that are critical for any modern biological investigation.

The biodiversity crisis pervades most of the issues I am discussing in this paper.

On monographs and inventories

I single out the importance of monographs and inventories because without them no real progress in taxonomy (nor also in phylogenetic biology) can ever occur. Monographs are the summation of scattered reports of species and subordinate taxa, carefully reconsidered and revisited. Given the paucity of taxonomists, few fungal groups ever get a substantial revisionary study even once or twice in a century. Monographs are the essential tools for progress in understanding biodiversity. Similarly, checklist inventories that do more than merely listing species determined and do include ecological and critical morphological data, contribute importantly to the summation of knowledge. It has long been my belief that monographic study on a not-too-large group remains the best subject for a doctorate thesis in taxonomy, providing the student with

the intellectual tools to investigate the past, and to learn the processes of discrimination, synonymy, and the intricacies of nomenclature.

Some pitfalls of the phylogenetic age: avoiding DNA taxonomy and the folly of the PhyloCode

Wheeler (2004) hit it on the head. "Well-intentioned proposals for a DNA-based taxonomy present a new and growing threat to the advance of taxonomy. Although DNA barcoding is an exciting new identification tool for taxonomy, it lacks the theoretical base for taxonomy and, unless handled rationally, could undermine the intellectual content of taxonomy making it a service industry providing an inferior service (Lipscomb. *et al.* 2003). DNA is simply data." To me, it is clearly impossible to equate DNA sequences with taxonomic insights.

An even worse pitfall is the PhyloCode and its absurd rankless classifications. It seems incredible that a whole school of well-intentioned biologists has wasted countless time and effort on such a proposal, antithetic to the whole concept of hierarchal taxonomy that has served us so well for so long. I shall make no attempt here to do more than ask you to read Wheeler's (2004) comments, summed up as "what the PhyloCode seeks to do does not need to be done and what it claims to do it does not. Taxonomy faces important and exciting intellectual and scientific challenges and should waste no more effort on what Carpenter (2003) aptly describes as 'pure folly.'"

On funding

The individual taxonomist faces an almost impossible task these days to fund collecting trips for her/himself and for graduate students and postdoctoral students. When I was supported by the National Science Foundation (NSF) for many years from the 1960's till the 1980's, obtaining funding for collecting in Asia, the Caribbean, and Macaronesia was very easy, perhaps because it cost so little to do. I took one student for a year to Asia, and up to six at a time for two-week trips to the Caribbean and the Bahamas, and finally 4 scientists at a time for three month-long trips to Macaronesia. We skimped by on very modest hotel rooms where we would study, document, and sometimes photograph specimens, often culturing them, and setting them to dry, from after dinner till midnight or later. We would arise by 6 am to go out in the field to collect all day, often lunching on slabs of bread, cheese, sausage, and a bottle of wine. The cost per specimen collected was minimal, and to this day the specimens we collected are being cited regularly in papers worldwide since many of the places we went were and still are only poorly-collected. The only grants that NSF supported in later years (when my applications were no longer funded) were *required* to have a molecular and phylogenetic component. Those that were funded, primarily phylogenetic studies, had budgets ten to fifty times the funding I had requested. Few of the successful grants in the 80's and 90's ever generated many new specimens, but did support comparatively expensive molecular analyses and equipment.

On the "bean-counting" mentality

Probably the most distressing aspect of the current scene in biology is the "bean-counting mentality" rampant in research institutes and universities worldwide. Under that mind-set many of us are now evaluated, compensated, employed, and given or not given tenure on the strength of ill-founded formulas in which ridiculous journal impact factors, numbers of papers, and grant monies are the variables. Given that an excellent monograph can be equivalent in research hours to 5–10 papers documenting single species descriptions or non-taxonomic research, and is likely to be published in a journal with a modest "impact factor" yet accrue citations over a time scale of many decades, not years, taxonomists will not be favored by the bean counters.

Towards a taxonomic renaissance

The sad truth is, in Wheeler's (2004) words, "The diversion of funds from taxonomy to phylogenetic biology is an international phenomenon." I know this to be a fact for the UK, Canada, the United States, and China. Nonetheless, I am deeply heartened as I see alpha taxonomic mycological work still being supported in most of Europe. Resources there are still being used for impressive monographic book-length studies like those of the *Flora Agaricina Neerlandica*, for the many superb volumes produced by the Centraalbureau voor Schimmelcultures, with others from France, Scandinavia, Switzerland, and especially Italy's Associazione Micologica Bresadola. Alpha taxonomy is alive and well in the professional mycological journals of Britain, the Czech Republic, Estonia, France, Germany, the Netherlands, Scandinavia, and Switzerland, as well as in Asia (China, Japan, Korea). Much more evident is the quality alpha taxonomy that is being published throughout Europe by societies that are essentially manned by amateurs ably assisted by professionals: journals like Belgium's *Miscellanea Micologica*, Denmark's *Svampe*, France's *Bulletin Mycologique et Botanique Dauphiné-Savoie*, Germany's *Mycologia Bavarica*, Italy's *Rivista di Micologia*, and Spain's *Boletin de la Socidad Micologica de Castellana*, to name but a few, whose pages abound with excellent photographs and frequently artistically produced line drawings. Couple that with some of the web-based bulletin boards (ASCOfrance comes immediately to mind) where amateurs and professionals can chat at length about their exciting finds and you can see why I have such faith in these alternatives to grant-financed phylogenetic papers and to symposia that add *so little* to the taxonomic imperative.

As an American I can only hang my head in shame at the lack of such publications by our amateur societies.[3] Europe, on the other hand, clearly continues to nurture the naturalist's involvement in taxonomy, as it has successfully done for the last century.

[3] Some alpha taxonomic works are accepted both in *Mycologia* (which has suffered from a lack of taxonomically-trained and nomenclaturally-savvy editors in recent years), and in the *Canadian Journal of Botany*. My Belgian colleague, Grégoire L. Hennebert, and I founded what may be the only strictly taxonomic/nomenclatural mycological journal, *Mycotaxon*, in 1974. It has recently revisited its focus (taxonomy and nomenclature) and now excludes purely phylogenetic papers. Instead of hard-copy checklists, it encourages *web-based* checklists that can be frequently updated.

In my deep concern for the need to redirect funding towards collecting, comparative morphology, and monographic studies, my unstated but equal concern for effective support of phylogenetic biology and genomics may appear to be lost. The contributions of these new technologies have been not only exciting but also illuminating, and intellectually stimulating. Nevertheless, phylogenetic studies mean nothing if the data on which they are based is flawed. As Wheeler (2004) points out, "Continuing emphasis on the mere computerization of label data from museums and herbaria is misguided, when eight out of ten records may be mistaken. There is little benefit in rapid electronic access to unreliable data." Amen.

When taxonomists examine herbarium specimens, confirmation of identifications should be part of the deal. If molecular phylogeneticists capture a misidentification, what is the process? For that matter, are we vigilant on re-annotation of GenBank sequences when misidentifications are discovered? (My information is that only the original depositor can correct the identification of a GenBank entry.)

The huge sums supplied by the National Science Foundation (NSF) to support ATOL (Assembling the Tree of Life) ($8 million in 2002, $12 million in 2003), or in the case of fungi, the Deep Hypha program—with many good aspects—may be deeply compromised by the few taxa involved. As one of my reviewers of this paper noted, "alpha taxonomy can both *enhance* Deep Hypha and remediate its shortcomings." The problems of missing taxa are well summed up in Wheeler's (2004) words, "Although the precise impact of species excluded from an analysis varies from case to case, there is general agreement that such missing taxa are a serious concern to the recovery of phylogenetic patterns (e.g. Novacek 1992; Wheeler 1992; Graybeal 1998; Hillis 1998; Hillis *et al.* 2003). For all but a few relatively well-known small clades, this ignorance of species diversity will pose an impediment to resolving phylogenetic relationships.... and phylogenies will be subject to frequent and major reorganizations."

A recent turn-about in NSF's priorities must be fully applauded: The PEET (Partnerships to Enhance Expertise in Taxonomy) program for training young taxonomists, and NSF's funding of Revisionary Syntheses in Systematics as well as their Planetary Biodiversity Inventory are important steps in the right direction. That some of these were implemented during Quentin Wheeler's three-year stint at NSF is not mentioned in his 2004 paper. Credit belongs to him and to his colleagues at NSF, Diana Lipscomb and Norm Platnick.

That in this day an alpha taxonomist can scarcely find a position in our universities is distressing. Positions in museums where there is time to generate monographs are equally hard to find. Where will universities and public museums find the money to support descriptive taxonomy? Wheeler (2004) has some cogent comments: "To meet the biodiversity crisis, taxonomy must rapidly transform to become big science. Its guiding agenda, after all, is to fully discover and describe the species of an entire planet. If it is worth billions to determine whether there is or ever was life on Mars, it is surely worth more to document the results of tens of millions of years of evolution on Earth.... Taxonomy not only deserves support, it deserves massive support to meet this last ditch effort to document species."

Are the people at NSF or the National Institutes of Health in the US, or the granting agencies in the U.K. listening? Or, for that matter, is even your university or mine listening? Will budding fungal taxonomists recognize that alpha taxonomy is indeed more "cutting edge science" and definitely more crucial in this era of biodiversity crisis than any seductive phylogenetic studies in an air-conditioned laboratory? I'm keeping my fingers crossed.

I close with this advice to young fungal taxonomists: (a) forget the lure of instant fame in following the latest technological fad, but instead (b) go out into the field and collect, take ample notes, culture if possible, study—if you can take along a field microscope—while your specimens are alive (Baral, 1992) and while you simultaneously swat mosquitoes in a tropical rain forest, (c) learn to love sleuthing in the stacks of a good library as well as on the internet, (d) scour the world's herbaria, (e) publish even if you feel you are only 95% correct, much preferable to being a perfectionist that never publishes—one whose data dies with himself or herself, (f) never be the graduate student who emails a scientist asking for cultures if you are incapable of doing your own fieldwork, of identifying specimens, and of using the taxonomic literature, and, (g) *above all,* leave a luxurious legacy of data for future taxonomists to build upon.

Whether you are working in a museum or in an academic position, maintain your central goals of producing the finest and most useful monographs, species descriptions, and floristic studies. Develop collaborations with your ecologist colleagues and build on the role that many fungi play in ecosystem function to make the strongest case for research funding. Forge collaborations between taxonomists and phylogeneticists that will get money to the taxonomists so that there is some product for posterity from their phylogenetic approximations. Collaterally, publish in the widest assortment of journals. Talk back to the bullies and to the "bean counters" and make the case for excellent, hypothesis-driven research in all areas of science — and make your own work an example.

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Distributional checklists—*Mycotaxon* posts downloadable PDF files or URL links first published in *Mycotaxon* by authors who amend or update species identifications, nomenclatural revisions, and range & substrate extensions as new data become available. To find the checklist page, first click ONLINE RESOURCES (under the *MYCOTAXON* header) and then REGIONAL CHECK LISTS. Users may also find checklist PDFs and URLs by clicking on links in the summary abstracts. (Abstracts are found following the PUBLICATIONS -> VOLUME LISTING -> VOLUME NUMBER -> TITLE pathway.)

Search—The **search!** engine option in the top right corner of every *Mycotaxon* webpage is yet another way to search for authors, taxa, and other online resources. Currently it only indexes taxa cited in titles, abstracts, or keywords of published papers. The search button also finds all nomenclatural novelties.

Errata

Volume 92

p. ii, lines 18-19	*for:* 8 Short Street / Cambridge, CB1 1LB, U.K.	
	read: 510 Lake Blvd., Apt. 166 / Davis, CA 95616	
p. ii, line 26	*for:*??? -> (1999-2010)	
	read: SHAUN R. PENNYCOOK, Auckland, New Zealand (2005-2010)	
p. v, line 3	for: *Phaeoacremonium* species and *Phaeomoniella chlamydospora*	
	read: *Phaeomoniella chlamydospora* and *Phaeoacremonium* species	
p.10, lines 40-41	*for:* http:aa ... htm)	*read:* <http://aa.uncw.edu/digilib/biology/fungi/taxonomy%20and%20systematics/padgett%20book/>
p.18, line 9	***Achlya ornata*** is a superfluous name. An earlier epithet that could have been transferred exists in *Newbya pascuicola* M.C. Vick & M.W. Dick (2002). We thank Dr. Dick for noting this error.	
p.31, lines 32-33	*for:* http:aa ... htm)	*read:* <http://aa.uncw.edu/digilib/biology/fungi/taxonomy%20and%20systematics/padgett%20book/>
p.262, line 41	for: ***Ophiostoma angusticollis***	read: ***Ophiostoma angusticolle***
p.387, line 7	for: *H. balaghattensis*	read: *H. balaghatense*
p.388, line 15	for: ***H. balaghattensis***	read: ***H. balaghatense***
p.388, line 36	for: ***Hemisthecium balaghattensis***	read: ***Hemithecium balaghatense***
p.417, line7	for: *C. saccharume*	read: *C. sacchari*
p.418, line 31	for: ***Corynespora saccharume***	read: ***Corynespora sacchari***
p.420, line 1	for: *C. saccharume*	read: ***C. sacchari***
p.425, line 8	for: *Corynespora rhapis-humulisi*	read: *Corynespora rhapidis-humulis*
p.425, line 18	for: ***Corynespora rhapis-humulisi***	read: ***Corynespora rhapidis-humulis***
p.426, line 1	for: *C. rhapis-humulisi*	read: *C. rhapidis-humulis*
p.426, line 5	for: *C. flagellatum*	read: *C. flagellata*
p.427, line 6	for: ***Corynespora flagellatum***	read: ***Corynespora flagellata***
p.431, lines 9-10	for: *C. ficus-altissimae*	read: *C. fici-altissima*
p.431, line 21	for: ***Corynespora ficus-altissimae***	read: ***Corynespora fici-altissimae***
p.433, line 6	for: *Corynespora ficus-altissimae*	read: *Corynespora fici-altissimae*
p.497, line 21	for: *Corynespora ficus-altissimae*	read: *Corynespora fici-altissimae*
p.497, line 22	for: *Corynespora flagellatum*	read: *Corynespora flagellata*
p.497, line 24	for: *Corynespora rhapis-humulisi*	read: *Corynespora rhapidis-humulis*
p.498, line 10	for: *Ophiosatoma angusticollis*	read: *Ophiostoma angusticolle*
p.500,line 7	*for:* **Villareal**	*read:* **Villarreal**
p.500, line 33	*for:* **Crous,** see	*read:* **Crous, Pedro W.,** see
p.501, lines 26-37	**Delete** (*entire entry:* **Dai** *through* 2005.)	
p.501, line 25	*for:* Acrogenospora	read: *Acrogenospora*
p.501, lines 25 –26	*for:* **Hong Zhu,**	*read:* **Zhu, Hong,** [on p.504]
p.502, line 37	*for:* **Villareal**	*read:* **Villarreal**
p.503, line 23	*for:* **Villareal**	*read:* **Villarreal**
p.503, line 36	**Delete** (*entire entry:* **Wang** *through* **Wang**)	
p.503, lines 38-39	for: *Phaeoacremonium* species and *Phaeomoniella chlamydospora*	
	read: *Phaeomoniella chlamydospora* and *Phaeoacremonium* species	
cov.3, line 2	for: *Phaeoacremonium* species and *Phaeomoniella chlamydospora*	
	read: *Phaeomoniella chlamydospora* and *Phaeoacremonium* species	

New!

MYCOTAXON Nomenclature Editor

In early September, MYCOTAXON appointed an assistant to the Editor-in-Chief, whose workload is now too heavy for one individual. MYCOTAXON Editorial Board member, Dr. **Shaun** Ross **Pennycook,** volunteered to screen manuscripts for nomenclatural errors before final editorial review. Our new Nomenclature Editor comes to us from Manaaki Whenua Landcare Research in Auckland, New Zealand, and is a fellow member of the IAPT's permanent Nomenclature Committee for Fungi. The MYCOTAXON Editor-in-Chief heartily welcomes Shaun, who will be the first editor to receive new submissions.

New MYCOTAXON submission procedure (effective immediately)

Authors are asked to download our ***new*** MYCOTAXON submission form and ***revised*** MYCOTAXON MSWord shell (with explanation of journal styles, requirements, 'clones' & graphics formats) from our *Instructions to Authors* webpage on <www.mycotaxon.com> before preparing a paper for submission to our journal. [These files are also available as Email attachments from the Editor-in-Chief <editor@mycotaxon.com> on request. New *Instructions to Authors* will be available online by December and in MYCOTAXON 94, scheduled for the usual January delivery.]

After peer review by two experts (one of whom has checked English grammar, nomenclature, and taxonomic authorities), manuscript text should be presubmitted directly to <PennycookS@LandcareResearch.co.nz> for nomenclatural review. Authors should include the (i) completed submission form, (ii) peer reviewer Email addresses, and (iii) formatted text, legends, and tables (but ***no*** graphics or illustrations). The Nomenclature Editor will return annotated files with a list of needed corrections to the authors, reviewers, and Editor-in-Chief. As final submission text ***must*** be correct, authors may again wish to consult their peer experts during revision for final submission.

Step 1 — Peer Review

__**Authors** send formatted manuscript text + MYCOTAXON peer review forms to **two** experts for presubmission review. At least one reviewer must agree to check English, nomenclature, & author citations prior to MYCOTAXON presubmission.

__**Peer reviewers** (i) return edited manuscripts & detailed comments to authors and (ii) Email forms & *brief* review summaries to authors & MYCOTAXON Editor-in-Chief.

Step 2 — Nomenclature Review

__After revising their manuscript, **authors** send the MYCOTAXON submission form, peer reviewer Email addresses, and formatted text clones (***no*** graphics, and with manuscript text, legends, and tables in 3 separate files) to our Nomenclature Editor <PennycookS@LandcareResearch.co.nz>.

__The **Nomenclature Editor** returns the annotated clones with his list of needed corrections to the authors, peer-reviewers, and Editor-in-Chief.

__The **authors** correct text clones (and consult peer reviewers, if necessary).

Step 3 — Final submission*

Authors Email/post the following to the Editor-in-Chief <editor@mycotaxon.com>:

__One completed MYCOTAXON submission form,

__**One** manuscript PDF/MSWord file **or** printed copy showing all text, legends, tables, footnotes & graphics in place,

__One **text clone** plus table/legend clones as appropriate (text only, **no** graphics, and with all tables in 1 **table clone**, and all footnotes/legends in 1 **legend clone**), *and*

__Artwork and graphics (**TIF, EPS**) files. Set halftone TIFs to 300 dpi and line/phylotree TIFs to 900-1200 dpi per 4.33"width (*4.33" = 11 cm*). Film-based photographic halftones and original line drawings are still accepted and may be sent by post.

NOTE: remove color from all digital graphics files by converting **all** halftones to **grayscale**, as color modes (e.g., RGB, CMYK) are *three times* the grayscale digital file size. Send digital phylotree & line drawing TIF files in **grayscale** or **bitmap** mode.

*Authors wishing to submit author-prepared PDFs must first **pre-flight** their files through Sheridan Press before sending to the Nomenclature Editor or Editor-in-Chief.

Step 4 — Final editorial review and press-preparation

__The **Editor-in-Chief** acknowledges submission, usually within two weeks.

__After editorial review, the Editor-in-Chief ***either*** Emails approval of files and requests author assurance that all text is now correct ***or*** returns marked clones to the author for correction.

__**Authors** return (with revisions when needed) a paragraph stating that there are no text errors and granting the Editor-in-Chief permission to adjust graphics, legends, and tables as needed during press preparation.

__The **Editor-in-Chief** processes all files through InDesign to prepare a press-quality PDF file to be sent to the authors for final inspection before publication.

Questions? — Write the Editor-in-Chief!

The Editor-in-Chief <editor@mycotaxon.com> is always available to answer questions regarding suitability of manuscripts for MYCOTAXON and to help guide prospective authors through the submission process.

Lorelei Norvell
MYCOTAXON Editor-in-Chief
October 10. 2005

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