MYCOTAXON

AN INTERNATIONAL JOURNAL DESIGNED TO EXPEDITE PUBLICATION OF RESEARCH ON TAXONOMY & NOMENCLATURE OF FUNGI & LICHENS

Vol. XLIV April-June 1992 no. 1

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ISSN 0093-4666 MYXNAE 44(1):1-256 (1992)

Published quarterly by MYCOTAXON, LTD., P. O. Box 264, Ithaca, NY 14851.
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MYCOTAXON

Volume XLIV, no. 1, pp. 1-12 April-June 1992

NEW PARMELIACEAE (LICHENES) FROM THE GUIANAS AND SURROUNDINGS

by

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summary

Five new species in the family Parmeliaceae (Lecanorales, lichenized Ascomycetes) are described, which have been discovered among recent collections from the three Guianas, Venezuela and Colombia (tropical South America): *Bulbothrix leprieurii* Aubel, *Parmotrema aptrootii* Aubel, *P. aurantiacoparvum* Sipman, *P. gradsteinii* Aubel and *P. verrucisetosum* Sipman.

Introduction

During the preparation of a treatment of Parmeliaceae for the Flora of the Guianas, five new taxa were discovered, for which descriptions are presented below.

Chemistry was analyzed by thin layer chromatography on Merck 60F-254 precoated plates with the solvent systems A & B according to White & James (1985).

The directors and curators of the herbaria from which collections were obtained on loan, are gratefully acknowledged, especially Dr. R. C. Harris (NY) for selecting specimens of special interest. Likewise dr. A. Fletcher (Leicester, U.K.) and dr. E. Sérusiaux (Liege, Belgium) for checking the manuscript and valuable advice. Much appreciated is the

support of the organizations FUDECI (Venezuela) and Corporacion de Araracuara (Colombia), who provided opportunities to collect material.

1. *Bulbothrix leprieurii* Aubel, sp. nov. Fig. 1.

TYPE: Guyana, Upper Mazaruni district, small white sand-savannah c. 2 km S of Waramadan, epiphyte on isolated, dwarfed tree, alt. c. 600 m, coord. 5°47' N, 60°46' W, 1 March 1985, H. Sipman & A. Aptroot 19187 (U holotype).

DIAGNOSIS: Thallus planus, arcte applicatus, pallide cinereus, usque ad c. 3 cm diametro, lobis sublinearibus - elongatis, c. 0.5 mm latis, bulbato-ciliatis, bulbis atris apice furcato-ciliatis, superne planis, soraliis superficialibus ad 0.6 mm diametro, sorediis c. 50 µm diametro, inferne atris, ad apices fuscis, rhizinis instructis; rhizinis sparsis, basi inflatis, atris, furcato-ramosis, ad 0.2 mm longis. Apothecia et pycnidia ignota. Materiae chimicae (TLC): atranorinum, acida gyrophoricum et lecanorinicum.

DESCRIPTION: Thallus corticolous, closely appressed, flat, light grey, up to over 3 cm wide; lobes sublinear - elongate, c. 0.5 mm wide; cilia black, bulbate with repeatedly dichotomously branched tips, to 0.2 mm long; upper surface mostly flat, continuous or in central parts ± transversely cracked, sorediate; soralia superficial, pale grey, rounded, c. 0.6 mm wide, flat, at last often excavate and showing the black lower cortex, producing c. 50 µm diam. soredia; lower surface black, near the lobe tips brown, sparsely rhizinate; rhizines slightly inflated at base, strongly dichotomously branched, black, to c. 0.2 mm long. Apothecia and pycnidia unknown. Chemistry (TLC): atranorin and gyrophoric acid with variable amounts of orsellinic and lecanoric acids. Colour reactions: medulla K-, C+ rose, KC+ rose, P-, UV-; surface K+ yellow, UV-.

DISTRIBUTION: Known thus far from Guyana and the Amazonian part of Colombia. Available collections are from light and low virgin forest with a humid tropical climate, or in disturbed places in such forest, at c. 200 and 600 m elevation.

ADDITIONAL SPECIMENS: COLOMBIA, Comisaría AMAZONAS, comunidad de Villazul, E of Araracuara, N-bank of river Caquetá, opposite Isla Mariñame, "Pantano de Monica Sosa", alt. c. 240 m, coord. 0°42' S, 72°07'W. c. 6 m tall, light forest, dominated by small *Clusia* and Bombacaceae, on peat, 4 km N of the river, 2 Nov. 1988, H. Sipman & J. Duivenvoorden 28392 (B). GUYANA, Upper Mazaruni district, Jawalla village, at confluence of Kukui river and Mazaruni river, in cultivated,

wel-lit area near the village, coord. 5°40'N, 60°29'W, alt. c. 500 m, 6 Febr. 1985, H. Sipman & A. Aptroot 18372a (B).

NOTES: The name of the new species is chosen in honour of F. R. Leprieur, famous collector of cryptogams in Guyane française.

B. leprieurii is the second sorediate species known in the genus. It differs from the other sorediate species, *B. imshaugii* (Hale) Hale, by the presence of gyrophoric acid instead of salazinic acid, and by its narrower, emaculate lobes (Hale 1976: 16). *Bulbothrix oliveirai* Fletcher appears to agree in chemistry, colour of lower side, shape of rhizines and cilia, but differs by being pustulate and rarely producing a few coarse soredia (Hale 1986: 86). Moreover the new species is not densely rhizinate on its lower side.

The occurrence of orsellinic and lecanoric acids besides gyrophoric acid is probably an artifact due to hydrolysis of gyrophoric acid in acetone solution, according to Leuckert (pers. comm.). Gyrophoric acid should be considered as the diagnostic substance.

In the Guianan specimens the soralia are always flat to excavate, in the Colombian plant they are partly capitate and partly flat to excavate.

2. *Parmotrema aptrootii* Aubel, sp. nov. Fig. 2.

TYPE: Guyana, Upper Mazaruni district, Kamarang, in the village, on Mahogany tree on river-bank, coord. 5°52' N, 60°37' W, alt. c. 500 m, 3-26 Febr. 1985, H. Sipman & A. Aptroot 18187 (U holotype).

DIAGNOSIS: Thallus adnatus, pallide viridis vel viridocinereus, c. 10 cm diametro; lobi apicibus rotundatis, 3-6 mm latis, eciliati, marginibus crenulato-undulatis, sorediosis; soralia ad partibus elevatis marginum, punctiformes vel elongata, sorediis agglutinatis; latus superior emaculatum, planum, ad margines cortice fragile; medulla alba; latus inferior ad apices fuscum et nudum, in centro ater et rhizinis instructum in partibus ad substratum appressis; rhizinae parvae, nigrae, ad 0.4 mm longae, simplices. Apothecia et pycnidia ignota. Materiae chimicae (TLC): acida usnica, echinocarpica et protocetrarica.

DESCRIPTION: Thallus corticolous, adnate, pale yellowish- to greenish grey, c. 10 cm diam.; lobes with rotund, 3-6 mm wide tips and crenulate-undulate, sorediate margins; soralia on raised parts of the margin, punctiform or expanding along the margin, soredia long remaining agglutinated in coralloid masses; cilia lacking; upper surface dull, emaculate, smooth and continuous near the tips, rugulose and cracked in the central parts, with flaking cortex near the raised lobe margins; medulla white, without pigment; lower surface black, near the

lobe tips brown, rugulose, slightly glossy, naked in a c. 3 mm wide zone at the lobe tips, with patches of dense, small rhizines on appressed parts in the centre of the lobes; rhizines slender, usually up to 0.4 mm long and unbranched, black. Apothecia and pycnidia unknown. Chemistry (TLC): usnic, echinocarpic and protocetraric acids. Colour reactions: medulla K+ yellow, C+ orange (short and fading), KC+ rose, P+ orange, UV-; cortex K-, UV-.

DISTRIBUTION: Known only from Guyana and, with some doubt, from Colombia.
The specimens are from well-lit sites with a humid tropical climate at 200 and 500 m elevation, i.c. on a Mahogany tree in a village and in stunted forest on peat.

ADDITIONAL SPECIMENS: COLOMBIA, Comisaría AMAZONAS, comunidad de Villazul, E of Araracuara, N-bank of river Caquetá, opposite Isla Mariñame, "Pantano de Monica Sosa", alt. c. 240 m, coord. 0°42' S, 72°07'W. c. 6 m tall, light forest, dominated by small *Clusia* and Bombacaceae, on peat, 4 km N of the river, 2 Nov. 1988, H. Sipman & J. Duivenvoorden 28394 (B)

NOTES: The name is chosen in honour of A. Aptroot, a Dutch lichenologist who made important lichen collections in tropical countries.

P. aptrootii is well characterized by its chemistry, which comprises usnic acid as only cortical substance and echinocarpic and protocetraric acids as medullary components. A somewhat similar species with echinocarpic and protocetraric acids in the medulla is *P. dilatatum*. It differs by its non-coralloid soralia and by having atranorin as main cortical substance. Another similar species, *P. apricum* (Krog & Swinscow) Krog & Swinscow, lacks echinocarpic acid and has equally non-coralloid soralia (Krog & Swinscow 1981: 170).

The Colombian specimen is slightly aberrant by the absence of well-developed soralia and by a less glossy, more rugulose lower side. It is tentatively referred to *P. aptrootii*.

3. *Parmotrema aurantiacoparvum* Sipman, sp. nov. Fig. 3.

TYPE: Guyana, Upper Mazaruni district, small white-sand savannah c. 2 km S of Waramadan, alt. c. 600 m, coord: 60°46' W, 5°47' N, 1 March 1985, H. Sipman & A. Aptroot 19186 (B holotype).

DIAGNOSIS: Thallus adnatus, pallide cinereus, ad c. 4 cm diametro; lobi apicibus rotundatis 3-4 mm latis, marginibus crenulato-undulatis, isidiati; isidia coralloidea, fragilia, ad 0.3 mm longa, marginalia vel

submarginalia, nonnumquam ciliata; cilia numerosa, nigra, ad 3 mm longa, tenues; latus superior emaculatum, planum vel in centro rugulosum, cortice ad marginibus loborum fragile; medulla aurantiaca; latus inferior ad apices fuscum nudum, in centro ater, rhizinis instructum in partibus ad substratum appressis; rhizinae nigrae, ad 0.5 mm longae, vulgo simplices. Apothecia et pycnidia ignota. Materiae chimicae (TLC): atranorinum, pigmenta ignota.

DESCRIPTION: Thallus corticolous, adnate, pale grey, sometimes slightly brownish, 2-4 cm wide; lobes with crenulate, 3-4 mm wide tips and crenulate-undulate, isidiate margins with flaking cortex; isidia coralloid-branched, concolorous with the thallus but brown-tipped, marginal or submarginal, up to c. 0.3 mm long, fragile, when well developed sometimes ciliate; cilia usually abundant, (1-)2-3 mm long, black, slender; upper surface dull, emaculate, smooth and continuous near the tips, rugulose and irregularly cracked in the central parts; medulla pigmented throughout, rusty orange, more intensely coloured near the lobe tips; lower surface black, near the lobe tips brown, more or less rugulose, slightly glossy, naked in a c. 3 mm wide zone at the lobe tips, sparsely rhizinate in the central part of the thallus, at least on appressed parts; rhizines 0.5 mm long and mostly unbranched, black. Apothecia and pycnidia unknown. Chemistry (TLC): atranorin and several unknown pigments or other substances. Colour reactions: medulla K+ dark purple (pigment!), C+ weakly purple, P-, UV-; cortex K+ yellow, UV-.

DISTRIBUTION: Thus far known from Colombia, Venezuela, Guyana and Guyane Française, where it has been collected on canopy branches or on small trees in well-lit forest or clearings.

ADDITIONAL SPECIMENS: COLOMBIA: Comisaría AMAZONAS, Comunidad de Villazul, E of Araracuara, Isla Mariñame in river Caquetá, alt. 240 m, coord. 0°45' S, 72°06'W, swamp with *Mauritia flexuosa* and little trees, c. 1.5 km S of the river, 1 Nov. 1988, H. Sipman & J. Duivenvoorden 28175 (B); Comisaría AMAZONAS. Comunidad de Villazul, E of Araracuara, N-bank of river Caquetá, opposite Isla Mariñame, "Pantano de Monica Sosa", alt. c. 240 m, coord. 0°42' S, 72°07'W, c. 6 m tall, light forest, dominated by small *Clusia* and Bombacaceae, on peat, 4 km N of the river, 2 Nov. 1988, H. Sipman & J. Duivenvoorden 28435 (B). GUYANE FRANÇAISE: Saül, primary forest near Boeuf Mort, alt. 200-300 m, coord. 53°12'W, 3°38'N, on branches 25 m high [in canopy], March 1985, A. Aptroot 15295 (U). GUYANA: Upper Mazaruni district, Kamarang, in the village, epiphyte on *Citrus*, coord. 60°37'W, 5°52'N, alt. c. 500 m, 3-26 Febr. 1985, H. Sipman & A. Aptroot 18125b (U); Upper Mazaruni district, Pakaraima mountains, c. 2 km NW of Kamarang, on thin stemlet in c. 10 m tall, well-lit

savannah-forest on ridge, coord. 60°38'W, 5°53'N, alt. c. 500 m, 4 Febr. 1985, H. Sipman & A. Aptroot 18284 (U); Upper Mazaruni district, N-slope of mount Roraima, c. 25 m tall, virgin, mossy forest, 25 m high in treecrown, coord. 60°46'W, 5°17'N, alt. 700 m, 12-19 Febr. 1985, H. Sipman & A. Aptroot 18819 (U); Upper Mazaruni district, trail from Kamarang river to Pwipwi mountain, in savannah bush c. 5 km N of Waramadan, coord. 60°46'W, 5°54'N, alt. c. 650 m, 27 Febr. - 1 March 1985, H. Sipman & A. Aptroot 19241a (B). VENEZUELA: Estado BOLIVAR, Cerro Guaiquinima, in central part of upper plateau (near camp 4), coord. c. 5°40'N, 63°34'W, alt. c. 950 m., low, mossy forest on rocky sandstone slope towards stream, 6 Febr. 1990, H. Sipman 26651a (B, VEN)

NOTES: The name reflects the conspicuous orange colour of the medulla and the small size of the plants.

P. aurantiacoparvum resembles most closely *P. mellissii* (Dodge) Hale, by its margins with long cilia, flaking cortex and fragile, ciliate isidia. However, soredia are never found in *P. aurantiacoparvum*, and the medullary chemistry is different. A similar rusty orange medulla seems unknown in any other *Parmotrema* species and is e.g. not mentioned by Hale (1974, 1990). The nature of the pigment is unknown; judging from the K-reaction, it might be an anthraquinone.

5. *Parmotrema gradsteinii* Aubel, sp. nov. Fig. 4.

TYPE: Guyane Française, Saül, fallen from canopy, 7 Aug. 1982, Boom & Mori 1521 (U holotype).

DIAGNOSIS: Thallus laxe adnatus, pallide cinereus, ad c. 10 cm diametro; lobi apicibus rotundatis 5-10 mm latis, marginibus undulatis; soralia, lobuli, pustuli isidiaque nulla; cilia numerosa, nigra, ad 2 mm longa, nonnumquam fasciculata; latus superior emaculatum, planum vel in centro rugulosum; medulla alba; latus inferior ad apices fuscum, nudum, in centro ater, rhizinis sparsis in partibus ad substratum appressis instructum; rhizinae nigrae, vulgo ad 1 mm longae, simplices. Apothecia concava, stipite angusto brevi, imperforata, margine crenulato, hymenio 80-150 µm alto, sporis 24-28 x 12-18 µm. Pycnidia conidiis ad 7 µm longis et 0.8 µm crassis, sublageniformibus. Materiae chimicae (TLC): atranorinum, acida gyrophoricum et lecanoricum.

DESCRIPTION: Thallus corticolous, loosely adnate, pale grey, available fragments up to 10 cm diam.; lobes with rotund or crenulate, 5-10 mm wide tips and slightly undulate, entire margins; lobules, isidia, pustules and soralia absent; cilia numerous, c. 1.5-2 mm long, black, often

bundled, especially in the shallow sinuses of crenulate lobe tips; upper surface dull, emaculate, smooth and continuous near the tips, rugulose and slightly cracked in the central parts; medulla white, without pigment; lower surface black, near the lobe tips brown, smooth or rugulose, slightly glossy, naked in a wide (over 5 mm) zone at the lobe tips, with isolated rhizines or small patches of rhizines on appressed parts in the centre of the lobes; rhizines usually up to 1 mm long and unbranched, black. Apothecia densely crowded, concave, with short and narrow stalk, imperforate, 2-5 mm wide, with strongly crenulate margin and brown disc; outer wall smooth or slightly rugulose; hymenium 80-150 µm high; spores 24-28(-30) x 12-18 µm. Pycnidia with up to 7 µm long and 0.8 µm thick, sublageniform conidia. Chemistry (TLC): atranorin, gyrophoric and lecanoric acids. Colour reactions: medulla K-, C+ red, KC+ red, P-, UV-; cortex K+ yellow, UV-.

DISTRIBUTION: Only known from Guyane française and Surinam, from canopy branches in primary forest around Saül, from low forest in Haut-Marouini, and from the Wilhelmina Mountains, at 200-300 m. elevation.

ADDITIONAL SPECIMENS: GUYANE FRANÇAISE: Saül, primary forest near Boeuf Mort, alt. 200-300 m, coord. 53°12' W, 3°38' N, March 1985, A. Aptroot 15294 (U); Saül, 2 km SW of the village, "sentier limonade", alt. 180-210 m, coord. 03°32'N, 53°12'W, lowland moist forest on lateritic soil, epiphytic on outermost canopy branches of *Brosimum parinarioides*, 11 July 1986, D. Montfoort & R.C. Ek 1233 (U); Camp no. 4 - Roche no. 2 Monpé Soula - Bassin du Haut-Marouini, 5 km à l'Ouest, alt. 300 m, coord. 54°04'W, 02°39'N, savane roche, sur arbustes des fourrés sommitaux, epiphyte, 31 Aug. 1987, J.J. de Granville, L. Allorge, W.J. Hahn, M. Hoff & Weizman 9911 (U). SURINAM: Wilhelmina Mountains, frequent on *Cochlospermum*, in forested hills 9 km north of Lucie Rivier, 12 km west of Oost Rivier, alt. 275 m, 17 July 1963, B. Maguire, J. P. Schulz, T. R. Soderstrom, N. Holmgren 54235 (NY).

NOTES: The name is chosen in honour of S. R. Gradstein, Dutch bryologist and leader of the expedition to Mount Roraima in 1985, which brought the largest lichen collections available until now from the Guianas.

P. gradsteinii is well characterized by the presence of gyrophoric acid as medullary substance and by its crenulate apothecia. A somewhat similar species is *P. abnuens* (Nyl.) Hale, which has the same C+ red medullary reaction. However, in *P. abnuens* this is caused by the presence of olivetoric acid, and the thallus is maculate (Hale 1965: 277). Another fairly similar species is *P. hololobum* (Hale) Hale: it differs by its

perforate apothecia with smaller spores [(12)15-18(20) x (6)8-10 µm] and filiform conidia up to 16 µm long (Krog & Swinscow 1981: 186).

The presence of lecanoric acid is probably an artifact, see remark under *Bulbothrix leprieurii*.

Pycnidia were found only in Boom & Mori 1521, mature apothecia in Boom & Mori 1521, Maguire et al. 54235 and Montfoort & Ek 1233.

Remarkable is the limited distribution of this species: it seems restricted to the eastern part of the Guianas and appears to be absent from the Guiana Highlands, the principal diversity centre of the region.

5. *Parmotrema verrucisetosum* Sipman, sp. nov. Fig. 5, 6.

TYPE: Guyana, Upper Mazaruni district, trail from Kamarang river to Pwipwi mountain, N of Waramadan, rocky savannah c. 10 km N of Waramadan, coord. 5°57'N, 60°45'W, alt. c. 800 m, 28. Febr. 1985, H. Sipman & A. Aptroot 19478 (B).

DIAGNOSIS: Thallus laxe adnatus, pallide cinereus, ad c. 12 cm diametro; lobi apicibus rotundatis 9-12 mm latis, marginibus crenulato-undulatis, ciliati; soralia, lobuli, pustuli isidiaque nulla, cum verrucis ciliatis; cilia numerosa, nigra, ad 3 mm longa; verrucae 0.2-0.4 mm latae, primo conicae, demum semiglobosae vel applanatae et granulis instructae; latus superior emaculatum, planum vel in centro rugulosum; medulla alba; latus inferior ad apices fuscum nudum, in centro ater, rhizinis sparsis vel aggregatis in partibus ad substratum appressis instructum; rhizinae nigrae, ad 1 mm longae, simplices. Apothecia et pycnidia ignota. Materiae chimicae (TLC): atranorinum, acida salazinicum et consalazinicum.

DESCRIPTION: Thallus corticolous, loosely adnate, pale grey, towards the centre more whitish, up to at least 12 cm wide; lobes with rotund or sligtly crenulate, 9-12 mm wide tips and crenulate-undulate, ciliate margins; lobules, isidia, pustules and soralia absent, ciliate warts present; cilia numerous, c. 2-3 mm long, black; warts 0.2-0.4 mm wide, at first conical, later hemispherical or flattened and producing coarse granules, often bearing one, rarely more, cilia; upper surface dull, emaculate, smooth and continuous near the tips, slightly rugulose and irregularly cracked in the central parts; medulla white, without pigment; lower surface black, near the lobe tips brown, mostly smooth and glossy, cracked, naked in a 10 mm or more wide zone at the lobe tips, with sparse rhizines or small patches of rhizines on appressed parts in the centre of the lobes; rhizines up to 1(-2) mm long, unbranched, black. Apothecia and pycnidia unknown. Chemistry (TLC): atranorin, salazinic and consalazinic acids. Colour reactions: medulla K+ yellow, soon turning

red, C-, KC-, P+ orange, UV-; cortex K+ yellow, UV-.

DISTRIBUTION: So far known from two localities in the Guiana Highlands area, one in Guyana, the other in Venezuela, in low forest at 800-950 m elevation.

ADDITIONAL SPECIMEN: VENEZUELA, Estado BOLIVAR, Cerro Guaiquinima, in central part of upper plateau (near camp 4), coord. c. 5°40'N, 63°34'W, alt. c. 950 m, low, mossy forest on rocky slope towards stream, epiphytic, 5 Febr. 1990, H. Sipman 26595 (B, VEN)

NOTES: *Parmotrema verrucisetosum* is very distinctive by its ciliate warts spread over the surface. Other salazinic-acid containing *Parmotrema* species differ clearly by producing marginal (sub)soralia, coralloid isidia or being without vegetative diaspores (Hale 1965, Krog & Swinscow 1981).

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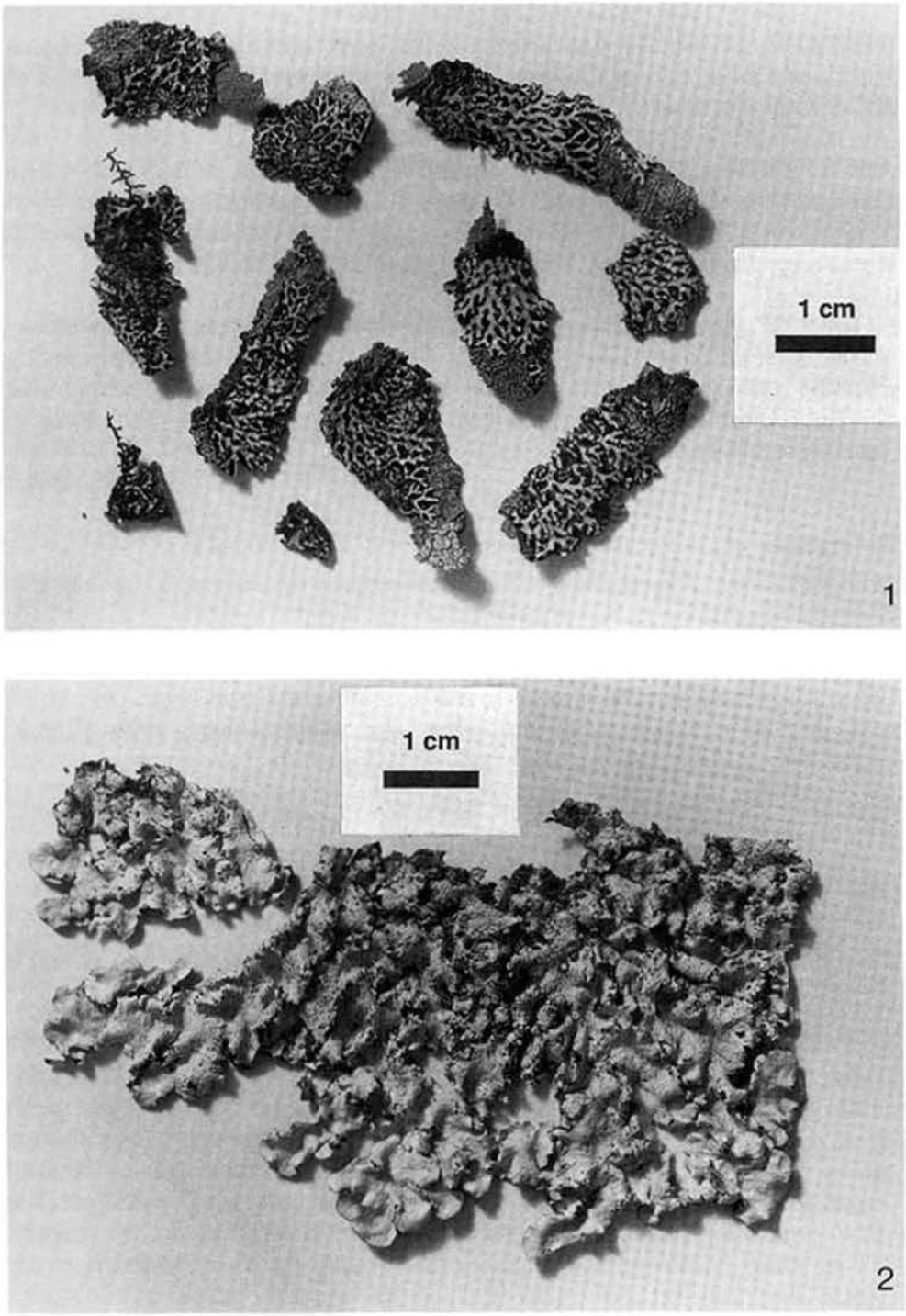
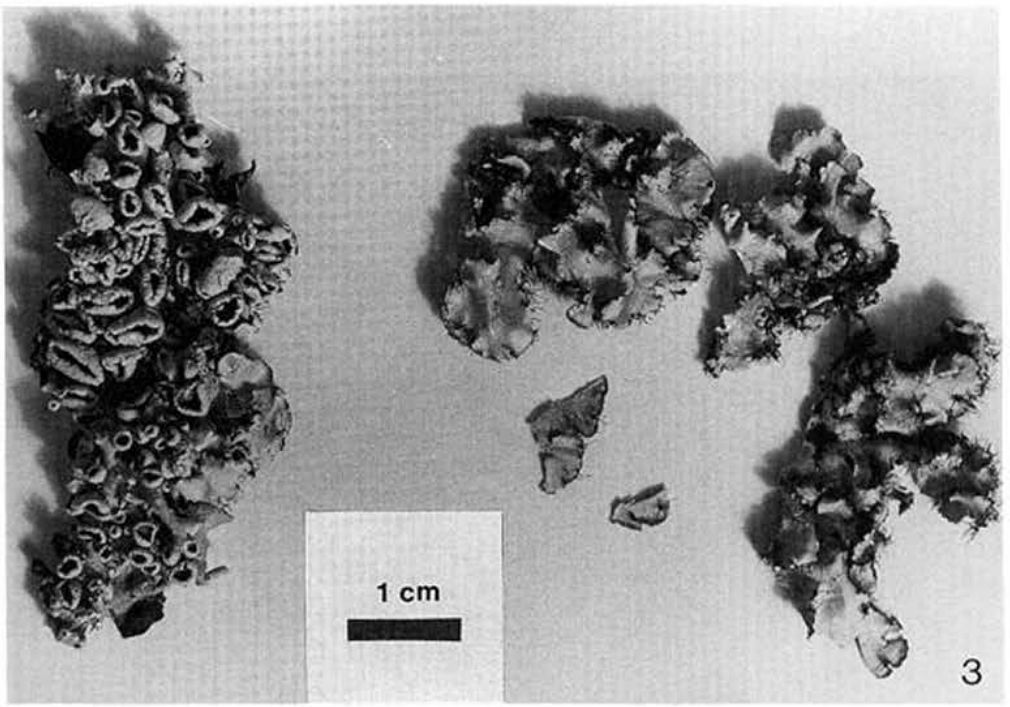


Figure 1-2: 1. *Bulbothrix leprieurii* Aubel (holotype), habitus; 2. *Parmotrema aptrootii* Aubel (holotype), habitus.



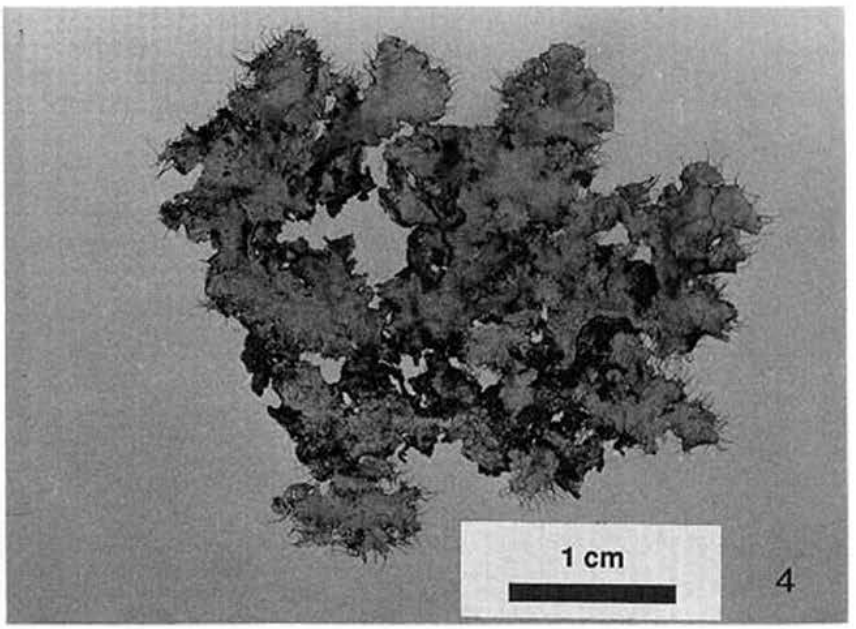
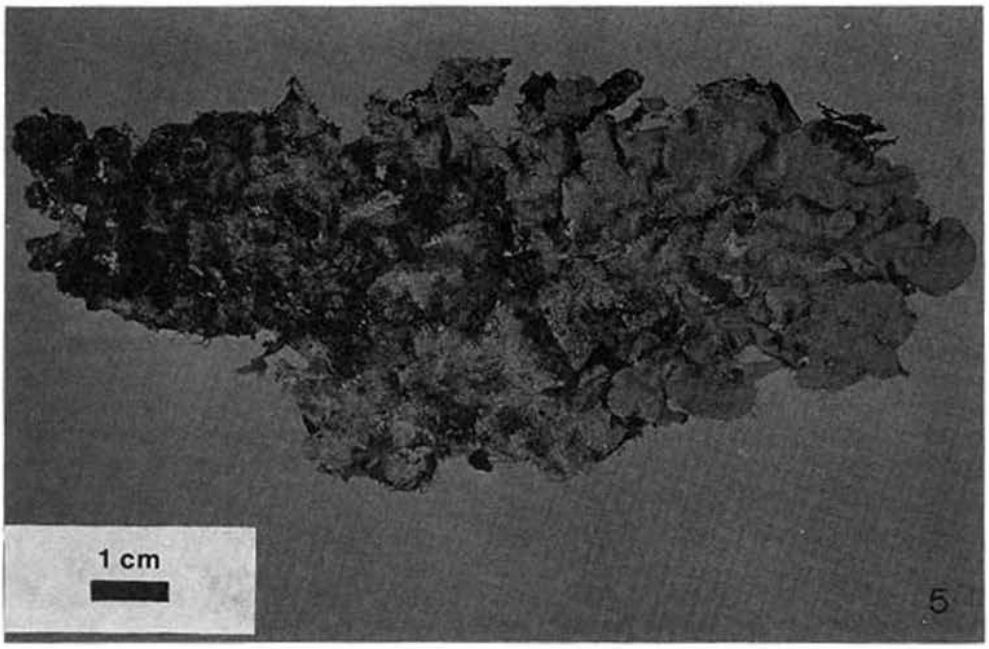


Figure 3-4: 3. *Parmotrema aurantiacoparvum* Sipman (holotype), habitus; 4. *Parmotrema gradsteinii* Aubel (holotype (left) and Aptroot 15294 (right)), habitus.



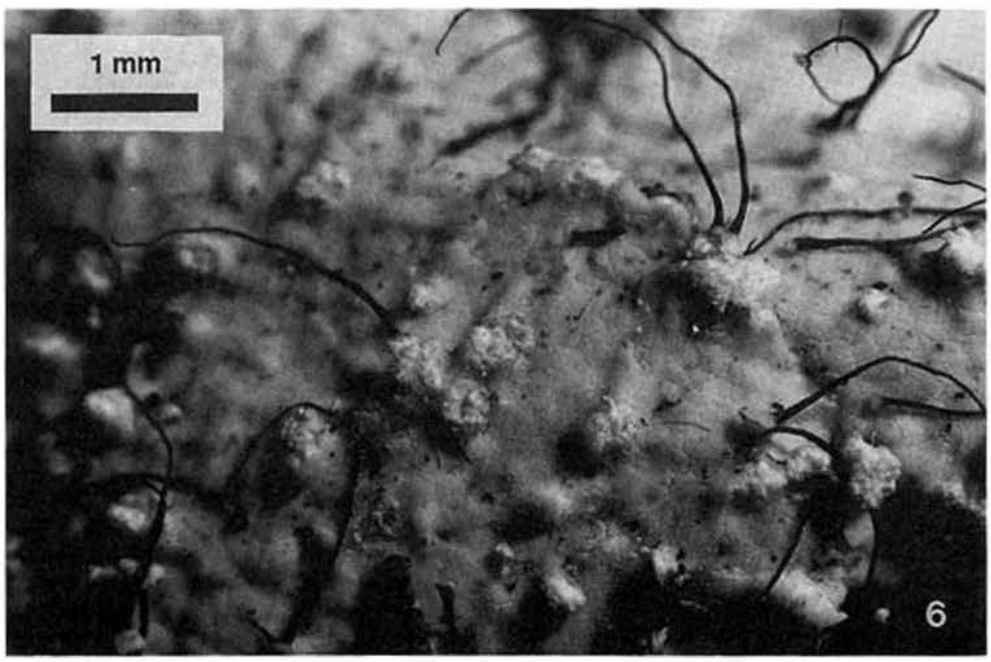


Figure 5, 6: *Parmotrema verrucisetosum* Sipman (Sipman 26595); 5, habitus. 6, detail with ciliate warts.

MYCOTAXON

Volume XLIV, no. 1, pp. 13-20 April-June 1992

ADDITIONAL NEW SPECIES AND NEW REPORTS OF PERTUSARIA (LICHENISED ASCOMYCOTINA) FROM AUSTRALIA

ALAN W. ARCHER

National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia, 2000

ABSTRACT: The species *Pertusaria gyrophorica* Archer, *Pertusaria novae-hollandiae* Archer, *Pertusaria subcerussata* Archer and *Pertusaria thamnolica* Archer are described as new; *Pertusaria cicatricosa* Müll.Arg., *Pertusaria pertusella* Müll.Arg.and *Pertusaria porinella* Nyl., are reported as new to Australia.The published chemistry of *Pertusaria communis* var. *neo-caledonica* Nyl., *Pertusaria plicatula* Müll.Arg. and *Pertusaria subtruncata* Müll.Arg. is revised.

INTRODUCTION

A number of new species in the lichen genus *Pertusaria* have recently been described (Archer 1991,1991a) and an examination of further specimens has shown the presence of additional undescribed taxa which are reported here. The sources of the specimens and the techniques used for the examination of specimens have been described previously (Archer 1991a); the chemistry of some taxa was also confirmed by liquid chromatography (Lumbsch & Elix 1985). The spore descriptions follow the nomenclature of Dibben (Dibben 1980:10). The figures illustrate holotypes.

Pertusaria gyrophorica Archer sp.nov. Fig.1

Thallus albidus vel cineraceus, tenuis, rimosus, superficies laevis et nitida, sorediatus sed isidiis destitutis, corticola; soralia albido-straminea, numerosa, dispersa, saepe confluentia, circularia vel irregularia, adnata, 0.4-1.0 mm diam.; apothecia disciformia, rara, marginibus incrassatis et involutis, disci concavai, albo-pruinosi, 0.5-1.0 mm diam.; asci clavate, 180-220 μm longi, 50-60 μm lati; sporae 8nae, biseriatae, ellipsoideae vel elongato-ellipsoideae, laeves, 45-55(-65) μm longae, 20-25 μm latae, parietibus *ca.* 1 μm crassis.
Thallus acidum gyrophoricum continens.
Type: Australia, New South Wales, 2 km N of Coffs Harbour, on bark of *Casuarina* along foreshore, 2 m, *J. A. Elix 1167*, 31.viii.1975; ANUC-holotype.

Thallus off-white to pale grey, thin, cracked, surface smooth and shiny, lacking isidia, sorediate, corticolous; *soralia* pale yellowish white, numerous, scattered, sometimes confluent, circular or irregular in outline, adnate, 0.4-1.0 mm diam.; *apothecia* disciform, uncommon, margins thick, inrolled, discs sunken, white pruinose, 0.5-1.0 mm diam.; asci clavate, 180-22- μm long, 50-60 μm wide; *spores* 8/ascus, biseriate, ellipsoid to elongate ellipsoid, smooth, 45-55(-65) μm long, 20-25 μm wide, wall *ca.* 1 μm thick.
Chemistry: K-, KC+ red, C+ red, Pd-; gyrophoric acid with minor amounts of lecanoric acid.

Specimens examined.
VICTORIA. Mt. Drummer, 18 km E of Cann River, on eucalypt, 360 m, *J. A. Elix* 5239, 21.xi.1978 (ANUC); track to Chatauqua Peak, 1 km N of Halls Gap, on eucalypt, *A. W. Archer P 81*, 30.x.1989 (NSW).
AUSTRALIAN CAPITAL TERRITORY. 2 km before Honeysuckle Creek Tracking Station, on eucalypt, 1000 m, *J. A. Elix 557*, 20.i.1975 (ANUC); Kowen Forest, 15 km E of Canberra, on eucalypt bark, 730 m, *J. A. Elix 1321*, 21.x.1975 (ANUC).
NEW SOUTH WALES. Brown Mountain, on eucalypt bark, 975 m, *J. A.Elix 1577*, 20.ii.1976 (ANUC); Laurieton, 30 km SSW of Port Macquarie, *G. N. Stevens 2012* p.p., 23.viii.1977 (BRIU); Tenterfield, *W. H. Ewers 3863*, 12.vii.1989 (herb. EWERS); Murphys Track, Dora Dora State Forest, 18 km SE of Holbrook, 35°51′S, 147°28′E, 620 m, on eucalypt, *J. A. Elix 23004*, 15.xi.1989 (ANUC); track by Mill Creek, ca 55 km NW of Sydney, on fallen eucalypt, *A. W. Archer P 161*, 11.v.1991 (NSW).

P. gyrophorica is one of a group of Australian sorediate *Pertusaria* taxa in the subgenus *Pionospora* which are rarely fertile and are best differentiated by their chemistry; e.g. *P. erythrella* Mull.Arg. contains norstictic acid, *P. scaberula* Archer contains lichexanthone and thamnolic acid and the saxicolous *P. persulphurata* Müll.Arg. contains thiophaninic and stictic acids. *P. gyrophorica* resembles *P. subrhodotropa* Archer, described from Western Australia (Archer 1991a), but that species contains lecanoric acid as the major lichen acid and lacks soralia. Two similar sterile, sorediate specimens from Queensland [*D. Verdon 5426* (CBG, H) and *H. Streimann 37614* (B, CBG)] contained lecanoric acid as the major lichen acid and are identified as *P. subrhodotropa*. *P. gyrophorica* occurs in south-eastern Australia where it grows predominantly on eucalypts.

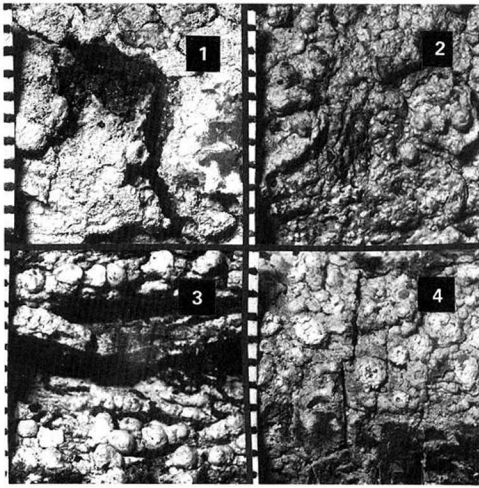
Pertusaria novaehollandiae Archer sp. nov. Fig.2

Thallus albido-olivaceus, surrimosus et subtuberculatus, superficies laevis et nitida, isidiis et sorediis destitutus; corticola; apothecia verruciformia, numerosa, dispersa, saepe confluentia, thallo concoloria, plano-hemisphaerica, basibus non constrictibus, 0.7-1.4 mm diam.; ostiola inconspicua, albido-hinnulea, saepe submammiformescentia, 0.1 mm diam., in verrucas singula; sporae 8nae, uniseriatae, laeves, ellipsoideae, fusiformescentes, 75-95 μm longae, 30-45 μm latae.
Thallus acidum miriquidicum et 4,5-dichlorolichexanthone continens.
Type. Australia, New South Wales, Cockle Creek, ca. 25 km N of Sydney, 33°40′S, 151°09′E, on *Casuarina*, 1 m, *A. W. Archer P 107*, 25.iv.1990; NSW-holotype.

Thallus pale greenish-grey, slightly cracked, subtuberculate, surface smooth and shiny, lacking isidia and soredia, corticolous; *apothecia* verruciform, numerous, scattered, sometimes confluent, inconspicuous on rough substrates, concolorous with the thallus, flattened hemishperical, not constricted at the base, 0.7-1.4 mm diam.; ostioles inconspicuous, pale fawn, sometimes becoming slightly mammiform, 0.1 mm diam., 1/verruca; *spores* 8/ascus, uniseriate, ellipsoid, smooth, becoming fusiform, 75-95 μm long, 30-45 μm wide.
Chemistry: K-, KC-, C-, Pd-; miriquidic acid and 4,5-dichlorolichexanthone.

Specimens examined.
NEW SOUTH WALES. Buckenbowra River, 7 km W of Batemans Bay, 35°42′S, 150°06′E, 1 m, on *Avicenna, H. Streimann 27783*, 29.v.1983 (CBG 8306052,H); Tomaga River Estuary, ca. 1 km S of Tomakin, 35°52′S, 150°13′E, on *Casuarina glauca, K. Kalb 21586*, 4.viii.1989 (herb. KALB); ibid., 35°51′S, 150°12′E, *J. A. Elix 23309*, 29.ix.1989 (ANUC).

The new species, characterised by inconspicuous pale fawn ostioles and the presence of miriquidic acid, is morphologically similar to *P. paragibberosa* Archer (Archer 1991a)



Figures 1-4. New species of *Pertusaria*. 1, *Pertusaria gyrophorica* ; 2, *Pertusaria novaehollandiae* ; 3, *Pertusaria subcerussata* ; 4, *Pertusaria thamnolica* .Scale in mm.

but differs chemically from that species, which contains 4,5-dichlorolichexanthone and 2'-O-methylperlatolic acid. Miriquidic acid is however closely related to 2'-O-methylperlatolic acid and is derived from that acid by oxidation of the pentyl chain in the A ring. *P. novaehollandiae* occurs in New South Wales where it grows on mangroves and coastal *Casuarinas* in contrast to *P. paragibberosa* which is predominantly an inland species.

Pertusaria subcerussata Archer sp. nov. Fig.3

Thallus albidus vel cineraceus, tenuis, rimosus, superficies laevis et nitida, isidiis et sorediis destitutus; corticola; apothecia verruciformia, numerosa, hemisphaerica vel

plano-hemisphaerica, thallo concoloria, 0.8-1.4 mm diam.; ostiola inconspicua, translucida, projecta e verrucis, ca. 0.2 mm diam., in verrucis 1-2na; sporae 4nae, uniseriatae, ellipsoideae, parietibus interioribus undulatis ("asper" sensu Dibben 1980), 90-95 μm longae, 35-50 μm latae.
Thallus lichexanthone solum continens.
Type: Australia, Queensland, Albert River Valley, S of Beaudesert, 28°10′S, 153°02′É, 200 m, on *Callitris, J. Hafellner 18464*, 1.ix.1986; GZU-holotype.

Thallus off-white to pale greyish-white, thin, cracked, surface smooth and shiny, lacking isidia and soredia, corticolous; *apothecia* verruciform, hemispherical or flattened hemispherical, concolorous with the thallus, 0.8-1.4 mm diam.; ostioles inconspicuous, translucent, projecting from the verrucae, ca. 0.2 mm diam., 1-2/verruca; *spores* 4/ascus, uniseriate, ellipsoid, rough, 90-95 μm long, 35-50 μm wide.
Chemistry: K-, KC-, C-, Pd-; lichexanthone only.

P. subcerussata is both chemically and morphologically distinct from other Australian *Pertusaria* species with four rough spores per ascus and most closely resembles *P. tetrathalamia* var. *plicatula* Müll.Arg., described from Brazil (J. Müller 1884:302); however this taxon has larger spores (125-190 μm long), 1-5 black ostioles per verruca and contains stictic acid in addition to lichexanthone. The new species is distinguished from the Australian *P. subisidiosa* Archer (Archer 1991a) by the absence of isidia and the lack of stictic acid. *P. subcerussata* is known only from the type specimen.

Pertusaria thamnolica Archer sp. nov. Fig.4

Thallus albidus vel cineraceus, areolatus et rimosus, superficies laevis et hebetata, isidiis et soredii destitutus; corticola; apothecia disciformia, conspicua, dispersa, 0.5-1.5 mm diam., margine crasso et involuto, thallo concoloria; discus planus, albido-pruinosus; sporae 8nae, uniseriatae, ellipsoideae, laeves, 22-32 μm longae, 12-17 μm latae, parietibus *ca.* 1 μm crassis.
Thallus acidum thamnolicum continens.
Type. Australia, New South Wales. E side of Mooney Mooney Creek, ca. 8 km WSW of Gosford, 33°26′E, 151°15′S, ca. 10 m, on *Casuarina, A. W. Archer P178*, 24.v.1991; NSW-holotype; ANUC-isotype.

Thallus off-white to pale grey, areolate and cracked, surface smooth and dull, lacking isidia and soredia, corticolous; *apothecia* disciform, discs conspicuous, scattered, 0.5-1.5 mm diam., with thick inrolled margins, surface of disc white pruinose; *spores* 8/ascus, uniseriate, ellipsoid, smooth, 22-32 μm long, 12-17 μm wide, spore wall *ca.* 1 μm thick.
Chemistry: K+ yellow, KC-, C-, Pd+ yellow; thamnolic acid.

Specimens examined.
NEW SOUTH WALES.Buckenbowra River Estuary, 7.5 Km W of Batemans Bay, 35°42′S, 151°06′É, 1 m, among *Avicennia* and *Casuarina, K. Kalb 18238*, 4.viii.1988 (herb. KALB); ibid., *K. Kalb 18921* (herb. KALB).

The new species resembles *P. truncata* Krempelh. but is distinguished from that species by the presence of thamnolic acid and the slightly larger spores; *P. truncata* contains picrolichenic acid and its spores are (16-)19-27 μm long and (8-)12-14.5 μm wide. (Kantvilas 1990). It is distinguished from *P. scaberula* Archer (Archer 1991a) by the absence of lichexanthone and the esorediate thallus. The thin-walled spores and the disciform apothecia place the new species in the subgenus *Pionospora* as defined by Dibben (Dibben 1980:38). The species is so far known only from the two localities in New South Wales.

NEW RECORDS

Pertusaria cicatricosa Müll.Arg. Proc. Roy. Soc. Edinburgh 11:461 (1882).
Type: Socotra, Balfour s.n., 1876; G-lectotype (here selected).

Pertusaria communis var. *neo-caledonica* Nyl. Bull. Soc. Linn. Normandie ser. 2,2:70 (1867).
Type: New Caledonia, Wagap, Plancher s.n., 1862; H-NYL 22885 [published as 22855 (Archer 1991)] lectotype.

Pertusaria subtruncata Müll.Arg. Flora 67: 397 (1884).
Type: Mauritius, Robillard s.n., 1876; G-holotype.

Thallus pale yellowish white to pale yellowish green, slightly tuberculate and cracked, surface smooth and dull, lacking isidia and soredia, corticolous; apothecia verruciform, concolorous with the thallus, conspicuous, numerous, crowded, sometimes confluent, flattened hemispherical, often irregular in outline, sometimes becoming constricted at the base, 0.8-1.5 mm diam.; ostioles inconspicuous, pale brown or translucent, 0.1-0.2 mm diam., 1 or less frequently 2-3/verruca, sometimes slightly sunken; spores 2/ascus, ellipsoid, rough, 100-140(-155) μm long 35-50 μm wide.
Chemistry: K-, KC-, C-, Pd-; 2,4,5-trichlorolichexanthone, 2,4- and 2-5-dichlorolichexanthones, stictic acid and constictic acid (tr).

Specimens examined.
AUSTRALIA, Queensland. Brisbane, Tingalpa Creek, *F. R. M. Wilson s.n.*, 18.viii.1896 (NSW L4640 p.p.);North Stradbroke Island, 2 km N of Dunwich, on *Avicennia marina*, sea-level, *R. W. Rogers 1999*, 10.viii.1972 (BRIU 2052); Noosa Heads National Park, in rain forest on fallen branches, 20 m, *J. A. Elix 10380*, 31.viii.1982 (ANUC)
VANUATU. s. loc.,*F. R. M.Wilson s.n.*, 1895 [as New Hebrides] (NSW L4656, L4657); Malekoula Is., Port Sandwich, Planter Point, *D. Tippet 61*, 19.viii.1985 (NSW).
FIJI. Viti Levu, Coral Coast, Tagaque Village, 20 km E of Sigatoka, on coconut palm, *J. A. Elix 15321*, 29.viii.1983 (ANUC).

The earliest name for this taxon is *Pertusaria communis* DC var. *neo-caledonica* Nyl. (Nylander 1867) but this variety is chemically and morphologically distinct from *P. pertusa* (Weigel) Tuck. (syn. *P. communis* DC), which contains 4,5-dichlorolichexanthone and stictic acid (Hanko 1983:114) and has smooth walled spores; specific status is therefore appropriate for this taxon. When var. *neo-caledonica* is raised to species level the earliest name is *P. cicatricosa*. Müll.Arg. Müller himself had noted the similarity of his new species with var. *neo-caledonica* in the protologue to *P. cicatricosa* (Müller, loc.cit.). Liquid chromatography showed that the previously reported xanthone (Archer 1991, 1991a) present in var. *neo-caledonica* and *P. subtruncata* Müll.Arg., i.e. 4,5-dichlorolichexanthone, is a mixture of chlorinated xanthones (vide supra); this combination of related tri- and di-chlorolichexanthones was first reported from *P. aleianta* Nyl. (Huneck & Höfle 1978).

P. cicatricosa was described from material collected on the island of Socotra and the protologue refers to two syntypes collected by Balfour and Schweinfurth respectively (Müller 1882). The specimen collected by Balfour has two rough spores per ascus, as described in the protologue and is chosen as lectotype. The specimen collected by Schweinfurth however has two smooth spores per ascus and contains thiophaninic and stictic acids; it resembles *P. subflavens* Müll.Arg., also described from Socotra (Müller loc. cit.). *P. cicatricosa* was also reported from Ceylon and New Caledonia (Müller 1884) and the specimens (from the Müller herbarium) corresponding to this report were examined. The specimen from Ceylon [Thwaites s.n., 1876 (G)] has two rough spores

per ascus but the specimen from New Caledonia [Balaba(?), Vieillard s.n.,(G)], labelled "*P. communis* var. *neo-caledonica* Nyl.", has two smooth, fusiform spores per ascus and contains 4,5-dichlorolichexanthone and can be identified as *P. irregularis* Müll.Arg., previuosly described from Australia (Müller1895; Archer 1991). Müller later referred to a further specimen of *P. cicatricosa* collected in New Caledonia by T. Saves in 1886 (Müller 1887) but this specimen was not seen.

P. subtruncata was described from Mauritius and the type specimen is identical both chemically and morphologically to *P.cicatricosa*. *P. goniostoma* Müll.Arg. (Müller 1884:285) may also be a later name for *P. cicatricosa;* the holotype of that species [New Caledonia, s. loc., *Vieillard s.n.*,1883 (G)] has two rough spores per ascus but was too small for chemical examination.

P. cicatricosa is characterisd by the two rough spores per ascus and the presence of tri-and di-chlorolichexanthones and stictic acid; it is differentiated from the chemically similar *P. pertusella* Müll.Arg.(q.v.) by the rough spores (smooth in the latter taxon). *P. cicatricosa* is a tropical to subtropical species which, in Australia, occurs in eastern Queensland.

Pertusaria pertusella Müll.Arg. Flora 67: 283 (1884).
Type: Mauritius, *Robillard s.n.*, 1876; holotype-G.

Pertusaria plicatula Müll.Arg. Bull. Herb. Boissier 3: 635 (1895).
Type: Australia, Queensland, s. loc., *Knight 41* p.p., 1887; holotype-G.

Pertusaria straminea Müll.Arg. ibid. p. 638.
Type: Australia ,Queensland, Thursday Island, *Hartmann s.n.*, 1887; holotype-G.

Thallus off-white to pale yellow green, areolate and cracked, surface slightly wrinkled and dull, corticolous; verrucae conspicuous, numerous, sometimes confluent, slightly flattened hemispherical, becoming constricted at the base, 0.5-1.0 mm diam.; ostioles inconspicuous, pale to dark brown, 1-5/verruca, often slightly sunken in the verruca; spores 2/ascus, elongate ellipsoid, smooth, 100-140(-160) µm long, 30-40(-45) µm wide.
Chemistry: K-, KC-, C-, Pd-; 2,4,5-trichlorolichexanthone, 2,4- and 2,5-dichlorolichexanthones and stictic acid and constictic acid (tr).

Additional specimen examined.
Australia, Northern Territory, 60 km S of Darwin, Darwin River, on *Brugiera, N. Sammy 87/035*, 19.ii.1987 (DNA 30327).

The specimens previously described as *P.plicatula* Müll.Arg. (Archer 1991) are also *P. pertusella*. The taxon is characterised by the two spored asci and the presence of tri- and dichlorolichexanthones and stictic acid; it is differentiated from the similar *P. cicatricosa* (q.v.) by the two smooth spores per ascus. *P. pertusella* occurs in northern and north-eastern Australia and Vanuatu, and has been reported from India (Müller 1892) and also from Queensland (Shirley 1889) but the specimen corresponding to the latter report was not seen.

Pertusaria porinella Nyl. Ann. Sci. Nat. Bot. (4) 19: 321 (1863).
Type: Mexico, Tampico, *Uzac s.n.*, 1858; holotype H-NYL 22966

Thallus thin, dull yellowish white to off-white, surface smooth and dull; corticolous; apothecia verruciform, concolorous with the thallus, numerous, scattered, rarely confluent, flattened hemispherical, sometimes becoming constricted at the base, 0.4-0.8 mm diam.; ostioles inconspicuous, translucent, 1/verruca; spores 2/ascus, ellipsoid, smooth, (75-)85-105(-112) µm long, 25-40 µm wide.

Chemistry: K- or weak yellow, KC-, C-, Pd- or weak yellow; stictic acid, ± constictic (tr) and cryptostictic acids (tr), ± lichexanthone.

Specimens examined:
Australia, Queensland. North Stradbroke Island, S of Dunwich, on *Avicennia*, sea-level, *R. Rogers 534*, 21.ii.1975 (BRIU); Noosa River [near Noosa Heads], on *Brugiera*, sea-level, *G. N. Stevens 2373 p.p.*, 18.xii.1975 (BRIU).
New South Wales. Sawtell [near Coffs Harbour], Boambie Creek, on *Avicennia*, sea-level, *G. N. Stevens 2042*, 24.viii.1977 (BRIU); Erina Creek, 3 km E of Gosford, on *Avicennia marina*, sea-level, *J. A. Elix 4714*, 8.v.1978 (ANUC); ibid., *J. A. Elix 4709b*, 8.v.1978 (ANUC).

P. porinella is distinguished from other two-spored Australian *Pertusaria* species with stictic acid by the absence of chlorinated xanthones and the presence of translucent ostioles. The taxon was reported to occur in Ceylon (Singh 1964:185) but the reference quoted (Müller 1884: 398) refers to the occurence of the taxon in San Diego, California. *P. porinella* was reported from Queensland (Bailey 1883) but the specimen corresponding to this report was not seen. In Australia *P. porinella* occurs on coastal mangroves from southern Queensland to northern New South Wales .

ACKNOWLEDGEMENTS

The author is grateful to the Herbaria referred to above for the loan of specimens and to Dr. J. A. Elix for the identification of the xanthones and the gift of authentic lichen acids, and to the National Herbarium of New South Wales for arranging the loan of type and other specimens and for permission to use the facilities of the herbarium.

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MYCOTAXON

Volume XLIV, no. 1, pp.21-26 April-June 1992

CONTRIBUTION TO THE STUDY ON THE GENUS SINOTERMITOMYCES FROM ASIA

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ABSTRACT Two new edible mushroom species : Sinotermitomyces griseus Zang and Sinotermitomyces rugosiceps Zang are described and illustrated from a collection on termite combs from Burma. The type specimens of the two species are deposited in the Cryptogamic Herbarium, Kunming Institute of Botany, Academia Sinica (HKAS).

KEY WORDS: Sinotermitomyces rugosiceps, Sinotermitomyces griseus.

汉 文 摘 要

本文报道了华鸡坟属两新种，即：糙盖华鸡坟 Sinotermitomyces rugosiceps Zang和灰色华鸡坟 Sinotermitomyces griseus Zang 均采自缅甸，模式标本均存于中国科学院昆明植物研究所隐花植物标本馆(HKAS) 撰摘人：臧 穆

The genus Sinotermitomyces Zang (Amanitaceae) is mainly restricted to Eastern and South eastern Asia monsoon forest, while only two original species: Sinotermitomyces cavus Zang and Sinotermitomyces carnosus Zang occur in tropical region of South western Yunnan and South eastern Tibet, China.(Zang, 1981). Recently, in Burma, the knowledge of this genus is quite limited and all the known another two relative species have been founded in Quercus and coniferous forests. The genus is well defined by a long tubelike tapering stipe buried on the termite combs below the ground. The Asian and Chinese people are popularly known as the edibility use of termite mushrooms and the distinctive mushrooms are grouped according to the special habitat, (Wang, 1985). The different termite combs where the termite fungi (e.g. Sinotermitomyces and Termitomyces etc.) are most likely to be found. The genus Termitomyces is a common genus during the rainy season in South and Southeast Asia and tropical Africa (Heim, 1977; Batra, 1979)

Taxonomic and Geographic distribution part

Sinotermitomyces Zang, Mycotaxon 13(1): 171. 1989.
Type species: Sinotermitomyces cavus Zang.

Key to the known species of genus Sinotermitomyces in Asia

1.Stipes leathery to fibrillose tubelike,equal,exact hollow 2
1.Stipes fleshy to fibrillose, clavate, tepering towards the base,stuffed or hollow.....3
2.Pileus conical, glabrous,basidiospores smaller, 2.4-5 X 3.5-9 um ..... 1.Sinotermitomyces cavus
2.Pileus subumbonate,rugose, covered with warts, basidiospores larger, 6.5-10 X 6.5 um ..... 4. S. rugosociceps
3.Pileus conical to plano-convex , pale white to brown,scabrous separated, without holes at the center, basidiospores smaller, 4.9-8 X 3-6 um .....2. S. carnosus
3.Pileus hemispheric,slightly umbonate, ivory grey to griseous brown, pierced with holes at the center, basidiospores larger, 9-11.7 X 6.5-8 um .....3. S. griseus

1. Sinotermitomyces carnosus Zang, Mycotaxon 13(1) : 172. 1981.(Fig. 9.)
China : Yunnan, Tsangyuan County, On termites nest. 30. VIII.1980. M. Zang 6752 (HKAS 6752).

2. Sinotermitomyces cavus Zang, Mycotaxon 13(1) : 172. 1981. (Fig. 9.)
China : Yunnan, Tengchung County, Tuan-Tian Village, on nest of termites, 2100 m. alt. 8 VIII 1980. X.J. Li 11 (HKAS 6533); Tengchung County , Pu-Chuan village, X. X. Ma 1. (HKAS 4612); Mangshi, 10 . VIII 1980. M. Zang 6545 . (HKAS 6545); Shweli County. on nest of termites, 12 VIII 1980. M. Zang 6563 (HKAS 6563);Jing Gu County. 10 VII 1985. K.Y.Guan 1. (HKAS 14626). Tibet (Xizang) : Motou, 2610 m. alt. 25.IX. 1985. R. G. Su 1343 (HKAS 16253).

3. Sinotermitomyces griseus Zang, sp. nov. (Fig.1-4, 9)
Pileus 3-4 cm., conicus vel umbonatus, convexus, siccus, scabridus. primo albidus vel eburneus, demum griseus vel fulvo-ravidus. Lamellae subliberae vel adnatae, albidae vel eburneae. Stipes 25-30 cm longus, 0.6-1 cm crassus, aequalis,carnosus vel fibrillosus, tubulosus, apice glabriusculus vel furfuraceus, griseus, deorsum laevigatus, badius. Annulus superus distinctus, cernuus. Stipes deorsum annulatus, parte stipitis urtra annula solido, inferiore cavo. Basidiosporae 9-11.7 X 6.5-8 um, hyalinae,globosae,ovoideae, laeves, inamyloideae. Basidia 15-20 X 8-10 um, clavata, 4 - sporigera. Pleurocystidia 18-26 X 7-11 um, cylindrica, fusiformis. Cheilocystidia 15-20 X 10.4-11.7 um late fusiformis. Hab. In sylvis mixtis coniferarum et Quercorum, ad terram in silva pluviali, nido Termitidarum (Odontotermes) erumpente.
Burma : Popa Mountain Park, The Union of Myanmar, Mandalay division. Under Conifers and Quercus forests, in red clay on nest termites, 23 X 1991. K.Y. Guan 2. (HKAS 23648,Typus).

Pileus 3-4 cm broad, hemispheric becoming convex, dry,occasionally obtusely conic, slightly umbonate when expanded, whereabouts pierced with small holes at the center when mature, minutely scabrous, surface white to griseous brown on margin and also becoming translucent-striate toward margin appressed. Context thin and rather firm, white, not changing color when cut or bruised. Gills crowded, almost free or adnate, white to near ivory white. Stipe 25-30 cm long, 0.6-1 cm thick, equal, tubelike, fleshy upward, fibrillose below. Annulus superior persistent as a floccose-membranous white collapsing hanging down loosely around the stipe, solid above the annulus, hollow below, upwards often covered with bran-like scales on the surface, glabrous at the below and with a discoid base. Basidiospores 9-11.7 X 6.5-8 um, hyaline, globose, ovoid, smooth, inamyloid. basidia 15-20 X 8-10 um, clavate, 4-spored. Pleurocystidia 28-35 X9-14 um, cylindric to fusiform. Cheilocystidia 19.5-30 X 10 14 um. broadly fusiform.

The most distinctive character of this grayish species and its stipe that is a different texture, the uppers is solid, the lower is hollow. The another distinctive characters are that the pileus with slightly umbonate and pierced with small holes and the larger basidiospores, however it is easily separate from Sinotermitomyces carnosus Zang.

4. Sinotermitomyces rugosiceps Zang, sp. nov. (Fig. 5-8,9)
Pileus 3.5-4.5 cm. conicus, campanulatus vel subumbonatus, convexus, siccus, verrucosus. Primo pallidus, demum cervinus vel brunneus. Lamellae liberae vel subliberae, albidae. Stipes 25-35 cm longus, 0.8-1.5 cm crassus. aequalis, cavus, tubulosus, coriaceus vel fibrillosus, apice laevigatus, sursam scabroso-furfuraceus, basim versus discoideus. Annulus superus distinctus, valvatus sursum. Basidiosporae 6.5-10 X 5-6.5 um , hyalinae, ovoideae, ellipsoideae, laeves,in solutione Melzeri aureo-brunneolae. Basidia 11-15.6 X 7-8 um. clavata, 4-sporigera. Pleurocystidia 16-22 X 8-9.5 um,cylindrica. Cheilocystidia 17-20 X 8-9 um, cylindrica.
Hab. In sylvis, ad terram in silva pluviali, nido Termitidarum (Odontotermes) erumpente.
Burma : Pyin Oo Lwin 1000 m. alt. The Union of Myanmar,Mandalay Division. under Monsoon forests. 22 X 1991. K.Y.Guan 1. (HKAS 23647 Typus)

Pileus 3.5-4.5 cm broad, conical, campanulate, subumbonate or convex, dry, surface white or pale white to waxy yellow or brown, covered with brownish pyramidal warts, which later may fall off or be washed off. Gills free or subfree, white. Stipes 25-35 cm long, 0.8-1.5 cm thick, equal, hollow, tubelike, leathery to fibrillose, glabrous above the annulus,minutely scurfy below and with a discoid base. Veil persistent as a thick, membranous leathery upwards annulus. Basidiospores 6.5-10 X 5-6.5 um, hyaline, ovoid to ellipsoid, smoo-

th, color near golden-brown in Melzer's reagent . Basidia 11 -15.6 X 7-8 um, clavate, 4-spored. Pleurocystidia 17-20 X 8-9.5 um, cylindric. Cheilocystidia 17-20 X 8-9 um, cylindric.

Sinotermitomyces rugosiceps is a fairly edible fungus, well characterized by the pileus covered with pyramidal warts, the larger size basidiospores and the hollow stipe. The similar species in which the stipe also hollow is Sinotermitomyces cavus Zang, which has a glabrous pileus and the smaller size basidiospores (3.5-9 X 2.4-5 um)

ACKNOWLEDGEMENTS

The author wishes to thank Prof. Richard P. Korf, Cornell University, for his critical rewiew of this manuscript and to Mr. K.Y. Guan, Kunming Institute of Botany, Academia Sinica, for collecting the specimens from Burma.

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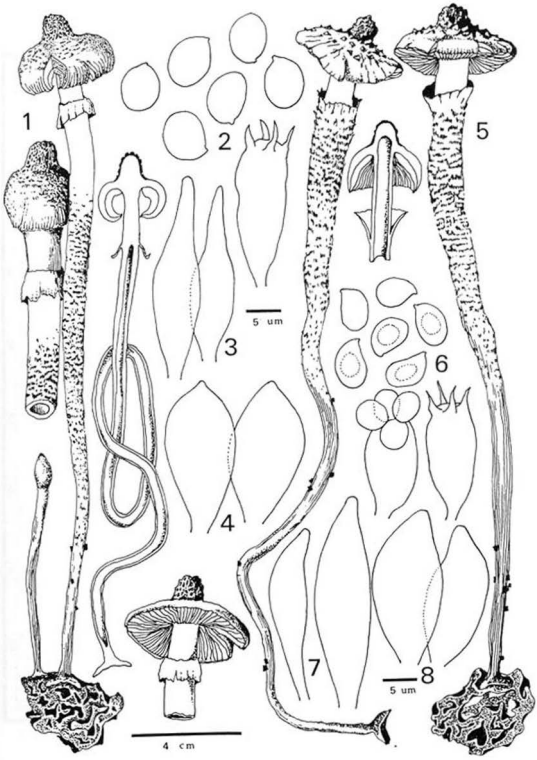

Figs. 1-8. Sinotermitomyces griseus Zang : 1. Basidiocarps; 2. Basidium; 3. Pleurocystidia; 4. Cheilocystidia. Sinotermitomyces rugosiceps Zang : 5. Basidiocarps; 6. Basidia and basidiospores; 7. Pleurocystidia ; 8. Cheilocystidia.

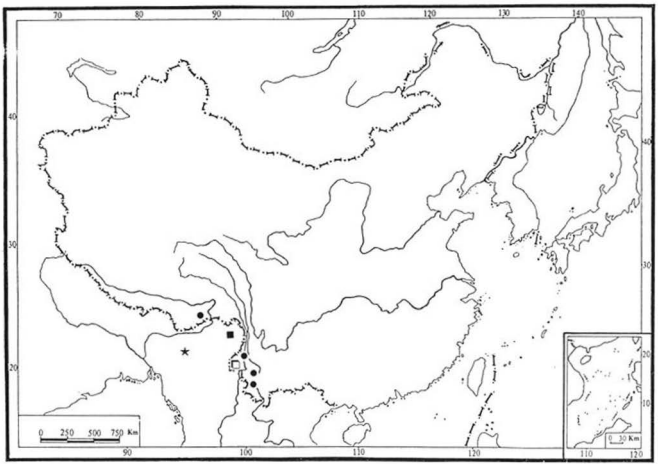

Fig. 9. Geographic distribution pattern of Genus Sinotermitomyces. ● S. cavus; □ S. carnosus; ★ S. griseus; ■ S. rugosiceps.

MYCOTAXON

Volume XLIV, no.1, pp. 27-30 April-June 1992

ECOLOGY AND TAXONOMY OF THE GENUS LEPISTA IN SARDINIA. 2. LEPISTA MASIAE sp. nov., A NEW ADVENTITIOUS SPECIES.

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SUMMARY

A new basidiomycetes species, Lepista masiae sp. nov., is described from Sardinia (Italy). Due to its micromorfological characters L. masiae is placed in the subgenus Rhodopaxillus (R. Maire) M. Bon.

KEY WORDS

Basidiomycetes, Agaricales, Lepista, Sardinia.

Records of exotic agaricomycetes are not very rare in Sardinia, especially in suitable places such as botanical gardens and pot of flowers (Ballero et al., 1991).

During the last season a lot of very interesting basidiomycetes were observed in many station of the Isle southern area Chlorophyllum molybdites (G.F.W. Meyer: Fr.) Mass., Agaricus haematosarcus Hein. et Gooss., Lepiota micropholis (Berk. et Br.) Sacc. , Sericeomyces viscidulus Hein., Leucoagaricus rubrotinctus (Peck) Sing. etc. and one of the new for the science recorded entities is the subject of this comunication.

This is a Lepista species which has been collected over several ways in a pot of flowers by our friend M. Masia who kindly sent us four collections. We feel necessary to propose the following new taxon.

Lepista masiae Ballero & Contu sp. nov.

Pileus 1-3 cm latus, carnosulus, explanatus, ad medium interdum levissime umbonato, margine involuto, exstriato, sine vestigia veli; cutis parce separabilis, leviter hygrophana, tomentosa, radialiter fibrillosa-virgata, obscure griseo-brunnea, fibrillis obscurioribus.

Lamellae tenues, remotae, decurrentes, pallidae dein ochraceo-luteolae, interdum leviter roseotinctae. Stipes 2-4.5 x 0.5 -1.4 cm, pileo confluens, solidus, plenus, subcylindraceus vel clavatus, ad basim saepe radiculis albidis mycelii obtecto; indumentum siccum, leviter costolatum, saepe fibrillosum, superne pruinosum, album. Caro sat conspicua, alba, immutabilis, odor saporque debilis.

Sporae 4.8-6 x 3.3-4.1 mu, hyalinae, cyanophilae, ellipsoideae, echinulatae, crassotunicatae. Basidia 22.5-36

x 7-7.5 mu, tetraspora, clavata, fibulata. Lamellarum trama subregularis. Cystidia nulla. Pilei cutis ex hyphis pro parte erectis efformata, pigmento intraparietalis praeditis. Fibulae numerosae.

Ad terram, gregaria vel subcaespitosa sub Ficus benjamina L. lecta. Autumno.

Typus: Italia, Sardinia meridionalis, Cagliari, sub Ficus benjamina L. , 19-9-1990. Legit M. Masia, det. M. Ballero & M. Contu (HOLOTYPUS, n° 90/52, in CAG).

Cap 1-3 cm broad, fleshy, explanded with a slightly umbonate centre, margin inrolled, not striate; surface slightly hygrophonous, tomentose to radially fibrillose, not viscid, dirty brown with fuscous shades near the centre.

Stipe 2-4.5 x 0.5-1.4 cm, confluent with the cap, solid, sub-cylindrical to clavate, at the base often with white. Mycelium remmnants, flesh rather thick, white unchanging; small and taste not distinctive.

Spore-print not obtained. Spores 4.8-6 x 3.3-4.1 mu, hyaline, ellipsoid, cyanophilous, strongly echinulate, thick walled, white with a small apiculus. Basidia 22.5-36 x 7-7.5 mu, four-spored, clavate, with clamps.

Hymenophoral trama subregular, made up of cilindrical, slightly pigmentate hyphae, ut to 10.5 mu broad. Cystidia of any kind none. Pileal surface a dry trichoderm mode up of cilindrical to slightly clavate up to 4.8 mu broad hyphae; connection present on all septa.

Habitat: gregarious to caespitose in a pot of flowers containg Ficus benjamina L. (Moraceae)

Material examined - Italy: south Sardinia, Cagliari, in a pot of flowers with Ficus benjamina, n° 90/52 19-9-1990, legit M. Masia, det. M. Ballero & M. Contu (holotypus); ditto, 7-10-1990 n° 90/55; ditto 29-10-1990 n° 90/184. Material in CAG.

DISCUSSION

According to M. Bon's recent treatment (1983) of the european representatives of Lepista this new species belongs to the subgenus Rhodopaxillus (R. Maire) M. Bon although spore size and ornamentation show a close resemblance to that of L. inversa (Scop.) Pat. and other taxa usually placed in Lepista sectio Gilva Harmaja (syn. Lepista sectio Inversae Sing. et Clemençon nom. inv.).

Among the entities of the subgen. Rhodopaxillus L. panaeola (Fr.) P. Karst. is comparable but discrepancies in cap colours, spore-size and ornamentation are clearly decisive.

Concerning the extra-european Lepista we have not been able to find a taxon covering the specimens studied (Bigelow and Smith, 1969). L. panaeoliformis (Murr.) Sing., thus far known only from type collection, came closest but it is clearly different in having paler colours and bigger spores.

Conseguently L. masiae (dedied to our friend Prof. M. Masia) will be easy to recognize if eventually collected out of Sardinia. This, in our opinion, should be probable

because macromycetes growing in pot of flowers (Ballero e Contu, 1991) have, at least in Sardinia and with a few exceptions, an exotic origin and their introduction in such country is tied to very peculiar circumstances and, definitively has to be retained as an exceptional event.

ACKNOWLEDGEMENTS

We express our most sincere thanks to Prof. J. Ammirati (Department of Botany, University of Washington, Seatle) for his precious collaboration and his kind consulence.

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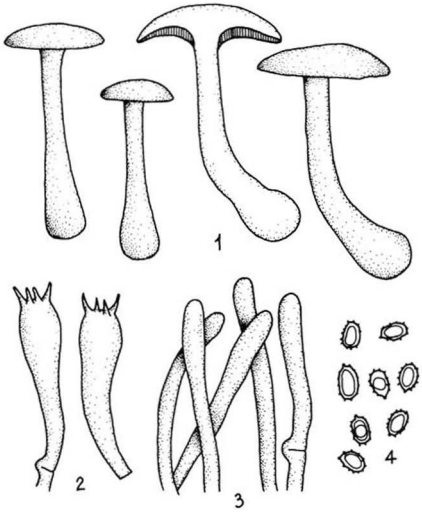

Lepista masiae sp. nov.
1) carpophores 2) basidia 3) pileal surface structure
4) spores

MYCOTAXON

Volume XLIV, no. 1, pp. 31-44 April-June 1992

NOTES ON SPANISH LEAF-INHABITING HYALOSCYPHACEAE

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Summary: One new genus and a new species of the Hyaloscyphaceous fungi are described: *Graddonidiscus* Raitv. & Galán for *Dasyscyphus coruscatus* Graddon and a new species *Graddonidiscus hispanicus* Raitv. & Galán on *Quercus* leaves. The taxonomic position of the new genus is discussed. *Lachnum trapeziforme* Vel. and *Hyaloscypha carpinacea* Vel. are recollected from Spain on *Quercus* and on *Alnus* leaves respectively. Their taxonomic positions are discussed and a new combination *Phialina carpinacea* (Vel.) Raitv. & Galán is proposed.

METHODS

Microscopic studies (squash mounts) were made using Melzer's reagent or Lactophenol-Methyl Blue with pretreatment in 5% KOH solution and directly photographed. Photomicrographs were made with a Nikon microscope (Optiphot model with an incorporated automatic system) using phase contrast (figs. 2-5, 7, 13, 21 & 25) or interferential contrast-Nomarski (figs. 12, 14, 15, 20 & 23). All measurements and line drawings were made with Carl Zeiss Jena microscope equipped with a drawing tube.

The specimens are preserved in the private herbarium of the first author (**RG**), deposited at the Herbarium of the University of Alcalá de Henares.

Lachnum trapeziforme Vel. Mon. Disc. Boh. 261 (1934). (Figs. 1-11).

Apothecia scattered or in small groups, stipitate, cup-shaped, up to 0.3 mm in diameter. Receptacle and and disc pure white, not changing after drying. Receptacle covered by white hairs. Stalk cylindrical, its length more or less equal to the diameter of the disc, 0.1 mm in diameter. Ectal excipulum composed of "textura prismatica", individual cells hyaline, thin-walled, about 11x5 µm. Hairs cylindrical with slightly tapering rounded tips, occasionally with a swollen basal cell, straight, 2-4-septate, hyaline, thin-walled but sometimes with a restricted lumen, finely granulate, bearing large crystals of calcium oxalate and apically agglutinated by large globules of amorphous matter, 60-70x3-4 µm. Asci arising from simple septa, cylindrical-clavate, with J+ apical pore, 8-spored with irregularly biseriate arrangement of the spores, 56x6.2-7.4 µm. Spores ellipsoid to clavate-ellipsoid, inequilateral, straight to slightly curved, very variable in their shape, hyaline, aseptate, 8-10.5x2.5-3.7 µm. Paraphyses narrowly lanceolate, slightly exceeding the asci, 2.5 µm in diameter.

On fallen leaves of *Quercus*.

Specimen examined: On fallen leaves of *Quercus faginea* Lam. ?, Arroyo de Fardes, Alfaguara, Granada, Spain, 21.11.1989, coll. A. Ortega et al. (**RG**-6565). On decaying leaves, Lightcliffe, Halifax, England, 15.10.1894, s.n. *Dasyscypha echinulata* (Rehm) Sacc. in Herb. Crossland (**K**).

This species is related to *L. rhytismatis* (Phill.) Nannf. but differs from it clearly in ascus and spore size. The fungus described by Dennis (1949: 29) as a "reduced form of *Dasyscypha soppitii* Massee" represents the same species. The collection at **K** is very scanty and contains only 3 apothecia in bad condition. So it was not sectioned but the original drawings on the label show quite clearly the identity of Crossland's collection to Velenovsky's species. Velenovsky's type of *L. trapeziforme* has been not available but Dr. B. Spooner (personal communication) agrees, that this name can be used for the described taxon.

Phialina carpinacea (Vel.) Raitv. & Galán comb. nov. Basionymum: *Hyaloscypha carpinacea* Vel. Mon. Disc. Boh. 273 (1934). (Figs. 12-19).

Apothecia gregarious, cup-shaped to discoid with well-defined margin, up to 0.3 mm in diameter, subsessile to shortly stalked (profile more or less conical in section), seated on a brown circle. Receptacle and disc white in fresh condition, pale yellow when dry. Margin and flanks (in minor degree) covered by short white hairs. Excipulum composed of "textura prismatica" to obscurely "textura angularis". Individual cells hyaline but brownish in the basal ring, thin-walled, prismatical to barrel-shaped, sometimes angular or quadrangular, relatively shorter in the basal region and relatively longer toward the margin, 7.4-12.4x4.3-6.2 µm. Hairs conical to cylindric-fusoid, mainly flexuous, never branched, hyaline, thin-walled, 2-4-septate, smooth in their lower part but granulate in one or two upper cells, 30-65 µm long, 4-5 µm in diameter in the widest part. Apical cells of hairs possess yellowish oily inclusions. Asci arising from the croziers, clavate to cylindric-clavate, sometimes stalked, with strongly J+ apical pore, 8-spored with biseriate or obliquely uniseriate arrangement of spores, 31-55x6.2-7.4 µm. Ascospores elliptic-fusiform, usually inequilateral and slightly curved, hyaline, aseptate, 13-16x2.4-2.6 µm. Paraphyses cylindrical-clavate, branched at the base, scarcely septate, not or very slightly exceeding the asci, apically 2-3.7 µm in diameter and containing yellowish oily inclusions.

On fallen decaying leaves of deciduous trees emerging on both surfaces from nerves or parenchyma.

Specimen examined: On dead leaves of *Alnus glutinosa*, Bridge on the "Arroyo de Barbaón", Parque de Monfragüe, Cáceres, Spain, 15.11.1986, coll. R. Galán & M. Jiménez (Holotype **RG**-6532).

The identity of the Spanish material to Velenovsky's species was confirmed by Dr. Seppo Huhtinen (personal communication). We had some difficulties in finding an appropriate genus for this peculiar species because it has an unusal combination of characters.

The brown stromatic basal ring is characteristic of *Calycellina* Höhn. but this genus in the sense of Lowen & Dumont (1984) not Baral (1989) has cylindrical to clavate obtusely rounded hairs.

The hairs of our fungus are somewhat similar to those described

in the genus *Asperopilum* Spooner but the latter has J- asci and paraphyses branched in their upper part (Spooner, 1987).

Our fungus also bears resemblance to some species of *Mollisina* Höhn. sensu Huhtinen (1987) but it lacks the solid refracting projections in some hairs (particularly on the flanks of the apothecium).

So remains the last possibility to place this species in *Phialina* Höhn. sensu Huhtinen (1990). In fact, it fits the genus rather well in its hair and paraphyse shape, yellow oily content in hairs and paraphyses and remains deviant in the hair granulation which does not dissolve in KOH, Melzer's reagent or lactic acid.

Graddonidiscus Raitv. & Galán gen. nov.

Apothecia gregaria, primo subglobosa dein cupulata, minuta, sessilia, albida vel pallide colorata, extus e margine breviter pilosa. Excipulum ectale ex "textura angularis-prismatica" compositur, cellulis hyalinis vel pallide fumosis, tenuiter tunicatis. Pili cylindracei, cylindraceo-fusoidei vel lageniformes, hyalini vel subfumosi, tenuiter tunicati, aseptati vel raro 1-septati, breves, apice vel intertum in parte superiore crystalliferes. Asci clavati vel cylindraceo-clavati, poro iodo coerulescentia, biseriati. Sporae ellipsoideo-clavatae vel suballantoideae, hyalinae, aseptatae. Paraphyses cylindracei, apice subclavati, ascos non superantes.

Species foliicolae.

Typus generis: Dasyscyphus coruscatus Graddon, Trans. Brit. Mycol. Soc. 69: 260 (1977).

Apothecia gregarious, at first subsphaerical, then cup-shaped, small, sessile, whitish or pale coloured, externally and particularly at the margin covered by short hairs. Ectal excipulum composed of "textura angularis-prismatica". Individual cells hyaline to pale smoky-brown, thin-walled, angular, elongated angular to prismatical. Hairs cylindrical to fusiform-cylindrical or bottle-shaped, straight or sometimes slightly flexuous, never branched, hyaline, thin-walled, aseptate or very rarely 1-septate, smooth, bearing sphaerical crystal caps or encrusted on their upper part by irregular crystals. Asci arising from simple septa, clavate to cylindric-clavate, sometimes shortly stalked, with J+ apical pore, 8-spored with biseriate arrangement of spores. Ascospores clavate-ellipsoid, usually inequilateral and slightly curved to almost allantoid, hyaline, aseptate. Paraphyses cylindrical, branched at the base, sparsely septate, not or very slightly exceeding the asci, slender, apically sub-

clavate.

Etymology: named in the honour of W.D. Graddon.

It is evident that the crystal caps on the hairs is not a sufficient character to place *D. coruscatus* Graddon in the genus *Dasyscyphus* (=*Lachnum* or its segregates). There has been. however, no particular need to erect a new genus for this peculiar species. Now when an another species congeneric with *D. coruscatus* is discovered the authors are forced to erect a new gwnus for two closely related foliicolous species which belong evidently to the subfamily Hyaloscyphoideae of the Hyaloscyphaceae (Raitviir, 1987). The structure of the excipulum and hairs of *Graddonidiscus* is typical for the members of this subfamily but it differs from all other genera of this subfamily in spherical conglomerations of crystals seated on the tips of the hairs. Its affinities may be toward *Incrupila* Raitv.

KEY TO THE KNOWN SPECIES

1. Ectal excipulum and hairs hyaline, ascospores 4-6x1.5-2 μm . . . . . *G. coruscatus*
- Ectal excipulum and hairs pale smoky brown, ascospores 6.3-7.5x2-3 μm . . . . . *G. hispanicus*

Graddonidiscus coruscatus (Graddon) Raitv. & Galán comb. nov. Basionymum: *Dasyscyphus coruscatus* Graddon, Trans. Brit. Mycol. Soc. 69: 260 (1977)

This species has been adequately described and illustrated by Graddon (1977). The differences between it and *G. hispanicus* are discussed under the latter species.

Graddonidiscus hispanicus Raitv. & Galán sp. nov. (Figs. 20-27).

Apothecia gregaria, primo subglobosa dein cupulata, ad 0.3 mm in diametro, sessilia, in vivo albida, in sicco sordide albida vel subgrisea, hymenio pallide ochraceo. Excipulum ectale ex "textura angularis-prismatica" compositur, cellulis pallide fumosis, tenuiter tunicatis, 8-10x5-6 μm. Pili lageniformes vel fusoideo-cylindracei, hyalini

vel subfumosi, tenuiter tunicati, aseptati vel raro 1-septati, 15-25x3-5 µm, apice vel intertum in parte superiore crystalliferes. Asci clavati vel cylindraceo-clavati, poro iodo coerulescentia, biseriati 27-33x5.0-6.5 µm. Sporae ellipsoideo-clavatae vel suballantoideae, hyalinae, aseptatae, 6.3-7.5x2.0-3.0 µm. Paraphyses cylindracei, apice subclavati, ascos non superantes, 1.5-2.5 µm in diametro.

Ad folia sicca Quercus ilex subsp. ballota (=Q. rotundifolia) crescit

Graddonidiscus coruscatus (Graddon) Raitv. & Galán similis, sporis majoribus e cellulis excipularibus subfumosis differt.

Holotypus: ad folia sicca Quercus rotundifolia, Tamajon, Guadalajara, Spain, 25.10.1990, C. Ochoa, G. Moreno & M. Heykoop legerunt, in herbario R. Galán conservatur (RG-6595).

Apothecia gregarious, at first subsphaerical, then cup-shaped, up to 0.3 mm in diameter, sessile. Receptacle and disc whitish in fresh condition; receptacle grayish, disc pale ochraceous when dry. Margin and flanks (in minor degree) covered by short grayish-white hairs. Excipulum composed of "textura angularis-prismatica". Individual cells pale smoky-brown, thin-walled, angular to prismatical, 8-10x5-6 µm. Hairs bottle-shaped to fusiform-cylindrical, sometimes slightly flexuous, never branched, hyaline, thin-walled, aseptate or very rarely 1-septate, smooth, 15-25x3-5 µm, bearing sphaerical crystal caps or encrusted on their upper part by irregular crystals. Asci arising from simple septa, clavate to cylindric-clavate, sometimes shortly stalked, with J+ apical pore, 8-spored with biseriate arrangement of spores, 27-33x5.0-6.5 µm. Ascospores clavate-ellipsoid, usually inequilateral and slightly curved to almost allantoid, hyaline, aseptate, 6.3-7.5x2.0-3.0 µm. Paraphyses cylindrical, branched at the base, scarcely septate, not or very slightly exceeding the asci, apically subclavate, 1.5-2.5 µm in diameter.

On fallen decaying leaves of *Quercus ilex* subsp. *ballota* (=*Q. rotundifolia*)

Specimen examined: On dead leaves of *Quercus ilex* subsp. *ballota*, Tamajon, Guadalajara, Spain, 25.10.1990, coll. C. Ochoa, G. Moreno & M. Heykoop (Holotype in the herbarium of R. Galán No. 6595)

This species is closely related to *Graddonidiscus coruscatus* (Graddon) Raitv. & Galán but differs from it in several characters. Its ectal excipulum is pale smoky-brown whereas the ectal excipulum of *G. coruscatus* is always hyaline. Also it has larger spores and com-

paratively wider asci. Also the hairs of *G. coruscatus* are never so typically bottle-shaped as in *G. hispanicus*.

ACKNOWLEDGEMENTS

One of the authors, R. Galán, thanks the Education and Science Ministry of Spain for the financial assistance to the Research Project (PA 86-0063): "Estudio de los hongos que fructifican enel Parque Natural de Monfragüe, Cáceres, España". He thanks also Drs. F. Esteve-Raventós, G. Moreno (Alcalá de Henares University) and A. Ortega (Granada University) for their valuable collaboration. The authors are greatly indebted to Dr. Brian Spooner (Kew) for helpful discussions and suggestions and to Dr. Seppo Huhtinen (Turku) for useful critical remarks. The authors thank Mrs. Urve Martinson (Tartu) for linguistic help.

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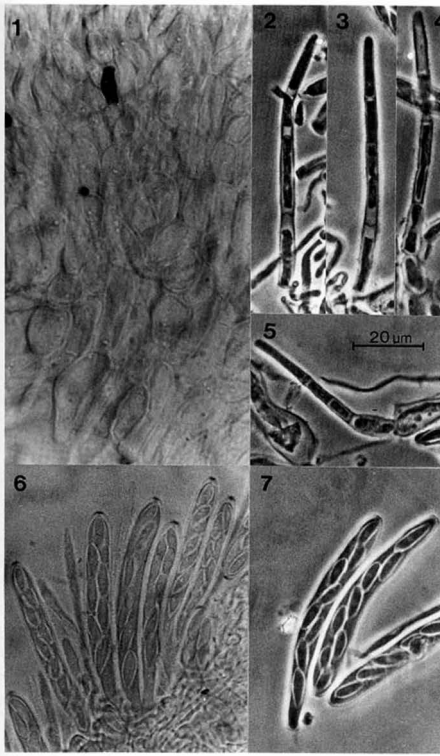
Figs. 1-11. *Lachnum trapeziforme*.
Fig. 1: Cells of the ectal excipulum; Figs. 2-7: Receptacular hairs; Figs 6-8: Asci containing spores and paraphyses; Fig. 9: Apothecia; Fig. 10: Margianl hairs; Fig. 11: Excipular cells.

Figs 12-19. *Phialina carpinacea*.
Fig. 12-13: Asci, paraphyses and spores; Fig. 14: Hairs (indicated by arrows) and excipular cells; Figs. 15-16: Flexuous hairs showing the granulate surface (arrows); Fig. 17: Asci, paraphyses and spores; Fig 18: Apothecia in different views; Fig. 19: Ectal excipulum and hairs.

Figs 20-27. *Graddonidiscus hispanicus*.
Figs. 20-21: Asci, paraphyses and spores; Figs. 23-24: Excipular cells and typically bottle-shaped (arrows) hairs with crystal caps; Fig. 25: spores; Fig. 26: Asci, paraphyses and spores; Fig. 27: Excipular cells and hairs.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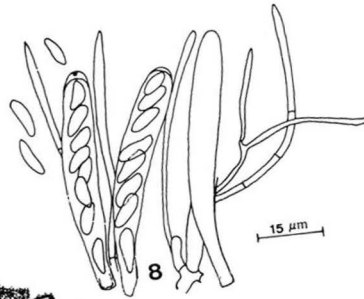

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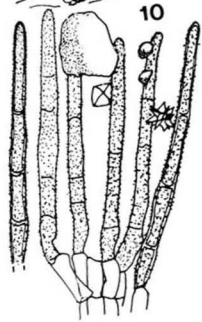

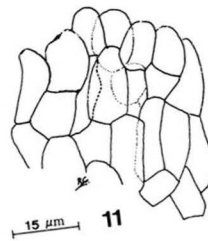

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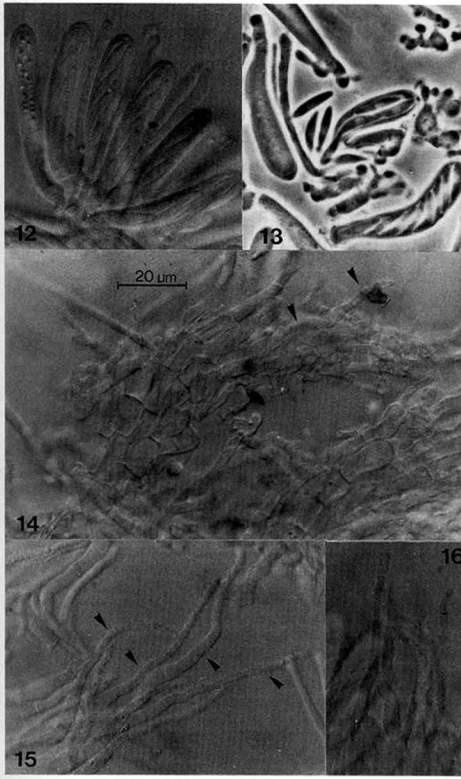
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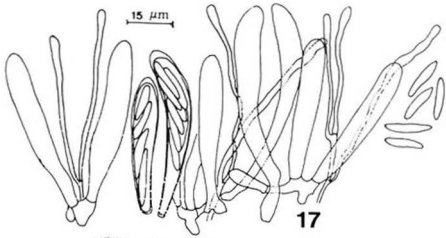

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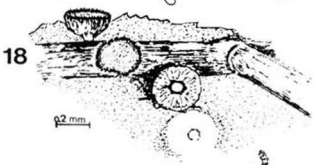

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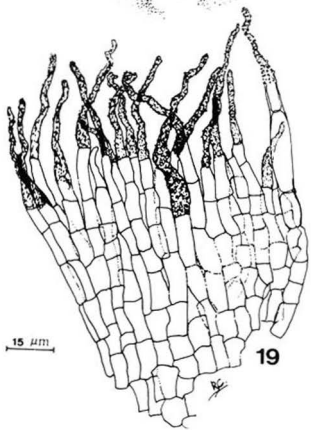

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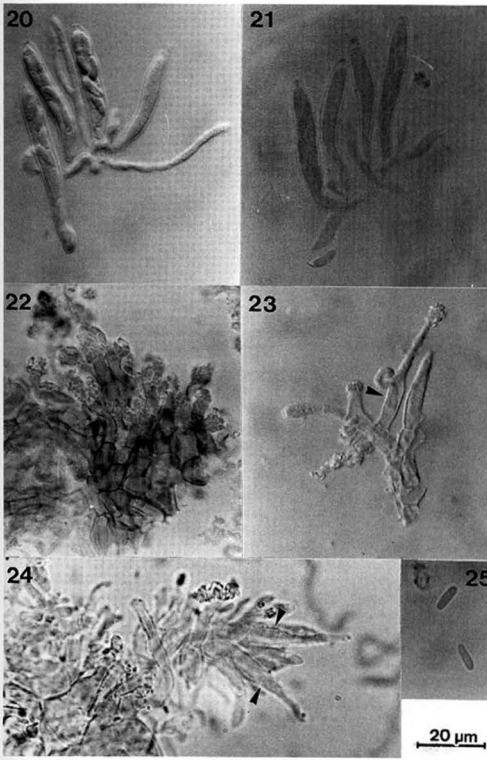
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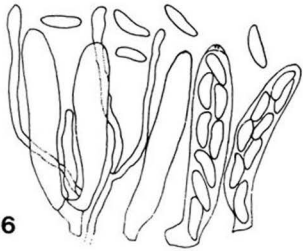

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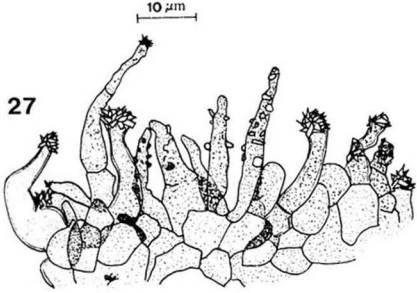

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MYCOTAXON

Volume XLIV, no. 1, pp. 45-50 April-June 1992

ANZIA CENTRIFUGA, A NEW LICHEN SPECIES FROM PORTO SANTO, MADEIRA

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SUMMARY

The new species *Anzia centrifuga* Haugan is described from the island Porto Santo, NE of Madeira, in the Madeira archipelago. The species is saxicolous in sunexposed and dry habitat. The genus *Anzia* is reported for the first time from Macaronesia.

INTRODUCTION

The genus *Anzia* Stizenb. was described by Stizenberger (1861) as a tribute to the Italian lichenologist Martino Anzi. *Anzia*, and the related genus *Pannoparmelia* (Müll. Arg.) Darb., are characterized by the presence of a spongy, cushion-like tissue on the lower side of the lobes. This tissue, which was named spongiostratum by Hannemann (1973), consists of loosely anastomosing hyphae, and originates from the meristematic zone in the apical part of the lobes (Henssen & Dobelmann 1987). *Anzia* is further characterized by having numerous spores in the ascus, a feature which distinguishes it from *Pannoparmelia*, which is octosporous (Darbishire 1912).

Anzia was divided into three sections by Asahina (1935). Sect. *Nervosae* was characterized by the presence of a chondroid axis in the medulla, which is lacking in the two other sections. Sect. *Simplices* and sect. *Duplices* were delimited by having a single-layered and double-layered medulla, respectively. Yoshimura (1987) limited the two latter sections since he found intermediate forms. The members of sect. *Anzia* sensu Yoshimura occur only in eastern Asia and eastern North America, while those of sect. *Nervosae* sensu Yoshimura are distributed throughout the tropical and subtropical regions of both the new and the old world (Yoshimura & Sharp 1968, Galloway 1978, Yoshimura 1987). A new species of *Anzia* has recently been discovered in the Madeira archipelago, and is described below.

MATERIAL AND METHODS

Material of the new species was collected by R. Haugan, H. Krog and E. Timdal (deposited in O) and P. W. James (deposited in BM) during an excursion to Madeira in April 1988. Specimens of related species (partly borrowed from UPS) were examined for comparison.

Sections for microscope studies were cut on a freezing microtome and mounted in H_2O, 10% KOH, 25% H_2SO_4, and acetone. A polarization filter was used to locate crystals of lichen substances and calcium oxalate. Thin-layer chromatography was performed in accordance with standard methods (Culberson & Kristinsson 1970, Culberson 1972). Calcium oxalate was identified by mounting a microscope preparation in 25% H_2SO_4, in which the oxalate crystals dissolve and recrystallize by forming needle-shaped crystals. Some microtome sections were washed in acetone in order to dissolve crystals of lichen acids before they were mounted in water or KOH. This proved the presence or absence of crystals which are not dissolved in acetone. Spores were measured in a microscope at 40× and 100× magnifications. Twentyfive spores were measured from four specimens. Spore measurements are given in the form $(x_L-1.5*\sigma_{n-1})-(x_L+1.5*\sigma_{n-1}) \times (x_B-1.5*\sigma_{n-1})-(x_B+1.5*\sigma_{n-1})$, rounded to the nearest 1 µm, where x_L and x_B are the arithmetic mean of spore length and breadth respectively, σ_{n-1} is the corresponding standard deviation, and * is the multiplication operator. Scanning electron microscopy (SEM) and a photomicroscope were used for photographs of cross-sections of the thallus. A stereo photomacroscope was used for habitus photographs.

RESULTS

Anzia centrifuga Haugan, sp. nov.

Thallus saxicolus, ad 30 cm diam., pallide griseus, orbicularis, sine sorediis et isidiis, in centrum emoriens. Laciniae 1–2 mm latae, crebro dichotome ramosae, imbricatae, rugosae, lobis obtusis pruinosis, leviter maculatis. Axis chondroideus depressus, interruptus. Rhizinae atrae, paucae. Spongiostratum continuum, atrum. Apothecia numerosa, ad 10 mm diam., pedicellata, cupulata, discis scabrosis, badiis vel atris. Hymenium ad 125 µm altum, incoloratum, epithecio olivaceo. Asci sporis numerosis; sporae 9–15 × 2–4 µm. Spermogonia ignota. Acidum divaricaticum, atranorinum et substantiae terpenoideae continens.

Type: Portugal, Madeira archipelago, Porto Santo, Pico do Castelo, 33°05'N, 16°20'W, 350 m alt., on sun-exposed rock, 7 April 1988, R. Haugan et al. 6126 (O, holotype; BM and UPS, isotypes).

Thallus saxicolous, adnate to loosely attached, orbicular, forming large rosettes up to c. 30 cm diam., pale grey, turning darker in older parts, without isidia and soredia; old specimens dying towards the center of the thallus. *Lobes* 1–2 mm wide, richly dichotomously branched, imbricate, broader and rounded towards the tips; older parts rugose, convex, richly pitted, with apothecial initials in the pits, smooth and flat towards the tips; lobe tips pruinose (calcium oxalate), faintly maculate. *Medulla* with a chondroid axis which is more or less discontinuous, being better developed above the rhizines than inbetween. *Lower side* with a continuous spongiostratum (frequently grazed by arthropods or snails, and therefore scattered towards the center), hardly visible from above, with a corticate outer surface when young. *Rhizines* developing from the chondroid axis, stout, black, sometimes weakly branched near the apex, rather scattered.

Apothecia common, to c. 10 mm diam., pedicellate, cupuliform; disc scabrous, somewhat shining when young, red-brown to black; margin entire, thin, crenate when old; the thalline exciple finely tomentose, white to yellowish. *Hymenium* up to 125 µm deep, colorless, with an olivaceous brown pigment in the epithecium. *Asci* with numerous, crescent-shaped spores, 9–15 × 2–4 µm. *Spermogonia* not seen.

Chemistry: Atranorin, divaricatic acid and several unknown terpenoids present; upper cortex K+ yellow (atranorin), C–, PD–, with crystals of unknown substance which are insoluble in acetone but soluble in KOH; medulla K–, C–, PD–, packed with crystals

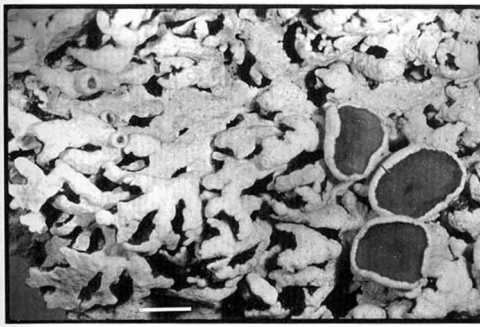

Fig. 1. *Anzia centrifuga*, habit. Holotype. Rule 2 mm.

which extend into the rhizines (soluble in acetone and KOH); medulla outside the chondriod axis containing crystals of divaricatic acid (soluble in acetone and KOH); the transition zone between medulla and spongiostratum with crystals of calcium oxalate which are masked by other substances unless the section is treated with KOH; the inner zone of the spongiostratum (near the medulla) contains crystals (soluble in acetone and KOH); the thalline exciple of the apothecia K+ yellow, with an outer zone characterized by the same crystals as in the upper cortex, and an inner zone with crystals similar to those in the medulla; crystals of calcium oxalate are extending from the medulla into the pedicels of the apothecia.

Distribution and ecology. The new species is known only from two localities on the volcanic neck Pico do Castelo on the island Porto Santo in the Madeira archipelago. The species grew on bare rock in a dry, sunexposed habitat, and was associated with e.g. *Heterodermia leucomelos* (L.) Poelt and *Ramalina* spp.

Additional specimen examined: Portugal: Madeira archipelago, Porto Santo, Pico do Castelo, 33°05'N, 16°20'W, alt. 430 m, on sun-exposed rock near the summit, 7 April 1988, R. Haugan et al. 6176.

DISCUSSION

The presence of a chondroid axis in *Anzia centrifuga* indicates inclusion in sect. *Nervosae*. The morphologically most similar species of this section is *A. parasitica* (Fée) Zahlbr, which is recorded from tropical America and Madagascar (des Abbayes 1956; Yoshimura 1987). This species has more slender lobes, the chondroid axis is more distinct than that of *A. centrifuga*, and the thallus is not dying towards the center. It contains divaricatic acid and atranorin, but differs from *A. centrifuga* in the terpenoid

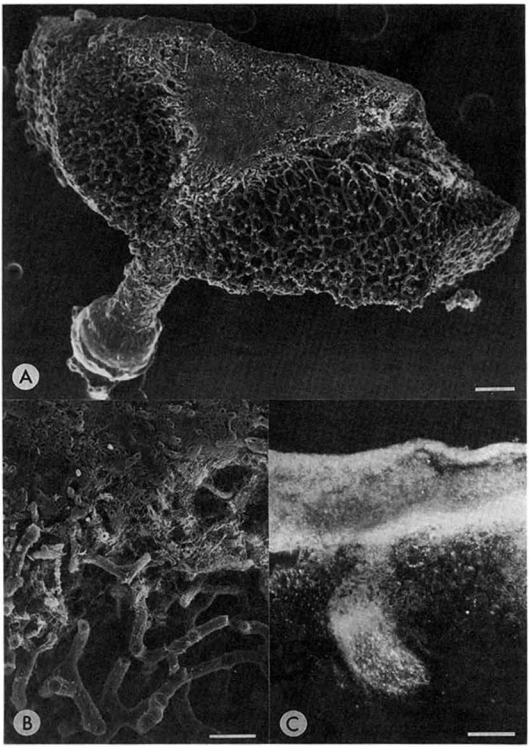

Fig.2. *Anzia centrifuga*; cross–sections of thallus. – **A.** SEM photograph showing the chondroid axis, spongiostratum and a rhizine; rule 100 µm. – **B.** SEM photograph showing the transition zone between medulla and the spongiostratum; rule 10 µm. – **C.** Photomicroscope photograph showing crystals in upper cortex, medulla and a rhizine; rule 100 µm.

pattern. It also differs ecologically in being a corticolous rainforest species.

There are several species of sect. *Nervosae* in SE Asia (Yoshimura 1987). None of these species seem to be similar to *A. centrifuga*, and they all differs morphologically, chemically and ecologically from the new species.

As mentioned above, the three sections of *Anzia* proposed by Asahina (1935) were reduced to two by Yoshimura (1987). According to Yoshimura (1987) sect. *Nervosae* is well delimited by the presence of a chondroid axis (which is convergent with the central axis in *Usnea*), while sect. *Anzia* lacks this structure. In *A. centrifuga*, the axis is discontinuous, and the species apparently occupies an intermediate position between the two sections. As in most species of sect. *Nervosae*, it has a continuous spongiostratum.

Anzia centrifuga has a most specialized ecology; it is the only known species of the genus growing on dry and sunexposed rock. Together with six *Ramalina* species which have been described from Porto Santo (Krog & Østhagen 1980; Krog 1990), it is apparently a representative of the unique endemic flora element on the volcanic necks of this island.

The genus is not previously reported from Macaronesia. The nearest region where the genus is represented, is in the East African montane rain forest, where the sorediate species *A. afromontana* R. Sant occurs. (Swinscow & Krog 1988).

ACKNOWLEDGEMENTS

I wish to thank Hildur Krog and Einar Timdal for comments on the manuscript and valuable help during the investigation of the species, and the curator of the herbarium in Uppsala for loan of the specimens. I also thank Professor Per Magnus Jørgensen for helpfully rewiewing the manuscript.

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MYCOTAXON

Volume XLIV, no. 1, pp. 51-54 April-June 1992

A UNDESCRIBED SPECIES OF OXYPORUS (POLYPORACEAE) FROM CHINA

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SUMMARY

A new species of the genus Oxyporus collected from Jilin Province (China) is described as Oxyporus sinensis Zeng sp. nov.. This species can easily be separated from O.populinus (Fr.) Donk by its thin tube layers, large pores and slightly large spores. O.nobilissimus Cooke is different from this species by its large basidiocarps and deep surface layer of interwoven fibers. We can also distinguish this species from O.phellodendri Bond.& Vass. by its more regular round pores and more perennial basidiocarps.

While studying the specimens of the Polyporaceae deposited in the Herbarium of Botany at the Biology Department of Northeast Normal University, the author noticed a species that named as Rigidoporus ulmarius (Sow.:Fr.) Imazki. However, it has lightcolored basidiocarps, and carefully examining snowed that it had numerous cystidia with thick wall and capitate incrustation in hymenium. Obviously, the species should belong to the genus Oxyporus. In this paper, it is described as new.

Microscopic characters were determined from freehand sections and squash mounts in 5 percent KOH. Scanning electron microscopy was also used for the determing of cystidia and spores.

Oxyporus sinensis Zeng, sp. nov. Fig. 1,2
Sporophorum perenne, sessile vel resupinato-reflexum, singulare vel imbricatum, suberoso-lignosum, 10 x 10 x 2 cm, in basi usque ad 4 cm crassum. Pileus canus vel

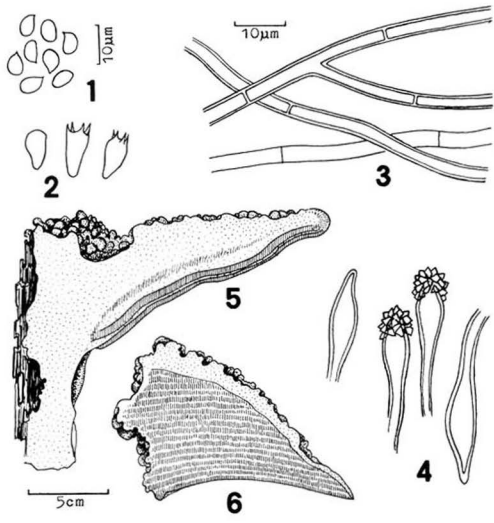

Fig.1 Oxyporus sinensis: 1.spores 2.basidia 3.hyphae 4.cystidia 5.basidiocarp O.populinus: 6.basidiocarp

flavo-albus, prope basin algis obtectis, superficie irregularibus verruculis, margine obtuso,sterili. Pori majores, orbiculares vel suborbiculares, 3-4 per mm, superficie flavo-umbrinis, dissepimentis tenuibus; tubuli stratosi, 2-5 strata, per stratum 0.2-0.5 cm crassum, inter strata contextibus pallidis. Contextus cremeus, suberosus, 1-3 cm crassus.
Systema hypharum monomiticum, hyphae septatae, ramis paucis,hyphae contextorum hyalinae, membranis crassioribus,hyphae tramarum hyalinae, membranis tenuioribus, 2-4 µm diam.. Cystidia numerosa, 15-28 x 4.5-6 µm, cylindrata vel clavata,membranis crassioribus, ad api-

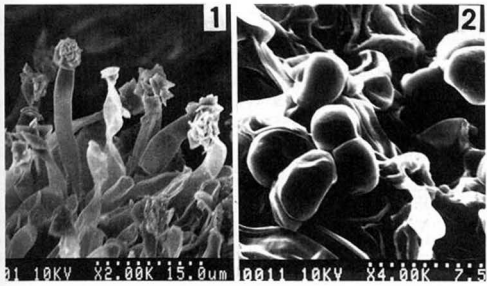

Fig.2 Oxyporus sinensis 1.cystidia 2.spores

ces crystallis, 5-10 μm diam.. Basidia clavata, 7-10 x 4-5 μm. Sporae subglobosae vel ellipsoidae, hyalinae. rasiles. 5-6(7) x 4-5 μm.
Ad bases arborum frondosarum.
Holotypus: Mt.Changbaishan, Aug.10,1980, Li. No.1324, in HBNNU conservantur,Changchun,China, isotype in O.

Sporophores perennial, sessile or effused-reflexed, single or sometimes imbricate and laterally fused, corky to woody, 10 x 10 x 2 cm, up to 4 cm thick at the base. Pileus buff or greyish, offen darkening with age and covered with algae at the base: surface scabrous,offen covered with irregular warts:margin obtuse, sterile.Pore surface buff to brownish,the pores large, circular to subcircular, 3-4 per mm, with thin dissepiments: tubes concolorous or slightly darker than the context, distinctly stratified, 2-5 strata, separated by a thin layer of context tissue, 0.5-1 cm deep. Context cream colored, cooky, azonate, up to 3 cm.
Hyphal system monomitic; contextual hyphae hyaline, simple-septate, slightly thick-walled,rarely branched, 2-4 μm in diam; tramal hyphae similar, mostly thin-walled. Cystidia abundant, thick-walled, cylindric to clavate, rarely bottle shaped, 15-28 x 4-6 μm, capitately incrusted,incrustation dissolving rapidly in KOH, incrusted portion 5-10 μm in diam. Basidia short clavate, 7-10 x 4-5 μm. Basidiospores ellipsoid to

subglobose. hyaline, smooth, 5-6(7) x 4-5 μm.
Type of rot: White rot of living and dead hardwoods.
Specimens examined: Jilin Prov., Dunhua Xian, Sep.12, 1985, Zeng No.0053; Jiaohe Xian, Aug.6,1987, Zeng No. 0968; Mt.Changbaishan, Aug.10,1980, Li No.1324(Holotype)deposited in HBNNU, Changchun, China.
Remarks: The species is well differentiated from the other species in the genus by its perennial, sessile basidiocarp with the tube layers separated by layers of context. The only three species in the genus with these characters are O.populinus, O.nobilissimus and O.phellodendri, but O.populinus has conchate pileus, thick tube layers, small pores, 6-8 per mm, slightly small spores, O.nobilissimus has enormous basidiocarps on conifers and deep surface layer of interwoven fibers and O.phellodendri has more regular round pores and more perennial basidiocarps.

ACKNOWLEDGEMENTS

I extend my sincere thanks to Dr. L.Ryvarden for his further examination of the species and critical review of the manuscrip. Prof.Zhao Yi-Tong of the Biology Department of Northeast Normal University, Changchun is sincerely thanked for his help in my Latin descriptions.

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MYCOTAXON

Volume XLIV, no. 1, pp. 55-58 April-June 1992

JUNGHUHNIA CONCHIFORMIS NOV.SP. (POLYPORACEAE, BASIDIOMYCETES)

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SUMMARY

A species of Polyporaceae collected from Jilin Province is reported as new in this paper. The main character of this species is that it combines a spherical incrustation at the top of cystidium in hymenium with dimitic hyphal system. Obviously, it should belong to the genus Junghuhnia. However, this species is different from the known species of Junghuhnia. The name J.conchiformis sp.nov. is proposed, and Latin descriptions, illustrations as well as the picturs of scanning electron microscopy are also given for the species.

Junghuhnia conchiformis Zeng & Ryv. sp. nov. Fig. 1,2 Sporophorum annuum, sessile vel resupinato-reflexed, conchiforme, saepe imbricatum, suberoso-lignosum, 0.2 x 1 x 2 cm. Pileus dimidiatus, primo canus vel flavo-albus, denso velveto, postea fuscans superficie alga obtecto. Pori regulares vel irregulares, inaeguales, 7-9 per mm, sepimentis tenuibus, superficie flavo-albus. Strata tubulorum flavida, 0.1-0.2 cm crassa, 1 stratum vel 2 strata. Contextus tenui, flavo-albus, 0.1 cm crassus.

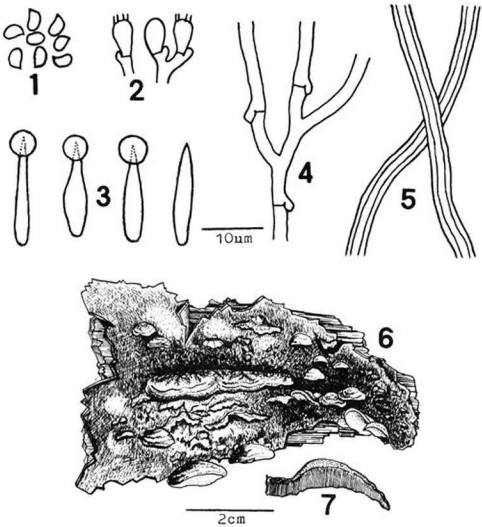

Fig.1 Junghuhnia conchiformis 1. spores 2.basidia 3.cystidia 4.generative hyphae 5.skeletal hyphae 6.basidiocarps 7. longitudinal section of basidiocarp

Systema hypharum dimiticum; hyphae generatoriae hyalinae, membrana tenui, fibulatae, 2-3 µm diam., ramis numerosis: hyphae skeletales hyalinae, numerosae, membrana crassa,non ramis,2-3 µm diam.. Cystidia conoidea vel teretia, membrana tenui, 2-4 x 15-20 µm, 10-15 µm ultra hymenia, crystallo major sphaerico ad extrema cystidiorum;sphaericae crustae 3-6 µm diam.,sublaeves, evanidae in KOH. Basidia minor, clavata, 2-4 x 3-6 µm. Sporae minor,ovoidae vel oblongae, hyalinae, 2.5-3.5 x 2-2.5 µm.

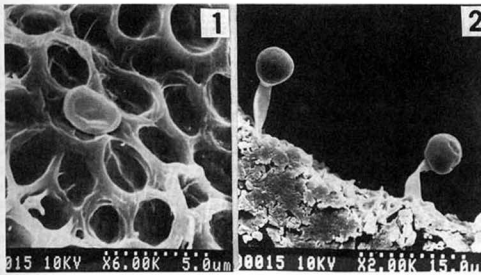

Fig.2 J. conchiformis 1.spores 2.cystidia (scanning electron microscopy photographs)

Ad corticem Abies nephrolepsis.
Holotypus: Jilin Prov.. Mt.Changbaishan, Aug.16, 1988, Zeng No.1654 in HBNNU conservantur, Changchun, China. isotype in O.
Fruitbody annual.sessile or resupinate-reflexed.rarely resupinate. conchate, often laterally fused and imbricate with many narrow pilei. corky to woody, 0.2 x 1 x 2 cm. Pileus dimidiate, at first canous or creamy white. velutinous, later darkened and often covered with algae. Pores regular or irregular,diameter variable, 7-9 per mm.sepiments of pores thin, pore surface cream to straw coloured, margin incurved. tubes cream to canous. 0.1-0.2 cm deep, 1 or 2 layers. Context thin, 0.1 cm deep. concolorous with tubes, corky to woody.
Hyphal system dimitic: generative hyphae thin walled, hyaline, clamps at the septa, frequently branched, 2-3 µm in diameter: skeletal hyphae numerous,hyaline,thick walled, unbranched,2-3 µm in diameter. Cystidia conoid or cylindric,hyaline, thin walled,2-4 x 15-20 µm, projecting the hymenium 10-15 µm,with a spherical incrustation at the top of cystidium, spherical incrustation 3-6 µm diameter, smooth, not dissolved in HCl solution but easily disappeared in KOH if you knock the cover glass slightly. Basidia minor, clavate, 2-4 x 3-6 µm. Spores minor, ovoide or oblong-ellipsoid, hyaline, 2.5 -3.5 x 2-2.5 µm, smooth, thin walled.

On the bark of Abies nephrolepsis.
Dist. Jilin Prov., Mt.Changbaishan, Aug.16, 1988, Zeng No. 1654(Holotype)deposited in HBNNU,Changchun,China.
Remarks: The diagnostic characters of J.conchiformis are the often conchate and imbricate fruitbodies, the conoid or cylindric thin-walled cystidia with a spherical incrustation at the top and the ovoide or oblong -ellipsoid spores. Most Junghuhnia species are resupinate and have thick-walled, heavily incrusted skeletocystidia. They are obviously different from this species. In some respects, J.conchiformis is similar to the some species of Antrodiella.However,the species of Antrodiella has no incrusted cystidia in the hymenium. Oxyporus has cystidia which can vary from strongly encrusted to more smooth ones, but its monomitic hyphal system is different from the species of Junghuhnia.

ACKNOWLEDGEMENTS

The first author (Z) wish to express his sincere thanks to Prof. Zao Yi-Tong of the Biology Department of Northeast Normal University for his help in Latin descriptions.

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MYCOTAXON

Volume XLIV, no. 1, pp. 59-72 April-June 1992

TAXONOMIC REVISION OF THE GENUS CHEILYMENIA - 4. THE SECTION PARACHEILYMENIAE.

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ABSTRACT

Three species of the genus Cheilymenia Boud. emend. J.Mor. belonging to the section Paracheilymeniae J.Moravec (1990) are introduced, based on the examination of type and other relevant material. Besides Cheilymenia pulcherrima (Cr.et Cr.) Boud. and Cheilymenia aurantiacorubra Thind et Kaushal, a new species, Cheilymenia lundqvistii spec. nov. from Macaronesia is described and illustrated. The description of this new taxon is based on the author's examination of a collection, which was published recently under " Cheilymenia sp. 2573" by Korf & Zhuang (1991).
Notes of several other species reported from Macaronesia are also given. Cheilymenia theleboloides (Alb.et Schw.) Boud. var. microspora Dennis in Dennis, Reid et Spooner (1977) is a nomen dubium. Cheilymenia cornubiensis (Berk.et Br.) Le Gal is excluded from the genus and the new combinations, Melastiza cornubiensis (Berk.et Br.) comb. nov. and Cheilymenia campestris (Cr.et Cr.) comb. nov. are proposed. C. campestris is a member of section Villosae J.Mor.

INTRODUCTION

The section Paracheilymeniae J.Mor. was erected for two species of the genus Cheilymenia Boud. emend. J.Moravec (1990), C. pulcherrima (Cr.et Cr.) Boud. and C. aurantiacorubra Thind et Kaushal.
By the kindness of Prof. Dr. Richard P. Korf (Ithaca), I had an oportunity to examine several collections of Cheilymenia previously published by Korf & Zhuang (1991) from Macaronesia. One of these, from CUP-MM herbarium, previously reported under the name "Cheilymenia sp. 2573" proves to be a new species which also belongs to the section Paracheilymeniae. It is described below as a new taxon, Cheilymenia lundqvistii J.Mor. spec. nov.

TAXONOMIC RESULTS AND DESCRIPTIONS

Reexamination of several species reported from Macaronesia revealed that the collection described by Korf & Zhuang (1991) as "Cheilymenia sp. 2771" is C. aurantiacorubra. The same species is also CUP-MM 2773, deposited temporarily within packet for CUP-MM 2559. It is a mixed collection derived from UPS 8212-a from which CUP-MM 2559 and CUP-MM 2773 were taken. Two other collections reported as members of Cheilymenia are here excluded from the genus.

The collection described as "Cheilymenia sp. 2557" (On goat dung in moist chamber, Madiera, Ribeira de Taborada, W. of casa des Queimadas, alt 950 m, 28.I.1969 leg. Leif Tibell - CUP-MM 2557 ex UPS 3629-a, a mixed collection) has been redetermined as Mycoarctium ciliatum Jain et Cain. The description of "Cheilymenia sp. 2557" given by Korf & Zhuang (1991 p.90) shows typical features of the peculiar monotypic genus Mycoarctium, especially very thin filiform paraphyses which are not enlarged above, and hairs possessing rather thick walls. I have found that the apothecia of this collection were mostly immature. This may explain why the collection was considered to be a species of Cheilymenia by the authors. However, I have found several apothecia possessing mature ascospores with a typical reticulate ornamentation and, as well as numerous straight hairs, hairs with hooked tips are also present. Furthermore, the apothecial anatomy of this collection essentially differs from Cheilymenia. All these features well agree with these of Mycoarctium ciliatum as described by Jain & Cain (1973). This taxon was also reported by Korf & Zhuang from Tenerife. Another taxon reported from Macaronesia is Cheilymenia theleboloides (Alb.et Schw.) Boud. var. microspora Dennis in Dennis, Reid et Spooner (1977), also included to the discomycete flora of Macaronesia by Korf & Zhuang (1991). However, the type collection (K) contains apothecia of several discomycetes on the substrate (cow dung). It is evident that the original diagnosis was based partly on apothecia of Cheilymenia granulata (Bull.) J.Mor., and that the thin-walled superficial hairs illustrated by Dennis were admixed from apothecia of Cheilymenia raripila (Phill.) Dennis growing densely clustered with the apothecia of the former. Other discomycetes which I have found on the same collection are Cheilymenia insignis (Cr.et Cr.) Boud., Saccobolus sp., Coprotus sp. and others. Consequently, I have no doubt that C. theleboloides var. microspora is a nomen dubium.

The two taxa of Cheilymenia determined from the Macaronesian collections and mentioned above are members of the section Paracheilymeniae and complete the section, which is typified by C. pulcherrima. The descriptions of the three species follow:

Cheilymenia Boud. emend J.Moravec, Mycotaxon 38:473, 1990. sect. **Paracheilymeniae** J.Moravec, Mycotaxon 38:475, 1990:

Type species:
Cheilymenia pulcherrima (Cr.et Cr.) Boud.

Ascobolus pulcherrimus Crouan et Crouan, Ann, Sci. Nat. (Bot.) IV, 10:196, 1858.
Peziza pulcherrima (Cr.et Cr.) Cooke, Mycogr. 84, 1876.
Humaria pulcherrima (Cr.et Cr.) Spegazzini, Michelia 1:37, 1878.
Lachnea pulcherrima (Cr.et Cr.) Gillet, Champ. Fr. 76, 1880.
Scutellinia pulcherrima (Cr.et Cr.) O.Kuntze, Rev. Gen. Pl. 2:869, 1891.
Lasiobolus pulcherrimus (Cr.et Cr.) Schroeter, Krypt.- Fl. Schles. (ed. Cohn) 3 (2):54, 1893.

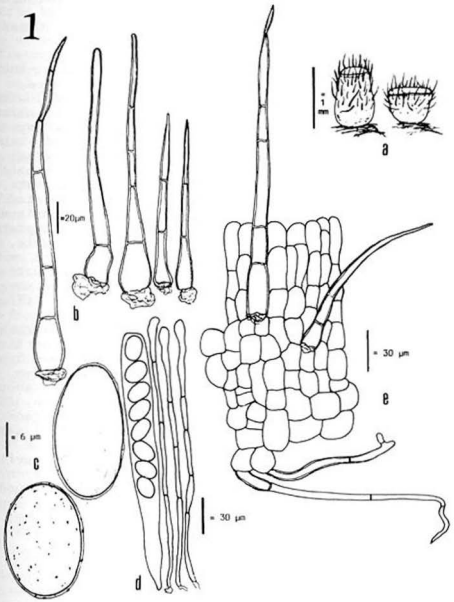

Fig. 1. Cheilymenia pulcherrima: a. Apothecia; b. Hairs; c. Ascospores under oil immersion + CB; d. Ascus and paraphyses, e. Texture of excipulum seen from outside (Isotype PC).

Patella pulcherrima (Cr.et Cr.) Seaver, N. Am. Cup-fungi (Operc.) 172, 1928.
Cheilymenia pulcherrima (Cr.et Cr.) Boudier, Hist. Class. Discom. Europ. 63, 1907.

Apothecia 0.3-0.6(-1) mm diam. and 0.4-1.2 mm high, scattered or clustered together, sessile, turbinate, subcylindric to barrel-shaped with discoid and flattened, bright orange-yellow hymenium; external surface yellowish-orange, densely or sparsely covered with pale brown hairs; the margin slightly raised, smooth, forming an inconspicuous collar. **Hairs** 80-220(-280) x 9-22.5 µm, superficial, usually swollen at the base and arising from cells of the ectal excipulum (the cells under the bases of hairs are usually abortive), straight or slightly curved, 1-3(-7) septate, thin-walled (the walls 0.6-1.5(-1.7) µm thick), pointed or blunt above, yellowish-brown. Hairs of the lower surface of the excipulum hyphoid and intermixed with hyaline septate hyphae. **Ectal excipulum** of textura globulosa angularis, composed of subglobose to ellipsoid cells, (8-)25-38 µm diam. , becoming smaller and vertically arranged towards the margin of apothecia and elongated to clavate at the margin, 15-28 µm wide. **Medullary excipulum** inconspicuously differentiated, composed of smaller, angular cells, which are 8-25 µm diam. and only occasionally elongated to irregular,short, 4-8 µm wide hyphae. **Hypothecium** not clearly differentiated, thin,composed of small, irregularly shaped cells and hyphae. **Asci** 150-180(-210) x 18-21.5 µm, eight-spored, broadly cylindric, with apex obtuse or truncate , the base shortly attenuated, simple. **Ascospores** uniseriate, ellipsoid, (17-)18-25.5(-27) x (10-)12-14.5(-15) µm with yellow refractive contents; perisporium (the outermost delicate layer) easily and soon separated from the ascospores in lactic acid (often even whilst the ascospores are still in the asci), smooth, or with only irregular secondary wrinkling or occasionally covered by very small cyanophilic pustules (under oil immersion + CB and SEM). **Paraphyses** cylindric, 4-5 µm thick, straight, with apex enlarged to 6-9 µm, septate, with yellow granular contents.

Habitat: on dung.

Specimens examined;

1. France: Finistère, Environs de Brest, Croit par peuplades sur les bouses de vache anciennes, s. date, leg. Crouan (CONC-A 2388, type of Ascobolus pulcherrimus - a slide sent from UPS); 2. A 2355 - isotype of the same locality (PC); 3. Finistére, in fimo vaccino, février leg. Crouan (CONC A 2397, probably the paratype - a slide sent from UPS). 4. Germany: NSG Hüttelmoor bei Rostock, auf Pferdemist, 17.VIII, 1984, leg. J. Duty, det. D. Benkert (BHU); 5. Italy: Mendola prés de Bolzano (Bozen), Août 1889, leg. Bresadola (PC ex herb. Bresadola, ut Lachnea pulcherrima); 6 Sweden, Upland, Bondkyrka parish, S. Norby (near Upsala), 26.VIII.1927,leg. J.A.Nannfeldt (409)-1368 Lachnea pulcherrima (Fungi exs. Suecici Lundell et Nannfeldt, UPS,PC).

C. pulcherrima is the type species of the section Parachei-lymeniae. It differs from other species of Cheilymenia in having extremely small, turbinate to barrel-shaped apothecia resembling these of Lasiobolus with a simple anatomy,

by the nearly smooth ascospore perisporium (only rarely covered by fine pustules) and the straight, superficial hairs, which are elongate-bulbous or conical at the base. It has been recently studied by Brummelen (1986). There are several differences in the description given above. I have found that the hairs are also more than 3 septate, and their walls are only up to 1.7 µm thick. Also, I have not found aseptate hairs in apothecia of the type and other material. Brummelen has given the hair walls as up to 2.5 µm thick in this species and also aseptate hairs. These differences might be caused by the fact that there are hairs of a Lasiobolus sp. admixed in the slides taken from the type collection that I have also seen. Furthermore, I have found that the perisporium is easily separable from the ascospores in CB, and usually early in development, just before the ascospores are released from the asci. Another difference is that I have found that the apothecia do not exceed 1 mm diam. only, whilst Brummelen (1986) has given the size as up to 2 mm. I think we must be careful here as there are several other discomycetes on the substrate of the type and other collections too. The colour of apothecia was originally given as yellow-orange. However, in one collection reported above (Benkert), the apothecia are blackish-grey when dried and greyish-yellow when revived. This unusual colour might be caused by a different preservation or drying. Brummelen (1986) suggests placeing C. pulcherrima close to Cheilymenia insignis (Cr.et Cr.) Boud..I have examined the type (a slide sent from UPS ex CONC) of C. insignis, which is the type species of the section Insigniae J.Moravec (1990). C. insignis is distinguished by the subglobose to discoid shape of the apothecia, and especially, by the type of hairs, which have bulbous or even truncate roots at their base, are rigid, thick-walled, and have numerous septa. For these features, the section Insigniae is in fact much closer to the section Cheilymenia, which is represented by three species including the type species Cheilymenia stercorea (Fr.) Boud.in the present sense. A species with a similar type of hairs to those of C. pulcherrima is Cheilymenia raripila (Phill.) Dennis, which is the type species of the section Raripilosae J.Moravec(1990). Species of that section differ, however, from species of section Paracheilymeniae especially in shape of apothecia, and by very large ascospores, which bear a densely,irregularly reticulate perisporium.

Cheilymenia aurantiacorubra Thind et Kaushal, Indian Phytopath. 33:428, 1980.

Apothecia 0.2-0.5 mm diam., scattered or densely clustered together, sessile, subglobose to subturbinate to barrel-shaped with flattened, smooth, orange to orange-red hymenium, external surface orange-red, usually pink at the base, covered with pale brown hairs; margin entire, slightly raised, fringed with hairs. **Hairs** 95-210(-250) x 6-16(-20) µm, superficial,pale brown, 1-3 septate, with walls 0.4-1.5 µm thick, straight, apices acute, subacute to obtuse, swollen at the base, the base usually bulbous or conical, arising from cells of the ectal excipulum, the cells under

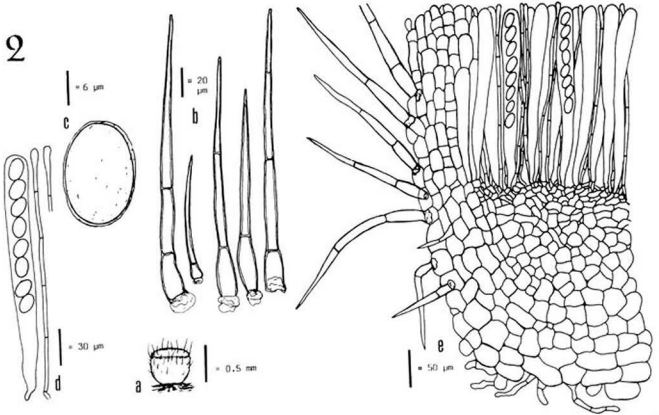

Fig. 2. Cheilymenia aurantiacorubra: **a**. Apothecium; **b**. Hairs; **c**. An ascospore under oil immersion + CB; **d**. Ascus and paraphyses; **e**. Section of the marginal part of an apothecium. (Isotype BRA, J.Mor.).

the base of hairs often abortive; hairs of the lower surface of apothecia hyphoid, septate. Hyaline hyphae also present near the base of apothecia. **Ectal excipulum** of textura globulosa-angularis, composed of subglobose to ellipsoid to angular cells, 15-45 µm diam., becoming smaller and vertically arranged towards the margin of apothecia , the upper marginal cells clavate.
Medullary excipulum inconspicuously or nearly not differentiated from the ectal layer, composed of mostly angular cells, which are 15-25(-35) µm diam., with occasionally elongated cells or short hyphae, which are 5-8 µm thick.
Asci 200-240(-250) x (13-)15-18 µm, cylindric, with apex obtuse or truncate , the base shortly attenuate, eight-spored.
Ascospores uniseriate, broadly ellipsoid, (15-)16.3-19 (-21.3) x (9-)10-12(-13) µm, the mature ascospores with yellow refractive contents when stained with CB, with a loosening, smooth or only occasionally wrinkled perisporium.
Paraphyses filiform, 3-4 µm thick, straight, septate, simple or rarely branched below, with apices enlarged to 4.5-6(-8) µm, containing orange granular contents.
Habitat: On cow dung.
Specimens examined:
1.India: Savanapur, Chandigarh, on a dung heap, Feb.10,1974 leg. S.C.Kaushal.(Isotype BRA,J.Mor. ex PAN 2584 holotype);
2.Finland: Tavastia australis, Tamela, Mustiala, in fimo vaccino 7.X. 1889 leg, P.A.Karsten (H 2977 and H 2978)- two packets containing basically the type collection of Ascophanus flavus Karst. = Cheilymenia karstenii J.Moravec (1990)- besides numerous apothecia of C. karstenii, apothecia of C. aurantiacorubra are associated with apothecia of other coprophilous discomycetes e.g. Lasiobolus sp., Ascophanus brunnescens P.A.Karst. and Ascobolus sp. on the same substrate of the Karsten's collection;
3. Macaronesia: Canary Islands, Tenerife, 11 km NE of La Laguna in the Anaga Mts., Paso, alt. c. 900 m., on cow dung, associated with Lasiobolus sp., C. lundqvistii and other discomycetes, 23.I. 1973 leg. N. Lundqvist (UPS 8212-c, temporarily in CUP-MM 2771- a mixed collection within the packet for CUP-MM 2573 from which CUP-MM 2573, 2771 and 2772 were taken). Also another collection from the same locality, CUP-MM 2773 ex UPS 8212-a deposited temporarily within the packet for CUP-MM 2559 until it is sent back to UPS, contains apothecia of C. aurantiacorubra mixed with apothecia of other discomycetes. (The former Macaronesian collection (CUP-MM 2771) was published under "Cheilymenia sp.2771" by Korf & Zhuang (1991)).

C. aurantiacorubra is undoubtedly very close to C. pulcherrima and could even be considered as a variety. It differs especially in ascospore size. The ascospores of C. aurantiacorubra do not exceed 22 x 13 µm, whilst these of C. pulcherrima may reach up to 27 x 15 µm. The other characters are very similar except the shape of apothecia which seem to be more turbinate in C. pulcherrima. Moreover, the colour of the apothecia of C. aurantiacorubra was described as orange-red (Thind & Kaushal 1980). For the time being, I keep these two taxa as independent species. After examination of the

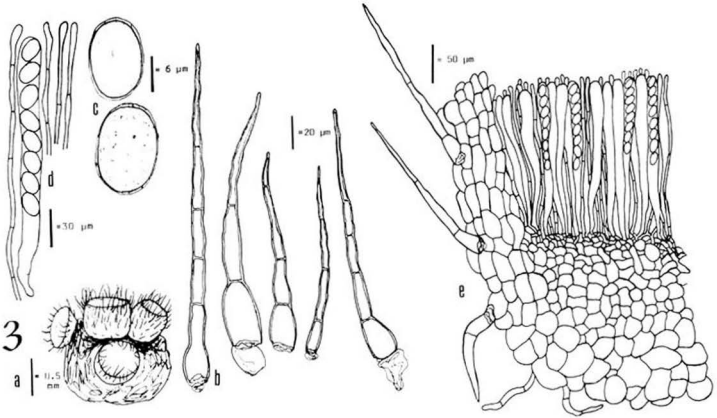

Fig.3. Cheilymenia lundqvistii: **a.** Apothecia, **b.** Hairs; **c.** Ascospores; **d.** Ascus and paraphyses; **e.** Section of the marginal part of an apothecium (Holotype UPS 8212-c, temporarily in CUP-MM).

type and other collections, I have found only slight differences from the original diagnosis. In particular, the anatomy of apothecia is much more simple in the description given by Thind et Kaushall (1980).

Cheilymenia lundqvistii J.Moravec spec. nov.
(= "Cheilymenia sp. 2573" in Korf & Zhuang, Mycotaxon 40:90, 1991.

Apothecia gregaria, minuta, 0.3-0.6 mm diam., subglobosa dein breviter crasse doliiformia, crasse cupularia,tota pallide griseo-luteola, extus pilis brevibus brunneolis obsita; thecio applanato usque subpulvinato. Pili superficiales, 60-245 x 7-22 µm, recti, basi simplices, bulbosi, e cellulis ecrescentibus, sursum subacuti vel acuti, septati, tenuiter tunicati, membranis 0.3-1.3 µm crassis, irregulariter undulatis. Excipulum externum textura globuloso-angulari, excipulum inferiore e textura angulari hyphis brevibus parvis mixtum. Asci 150-200 x 11-15 µm cylindracei, apice obtusi, octospori. Paraphyses filiformes, 3-4.5 µm crassae, apice dilatatae (5-7 µm), subluteolae. Ascosporae monostichae, ellipsoideae, (11-)12-15 x 7.5-9 µm, eguttulatae, perisporio laevi, sublaevi, sed etiam minute verruculoso.
Habitat: ad excrementa vaccina.
Holotype: Macaronesia, Tenerife, prope La Laguna, Anaga Mts. Paso, alt. ca 900 m, 23.I.1973 leg. N. Lundqvist. Typus UPS 8212-c et in CUP-MM 2573.

Apothecia 0.3-0.6 mm diam., gregarious, first subglobose, becoming broadly and rather low barrel-shaped to thickly cupuliform with flattened to nearly pulvinate hymenium, pale grey-yellowish, external surface covered with brownish hairs. **Hairs** 60-245 x 7-22 µm, straight but with conspicuously irregularly wavy walls, which are 0.3-1.3 µm thick, 1-4 septate, pale brown, with apices acute or subacute, superficial, arising from the cells of the ectal excipulum, the base of the hairs usually abortive. Hyphoid hairs and septate hyphae are also present on the lower surface of the excipulum. **Excipulum** only inconspicuously differentiated. The ectal layer of textura globulosa-angularis, composed of subglobose to ellipsoid, mostly angular cells, which are 16-40 µm diam., elongated and clavate, vertically arranged towards the margin of the apothecia. Medullary layer of textura angularis composed of golden yellow, angular cells which are 8-12 µm diam., occasionally intermixed with elongated cells or short hyphae, gradding to a thin hypothecium, which is composed of swollen, irregular, small cells and hyphae. **Asci** 150-200 x 11-15 µm, cylindric, with apex obtuse, and with a simple, shortly attenuated base.
Ascospores uniseriate, ellipsoid, (11-)12-13.6(-15) x 7.5-9 µm, eguttulate, with yellow refractive contents when the mature ascospores are stained with CB; perisporium loosening, smooth, secondary wrinkled, but rarely also covered by very small cyanophilic pustules (under oil immersion + CB).
Paraphyses filiform, 3-4.5 µm thick, septate, straight,with apex enlarged to 4.5-6.5(-7) µm, with yellowish contents.
Habitat: On cow dung.
Holotype: Macaronesia, Canary Islands, Tenerife, 11 km NE of La Laguna in the Anaga Mts., Paso, Alt. c. 900 m., shrubby steep slope facing the east, 23.I.1973 leg. Nils Lundqvist. The holotype in UPS 8212-c, temporarily in CUP-MM 2573.

The apothecia of C. lundqvistii are associated with apothecia of C. aurantiacorubra and other discomycetes, therefore CUP-MM 2573,2771 and 2772 were taken from this mixed collection. **Isotype**: a slide with mounted sections of apothecia taken from the holotype (temporarily in CUP-MM 2573 and J.Mor. until it is sent back to UPS).

All features of this new species agree well with those of the two species of the section Paracheilymeniae especially the type and shape of hairs, excipulum and ascospores. C. lundqvistii is distinguished from C. pulcherrima and C. aurantiacorubra sufficiently by its much smaller ascospores. Moreover, the shape and pale colour of its extremely small apothecia, and also the conspicuously irregularly wavy walls of hairs distinguish this taxon.

AN ADDITIONAL NOTE: C. CORNUBIENSIS EXCLUDED FROM CHEILYMENIA

In addition to the above introduction of the section Paracheilymeniae and notes on taxonomy, I wish to add one important result of the taxonomic revision of the genus Cheilymenia. The following new combinations are proposed here:

Melastiza cornubiensis (Berk.et Br.) J.Moravec comb. nov.
Basionym: Peziza cornubiensis Berkeley et Broome, Ann. Mag. Nat. Hist. ser. 2, 13:463, (n.767), 1854.
Syn.: Cheilymenia cornubiensis (Berk.et Br.) Le Gal, Rev. Mycol.18 (2):82, 1953.
Examination of the type material (K,NY) revealed that this taxon is a typical member of the genus Melastiza Boud. It differs only slightly from Melastiza chateri (W.G.Smith) Boud. in having slightly paler, brownish apothecial hairs and orange hymenium. Nevertheless, the hairs are septate, brownish, obtuse above, and the ascospores are of the same size and reticulate ornamentation as these of M. chateri.

It is difficult to understand why Peziza cornubiensis Berk. et Br. was transferred to Neottiella by Cooke (1876), and to Cheilymenia by Le Gal (1953). Massee (1895) in a redescription of Neottiella cornubiensis (Berk.et Br.) Cooke has given the colour of hymenium as "orange" and external surface "pale yellow dotted towards the margin with short blunt, thin walled septate hairs, slightly coloured" and the ascospores " becoming sparsely ornamented with minute warts at maturity". Such hairs and their distribution represent one of the typical features of Melastiza, and it is evident that it was known to authors. The fact that ascospores were considered warted was the result of the use of insufficient optics and staining methods. I have found no essential differences between M. cornubiensis and M. chateri. If M. cornubiensis should be identical with M. chateri or merely a form of it, the epithet "cornubiensis" has priority as it represents the oldest name for this taxon. The reason for the type examination was that this taxon was transferred to Cheilymenia by Le Gal (1953) and that such a concept has been generally adopted. Le Gal (1953) identified P. cornubiensis with Peziza campestris Crouan et Crouan, Fl.

du Finist.,p.53, 1867, on the basis of her examination of the type of the latter, and, consequently, she transferred P. cornubiensis to Cheilymenia. However, it was an evident error as the type of P. campestris, according to Le Gal's detailed description and illustration, is quite a different fungus. It represents a species of Cheilymenia belonging to the section Villosae J.Mor. ser. Obtusipilosae J.Moravec (1990). It has the same type and shape of apothecia and fibrillose, frequently septate or articulate hairs which are blunt above, as are those of Cheilymenia magnifica (W-y.Zhuang et Korf) J.Moravec (1990). Furthermore,the ascospores, bearing a separable perisporium covered by irregular fine warts are very similar. However, the ascospore size is quite different. Whilst the ascospores of C. magnifica measure 12.2-16.8 x 7.5-9(-10) µm, these of P. campestris are much larger, 17-23.5 x 11-13 µm. It is not identical with any other species of Cheilymenia and I propose a new combination here:

Cheilymenia campestris (Crouan et Crouan) J.Moravec comb. nov. Basionym: Peziza campestris Crouan et Crouan, Fl. Finist. p. 53, 1867.

Peziza fibrillosa Currey was also transferred to Cheilymenia by Le Gal (1953a). Dennis (1978) compared Cheilymenia cornubiensis to Cheilymenia fibrillosa (Currey) Le Gal. I have examined the type (K) of P. fibrillosa and other collections of this taxon. It is distinct from M. cornubiensis.

P. fibrillosa has smooth ascospores, and is a member of the genus Tricharina Boud. as recently recombined to this genus by Yang et Korf (1985). Consequently, both Tricharina fibrillosa (Currey) Yang et Korf and also Melastiza cornubiensis (Berk.et Br.) J.Mor. are here excluded from the genus Cheilymenia.

ACKNOWLEDGEMENTS

I gratefully acknowledge the cooperation of the curators of herbaria for the loan of the type and other material mentioned in the present paper. I am very grateful to Prof. Dr. Richard P. Korf (Ithaca) for kindly sending me the collections from Macaronesia and kind permission to evaluation the species of Cheilymenia described in Korf & Zhuang (1991). I am very much obliged to Prof.Dr. Nils Lundqvist (Stockholm) for helpful advice and collaboration in location of type material and especially for the loan of slides taken from type material of CONC herbarium.
I thank Dr. Brian M. Spooner (Kew) for his arrangement of loan of the type material and for kindly reviewing the paper. My thanks belong also to Dr. M. Svrček (Prague) for kindly correcting of the Latin diagnosis. Finally, I express my special thanks to Mr. J. Lhotecký (Brno) for the preparation of the SEM photomicrographs, and to Dr. V. Antonín for kindly reading the manuscript.

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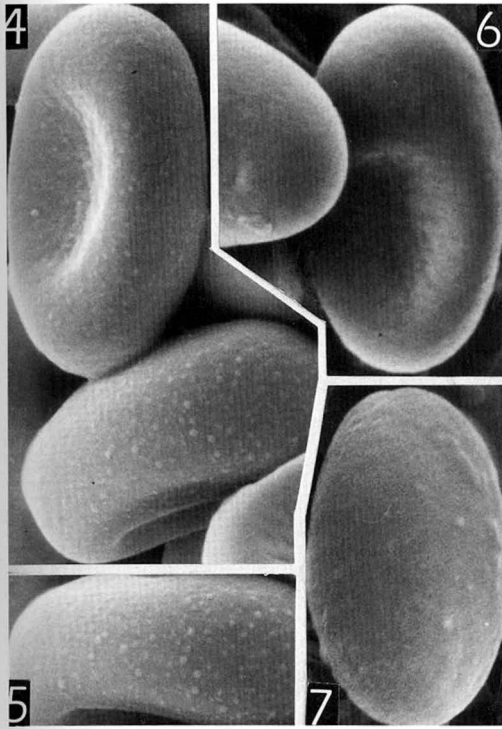
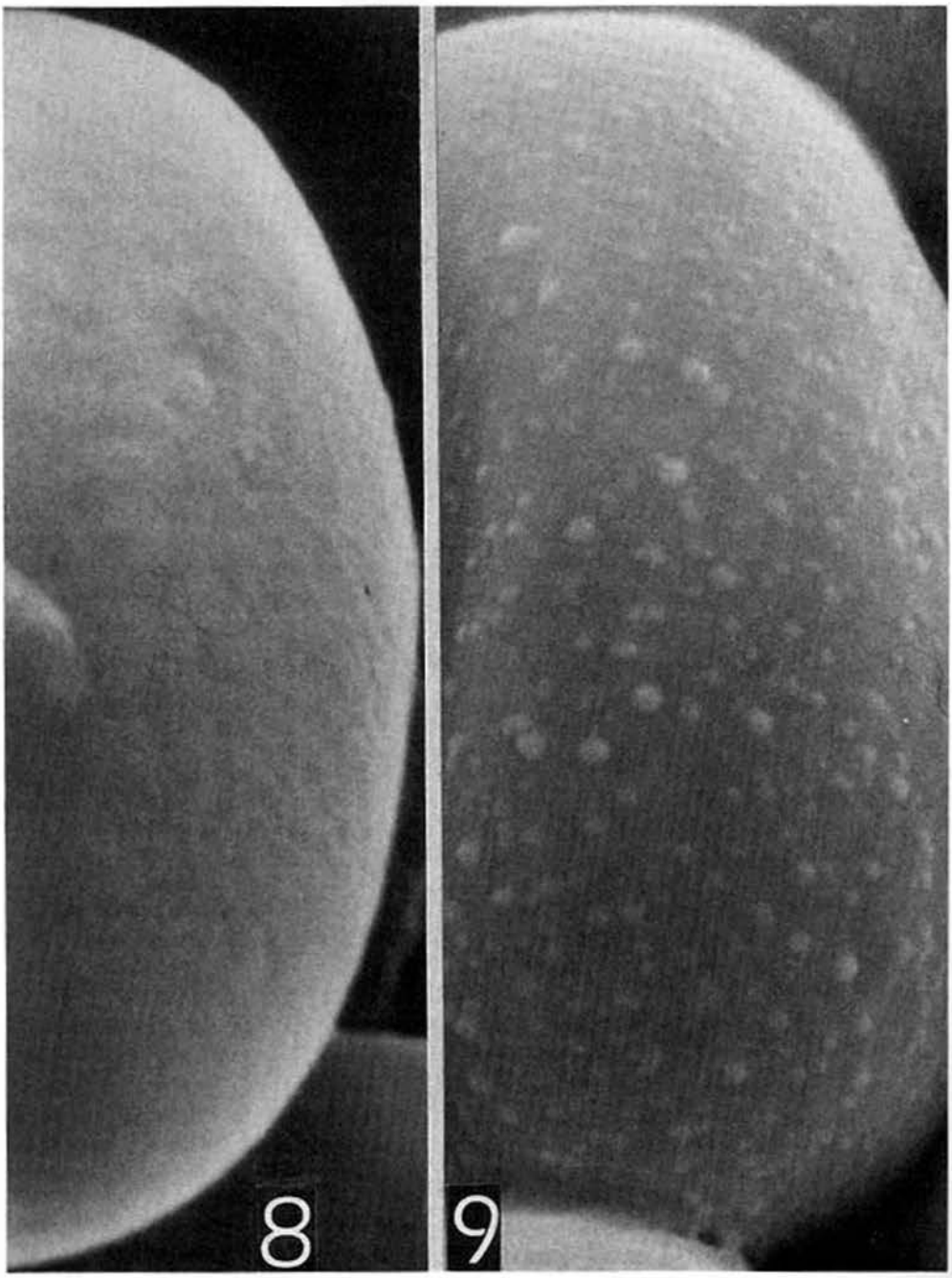


Figs.4-7. SEM photomicrographs of ascospores: 1-6. Cheilymenia pulcherrima (from Nannfeldt 409, PC);
7. Cheilymenia aurantiacorubra (Isotype BRA).



Figs. 8-9. SEM photomicrographs of ascospores (parts) of Cheilymenia pulcherrima (from Nannfeldt 409 PC).

MYCOTAXON

Volume XLIV, no.1, pp. 73-87 April-June 1992

FUNGI OF NABOGAME, CHIHUAHUA, MEXICO

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ABSTRACT: A list is presented of 118 macrofungi collected from the vicinity of Nabogame, Chihuahua, Mexico. Of these, 27 are reported from Mexico for the first time: *Agaricus solidipes, Boletus affinis, B. bicolor, B. smithii, Cantharellus minor, Collybia cylindrospora, C. subnuda, Crepidotus malachius* var. *malachius, Disciceda pedicellata, Fomitopsis palustris, Gloeophyllum protractum, Heliocybe sulcata, Lactarius lignyotus, L. peckii, L. resimus, Lepiota brunnea, Marasmius splachnoides, Meruliopsis ambiguus, Oligoporus balsameus, Panaeolus papilionaceus, Ramaria candida, R. rasilispora, Russula rubescens, Seismosarca hydrophora, Steccherinum laeticolor, Suillus pinorigidus,* and *Tricholoma alboburneum.* Sixty others are recorded as new to the state of Chihuahua.

RESUMEN: Se presenta una lista de 118 macromicetos procedentes de Nabogame, Chihuahua, México. De éstos, 27 se citan por primera vez la micobiota mexicana: *Agaricus solidipes, Boletus affinis, B. bicolor, B. smithii, Cantharellus minor, Collybia cylindrospora, C. subnuda, Crepidotus malachius* var. *malachius, Disciceda pedicellata, Fomitopsis palustris, Gloeophyllum protractum, Heliocybe sulcata, Lactarius lignyotus, L. peckii, L. resimus, Lepiota brunnea, Marasmius splachnoides, Meruliopsis ambiguus, Oligoporus balsameus, Panaeolus papilionaceus, Ramaria candida, R. rasilispora, Russula rubescens, Seismosarca hydrophora, Steccherinum laeticolor, Suillus pinorigidus,* y *Tricholoma alboburneum.*. Sesenta otros son nuevos registros del Estado de Chihuahua.

Floristic work on the fungi of the state of Chihuahua, Mexico, has been scanty. Pérez-Silva & Aguirre-Acosta (1986) list only 182 species collected from 13 sites in the state. Much of this work has been in the lowland desert portions of the state, although some work has been done in the montane regions of the Sierra Madre Occidental, which forms the border with Sonora. The mycoflora of the Sierra Madre shows strong affinities with that of the montane regions of the western United States (Guzmán 1973).

The site of our study was the village of Nabogame, Municipio Temósachi, Chihuahua. The town is located at 28°30′ N, 108°30′ W, at an elevation of 1800 m, 10 km east of the Sonoran state line (figure 1). The inhabitants are members of the Mountain Pima group of Native Americans (Laferrière & Van Asdall 1991). The town should not be confused with the larger Tepehuan community of the same name in southern Chihuahua.

The predominant natural vegetation of Nabogame is pine-oak forest, although human utilization has modified the natural cover (Laferrière 1991a). The agricultural portions of the community are surrounded by fields left fallow for various lengths of time. On steeper and rockier slopes the forest has been left largely intact although intense cattle grazing has reduced herbaceous vegetation. In moister areas along streambanks are located stands of sabino (Arizona cypress, *Cupressus arizonica* E. Greene), ahasiqui (a wild cherry, *Prunus gentryi* Standl.), and haya (bigtooth maple, *Acer grandidentatum* Nutt.). Madroño (madroño, *Arbutus xalapensis* H.B.K. and *A. arizonica* (A. Gray) Sarg.), fresno (ash, *Fraxinus papillosa* Lingelsheim and *F. pennsylvanica* Marsh. ssp. *velutina* (Torr.) Miller.), táscate (alligator juniper, *Juniperus deppeana* Steud. var. *robusta* Mart.), and manzanilla (manzanita, *Arctostaphylos pungens* H.B.K.) are also present (Laferrière et al. 1991a,b). A list of 612 species of vascular plants collected in the area is given by Laferrière (1991a, 1992b).

Rainfall in the area is bimodal, with spring and fall dry seasons separating the thunder shower season of July and August from the snow and light rain characteristic of the winter months. Beginning in August 1987, the region experienced a severe drought (Laferrière 1992a) which reduced the number of fleshy fungi fruiting.

Between October, 1986, and November 1988, the first author collected over 200 fungal specimens from the vicinity of Nabogame. Logistical constraints necessitated sun-drying of specimens for shipment to Tucson. The poor condition of some of the specimens prevented positive identification. Specimens of *Agaricus, Agrocybe, Amanita, Calvatia, Clitocybe, Collybia, Coprinus, Cortinarius, Hygrophorus, Inocybe, Lactarius, Lycoperdon, Russula, Sparassis,* and *Stropharia* were collected which could not be identified to species. Other specimens could not be identified to genus.

The specimens we were able to identify are listed below. For each species the substrate, month of collection, and the first author's collection numbers are given. Collection numbers lower than 1275 represent collections from 1987, while higher numbers were from 1988. Vouchers are on deposit at ARIZ. Duplicates of some of the species were sent to BPI, MEXU, and XAL.

Of the 118 species on the list, 28 are here reported from Mexico for the first time. Sixty others are reported for the first time from Chihuahua, although they have been recorded from other parts of Mexico (Acosta & Guzmán 1984; Anell & Guzmán 1987, 1988; Bandala-Muñoz et al. 1983, 1988; Bautista et al. 1986; Chacón & Guzmán 1983; Dubovoy et al. 1966; Estrada-Torres & Aroche 1987; García-Romero et al. 1970; Guzmán & Herrera 1971, 1973; Herrera & Guzmán 1966, 1972; Mendiola & Guzmán 1973; Pérez-Silva & Aguirre-Acosta 1985; Salcedo & Herrera 1966; Villarreal & Guzmán 1986). Two other collections have already been described as new species, i.e. *Polyporus tenuiparies* and *Albatrellus mexicanus* (Laferrière & Gilbertson 1990 a,b). Taken together, the Nabogame study represents a 48% increase in the number of macrofungi known from the state. An Ⓜ indicates a species reported from Mexico for the first time, while a Ⓒ represents a new report from Chihuahua.

ASCOMYCETES

HELVELLACEAE

HELVELLA LACUNOSA Afz.:Fr. Terrestrial under Arizona cypress. August. #1891. Ⓒ

HYPOMYCETACEAE

HYPOMYCES LACTIFLUORUM (Schw.:Fr.) Tul. On terrestrial *Lactarius* sp. in dry oak woodland. August. #770. Ⓒ

MORCHELLACEAE

MORCHELLA CRASSIPES Pers.:Fr. Terrestrial near creekbank under Arizona cypress. May. #475. Ⓒ

PEZIZACEAE

ALEURIA AURANTIA (Pers.:Fr.) Fuckel. Spores 7.5 x 14 µm, ornamented. Terrestrial under oak and madroño. August. #1851. Ⓒ

This is the southern, small spored variety mentioned by Arora (1986).

XYLARIACEAE

XYLARIA POLYMORPHA (Pers.:Fr.) Grev. On oak. May and August. #447, 1720. Ⓒ

BASIDIOMYCETES

AGARICACEAE

AGARICUS ARVENSIS Schaeff.:Fr. Terrestrial near creekbank under Arizona cypress and *Ilex tolucana* Hemsl. August. # 961. C

AGARICUS SILVATICUS Schaeff. Terrestrial under oak and Arizona cypress. August. #737, 745, 746, 773. C

AGARICUS SILVICOLA (Vitt.) Sacc. Terrestrial on bank of dry creekbed under oak and ash. July and August. # 616, 1719, 1735. C

AGARICUS SOLIDIPES Pk. Terrestrial in cowpasture. May and June. #438, 1453. M

ALBATRELLACEAE

ALBATRELLUS MEXICANUS Lafer. & Gilbn. Terrestrial under Arizona cypress. August. #1889. Type collection (Laferrière & Gilbertson 1990a).

AMANITACEAE

AMANITA *aff.* CAESAREA (Scop. per Fr.) Grev. Cap 10-18 cm across, plano-convex to plane, slightly umbonate, glabrous, dry to subviscid when moist, white, sometimes with very faint tannish tint, especially toward center; margin striate. Gills crowded, pale yellow. Annulus superior, membranous, pendulant, pale yellow. Stipe white, 12-18 cm tall, hollow, tapering toward apex. Volva 3-5 cm deep, membranous, white. Spores ellipsoid to subglobose, [4.5-] 6.0-8.5 [10.5] µm long, [3.5-] 4.0-5.5 µm wide, thin-walled, hyaline, nonamyloid; print white. Terrestrial in fields and open oak-pine woodlands. August. #927. C

Called "hongo de comer", i.e. "eating fungus", by the Mountain Pima people, this mushroom is one of the few species of fungi the inhabitants of Nabogame consume (Laferrière 1991b). Cited as *A. tuza* Guzmán in Laferrière (1991a,b). This may be a new species but additional collections would be necessary to determine its relationships.

AMANITA CHLORINOSMA (Austin) Lloyd. Terrestrial in fields and oak woodlands. July and August. #1007, 1571, 1841. C

AMANITA CITRINA Schaeff. Terrestrial in oak woodland. July and August. #702, 1585. C

AMANITA FLAVORUBESCENS Atk. Terrestrial under oak and Arizona cypress. August. #821. C

AMANITA FROSTIANA Pk. Terrestrial in pine-oak forest. August. #896. C

AMANITA PANTHERINA (DC.:Fr.) Secr. Terrestrial under *Quercus hypoleuca* and *Arbutus xalapensis*. August. #820. C

AMANITA PELIOMA Bas. Terrestrial in pine-oak forest. August. #895. C

AMANITA VAGINATA (Bull:Fr.) Vitt. Terrestrial under *Quercus chihuahuensis* and *Q. durifolia.* August. #985, 1830.

AMANITA VIROSA (Fr.) Bertillon in DeChambre. Terrestrial in pine-oak forest. August. #767.

ASTRAEACEAE

ASTRAEUS HYGROMETRICUS (Pers.) Morg. Terrestrial under Arizona cypress. July. #1566.

AURICULARIACEAE

AURICULARIA AURICULA (L.:Fr.) Underwood. On oak. July and August. # 945, 1590, 1729, 1730. C

BOLBITIACEAE

AGROCYBE PRAECOX (Pers.:Fr.) Fay *vel aff.* Terrestrial in mixed oak-pine-cypress forest. August. #1858.

The specimen matches the description given by Arora (1986) except that the species typically occurs in the spring.

BOLETACEAE

BOLETUS AFFINIS Pk. Terrestrial in oak forest under *Quercus viminea.* August. #819. M

BOLETUS BARROWSII A.H. Smith. Terrestrial in pine-oak forest. August. #1755. C

BOLETUS BICOLOR Pk. Terrestrial in pine-oak forest. July. #544. M

BOLETUS EDULIS Bull.:Fr. Terrestrial in oak woodlands. August. #691, 751, 818, 894, 1806.

BOLETUS FROSTII Russell *apud* Frost. Terrestrial in pine-oak forest. August. #764.

BOLETUS SMITHII Thiers. Terrestrial in oak forest. August. #792. M

CHALCIPORUS PIPERATUS (Bull.:Fr.) Bat. Terrestrial under *Quercus chihuahuensis.* August. # 928. C

Reported from Mexico as *Boletus piperatus* Bull.:Fr. (Estrada-Torres & Aroche 1987) or *Suillus piperatus* (Bull.:Fr.) Kuntze (Herrera & Guzmán 1972).

LECCINUM SCABRUM (Bull.:Fr.) S.F. Gray *vel. aff.* Terrestrial in pine-oak forest. August. #763. C

The specimen does not match Miller's (1978) description of *L. scabrum* in that the cap is slightly viscid rather than glabrous.

STROBILOMYCES FLOCCOPUS (Vahl.:Fr.) Karst. Terrestrial in open oak woodland. July. #1557.

SUILLUS PINORIGIDUS Snell & Dick. Terrestrial in oak forest. July. #615. M

TYLOPILUS PLUMBEOVIOLACEUS (Snell & Dick) Singer. Terrestrial under Arizona cypress. August. #1803. C

XEROCOMUS CHRYSENTERON (Bull.) Quél. Terrestrial in pine-oak forest. August. #766, 1117.

CANTHARELLACEAE

CANTHARELLUS MINOR Pk. Terrestrial in pine-oak forest. August. #1728, 1849. M

CLAVARIACEAE

CLAVICORONA PYXIDATA (Fr.) Doty. Terrestrial in oak and pine-oak forests. August. #889, 987, 988, 1867, 1892. C

RAMARIA ARAIOSPORA Marr & Stuntz. var. RUBELLA Marr. & Stuntz. Terrestrial in oak forest. August. #846. C

RAMARIA CANDIDA Corner. Terrestrial under Arizona cypress. August. #1893. M

The species is previously reported from Japan and Georgia (Corner 1970). We agree with Corner (1970) that this may be an albino form of some other species, possibly *R. rasilispora.*

RAMARIA RASILISPORA Marr & Stuntz. Terrestrial under oak and/or pine. August. #989, 1787. M

COPRINACEAE

ANELLARIA SEMIOVATA (Sow.:Fr.) Pears. & Dennis. On cow dung. August. #960, 1764. C

Reported from Zacatecas as *Panaeolus semiovatus* (Sow.:Fr.) Lundell & Nannf. (Acosta & Guzmán 1984).

COPRINUS COMATUS (Müll.:Fr.) S.F. Gray. Terrestrial in pine-oak forest. August. #847.

COPRINUS MICACEUS (Bull.:Fr.) Fr. On oak bark. August. #771. C

PANAEOLUS FIMICOLA (Fr.) Gill. On cow dung. July. #582. C

PANAEOLUS PAPILIONACEUS (Bull.:Fr.) Quél. On cow dung. August. #649. M

CORTICIACEAE

MERULIUS INCARNATUS Schw. On oak. August. #842, 1721.

MERULIPOSIS AMBIGUUS (Berk.) Ginns. On living Arizona cypress. August. #1888. M

PHLEBIA INCARNATA (Schw.) Nakasone & Burdsall. On oak. August. #842, 1721. C

Reported from Zacatecas as *Merulius incarnatus* Schw. (Acosta & Guzmán 1984).

CORTINARIACEAE

CREPIDOTUS MALACHIUS (Berk. & Curt.) Sacc. var. MALACHIUS. On oak. August. #1840. M

First report of this variety from Mexico, although var. *trichiferus* Hesler & A.H. Smith has been reported from Veracruz (Hesler & Smith 1965).

ROZITES CAPERATUS (Pers.:Fr.) Karst. Terrestrial in pine-oak forest. August. #891. C

The spores are 8-12 x 5-7 μm, which is slightly smaller than those reported by Moser (1983), i.e. 11-14 x 7-9 μm.

DACRYMYCETACEAE

DACRYMYCES CHRYSOSPERMUS Berk. & Curt. On pine and Arizona cypress. August. #747, 887. C

Reported from Mexico as *D. palmatus* (Schw.) Bres. (García-Romero et al. 1970; Mendiola & Guzmán 1973).

DACRYOPINAX SPATHULARIA (Schw.:Fr.) Martin. On oak or pine. August and September. #906, 1766. C

DEMATIACEAE

BIPOLARIS RAVENELII (Curt.) Shoemaker. Common on *Sporobolus indicus* (L.) R. Br., especially along frequently used pathways. September. #1127.

GANODERMATACEAE

GANODERMA LUCIDUM (W. Curt.:Fr.) Karst. On oak. August. #694, 925, 932, 1774, 2274. C

GEASTRACEAE

GEASTRUM SACCATUM Fr. *vel aff.* Terrestrial under oak and madroño, August. # 1734. C

GEASTRUM TRIPLEX Junghuhn. Terrestrial under maple and Arizona cypress. August. #1706, 1707. C

HYDNACEAE

DENTINUM REPANDUM (L.:Fr.) S.F. Gray. Terrestrial under oak. August. #1724.

Reported from Chihuahua as *Hydnum repandum* L.:Fr. (Pérez-Silva & Aguirre-Acosta 1986).

LEPIOTACEAE

CHLOROPHYLLUM MOLYBDITES (Meyer:Fr.) Mass. Terrestrial on sandy riverbank. August. #1708. C

LEPIOTA BRUNNEA Farlow & Burt. Terrestrial in pine-oak forest. August. #886. M

MACROLEPIOTA PROCERA (Scop.:Fr.) Sing. Terrestrial under *Quercus chihuahuensis.* July and August. #799, 1484, 1502.

LYCOPERDACEAE

CALVATIA CYATHIFORMIS (Bosc.) Morgan. Terrestrial in grassy fields. July. #581, 1485.

DISCISEDA PEDICELLATA (Morg.) Hollos. Terrestrial in grassy fields. August. #739. M

LYCOPERDON MARGINATUM Vitt. Terrestrial in oak and pine-oak forests. August. #714, 1634. C

Reported from Mexico as *L. candidum* Pers. (Guzmán & Herrera 1973).

LYCOPERDON OBLONGISPORUM (Pers.) Schwn. Terrestrial in grassy fields. July. #2318. C

LYCOPERDON PUSILLUM (Batsch:Pers.) Schum. Terrestrial in grassy fields. July. #624. C

Reported from Mexico as *Bovista pusilla* (Batsch.:Pers.) Pers. (Guzmán & Herrera 1973).

LYCOPERDON PYRIFORME Schaeff.:Pers. On oak. August. #899, 1008, 1850. C

MYCENASTRUM CORIUM Desv. Terrestrial on sunlit creekbank. May. #441. C

NIDULARIACEAE

CRUCIBULUM LAEVE (Huds. trans Relhan.) Kambly. On oak. August. #692, 760.

Reported from Chihuahua as *C. vulgare* Tul. (Pérez-Silva & Aguirre-Acosta 1986).

CYATHUS STERCOREUS (Schw.) de Toni in Sacc. On dung. August. #628.

POLYPORACEAE

ABORTIPORUS BIENNIS (Bull.:Fr.) Sing. Terrestrial in oak woodland. August. #701, 931. C

FOMITOPSIS PALUSTRIS (Berk. & Curt.) Gilbn. & Ryv. On *Pinus arizonica*. August. #1633. M

GLOEOPHYLLUM PROTRACTUM (Fr.) Imazeki. On pine. October. #2222. M

GLOEOPHYLLUM SEPIARIUM (Wulf.:Fr.) Karst. On pine and Arizona cypress. August and October. #1763, 2221.

Reported from Chihuahua as *Lenzites sepiaria* (Wulf.:Fr.) Fr. (Pérez-Silva & Aguirre-Acosta 1986).

LENZITES BETULINA (L.:Fr.) Fr. On oak. August. #962, 1722. C

OLIGOPORUS BALSAMEUS (Pk.) Gilbn. & Ryv. On living Arizona cypress. August. #1887. M

PHAEOLUS SCHWEINITZII (Fr.:Fr.) Pat. On dead oak wood, or terrestrial in oak forest, probably from buried wood. August. #888, 1632. C

Reported from Mexico as *Romellia sistotremoides* (Alb. & Schw.) Murr. (Guzmán & Herrera 1971).

PHELLINUS GILVUS (Schw.:Fr.) Pat. On oak. August and October. #713, 719, 2142.

Reported from Chihuahua as *Polyporus gilvus* (Schw.) Fr. (Pérez-Silva & Aguirre-Acosta 1986).

POLYPORUS ARCULARIUS (Batsch:Fr.) Fr. On oak. May, July and August. #492, 598, 1759.

POLYPORUS TENUIPARIES Lafer. & Gilbn. On *Quercus chihuahuensis*. July. #602. Type collection (Laferrière & Gilbertson 1990b).

PYCNOPORUS CINNABARINUS (Jacq.:Fr.) Karst. On oak. May, August, and October. #433, 829, 2058. C

SPONGIPELLUS PACHYODON (Pers.) Kotl. & Pouz. On oak. August. #1753. C

SPONGIPELLUS UNICOLOR (Schw.) Murr. On living *Quercus chihuahuensis*. August. #1868, 1901. C

Reported from Nuevo León as *Polyporus obtusus* Berk. (Guzmán & Herrera 1971).

TRAMETES CERVINA (Schw.) Bres. On oak. August, November. #1813, 2256.

TRAMETES VERSICOLOR (L.:Fr.) Pilát. On oak. August. #1723, 2149. C

Reported from Mexico as *Polyporus versicolor* L.:Fr. (Pérez-Silva & Aguirre-Acosta 1985) or *Coriolus versicolor* (L.:Fr.) Quél. (Guzmán & Herrera 1971).

TRICHAPTUM ABIETINUM (Dicks.:Fr.) Ryv. On *Pinus arizonica*. August. #1816. C

Reported from Mexico as *Coriolus abietinus* (Dicks.:Fr.) Quél. (Guzmán & Herrera 1971).

RUSSULACEAE

LACTARIUS HYGROPHOROIDES Berk. & Curt. var. HYGROPHOROIDES. Terrestrial under oak. August. #1805. C

LACTARIUS INDIGO (Schw.) Fr. Terrestrial under oak, Arizona cypress, and ahuasiqui. August. #823, 1733.

LACTARIUS LIGNYOTUS Fr. Terrestrial under Arizona cypress. August. #1874. M

LACTARIUS PECKII (Burlingham) Sacc. Terrestrial in oak woodland. August. #930. M

LACTARIUS RESIMUS (Fr.) Fr. Terrestrial in pine-oak forest. August. #1821. M

LACTARIUS VOLEMUS (Fr.) Fr. Terrestrial in pine-oak forest. August. #1820. C

LACTARIUS ZONARIUS (Bull.) Fr. Terrestrial in oak woodland. August. #774.

RUSSULA RUBESCENS Beardslee. Terrestrial under oak and madroño. August. #707. M

SCLERODERMATACEAE

SCLERODERMA VERRUCOSUM Pers. Terrestrial under *Quercus chihuahuensis.* August. #1004.

STECCHERINACEAE

STECCHERINUM LAETICOLOR (Berk. & Curt.) Banker. On dead branch of live *Quercus chihuahuensis.* August. #1002. M

STEREACEAE

STEREUM HIRSUTUM (Willd.:Fr.) S.F. Gray. On oak. August. #603, 1725, 1756, 1818, 1822. C

STEREUM OCHRACEO-FLAVUM (Schw.) Ell. On oak. August. #1736. C

TREMELLACEAE

EXIDIA GLANDULOSA Fr.:Fr. On oak. August. #1760. C

SEISMOSARCA HYDROPHORA Cke. On oak. August. #717.
First report from Mexico.

TREMELLA MESENTERICA Retz.:Fr. On oak. August. #1738, 1807, 1827. C
Reported from Mexico as *T. lutescens* Pers.:Fr. (García-Romero et al. 1970; Mendiola & Guzmán 1973; Pérez-Silva & Aguirre-Acosta 1985).

TRICHOLOMATACEAE

ARMILLARIA MELLEA (Vahl:Fr.) Kummer. Cap yellow-brown to tan, dry, caespitose; margin cream-colored. Gills white, becoming tan with age. Stipe cream-colored. Annulus hairy. Basidia simple-septate at the base.

Print white. On oak and *Pinus engelmannii*. August, September, and October. #1005, 1136, 2223.

Reported from Chihuahua as *Armillariella mellea* (Vahl:Fr.) Karst. (Pérez-Silva & Aguirre-Acosta 1986).

CLITOCYBE CANDIDA Bres. Terrestrial in pine-oak forest. August. #2336. C

CLITOCYBE GIBBA (Pers.:Fr.) Kummer. Terrestrial under oak. August. #1718.

COLLYBIA CYLINDROSPORA Kauffman. On oak. #1483. M

COLLYBIA MACULATA (Alb. & Schw.:Fr.) Quél. Terrestrial in pine-oak forest. August. #708, 817. C

COLLYBIA SUBNUDA (Ellis ex Pk.) Gilliam. On leaves of pine and *Quercus viminea*. August. #697. M

HELIOCYBE SULCATA (Berk.) Redhead & Ginns. On pine shingles of a house. July. #1495. M

Called "hongo de la casa" i.e. "house fungus" by the Mountain Pima.

HOHENBUEHELIA ANGUSTATA (Berk.) Sing. On *Q. chihuahuensis*. August. #843. C

HOHENBUEHELIA PETALOIDES (Bull.:Fr.) Schulz. On oak. August. #1773. C

LENTINELLUS URSINUS (Fr.:Fr.) Kuehner. On oak. August. #696. C

LENTINUS LEVIS (Berk. & Curt.) Murr. On oak and madroño. July, August, and September. #695, 1134, 1527. C

Reported from Mexico as *Pleurotus levis* (Berk. & Curt.) Singer (Bandala-Muñoz et al. 1988; Pérez-Silva & Aguirre-Acosta 1985).

LENTINUS STRIGOSUS (Schwein.) Fr. On oak. July. #1558. C

Reported from Mexico as *Panus rudis* Fr. (Herrera & Guzmán 1972).

MARASMIUS SPLACHNOIDES Fr. Terrestrial in grassy field. July. #627. M

OMPHALOTUS OLEARIUS (DC.:Fr.) Sing. On buried wood in oak woodland, and terrestrial near large *Opuntia robusta* specimen in cowpasture. August. #893, 922, 1601. C

SCHIZOPHYLLUM COMMUNE Fr.:Fr. On oak. August. #1761.

TRICHOLOMA ALBOBRUNNEUM (Pers.:Fr.) Kummer. Terrestrial in grassy field. August. #824. M

XEROMPHALINA CAMPANELLA (Batsch.:Fr.) Kummer. On dead Arizona cypress. August. #1859.

USTILAGINACEAE

USTILAGO ZEAE (Beckm.) Unger. On *Zea mays* L. #1022.
Often reported as *U. maydis* (DC.) Corda (Durán 1987). Called "hongo de maiz", i.e. "maize fungus", in Nabogame.

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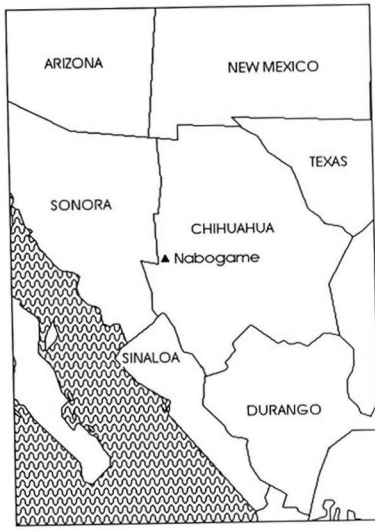
Figure 1: Map showing Mountain Pima village of Nabogame



MYCOTAXON

Volume XLIV, no. 1, pp. 89-102 April-June 1992

SYSTEMATIC AND BIOLOGICAL STUDIES IN THE BALANSIEAE AND RELATED ANAMORPHS. II. CULTURAL CHARACTERISTICS OF ATKINSONELLA HYPOXYLON AND BALANSIA EPICHLOE

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ABSTRACT

The cultural characteristics, including colony appearance and growth rates, and the morphology of the *Acremonium* and *Ephelis* synanamorphs, of *Atkinsonella hypoxylon* (Peck) Diehl, and the *Ephelis* anamorph of *Balansia epichloe* (Weese) Diehl, *in vitro* are described and illustrated. Comparison is made between these and some of the endophytic microconidial anamorphs of grasses classified in *Acremonium* Link, section *Albo-lanosa* Morgan-Jones & W. Gams.

INTRODUCTION

As indicated in the prologue to this series of papers (Morgan-Jones *et al.*, 1992), very few studies have been conducted on members of the Balansieae [Clavicipitoideae, Clavicipitaceae, Clavicipitales] *in vitro* and little information exists on variation among populations. Likewise, the cultural characteristics on agar media of species classified in the tribe having differing ecological relationships with their hosts are either not known or have only partly been investigated in a few. The majority of fungi classified in the Balansieae, particularly species of *Balansia* Speg., occur on members of the grass subfamily Panicoideae [see Diehl (1950); Clay (1988)]. In contrast to these, anamorphic fungi classified in *Acremonium* Link, section *Albo-lanosa* Morgan-Jones & W. Gams, that occur as symptomless endophytes of wild and pasture

Alabama Agricultural Experiment Station Journal Series No. 18-913167

grasses belonging mostly to the subfamily Pooideae (syn. Festucoideae), have been extensively described in culture [see Morgan-Jones and Gams (1982); Clay (1986); Siegel *et al.* (1987); White and Morgan-Jones (1987c)]. These anamorphs, most of which are not known to produce conidia *in vivo*, are thought to be phylogenetically related to the Balansieae, and to *Epichloe typhina* (Tul.) Fr. in particular (Schardl and Siegel, 1991), which also occurs on the Pooideae. One, *Acremonium typhinum* Morgan-Jones & W. Gams, is the anamorph of that ascomycete.

Acremonium grass endophytes generally grow slowly on agar media (White and Morgan-Jones, 1987c) but usually do not sporulate well, although conidia are produced *in vitro* under most growing conditions. An exception is an unnamed endophyte of *Festuca versuta* Beal described by White and Cole (1986) that is not known to produce conidia *in vivo* or *in vitro*. In these anamorphs, conidia are borne on solitary, determinate, aculeate conidiogenous cells that arise from hyphae as lateral branches and are, in some species, delimited from them by a transverse basal septum, in others not (Morgan-Jones and Gams, 1982; Latch *et al.*, 1984). Their colonies are mostly white, at least when young, and lanose, hence the section designation *Albo-lanosa*. In this respect, they resemble members of *Verticillum* Nees section *Prostrata* W. Gams, which is typified by the microconidial anamorph of *Cordyceps militaris* (L.) Link, the type species of *Cordyceps* (Fr.) Link [Cordycipitoideae, Clavicipitaceae, Clavicipitales]. Species classified in that section of *Verticillium* have similar appearing, although faster growing, colonies in culture but differ from *Acremonium* grass endophytes in having verticillate conidiophores. *Acremonium chilense* Morgan-Jones, White & Piontelli, a recently described endophyte of *Dactylis glomerata* L. in Chile (Morgan-Jones *et al.*, 1990), has colonies that are similar to those of section *Prostrata* and is considered to be intermediate in its characteristics between that group and species classified in section *Albo-lanosa*. Considerable variation in cultural characteristics and growth rates is known to occur among *Acremonium* endophytes (White and Morgan-Jones, 1987c; Clay and Leuchtmann, 1989). The latter authors found a number of isolates, from a range of woodland grasses, to be to various degrees different from previously described taxa and some could not be identified with reasonable certainty. Christensen and Latch (1991) found cultural, morphological and physiological variation among thirty isolates of *Acremonium*, mostly *A. coenophialum* Morgan-Jones & Gams, from seeds of *Festuca arundinacea* originating in Algeria, Europe, North America, Australia and New Zealand. On account of smaller mean conidial length and, interestingly, failure to deter host-plant feeding by the aphid *Rhopalosiphium padi*, five of these isolates were thought to be possibly non-choke forming isolates of *Epichloe typhina*. Variation has also been documented to occur within isolates of *Acremonium* endophytes [*A. lolii* Latch, Christensen & Samuels] from perennial rye-grass [*Lolium perehne* L.] (Christensen *et al.*, 1991).

In order to compare *in vitro* characteristics of members of the Balansieae, other than *Epichloe typhina*, with *Acremonium* section *Albo-lanosa* anamorphs, *Atkinsonella hypoxylon* (Peck) Diehl and *Balansia epichloe* (Weese) Diehl have been brought into pure culture. Apart from belonging to different genera, these two fungi differ appreciably in their association with their respective hosts. *Atkinsonella hypoxylon* grows epiphytically around

meristems, young leaves and inflorescences of its hosts, species of *Danthonia* L., including *D. compressa* Austin, *D. sericea* Nutt., and *D. spicata* (L.) Beauv., (Leuchtmann and Clay, 1988; 1989b). This epiphytic, localized habit is considered to be a primitive condition (White and Morgan-Jones, 1992) but infection by this fungus often results in destruction of the host inflorescence as stromata are formed. Concurrent with reduced fecundity, however, plants infected by *A. hypoxylon* show enhanced vegetative growth, perhaps due to diversion of energy from inflorescence maturation (Clay, 1984). *Balansia epichloe* is considered to have advanced beyond the condition in *A. hypoxylon* in that it has become partly endophytic. Its mycelium was reported by Rykard *et al.*, (1985) to be systemic and intercellular in buds, stems, and leaves of *Chasmanthium laxum* (L.) Yates and *Sporobolus indicus* (L.) Br. [as *S. poiretii* (Roem. & Schult.) Hitchc.]. In this respect, it is comparable to other grass endophytes such as, for example, *Balansia aristidae* (Atk.) Diehl, *Epichloe typhina*, and *Acremonium* spp. *Balansia aristidae* spreads systemically into successive tillers of *Aristida purpurascens* Poir. (Morgan-Jones, unpublished data). *Balansia epichloe* appears to do little damage to infected leaves and does not always adversely affect the reproductive capacity of its host, although it causes some energy loss that, in heavily infected plants, might result in no inflorescence being formed. Clay (1990) found flowering in ramets of *Sporobolus indicus* (smut grass) to be greatly suppressed when infected by *B. epichloe*. It was suggested that such inflorescence suppression might free energy resources for increased vegetative growth but in both infected and uninfected ramets this was not found to be appreciably different, neither was survivability. Both growth reduction and enhancement have been reported to occur in infected hosts (Clay, 1990; Diehl, 1950). Reduction in number of fertile tillers being formed in infected as compared to uninfected plants was thought by Porter *et al.* (1985) to be due either to nutrient drain or the effects of growth regulating compounds produced by *B. epichloe*. Following endophytic growth within leaf tissues, hyphae of *B. epichloe* emerge through stomata, or in between epidermal cells (Rykard *et al.*, 1985), to form a superficial primary stroma from which the *Ephelis* macroconidial anamorph is first formed, followed by the ascostroma. During the process of stroma maturation, hyphae of *B. epichloe* have been shown to penetrate between the epidermal cells and cuticle in the host grasses *Chasmanthium laxum* and *Sporobolus indicus* (Rykard *et al.*, 1985). It is thought that cuticle constituents might be an additional energy source for this process (White *et al.*, 1991) since progressive disintegration of this structure occurs during stroma development. In contrast to *A. hypoxylon*, *B. epichloe* has a comparatively wide host range, occurring on grasses belonging to the subfamilies Chloridoideae, Panicoideae and Pooideae.

MATERIALS AND METHODS

Isolates of *Atkinsonella hypoxylon* and *Balansia epichloe* were obtained from stromata collected from grass populations in Piscataway, New Jersey, and Montgomery, Alabama, respectively, during the summer of 1990. Three isolates of *A. hypoxylon* [1, 2 and 3] originated from stromata on three different vigorous, and otherwise healthy-appearing, plants from a population of *Danthonia spicata* which bore stromata on 20-40% of flowering culms. A fourth isolate [4] originated from a stroma borne on a relatively stunted plant from a

cluster of such plants, all culms of which bore stromata. An isolate of *B. epichloe* was obtained from a stroma on a leaf of *Sporobolus indicus* [= *Sporobolus poiretii*].

Isolations were made as follows. Stromata were removed from host plants and surface disinfected by vigorous agitation in 50% Clorox solution for three minutes, after which they were washed in sterile, distilled water. They were then cut into pieces approximately 2 mm in diameter, using flame sterilized razor blades and plated on to potato dextrose agar [Difco]. Following incubation for three weeks at 25 C, plates were examined and subcultures prepared. Isolates were grown on a number of different agar media.

Media for cultural studies included PDA, glucose agar and fructose agar. The latter were prepared using Marashige and Skoogs Salt Base, 1.5% agar, and filter sterilized glucose and [D] fructose [1% or 3% wt./vol.]. In addition, 3% glucose agar media, supplemented with yeast extract [4% wt./vol.], biotin [100 mg/l], or thiamin [100 mg/l], were prepared.

For cultural studies and determination of growth rates, plugs of agar, approximately 2 mm in diameter, bearing mycelium, were cut from the margins of actively growing colonies growing on 1% glucose agar and placed at the center of petri dishes containing the growth media to be tested. Five replicates were prepared for each isolate/medium combination. Plates were sealed with parafilm and incubated at 25 C in darkness for 30 days, following which colonies were examined and colony diameters measured. Measurements were taken of each replicate of each isolate on all culture media. Mean colony diameter and standard error of growth rates were calculated.

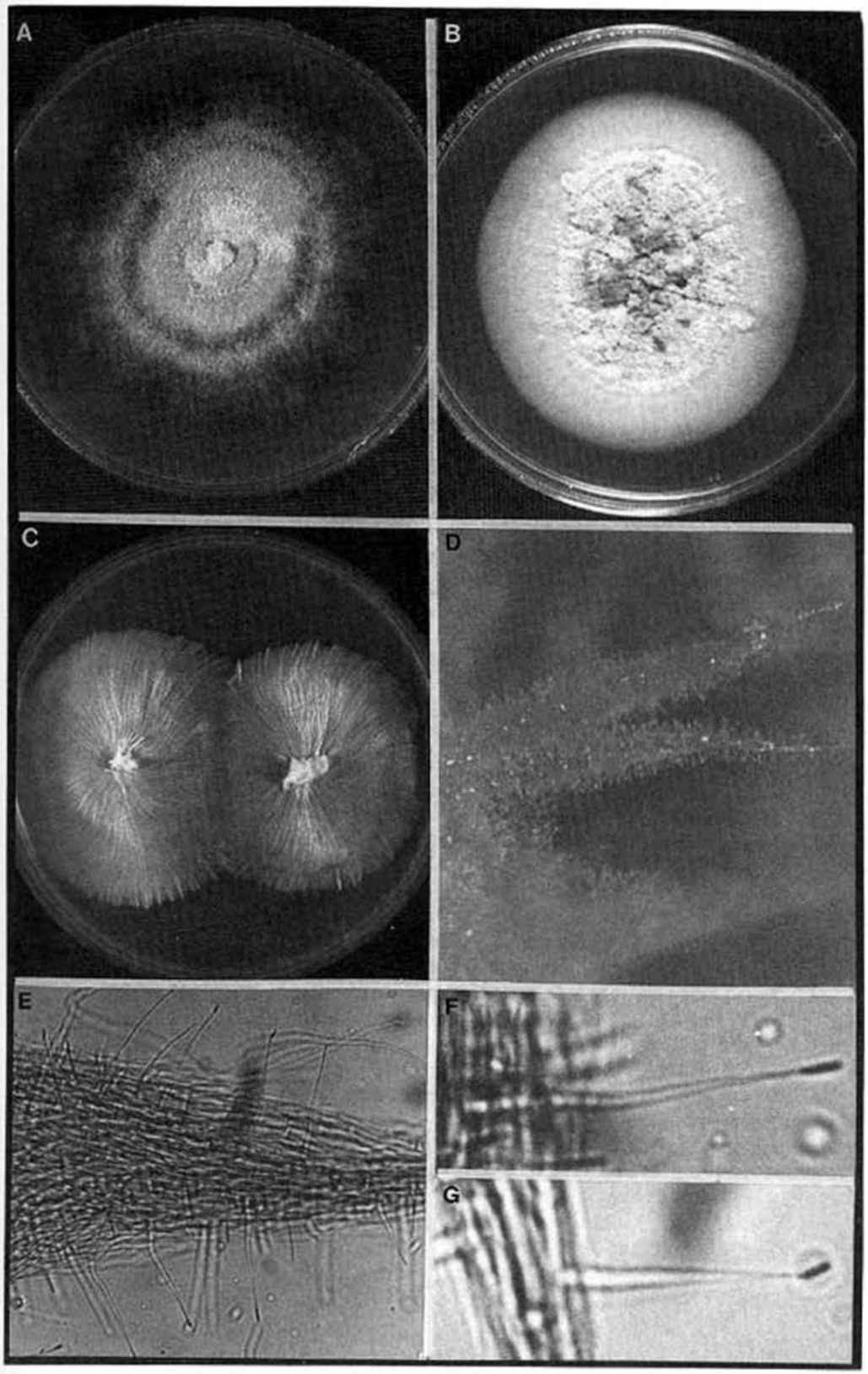
COLONY AND MORPHOLOGICAL CHARACTERISTICS

Atkinsonella hypoxylon

Isolates 1-3.

Colonies (Plate 1, A) attaining an average diameter of 71.5 $\pm$ 1.5 mm on PDA after 30 days at 25 C, loosely cottony to somewhat dense, lanose towards the center, at first white to cream, becoming ochraceous or slightly olivaceous with age, sometimes zonate, progressively sparse toward the periphery, margin thin, uneven, arachnoid; reverse whitish to olive. Colonies on 3% glucose agar slower growing, attaining an average diameter of 44.67 $\pm$ 2.84 mm after 30 days at 25 C, white to ochraceous, mycelium appressed to agar surface, appearing moist, with prominent, curved to undulate, radiating hyphal strands extending to

PLATE 1. *Atkinsonella hypoxylon.* A, Isolate 1, 30-day-old colony on PDA; B, Isolate 4, 30-day-old colony on PDA; C, Isolate 1, 35-day-old colony on 3% fructose agar; D, Isolate 4, *Acremonium* anamorph groups of compacted hyphae in the form of synnemata produced on 30-day-old colony on PDA; E, close up of synnema showing laterally borne conidiogenous cells; F & G, conidiogenous cells and conidia.


A
B
C
D
E
F
G

the extreme edge, margin waxy, fimbriate, scalloped; reverse white to cream colored, often with a whitish diffusible exudate visible. Colonies on 3% fructose agar (Plate 1, C) attaining an average diameter of 37.4 ± 6.75 mm after 30 days at 25 C, similar in appearance to those on glucose agar, but not becoming as yellowish and with more evident whitish exudate.

Colonies on PDA producing, after 2 weeks, *Ephelis* macroconidia only. Mycelium composed of smooth, septate, hyaline, 1.5-2.5 µm wide hyphae. Conidiogenous cells (Plate 2, B; Figure 1, E) holoblastic, sympodial, borne solitarily, terminally or on short lateral branches of aerial mycelium, more or less cylindrical, delimited by a transverse septum, often slightly swollen immediately or a short distance above the septum, attenuating gradually distally, 11-12 µm in length, occasionally up to 3 µm in diameter where widest. Delimiting septa thin, obscure. Conidia borne apically in succession, usually in groups of three to five, each conidium originating from a meristematic locus proximal to, but to one side and just below, that of the preceding conidium, acicular, straight or very slightly curved, aseptate, hyaline, 13-30 x 1-1.5 µm in size.

Isolate 4.

Colonies (Plate 1, B) attaining an average diameter of 75.4 ± 3.5 mm on PDA after 30 days at 25 C, white to cream to pale salmony, sometimes with a purple tinge toward the center, more or less evenly colored or, more often, irregularly patchy, densely lanose or, in part, somewhat velutinous and becoming felted with age, often with central portion somewhat tufted and occasionally faintly sulcate, and a wide, uniform, marginal zone, margin even; reverse colorless or very slightly purplish centrally. Colonies attaining an average diameter of 12 mm on 3% glucose agar after 30 days at 25 C, whitish to pale beige or reddish brown with age, appressed to the agar medium and moist in appearance, mycelium mostly immersed, margin even; reverse colorless or beige to reddish brown. Colonies attaining an average diameter of 13 mm on 3% fructose agar after 30 days at 25 C, similar to those on glucose agar.

Colonies on PDA producing, after 2 weeks, *Acremonium*-like microconidia only. Mycelium similar to that of isolates 1-3 but with some hyphae convoluted. Conidiogenous cells (Plate 1, E-G; Figure 1, B) probably phialidic, solitary, arising laterally from aerial hyphae as slender, determinate branches, oriented at more or less right angles to the parent hyphae, usually, but not always, delimited by a basal transverse septum located proximal to the juncture with the hypha, cylindrical but attenuating gradually over two-thirds of its length, straight or sometimes bent, 35-40 µm long, 2-2.5 wide towards the base, bearing a cluster of conidia at the extreme apex. On fructose and glucose agar conidiogenous cells borne on loose aerial hyphae. On PDA synnemata-like hyphae ropes or strands are formed (Plate 1, D & E; Figure 1, A) from which conidiogenous cells are abundantly produced. Strands made up of parallel, somewhat interweaving hyphae, dense and wide at the base but attenuating towards their tip. Conidia at first narrowly oblong, becoming predominantly ellipsoidal to somewhat ovoid, aseptate, hyaline, smooth, sometimes guttulate, 3-6 x 1-2.5 µm, borne and accumulating in small heads or clusters at the apex of the conidiogenous cells. Older conidia thicker-walled, swollen, broadly

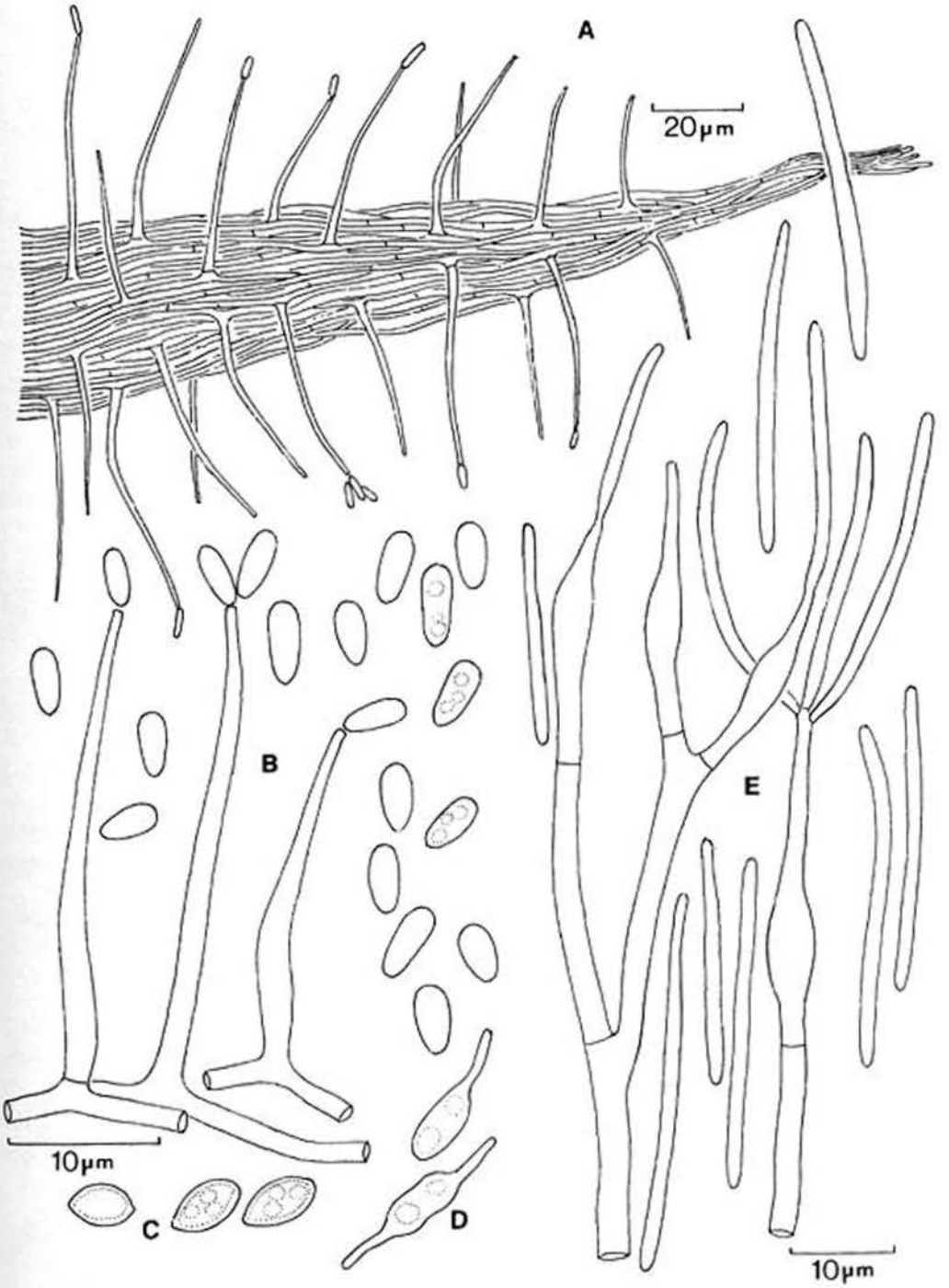


FIGURE 1. *Atkinsonella hypoxylon. Acremonium* microconidial and *Ephelis* macroconidial synanamorphs. A, synnema, made up of a compacted group of more or less parallel or interweaving hyphae; B, *Acremonium*-like conidiogenous cells and microconidia; C, mature, inflated microconidia; D, germinating microconidia; E, *Ephelis* conidiogenous cells and macroconidia.

ellipsoid, and sometimes very slightly papillate at each end. Conidial germination mono or bipolar (Figure 1, D).

Balansia epichloe

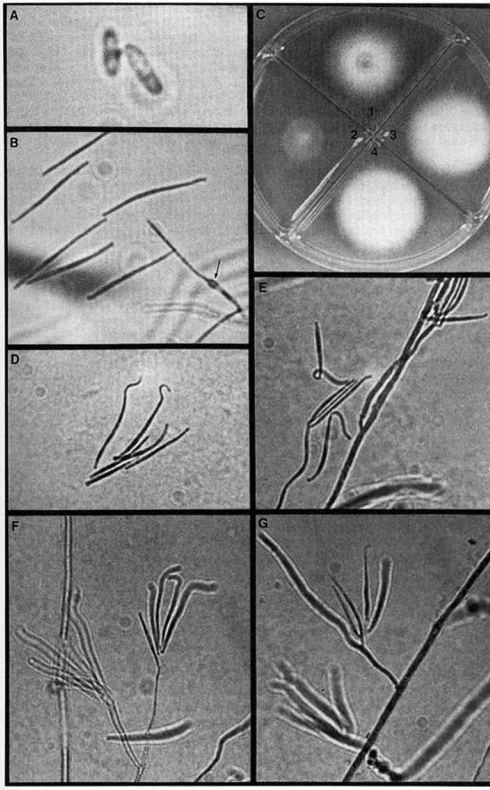
Colonies on PDA attaining an average diameter of 31.5 ± 3.8 mm after 30 days at 25 C, white, dense, lanose, with margin more or less even, but usually thin and rather ill-defined; reverse colorless. Colonies on 3% glucose agar, amended with yeast extract (Plate 2, C [3]), attaining an average diameter of 28.7 ± 3 mm after 30 days at 25 C; somewhat slower growing without amendment, attaining a diameter of 22 ± 0.82 mm under the same conditions. Colony appearance on the various media generally similar to that on PDA but aerial mycelia varying from sparse to dense. Colonies on 3% fructose agar, 6.6 ± 0.6 mm after 30 days at 25 C.

Mycelium composed of smooth, septate, hyaline, 1-2 µm wide hyphae. *Ephelis* macroconidial anamorph produced in culture. Conidiogenous cells holoblastic, sympodial, arising terminally and laterally from micronematous conidiophores that arise as lateral hyphal branches, solitary, in pairs, or, more rarely, in a verticil of three (Plate 2, E-G; Figure 2), cylindrical, attenuating slightly distally, varying in length, where lateral up to 22 µm, where terminal up to 100 µm. Conidia borne in succession apically, usually 3 to 5, occasionally up to 8, on each conidiogenous cell, filiform, more or less straight or slightly curved over much of their length, often bent or hooked towards their pointed distal end (Plate 2, D), narrowly subtruncate at the base, aseptate, hyaline, 17-27 µm long, 1 µm wide at the broadest part, 0.5 µm at the extreme tip.

DISCUSSION

In general appearance and coloration, colonies of *A. hypoxylon* and *B. epichloe* are broadly similar to those of the *Acremonium* anamorphs classified in section *Albo-lanosa*. The dense, deep, white, lanose colonies of *B. epichloe* are also reminiscent of those of *Acremonium chilense* and some species classified in *Verticillium* section *Prostrata*, which, as indicated above, is typified by the *Verticillium* anamorph of *Cordyceps militaris*, another member of the Clavicipitaceae. As has been discussed elsewhere (Morgan-Jones *et al.*, 1990), both of the anamorph form-genera *Acremonium* and *Verticillium*, as presently constituted, are artificial and heterogenous. Species classified in section *Prostrata* of the latter are, phylogenetically, probably closer to taxa classified in *Acremonium* section *Albo-lanosa* than they are to those placed in *Verticillium* section *Verticillium* typified by *V. tenerum* (Nees) Link, the anamorph of *Nectria inventa* Pethybr. While the growth rates of *A. hypoxylon*

PLATE 2. A, *Atkinsonella hypoxylon* microconidia (isolate 4); B, *Ephelis* macroconidial anamorph of *A. hypoxylon* (isolate 1) [arrow indicating conidiogenous cell]; C, *Balansia epichloe* colonies after 30 days [1, on thiamine & salt base; 2, on biotin & salt base; 3, yeast extract & salt base; 4, salt base alone]; D-G, *Ephelis* macroconidial anamorph of *B. epichloe*, conidiogenous cells and conidia.


A
B
C
1
2
3
4
D
E
F
G

in vitro is appreciably faster than is typical of the *Acremonium* anamorphs [see White and Morgan-Jones, 1987c] that of *B. epichloe* is more typical of the group. In this regard, however, there is much variation, even within individual species. Isolates identified as *Acremonium starrii* White & Morgan-Jones, for example, originating from different host grasses, differ appreciably in growth rates (White and Morgan-Jones, 1987c). *Acremonium chilense* grows much faster than other species of section *Albo-lanosa* on a range of different sugar media (Morgan-Jones *et al.*, 1990). It is, perhaps, noteworthy that *A hypoxylon*, an epiphyte, has a higher growth rate *in vitro* than do endophytes such as *B. epichloe* and *Acremonium* spp.

In view of the documented variation, alluded to above, found among *Acremonium* endophytic anamorphs, including *A. coenophialum* and *A. starrii* White & Morgan-Jones (White and Morgan-Jones, 1987c; Christensen and Latch, 1991), the appreciable differences found in cultural expressions between isolates 1-3 from healthy looking plants of *Danthonia spicata* and isolate 4 from a stunted plant of that grass is of some interest. There is apparently biotype divergence among populations of these fungi. The fact that isolate 4 had not only a more detrimental effect on its host than the other three, but originated from among a group of stunted plants all of which bore stromata, indicates that it may be a more pathogenically aggressive biotype. The occurrence of only *Ephelis* macroconidia in cultures of isolates 1-3, whereas isolate 4 produced only *Acremonium*-like microconidia, also reflects a measure of divergence. The variation found in culture among some *Acremonium* endophytes makes classification at the species level problematic and reevaluation of the presently accepted taxonomy may be warranted (Morgan-Jones *et al.*, 1992). Variation encountered in *Atkinsonella hypoxylon* during the course of this study, however, allows anamorph species concepts to be viewed in better perspective. Leuchtmann and Clay (1989a) reported that *Acremonium* microconidia [referred to as '*Sphacelia* conidia'] were sparsely formed in cultures of *A. hypoxylon* and *A. texensis* (Diehl) Leuchtmann & Clay, the greater number being produced at 15 C on cornmeal dextrose agar and cornmeal malt-extract agar. At this temperature, *Ephelis* macroconidial production was found to be suppressed. No microconidia were observed in some isolates of *A. hypoxylon* whereas the *Ephelis* anamorph was produced after 2-4 weeks at 25 C in all six strains each of *A. hypoxylon* and *A. texensis* studied.

By referring to the microconidial anamorphs of *A. hypoxylon* and *A. texensis* as '*Sphacelia* states', rather than as being *Acremonium*-like, Leutchmann and Clay (1989a) perpetuated the sometime use of the generic name *Sphacelia* Lev. for anamorphs of the Clavicipitaceae other than those of *Claviceps* Tul. The type species of *Sphacelia*, *S. segetum* Lev., is the anamorph of *Claviceps purpurea* (Fr.) Tul. This use stems in large part from the naming of the microconidial anamorph of *Epichloe typhina* (Fr.) Tul. as *Sphacelia typhinum* Sacc., a binomial now considered to be a *nomen dubium* [see White and Morgan-Jones, 1987b], by Saccardo (1881). The anamorph of *E. typhina* is now, as indicated above, known as *Acremonium typhina* (Morgan-Jones and Gams, 1982). To justify naming the microconidial states of the two *Atkinsonella* species as *Sphacelia* anamorphs, Leuchtmann and Clay (1989a) cited a number of supposed differences between them and *A. typhinum*. These included the fact that conidiogenous cells in the latter are narrower and

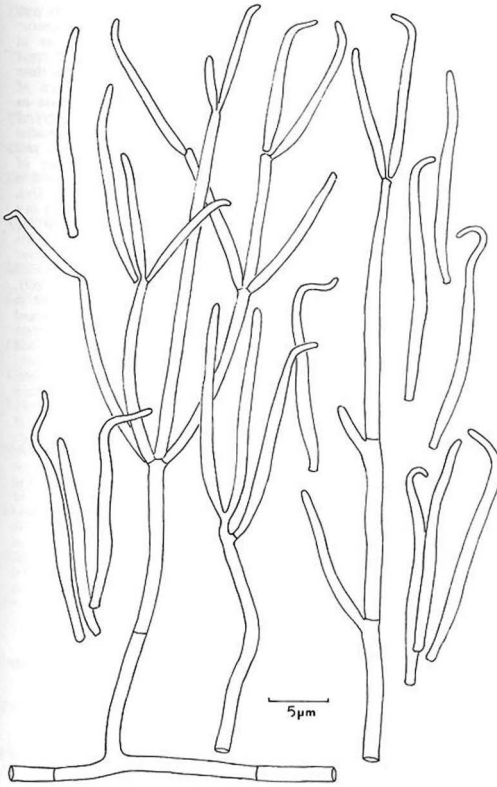


FIGURE 2. *Balansia epichloe*. *Ephelis* conidiogenous cells and conidia.

aculeate, gradually attenuating distally. They also noted, citing White and Morgan-Jones (1987b), that, *in vitro*, conidiogenous cells of *A. typhinum* occur solitarily and that its conidia are inequilateral rather than ovoid as in *Atkinsonella* microconidia. Leuchtmann and Clay (1989a) considered these differences, referred to as being fundamental [*sic*], to argue against a close relationship between *Atkinsonella* and *Epichloe* and viewed placement of *Atkinsonella* microconidial anamorphs in *Acremonium* section *Albo-lanosa* as inappropriate. Morgan-Jones and White (1989), following a study of *Atkinsonella texensis*, reached a different conclusion since the microconidial anamorph of this fungus was found to be quite similar in conidiogenous cell characteristics to *Acremonium typhinum*. The detailed morphology of conidiogenous cells of both *Atkinsonella hypoxylon* and *A. texensis* appears to vary, depending upon growing conditions. Under certain conditions *in vivo*, microconidial conidiogenous cells are arranged more or less parallel-sided in a close palisade upon a stromata made up of tightly packed hyphae and are relatively short, cylindrical over two thirds of their length, but often attenuate abruptly to give the distal third an aculeate aspect. In contrast, a much looser stromata can occur under different growing conditions as when in a humid environment, as illustrated in *A. texensis* by Morgan-Jones and White (1989). Conidiogenous cells that are very similar to those of species classified in *Acremonium* section *Albo-lanosa* arise from such stromata and are not arranged in a tight palisade. The *in vitro* study of *A. hypoxylon* reported herein confirms the similarity between the microconidial anamorph of this species and that of *E. typhina* and such species of *Acremonium* as *A. coenophialum*, *A. lolii* and *A. starrii*. The conidiogenous cells produced in culture are long, aculeate, and mostly borne solitarily. These are similar to those of some *Acremonium* species, particularly *A. coenophialum*, not only in shape but in lacking a septum, delimiting a separate cell from the repent hypha, at the base of the lateral conidiogenous portion. The synnemata of compacted hyphae, described above, interestingly, closely resemble those reported by White and Cole (1985) in *A. coenophialum* grown in axenic culture on seedlings of *Festuca arundinaceae* Schreb. With regard to conidium shape, two main types of conidia are known in *Acremonium* section *Albo-lanosa* [see Morgan-Jones *et al.*, 1992]. Conidia of *Acremonium chisosum* White & Morgan-Jones (White and Morgan-Jones, 1987a) and *A. chilense* are similar to those of *Atkinsonella* microconidial anamorphs in being equilateral. Those of the former are ovoid, essentially the same shape as the microconidia of *A. hypoxylon* and *A. texensis*. Microconidial shape is, therefore, not considered to be a reason for naming *Atkinsonella* microconidial anamorphs *Sphacelia* rather than *Acremonium* and their inclusion in *Acremonium* section *Albo-lanosa*.

ACKNOWLEDGMENT

We thank Dr. Roger D. Goos, Department of Botany, University of Rhode Island, for reviewing this paper.

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MYCOTAXON

Volume XLIV, no. 1, pp.103-126 April-June 1992

A KEY TO AND DESCRIPTIONS OF SPECIES ASSIGNED TO *OPHIODOTHELLA*, BASED ON THE LITERATURE

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ABSTRACT

A review of the literature yielded 26 species that have been described in or transferred to the genus *Ophiodothella* (Henn.) Höhn. Taxonomic descriptions have been compiled for each of these species, with additional comments where appropriate. As an aid to identification, a preliminary key to species and a host index based on the published information are provided.

Keywords: Ascomycotina, *Ophiodothella*, Phyllachoraceae, descriptions, key.

INTRODUCTION

Ophiodothella is a genus of obligate parasites that cause diseases of various plants in tropical and subtropical regions. All species occur on living leaves, and one, *O. orchidearum*, also attacks stems, flowers, and pseudobulbs. In about half of the species the lesions are described as amphigenous; in the rest they are either epi- or hypophyllous, but for six species lesion position was not designated. The fungus produces ostiolate perithecia in the leaf mesophyll which are covered by a

[1] Deceased

characteristic black clypeus (pseudoclypeus). Depending upon the species, the perithecia may form in living leaves or on fallen leaves after overwintering. Filamentous paraphyses are reported in 14 species, including the type. The asci are unitunicate, cylindrical to fusiform, with an undifferentiated apex that may or may not stain blue in iodine (Melzer's Reagent). Each ascus contains eight hyaline, filiform ascospores which may be one-, two-, or several-celled. An acervulate anamorph with scolecosporous conidia has been described in one species, and a pycnidial anamorph has been reported in three others, one of which may be a spermatial state. Thus the majority of species appear to lack an anamorphic state.

Of the 26 species placed in *Ophiodothella*, only one, *O. ingae*, appears to have been transferred out of the genus. Since the genus has never been monographed, the validity of all of the species has not been confirmed, but on the basis of the published descriptions, they appear to fit the circumscription of the genus. Several of the descriptions, however, are incomplete. The primary points of disagreement in the descriptions are in ascospore septation (unicellular vs. septate) and the presence or absence of paraphyses. Both of these characters can be difficult to determine because of the age or condition of the material examined.

Ophiodothella species have been found on 45 species of host plants in 26 genera belonging to 15 families. Twelve host species belong to the Orchideaceae; all are attacked by *O. orchidearum*. Ten species occur on members of the Ericaceae. Eight species of *Ophiodothella* occur on species of *Vaccinium* and five on species of *Ficus*.

Species of *Ophiodothella* have been reported from 15 countries, all of which are located in tropical or warm temperate areas of the world. The most northerly species is *O. vaccinii*, which has been found in southern Illinois of the United States. The greatest number of species, eight, occurs in Brazil; six are found in the United States. The most widespread species is *O. orchidearum*, which is found in six countries in North, Central, and South America and in the Philippines. In the United States *O. vaccinii* occurs in nine states (Arkansas, California, Florida, Georgia, Illinois, Mississippi, North Carolina, South Carolina, and Texas).

The genus *Ophiodothella* was created by Höhnel (1910) when he raised the subgenus *Ophiodothella* Hennings to generic rank, with *Ophiodothis atromaculans* Henn. as the basionym. Hennings (1904) had erected *Ophiodothella* to accommodate several species of *Ophiodothis* in which the asci were fusoid and lacked the thickened apical cap characteristic of species of *Ophiodothis*, which also had cylindrical asci. The type of *Ophiodothis* was later shown to be synonymous with *Balansia* in the Clavicipitales (Atkinson, 1905), necessitating the transfer of the species to other genera. Since the majority of the species in the genus had a well-developed, blackened, stromatic clypeus covering the perithecia, they were transferred to *Ophiodothella* (Höhnel, 1910). Subsequently, some other species

described under *Ceuthocarpon, Dothidea, Linospora, Oxydothis*, and *Scolecodothis* also were moved to the genus *Ophiodothella* (Barr, 1978; Petrak, 1951). Eriksson and Hawksworth (1987) list *Microphiodothis* Speg., *Scoledothis* Theiss. & H. Syd., and *Scolecodothopsis* F. Stev. as synonyms of *Ophiodothella*. *Ophiodothella* is considered closely related to *Phyllachora* and other members of the Phyllachoraceae (Polystigmataceae).

Ophiodothella was originally placed in the Dothideales on the basis of having no true perithecial wall (Clements and Shear 1931; Theissen & Sydow, 1915), but an ontogenetic study by Boyd (1934) showed a definite wall, which eventually led to the transfer of the genus to the pyrenomycetes. Although Boyd (1934) had suggested that the genus belonged in the Clypeosphaeriaceae in the Sphaeriales, Miller (1949) placed it among the Diaporthaceae. Müller and von Arx (1973) transferred the genus to the Polystigmataceae (Sphaeriales), whereas Barr (1976) placed it in the Melogrammataceae in the new order Phyllachorales. More recently, Cannon (1988) proposed placing the family in the Diaporthales, and Barr (1990), reversing her earlier arrangement, returned it to the Xylariales.

Most of the taxonomic literature of the genus *Ophiodothella* was published several decades ago and much of it was written in French, German or Latin. This paper presents a general taxonomic literature review of this genus. Descriptions in English are provided for each species, following a standard format and using current terminology. A preliminary key to species is compiled as and aid to identification. Descriptions are arranged alphabetically by specific epithet. Host names are taken from the literature and have not been checked for currency.

KEY TO SPECIES

1 On *Vaccinium caracasanum* ..... *O. cuervoi*
1' On other host species 2
2(1') Ascus width 10 µm or more 3
2'(1') Ascus width 10 µm or less 15
3(2) Ascospore length more than 70 µm 4
3'(2) Ascospore length less than 65 µm 8
4(3) Ascospore width 2-4 µm, asci cylindrical or cylindric-clavate 5
4'(3) Ascospore width 4-6 µm, asci more or less fusiform 6
5(4) Leaf spot indefinite, ascus width 10-12 µm ..... *O. galophila*
5'(4) Leaf spot distinct, ascus width 12-24 µm ..... *O. vaccinii*
6(4') Ascospore length less than 100 µm 7
6'(4') Ascospore length more than 150 µm ..... *O. longispora*

7(6) Asci tapering gradually to base; scolecosporous anamorph present ..... *O. fici*
7'(6) Asci short-stipitate; anamorph absent ..... *O. sydowii*
8(3') Ascospore width more than 3 µm 9
8'(3') Ascospore width less than 3 µm 12
9(8) Perithecia less than 200 µm diameter ..... *O. leptospora*
9'(8) Perithecia more than 200 µm diameter 10
10(9') Ascus width less than 15 µm ..... *O. floridana*
10'(9') Ascus width more than 15 µm 11
11(10') Leaf spot amphigenous, asci clavate ..... *O. neurophila*
11'(10') Leaf spot hypophyllous, asci fusoid ..... *O. circularis*
12(8') Ascus length less than 80 µm 13
12'(8') Ascus length more than 200 µm ..... *O. palmicola*
13(12) Asci cylindrical to cylindric-clavate ..... *O. ingae*
13'(12) Asci ellipsoid 14
14(13') Asci ellipsoid, sessile; perithecia solitary in each stroma ..... *O. liebenbergii*
14'(13') Asci clavate-ellipsoid, stipitate; perithecia 1-3 in each stroma ..... *O. edax*
15(2') Asci cylindrical, not attenuated toward the apex 16
15'(2') Asci fusoid or obclavate, more or less attenuated towards the apex 23
16(15) Ascus width more than 8 µm 17
16'(15) Ascus width less than 7 µm 20
17(16) Leaf spots amphigenous, circular 18
17'(16) Leaf spots hypophyllous, angular ..... *O. tarda*
18(17) Perithecia several in each stroma 19
18'(17) Perithecia single in each stroma ..... *O. bignoniacearum*
19(17) Perithecia 2-3 in each stroma; ascus width 9.5-11 µm ..... *O. tithoniae*
19'(17) Perithecia 5-10 in each stroma; ascus width 9 µm ..... *O. ulei*
20(16') Ascus width average 7 µm 21
20'(16') Ascus width less than 5 µm 22
21(20) Perithecia single in each stroma; paraphyses abundant ..... *O. ferruginea*
21'(20) Perithecia several in each stroma; paraphyses absent ..... *O. panamensis*
22(20') Clypeus epiphyllous; paraphyses absent; ascus length 70-80 µm ..... *O. trichocarpa*
22'(20') Clypeus hypophyllous; paraphyses present; ascus length 80-100 µm ..... *O. leucospila*

23(15') Ascospore length more than 50 µm 24
23'(15') Ascospore length less than 45 µm 25
24(23) Ostiole prominently papillate; ascus size 50-70 x 5-8 µm ..... *O. atromaculans*
24'(23) Ostiole inconspicuous; ascus size 65-95 x 6-9 µm ..... *O. orchidearum*
25(23') Perithecia more than 200 µm in diam ..... *O. balansae*
25'(23') Perithecia less than 120 µm in diam ..... *O. paraguariensis*

OPHIODOTHELLA (Henn.) Höhn.

"Stroma phyllachoroid, occupying the entire leaf thickness, not erumpent. Asci clavate or cylindrical, without a mucilaginous cap. Paraphyses sparse or lacking. Locules single or a few, mostly soft. Spores hyaline, threadlike, rarely cylindrical" (Höhnel, 1910).
Type species: *Ophiodothella atromaculans* (Henn.) Höhn.

The genus was circumscribed by Hanlin (1990a) as follows: Ascoma an ostiolate perithecium, immersed in host tissue, single or clustered, with erumpent ostiolar neck surrounded by a black clypeus; perithecium brown, broadly obpyriform to laterally ovoid, with a single ostiolar neck, but sometimes ostioles amphigenous; ostiole lined with periphyses. Perithecial wall several layers thick, outer cells angular, moderately thick-walled and pigmented, inner cells thin-walled, hyaline and flattened. Centrum containing filamentous, branched paraphyses. Asci unitunicate, lining the perithecial wall, but arranged only at sides of perithecia with amphigenous ostioles, ellipsoidal to oval, short-stalked, with a thickened apex and amyloid pore, 8-spored. Ascospores filiform, 1-celled, lying parallel in ascus or coiled around one another, hyaline, but often appearing greenish, with a single row of oil droplets when freshly discharged.

SPECIES DESCRIPTIONS

1. ***Ophiodothella atromaculans*** (Henn.) Höhn.
Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Abt. 1, 119:940 (1910).
≡ *Ophiodothis atromaculans* Henn. - Hedwigia 43:258 (1904).

Leaf spots amphigenous, forming an effuse, black stromatic crust, more or less covering the leaf. Clypeus amphigenous, gregarious, rounded-pulvinate, black and shiny, 250-300 mm diam. Perithecia few to solitary, immersed, subglobose with a papillate ostiole. Paraphyses sparse, filiform. Asci fusoid, attenuated towards the rounded apex, without a cap, substipitate, 8-spored, 50-70 X 5-8 µm. Ascospores filiform, parallel in the ascus, as long as the ascus, hyaline, pluriguttulate, afterwards multiseptate, 1.5-2 µm wide.

Anamorph: None reported.
Habitat: On living leaves of *Lonchocarpus* sp. (Fabaceae).
Distribution: Brazil.
Etymology: *atromaculans* = Latin, atro (black) + maculans (spotting), in reference to the black clypeus formed on the leaves.
Comments: Von Höhnel (1910) reported that the original material had a thin, widespread, dark-brown stroma on both sides of the leaf containing groups of 2-5 perithecia ca. 260 µm wide X 220 µm high, but with the perithecia protruding more prominently on the lower side of the leaf. The leaf epidermis was filled with dark-brown, elongate hyphal cells that formed the carbonaceous clypeus above and below the perithecium. The dark hyphae penetrated somewhat into the adjacent mesophyll tissue but not into the interior of the leaf, so that the sides of the perithecia were delimited only by thin, pale, walls. The short ostiole formed on the underside of the leaf. Theissen and Sydow (1915) reported that the asci were cylindrical-clavate and that paraphyses were lacking. They gave the size of the asci as 65-75 X 6-8 µm and the ascospores as 45-52 X 2 µm.
References: Hennings, 1904 (Icon); Höhnel, 1910; Theissen and Sydow, 1915; Saccardo, 1905.

2. ***Ophiodothella balansae*** (Speg.) Höhn.
Fragmente zur Mykologie 12:65 (1910).
≡ *Ophiodothis balansae* Speg. - Fungi Guar. Pug. I, n. 291. (1885).

Leaf spots amphigenous, suborbicular, 5-15 mm wide, black, indeterminate. Clypeus ("stroma") innate (in leaf spots or near them), densely aggregated, suborbicular, rarely confluent, not prominent, often with one perithecium, coriaceous, wall indistinct, black, opaque. Perithecia globose-lenticular, 200-300 µm in diam., ostiole not prominent, center of perithecium filled with white matter. Paraphyses lacking. Asci obclavate, slightly thick-walled, apex attenuated and truncate, base abruptly narrowed, slightly pedicellate, 65 X 10 µm, 8-spored. Ascospores fasciculate-polystichous, aciculate, attenuated and acute at both ends, slightly curved, with a septum at the middle, not constricted at septum, guttulate, hyaline, with granular contents, 35-40 x 2.5 µm.
Anamorph: None reported.
Habitat: On living leaves of Bignoniaceae.
Distribution: Brazil.
Etymology: *balansia* = Latin, in honor of Benjamin BALANSA, a French collector of plants in Argentina.
References: Spegazzini, 1885; Saccardo, 1891; Höhnel, 1910.

3. ***Ophiodothella bignoniacearum*** Chardon
Mycologia 32:178 (1940).

Leaf spots amphigenous, conspicuous, large, consisting of brown circular areas, 4-10 mm diam., provided with numerous black punctiform perithecia, visible on both surfaces of leaf. Perithecia single, globose to flattened, 220-300 x 180-216 µm, with clypeus above and surrounded by prosenchymatous wall, 6-10 µm thick. Ostiole short-papillate, with periphyses. Paraphyses present but inconspicuous with age. Asci cylindric, 8- spored, short-stalked, 72-85 X 8-9 µm. Ascospores filiform, hyaline, 1-celled, tightly pressed together in the ascus.
Anamorph: None reported.
Habitat: On living leaves of Bignoniaceae.
Distibution: Brazil.
Etymology: *bigoniacearum* = Latin, (on Bignoniaceae), for the host family.
Reference: Chardon *et al.*, 1940.

4. ***Ophiodothella circularis*** (Bres.) Petrak
Sydowia 5: 40 (1951).
≡ *Oxydothis circularis* Bres. apud Rick - Ann. Mycol. 4:311. 1906. (nom. nud.)
≡ *Scolecodothis circularis* (Bres.) Theiss. et H. Syd. - Ann. Mycol. 12:277 (1914).
= *Cocconia sphaerica* Rick - Fungi austro-amer. 72. (1906).

Leaf spots hypophyllous, indefinite or irregularly rounded, brown, up to 4 mm in diameter. Clypei situated in leaf spots, solitary or aggregated, black and shiny. Perithecia crowded, globose or cuboidal, 360-450 µm wide X 300-320 µm high. Asci slender, narrowed at both ends, short-stipitate, 105 x 18-22 µm, not blueing in iodine, 8-spored. Ascospores parallel, tetrastichous, straight or curved, hyaline, non-septate, 56-66 x 4-5 µm.
Anamorph: None reported.
Habitat: On living leaves of *Myrsines* sp. (Myrsinaceae).
Distribution: Brazil.
Etymology: *circularis* = Latin (circular), with reference to the rounded leaf spots.
Comments: The origin of this binomial is unclear. The reference provided for the basionym of this species by Theissen and Sydow (1915) is to an article by Rick (1906), who lists the fungus as occurring in South America. He gives no indication of the origin of the name or why it is attributed to Bresadola, nor does he provide a description. Saccardo (1926) later gave the citation for the transfer of *Oxydothis circularis* to *Scolecodothis* as Theissen and Sydow (1914), but this article contains no mention of this species. The actual transfer was made in a later paper (Theissen and Sydow, 1915), and *Cocconia sphaerica* Rick was listed as a synonym. The basionym thus appears to be a nomen nudum, as indicated by Saccardo (1926), who provided a Latin description.

References: Rick, 1906; Theissen and Sydow, 1914, 1915; Saccardo, 1926; Petrak, 1951.

5. ***Ophiodothella cuervoi*** Chardon apud Toro and Chardon
Ann. Mycol. 32:114. (1934).

Leaf spots ("stromata") epiphyllous or hypophyllous, rarely amphigenous, irregularly orbicular, convex, black, shiny. Clypeus of stromatic composition; lower wall cellular, indistinct. Perithecia solitary, depressed-globose. Paraphyses present. Asci clavate, 8-spored, few in number, pedicellate. Ascospores distichous, hyaline, non-septate, cylindrical, acute at both ends.
Anamorph: None reported.
Habitat: On living leaves of *Vaccinium caracasanum* (Ericaceae).
Distribution: Colombia.
Etymology: *cuervoi* = Latin, in honor of Luis Augusto CUERVO, historian and Governor of the Department of Santander del Norte, Colombia, site of the type collection.
Comments: No measurements were provided for this species.
References: Toro and Chardon, 1934; Petrak, 1935.

6. ***Ophiodothella edax*** (Berk. et Broome) Höhn.
Fragmente zur Mykolologie 12:65 (1910).
≡ *Dothidea edax* Berk. et Broome - J. Linn. Soc. 14:135 (1875)
≡ *Ophiodothis edax* (Berk. et Broome) Sacc. - Syll. Fung. 2:653 (1883)

Leaf spots indefinite, consisting of a yellowish discoloration of the leaf tissue. Stromata occurring as elongated groups between veins, up to 3 mm long and 1 mm wide, with younger stromata forming in rings around the older ones. Single stromata amphigenous, mostly epiphyllous, but visible on opposite side of leaf, minute, punctiform, ca. 300 µm diam., usually confluent in groups. Stromata in mesophyll consisting of rather loosely reticulate, branched, hyaline to pale olivaceous brown hyphae which are 2.5-4 µm thick. Clypeus epidermal, amphigenous, brownish black, opaque, often somewhat raised and bluntly conical over the apex of the perithecia, 20-30 µm thick. Perithecia 1-3 in each stroma, globose or flattened globose, deeply immersed, 150-250 x 150-200 µm. Ostiole papillate or conically truncate, completely immersed under the clypeus, lined with periphyses. Perithecial wall subhyaline to pale brown, concentrically fibrose, 8-10 µm thick. Paraphyses not seen. Asci numerous, 8-spored, clavate-ellipsoid, pedicellate, 70-80 x 10-13 µm. Ascospores hyaline, filiform, parallel in ascus, non-septate, straight or curved, tapering somewhat to the blunt ends, 45-60 x 3-3.3 µm.
Anamorph: Berkeley and Broome (1875) stated that the leaf spots also bore bright scarlet tendrils composed of minute spores, which they considered a probable second form of fructification. Saccardo (1883) referred to these spores as probable

spermatia from a spermogonium. Von Höhnel (1910) considered them a true conidial state, which he called *Gloeosporium*-like. Doidge (1942) makes no mention of a second spore state in her description of South African material.
Habitat: On living leaves of *Tephrosia elongata* and *T. suberosa* (Fabaceae).
Distribution: Sri Lanka and South Africa.
Etymology: *edax* = Latin (destructive), an apparent reference to its parasitic habit.
Comments: Theissen and Sydow (1915) stated that they could not confirm the presence of paraphyses in this species, and Doidge (1942) did not observe them in her material. Theissen and Sydow (1915) also reported that the fruiting structures did not give a blue reaction in iodine.
References: Berkeley and Broome, 1875; Höhnel, 1910; Saccardo, 1883; Theissen and Sydow, 1915; Doidge, 1942.

7. ***Ophiodothella ferruginea*** (Ellis et G. W. Martin) M. E. Barr
Mycologia Memoir 7:131 (1978).
≡ *Linospora ferruginea* Ellis et G. W. Martin - Amer. Nat. 18: 69 (1884).
≡ *Ceuthocarpon ferrugineum* (Ellis et G. W. Martin) Berl. - Icon. Fung. 2:147, 153 (1900).

Leaf spots pale yellowish-brown, with a darker, narrow, slightly raised border, 1.5-2 mm wide. Perithecia solitary, one in the center of each spot, subglobose, 150 µm in diam., immersed and covered above by a black clypeus which is perforated by the scarcely prominent ostiole. Paraphyses abundant, filiform. Asci cylindrical, 8-spored, sessile or nearly so, 75-80 X 7 µm. Ascospores filiform, acute at each end, yellowish, 33-54 X 1.5-2 µm.
Anamorph: None reported.
Habitat: On living leaves of *Andromeda ferruginea* (Ericaceae).
Distribution: United States (Florida).
Etymology: *ferruginea* = Latin, ferrugo (the color of iron rust, i.e., rust-colored). Since the lesions in this species were not described as rusty brown, the specific epithet was probably based on that of the host.
References: Berlese, 1900 (Icon); Ellis and Martin, 1884; Barr, 1978.

8. ***Ophiodothella fici*** E. A. Bessey
Mycologia 11:55 (1919).

Leaf spots yellowish-green, with ferruginous margin, center occupied by a single black stroma or groups of concentrically arranged black stromata; heavily infected leaves fall prematurely in great numbers. Stromata 1-10 mm in diam., extending from the upper to the lower surface of the leaf, shiny black on the lower surface and whitish on the upper. Perithecia few or many in each stroma (depending upon stroma size), situated in the lower stroma but extending into the upper stroma, 400-450 X 300-500 µm, ostiole only very slightly papillate. Perithecial wall indistinct. Paraphyses filiform, septate, equal to the asci in length.

Asci numerous, 8-spored, arising in basal portion of the perithecium, elongate-fusiform, tapering gradually to the base and somewhat more abruptly to the rounded apex, 105-175 X 12-16 µm. Ascospores filiform, slightly clavate, dilutely brown, very granular, with a clear vacuole at middle of spore, not septate, 77-87 X 4.7-6.2 µm.

Anamorph: Pycnidia occuring in upper stromatic layer, appearing before the perithecia, ostiolate, 180-300 µm wide X 75-100 µm high; conidia elongate, slightly clavate, usually curved, rarely hooked, not septate, hyaline or dilute brown, 12-19 X 1 µm.

Habitat: On living leaves of *Ficus aurea* (Moraceae).

Distribution: United States (Florida).

Etymology: *fici* = Latin, (on *Ficus*), for the host genus.

Comments: The original description was in English, but Saccardo (1926) provided a Latin version.

References: Bessey, 1919 (Icon); Saccardo, 1926.

9. ***Ophiodothella floridana*** Chardon
J. Dept. Agric. Porto Rico 13(1):14 (1929).

Leaf spots large, conspicuous, roughly circular or irregular through coalesence, 8-15 mm across, amphigenous but more pronounced on the underside of the leaf, with a dull black, conspicuous stroma, 5-12 mm across, in the center of the spot, bordered by a distinct yellowish zone which borders the stroma on all sides; stroma with numerous perithecia (locules) in a row facing the undersurface, immersed in the mesophyll of the leaf, with heavy stroma above, lighter below; paraphyses present; perithecia globose or elliptical, 250-350 X 200-280 µm; asci cylindric-clavate, 8-spored, 80-112 X 11-13 µm; ascospores filiform, 1-celled, hyaline, 56-64 X 4 µm.

Anamorph: None reported.

Habitat: On living leaves of *Ficus* sp. (Moraceae).

Distribution: Puerto Rico, United States (Florida - Type).

Etymology: *floridana* = Latin, (from Florida), referring to the type locality.

Comments: This species was published only in English, but the name is valid as it was published before 1935 (Greuter *et al.*, 1988).

References: Chardon, 1929; Petrak, 1929.

10. ***Ophiodothella galophila*** H. Syd.
Ann. Mycol. 23:383 (1925)

Leaf spots indefinite, consisting of a chlorotic zone, orbicular or irregular in outline, ca. 5-12 mm diam., often becoming rhomboid and limited by leaf veins, underside yellow, upper side dark reddish-brown, then becoming gray or grayish-black above and black below. Clypei ("stromata") irregularly scattered, often solitary, then 2-3 aggregated and somewhat confluent, visible on both sides

of leaf, composed of very densely interwoven hyphae 4-5 µm wide, coriaceous-gelatinous, with surface punctured by ostioles. Perithecia usually developed in middle of clypeus, irregularly distributed or densely crowded, mostly arranged in two rows, applanate-globose, rarely elliptical or ovate, 250-350 µm in diam.; ostiole truncate-conical, with periphyses. Perithecial wall ca. 15-20 µm wide, concentrically fibrous. Paraphyses broadly filiform, more or less attenuated toward the apex, becoming mucilaginous, 5-7 µm wide. Asci narrowly clavate or cylindric-fusiform, attenuated towards the base, rounded at the apex, subsessile or very shortly stipitate, thin-walled, 8-spored, sporogenous part 95-130 X 10-12 µm. Ascospores broadly filiform, parallel, usually curved, rarely almost straight, usually slightly attenuated at both ends, with granular contents or often guttulate, rarely indistinctly 3-4 septate, hyaline, 75-95 X 2.5-3.2 µm.

Anamorph: *Linochora galophila* H. Syd. This occurs in conjunction with the ascigerous state.

Habitat: On living leaves of *Ficus jimenezius* (Moraceae).

Distribution: Costa Rica.

Etymology: *galophila* = Greek, galo (milk) + philos = (loving), an apparent reference to the milky latex of the host.

References: Sydow, 1925a; Petrak, 1928.

11. ***Ophiodothella ingae*** (Henn.) Theiss. et H. Syd.
Ann. Mycol. 13:614 (1915).
≡ *Phyllachora ingae* Henn. - Hedwigia 48:8 (1908).

Although the ascospores in this species were originally described as filiform, Müller and von Arx (1962) and Cannon (1989) state that they are isthmoid and the species therefore belongs in *Diatractium*.

References: Hennings, 1908; Theissen and Sydow, 1915; Müller and von Arx, 1962; Cannon, 1989 (Icon).

12. ***Ophiodothella leptospora*** (Speg.) Höhn.
Fragmente zur Mykologie 12:65 (1910).
≡ *Ophiodothis leptospora* Speg. - F. Puigg. n. 331. (1887).

Leaf spots ("stromata") hypophyllous, innate, small, slightly raised, 5 mm in diameter, becoming ash-gray to dark bluish-gray, surrounded by a pale white areole, sparse or subaggregated, rarely confluent. Perithecia 2-5 in each stroma, crowded together, globose to angular, immersed, not raised, 120-150 µm in diameter. Paraphyses absent. Asci ellipsoidal or ovate, attenuate-rounded above, thin-walled, foveolate, abruptly short-stipitate, 50-60 X 10-22 µm, 8-spored. Ascospores cylindrical, crowded together, attenuated and rounded at both ends, non-septate, straight or curved, hyaline, 40 X 4-5 µm.

Anamorph: None reported.

Habitat: On living leaves of unidentified plant.

Distribution: Brazil.
Etymology: *leptospora* = Greek, lepto (slender) + spora (spore), with reference to the scolecosporous ascospores.
References: Spegazzini, 1887; Saccardo, 1891; Höhnel, 1910.

13. ***Ophiodothella leucospila*** (Berk. et M. A. Curtis) Miller et Thompson Mycologia 32:10 (1940).
≡ *Sphaeria leucospila* Berk. et M. A. Curtis - Grevillea 4:153 (1876).
≡ *Linospora leucospila* (Berk. & M. A. Curtis) Sacc. - Syll. Fung. 2:357 (1883).

Leaf spots consisting of light-colored areas along midrib and main lateral veins. Stromatic clypeus narrow, reduced in size, black. Perithecia hypophyllous, sunken in mesophyll under a black epidermal clypeus. Perithecial wall well organized, consisting of concentrically arranged cells that form a short papilla with a narrow ostiole which penetrates the clypeus. Paraphyses present, tending to disappear with maturity. Asci cylindrical, 8-spored, 80-100 X 4.6 µm. Ascospores filiform, about as long as the ascus and 1 µm thick.
Anamorph: None reported.
Habitat: On living leaves of *Platanus occidentalis* (Platanaceae).
Distribution: United States (Georgia, South Carolina - Type).
Etymology: *leucospila* = Greek, leuco (white) + spilo (spot), in reference to the light-colored lesions.
Comments: Ellis and Everhart (1892) include a description of this species, based on Berkeley (1876).
References: Berkeley, 1876; Saccardo, 1883; Ellis and Everhart, 1892; Miller and Thompson, 1940.

14. ***Ophiodothella liebenbergii*** Doidge
Bothalia 4:459 (1942).

Leaf spots pale brown, circular to irregular in outline, up to 10 mm in diameter, often numerous, becoming confluent and covering a large portion of the leaf. Stromata epiphyllous, scattered on the leaf spots, discrete or in small, closely crowded groups of 2-3, black, convex, shiny, up to 0.3 mm wide. Stromata in the mesophyll composed of rather loosely reticulate hyaline hyphae. Clypeus in the upper epidermis opaque, blackish-brown, 20-25 µm thick, up to 40 µm thick over the perithecial apex, not extending beyond the perithecium, composed of closely interwoven, dark olive-brown hyphae 2.5-4 µm thick. Perithecia solitary, subglobose or somewhat irregular in shape, deeply immersed in the mesophyll, 160-250 X 150-180 µm. Ostiole flat, truncateconical, immersed in the clypeus, lined with periphyses, with a more or less round pore 15-20 µm in diameter. Perithecial wall delicate, hyaline, 5-7.5 µm thick, closely appressed to the host mesophyll cells. Paraphyses sparse. Asci fairly numerous, 8-spored, ellipsoidal, rounded at the apex,

sessile, straight or somewhat curved, 65-75 X 10-15 µm. Ascospores linear, parallel but twisted in the ascus, hyaline, non-septate, 50-62.5 µm long X 2.5-3 µm wide at the rounded or truncate base and tapering gradually towards the apex, usually more or less sinuous.
Anamorph: None reported.
Habitat: On living leaves of *Ochna pulchra* (Ochnaceae).
Distribution: South Africa.
Etymology: *liebenbergii* = Latin, in honor of L. C. C. LIEBENBERG, a plant collector in South Africa who collected the original specimen.
Reference: Doidge, 1942.

15. *Ophiodothella longispora* Swart
Trans. Brit. Mycol. Soc. 79:567 (1982).

Perithecia single, immersed in host mesophyll, up to 600 µm in diam. Ostiole with periphyses, situated under a stroma, surrounded by a pseudoclypeus of dark host cells and some hyphae, wall composed of thin-walled hyaline cells, a smaller dark area may develop below the ascocarp in mesophyll and epidermis. Septate paraphyses present. Asci eight-spored, with a thick gelatinous wall without apical structures, 180-220 X 23-27 µm. Ascospores parallel, unicellular, 150-200 X 4-6 µm, with a gelatinous outer wall layer, somewhat curved, rounded at both ends.
Anamorph: None reported.
Habitat: On living leaves of *Eucalyptus goniocalyx* (Myrtaceae).
Distribution: Australia.
Etymology: *longispora* = Latin, longi (long) + spora (spore), referring to the long ascospores.
Reference: Swart, 1982 (Icon).

16. *Ophiodothella neurophila* H. Syd.
Ann. Mycol. 29:212 (1931).

Leaf spots scattered, amphigenous, irregularly angular or rarely orbicular in outline, on upper surface, at first yellowish brown, later turning reddish brown with a pale or greyish center, on the lower surface indistinctly yellowish or greyish-green, about 5-12 mm in diameter. Clypeus on both surfaces 25-50 µm wide, composed of dark brown cells 4-5 µm wide. Stromata mostly formed close to the leaf veins, immersed in the mesophyll, composed of extensively reticulate-branched yellowish to pale brown hyphae 3-5 µm wide. Perithecia globose, ovate or ellipsoidal, 250-350 µm in diameter. Perithecial wall membranaceous, 12-15 µm thick, composed of concentrically arranged greyish to olivaceous brown cells. Ostiole papillate, perforating the clypeus, lined with periphyses. Paraphyses very numerous, mostly simple, filiform. Asci numerous, 8-spored, clavate, much more attenuated towards the base, subsessile or very shortly stipitate, thin-walled, 70-90 X 15-25 µm. Ascospores polystichous, narrow and elongate-fusoid, attenuated towards both ends,

rounded at the tips, more or less sickle-shaped or sigmoid, rarely substraight, hyaline, 40-60 X 3-5 µm.
Anamorph: None reported.
Habitat: On living leaves of *Streptocaulon baumis* (Periplocaceae).
Distribution: Philippines.
Etymology: *neurophila* = Greek, neuro (nerve, vein) + philos (loving), in reference to the clustering of the stromata along the leaf veins.
References: Petrak, 1931; Sydow and Petrak, 1931.

17. ***Ophiodothella orchidearum*** Cash et Watson
Mycologia 47:734 (1955).

Diseased spots pale or indefinite whitish areas with dark margins on leaves, stems and other plant parts. Perithecia scattered over the leaf spot, subepidermal, lenticular to depressed-globose, with membranaceous wall, 300-500 X 200-300 µm. Ostiole 25 µm in diameter, short, inconspicuous, surrounded by a pseudoclypeus consisting of blackened host tissue. Paraphyses filiform, flexuous, guttulate, hyaline, 1-1.5 µm wide. Asci arcuate or straight, cylindric-fusoid, abruptly narrowed to a short stalk and attenuated toward the rounded apex, 8-spored, 65-95 X 6-9 µm. Ascospores elongate, straight or spirally twisted in the ascus, multiguttulate, 3-12 septate, often slightly constricted about one third the length from each end, hyaline to pale greenish, 55-66 X 1.8-3 µm.
Anamorph: None reported.
Habitat: On living stems, leaves, flower stalks, flower scapes, and pseudobulbs of *Cattleya mossiae, Cattleya* sp. *Laelia superbiens, Laelia* sp., *Odontoglossum uroskinneri, Oncidium bicallosum, O. cavendishianum, O. leucochilum, O. splendidum, Phalaenopsis schilleriana, Sobralia xantholeuca, Sobralia* sp. (Orchidaceae).
Distribution: Brazil, Colombia, Guatemala - Type, Mexico, Philippines, Venezuela.
Etymology: *orchidearum* = Greek, orchidea (orchid) + Latin -arum (belonging to), for the common name of the hosts.
Comments: This species was described from plants intercepted at United States ports of entry by Plant Quarantine Inspectors. It appears not to have been reported from the countries of origin.
Reference: Cash and Watson, 1955.

18. ***Ophiodothella palmicola*** Batista et Peres
Saccardoa 1:49 (1960).

Leaf spots epiphyllous, numerous, black, shiny, 1-2 mm wide, arranged in rows. Clypeus epidermal or immersed in mesophyll, dark brown, pulvinate, carbonaceous, 45-90 µm thick. Perithecia oblong-depresed, with papillate ostiole, extending from epidermis to mesophyll, aggregated, 690-900 X 75-160 µm, with a hyaline basal wall which is 7-12 µm thick. Paraphyses filiform, non-septate, hyaline, 0.1-0.2 µm thick.

Asci cylindrical or fusiform, unitunicate, 8-spored, sessile or short-stipitate, 200-240 x 10-13 µm. Ascospores fusoid-elongate or filiform, straight or curved, non-septate, hyaline, 22-25 x 2-2.5 µm.
Anamorph: None observed.
Habitat: On living rachis of an unidentified palm.
Distribution: Guyana.
Etymology: *palmicola* = Latin, palma (palm), + -icola (inhabiting), referring to the host.
Reference: Batista and Peres, 1960 (Icon).

19. *Ophiodothella panamensis* Stevens
Illinois Biol. Monogr. 11(2):44. (1927).

Leaf spots up to about 5 mm in diameter or larger by coalescence, irregularly circular, with a narrow yellow margin, each occupied by a single stroma. Clypeus epidermal, amphigenous, black. Stromata about 1-2 mm wide, visible on both leaf surfaces, dull black, rough, the upper subepidermal portion about 70-110 µm thick. The major portion of the stroma below the palisade layer is composed of colorless, thin-walled prosenchymatous cells, about 230 µm thick and 700-900 µm in diameter, extending also to some extent between the palisade cells and developing extensively between the cells of the spongy tissue. Perithecia several in each stroma, located in the mesophyll, globose, about 230 µm in diameter, with a papillate, hypophyllous, ostiole. Paraphyses lacking. Asci long, narrow, stalked, arising from all parts of the perithecial wall, 72 x 7 µm. Ascospores filiform, curved, obtuse, hyaline, 61-65 x 1.5 µm.
Anamorph: None reported.
Habitat: On living leaves of *Cordia heterophylla* (Ehretiaceae).
Distribution: Panama.
Etymology: *panamensis* = Latin, Panama (the country) + -ensis (origin of), referring to the type locality.
Comments: No Latin description was provided, but the name is valid as it was published before 1935 (Greuter *et al.*, 1988).
References: Stevens, 1927 (Icon); Petrak, 1928.

20. *Ophiodothella paraguariensis* (Speg.) Höhn.
Fragmente zur Mykologie 12:65 (1910).
≡ *Ophiodothis paraguariensis* Speg. - Fungi Guar. Pug. I, n. 292. (1885).

Leaf spots epiphyllous, rarely amphigenous, indefinite, 1-15 mm wide, becoming dry and rusty brown to black. Stromata epiphyllous, rarely hypophyllous, 260-320 µm in diameter, covered by black, shiny, slightly raised clypeus, concentrically arranged on the leaf spot. Perithecia solitary, but seldom 2-3 within a stroma, 80-220 µm in diameter. Asci 8-spored, fusoid or fusoid-subclavate, the upper part truncate and thick-walled, the lower part attenuated, slightly pedicellate,

50-60 x 7-9 µm. Ascospores fusoid-acicular, acutely rounded at both ends, straight or slightly curved, multiguttulate, 40-45 x 2-2.5 µm.
Anamorph: None reported.
Habitat: On living leaves of *Rollinia emarginata* (Annonaceae).
Distribution: Paraguay.
Etymology: *paraguariensis* = Latin, Paraguay (the country) + -ensis (origin of), for the type locality.
Comments: Spegazzini (1922) reported that the fungus was common on living leaves around Asunción, but that these specimens had asci 90 X 10 µm and ascospores 60 X 3 µm.
References: Spegazzini, 1885, 1922; Saccardo, 1891; Höhnel, 1910.

21. *Ophiodothella sydowii* Petrak
Sydowia 2:63 (1948).

Leaf spots visible on both surfaces, irregularly dispersed, orbicular or elliptic to angular, 5-15 mm diam., often confluent, pale brown or reddish. Stromata only hypophyllous, irregularly dispersed or sometimes circularly distributed, 0.5-1.5 mm diam. Clypeus epidermal, black, 50-90 µm thick, pseudoparenchymatous, more or less raised. Perithecia globose or ellipsoid, 350-500 µm diam., ostiole bluntly conic, wall consisting of layers of pale olivaceous to subhyaline cells 3-5 µm in width. Asci fusiform or clavate-fusiform, the basal part more attenuated, short-stipitate, 120-150 x 17-24 µm. Ascospores parallel in ascus, narrowly elongate-fusiform, gradually attenuated to both ends, curved, rarely straight, hyaline, non-septate, 75-95 x 5-6 µm.
Anamorph: None reported.
Habitat: On living leaves of *Cavendishia* (Ericaceae).
Distribution: Ecuador.
Etymology: *sydowii* = Latin, in honor of the German mycologist, Hans SYDOW.
Reference: Petrak, 1948.

22. *Ophiodothella tarda* (Harkn.) Höhn.
Fragmente zur Mykologie 12(630):65 (1910).
≡ *Ophiodothis tarda* Harkness - Bull. Calif. Acad. Sci. I, 2629. (1884).

Leaf spots hypophyllous, angular to irregular, 3-4 mm wide, often confluent. Perithecia with a papillate ostiole, covered by a black shiny clypeus. Asci 8-spored, cylindrical, abruptly contracted, curved and bulbose at the base, 57 x 9 µm. Ascospores filiform, pluriguttulate, 42 x 2 µm.
Anamorph: None reported.
Habitat: On living leaves of *Rhus diversiloba* (Anacardiaceae).
Distribution: United States (California).
Etymology: *tarda* = Latin, tardus (slow, tardy), referring to the delayed formation of the ascomata.

Comments: Harkness (1884) reported that the "fruit" formed slowly after lying long on the ground.
References: Harkness, 1884; Saccardo, 1891; Höhnel, 1910.

23. ***Ophiodothella tithoniae*** Chardon apud Chardon et Toro
Mycol. Explor. Venezuela, Monograph Univ. Puerto Rico, Ser. B., 2:175 (1934).

Leaf spots amphigenous, more or less circular or slightly angular, more distinct on the upper leaf surface than on the lower, about 3 mm in diameter. Clypei ("stromata") dull black, somewhat angular, 2 mm wide, conspicuous and rugose above, scarcely visible and brown on the lower leaf surface, always surrounded by a discolored zone of host tissue. Perithecia 2-3 in each stroma, lenticular, flattened, large, with a heavy black clypeus above, 200-350 x 160-200 μm. Paraphyses absent. Asci cylindrical to clavate, 8-spored, 68-82 x 9.5-11 μm. Ascospores filiform, hyaline, nonseptate, tightly appressed in the ascus, arcuate when free, 45-54 x 1.5-2.7 μm.
Anamorph: None reported.
Habitat: On living leaves of *Tithonia rotundifolia* (Asteraceae).
Distribution: Venezuela.
Etymology: *tithoniae* = Latin, (on *Tithonia*), for the host genus.
References: Chardon, 1934; Petrak, 1935.

24. ***Ophiodothella trichocarpa*** H. Syd.
Leafl. Philipp. Bot. 9:3126 (1925).

Leaf spots distinct, amphigenous, orbicular, 3-8 mm in diameter, whitish to yellowish brown, with a narrow, raised brown border. Clypeus epidermal, distinct on the upper leaf surface, not or scarcely developed on the lower surface, convex, black and shiny, covering the solitary perithecium, 20-25 μm thick. Perithecia epiphyllous, loosely aggregated on the leaf spot, situated in the leaf mesophyll, occupying 2/3 to 3/4 the thickness of the leaf, 250-400 μm wide. Paraphyses absent. Asci cylindrical, delicate, shortly pedicellate, 70-80 x 3-4 μm. Ascospores hyaline, filiform, arranged parallel in the ascus, about as long as the length of the ascus, 0.75 μm wide.
Anamorph: None reported.
Habitat: On living leaves of *Dracontomelon cumingianum* (Anacardiaceae).
Distribution: Philippines
Etymology: *trichocarpa* = Greek, tricho (hair) + carpo (fruit), perhaps in reference to the filamentous (hair- like) spore.
References: Sydow, 1925b; Petrak, 1928.

25. *Ophiodothella ulei* (Rehm) Höhn.
Fragmente zur Mykologie 12:64 (1910).
≡ *Ophiodothis ulei* Rehm - Hedwigia 36:380 (1897).

Leaf spots amphigenous, orbicular, scattered, dull black, flat, irregularly rounded, often confluent, later becoming whitish, up to 3 mm in diameter. Stromata amphigenous, mostly hypophyllous. Clypeus up to 2 mm in diameter, flat, black and somewhat shiny, 20-25 µm thick. Perithecia 5-10 immersed in the mesophyll, 200-230 µm wide x 160-185 µm high. Paraphyses absent. Asci cylindrical, sessile, 8-spored, 85-100 x 6-8 µm. Ascospores filiform, guttulate, hyaline, arranged parellel in ascus, non-septate, 75-85 x 1-1.5 µm.
Anamorph: None reported.
Habitat: on living leaves of Fabaceae.
Distribution: Brazil.
Etymology: *ulei* = Latin, in honor of Ernst Heinrich Georg ULE, a German who collected plants for the National Museum in Rio de Janeiro.
References: Rehm, 1897; Saccardo, 1899; Höhnel, 1910; Theissen and Sydow, 1915.

26. *Ophiodothella vaccinii* Boyd
Mycologia 26:465 (1934).

Leaf spots amphigenous, circular, light yellow when young, upper surface becoming reddish-orange or occasionally red when mature, often with a yellow halo, lower surface ocher to pale yellow-orange, up to 2 cm in diam., bearing numerous conidiomata, often turning black on fallen leaves. Ascoma an ostiolate perithecium, immersed in tissue of leafspot, formed in fallen, overwintered leaves. Perithecium obpyriform to oval, (120)-130-(150) µm high X (134)-155-(192) µm wide, usually with a single ostiolar neck but sometimes with amphigenous ostiolar necks; ostiolar necks surrounded by a black clypeus (pseudoclypeus), becoming papillate at maturity. Perithecial wall prosenchymatous, in amphigenous perithecia with pseudoparenchyma cells at the equator. Paraphyses hymenial, filamentous, septate, often branched, lining bottom and sides of perithecial wall, 79-112 x 3-4 µm. Asci numerous, arising among paraphyses, lining inside of perithecium, except in perithecia with amphigenous ostioles where they are restricted to sides of perithecium at equator and projecting inward, parallel to longitudinal axis of leaf. Asci unitunicate, cylindrical, tapered at base, slightly thickened at apex, 100-130 x 12-24 µm, often curved, with pore blueing in iodine, 8-spored. Ascospores hyaline, one-celled, filiform, usually slightly curved, 72-116 x 2-4 µm, with a single row of large oil droplets.
Anamorph: *Acerviclypeatus poriformans* Hanlin (Hanlin, 1990b).
Habitat: On living leaves of *Vaccinium arboreum, V. candicans, V. corymbosum, V. stamineum* var. *melanocarpum, V. ashei, V. tenellum* and *V. virgatum*.
Distribution: United States (Arkansas, California, Florida, Georgia - Type, Illinois, Mississippi, North Carolina, South Carolina, Texas).

Etymology: *vaccinii* = Latin, (on *Vaccinium*), for the host genus.
Comments: Boyd (1934) studied the ascomal ontogeny of this species and found that it forms a true perithecium with a paraphysate centrum.
References: Boyd, 1934 (Icon); Petrak, 1935; Hanlin, 1990c (Icon).

HOST INDEX

ANACARDIACEAE

Dracontomelon cumingianum Baill.
O. trichocarpa
Rhus diversiloba Torr. & A. Gray
O. tarda

ANNONACEAE

Rollinia emarginata Schlecht.
O. paraguariensis

ASTERACEAE

Tithonia rotundifolia (Mill.) S. F. Blake
O. tithoniae

BIGNONIACEAE

O. balansae
O. bignoniacearum

EHRETIACEAE

Cordia heterophylla Poir.
O. panamensis

ERICACEAE

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O. ferruginea
Cavendishia sp.
O. sydowii
Vaccinium arboreum Marsh.
O. vaccinii
Vaccinium ashei Reade
O. vaccinii
Vaccinium candicans Michx.
O. vaccinii
Vaccinium caracasanum H.B.K.
O. cuervoi
Vaccinium corymbosum L.
O. vaccinii
Vaccinium stamineum L.
O. vaccinii
Vaccinium tenellum Aiton
O. vaccinii
Vaccinium virgatum Aiton
O. vaccinii

FABACEAE

O. ulei
Lonchocarpus sp.
O. atromaculans
Tephrosia elongata E. Mey.
O. edax
Tephrosia suberosa DC.
O. edax

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O. edax
O. fici
Ficus carica L.
O. fici
Ficus jimenezius Standl.
O. galophila
Ficus sp.
O. floridanum

MYRSINACEAE

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MYRTACEAE

Eucalyptus goniocalyx F. Muell. ex Miq.
O. longispora

OCHNACEAE

Ochna pulchra Hook.
O. liebenbergii

ORCHIDACEAE

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O. orchidearum
Cattleya sp.
O. orchidearum
Laelia superbiens Lindl.
O. orchidearum
Laelia sp.
O. orchidearum
Odontoglossum uroskinneri Lindl.
O. orchidearum
Oncidium bicallosum Lindl.
O. orchidearum
Oncidium cavendishianum Batem.
O. orchidearum
Oncidium leucochilum Batem.
O. orchidearum
Oncidium splendidum A. Rich. ex Duch.
O. orchidearum
Phalaenopsis schillerianum Reichb. f.
O. orchidearum
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O. orchidearum
Sobralia sp.
O. orchidearum

PALMAE

O. palmicola

PLATANACEAE

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O. leucospila

PERIPLOCACEAE

Streptocaulon baumis Decne.
O. neurophila

FAMILY UNKNOWN

Unidentified plant
O. leptospora

GEOGRAPHIC DISTRIBUTION OF *OPHIODOTHELLA* SPECIES

AUSTRALIA
O. longispora

BRAZIL
O. atromaculans
O. balansiae
O. bignoniacearum
O. circularis
O. leptospora
O. orchidearum
O. ulei

COLOMBIA
O. cuervoi
O. orchidearum

COSTA RICA
O. galophila

ECUADOR
O. sydowii

GUATEMALA
O. orchidearum

GUYANA
O. palmicola

MEXICO
O. orchidearum

PANAMA
O. panamensis

PARAGUAY
O. paraguariensis

PHILIPPINES
O. neurophila
O. orchidearum
O. trichocarpa

PUERTO RICO
O. floridana

SOUTH AFRICA
O. edax
O. liebenbergii

SRI LANKA (CEYLON)
O. edax

UNITED STATES
O. ferruginea
O. fici
O. floridana
O. leucospila
O. tarda
O. vaccinii

VENEZUELA
O. orchidearum
O. tithoniae

ACKNOWLEDGMENTS

We thank Dr. James K. Mitchell, Extension Plant Pathologist, University of Arkansas, for permission to include his unpublished discovery of *O. vaccinii* in Arkansas. We also thank the staff of the Reference Department of the University of Georgia Science Library for their assistance in securing many of the references cited in this paper. The manuscript was reviewed by R. G. Roberts and A. Y. Rossman. This project was supported in part by funds from NSF Grant INT-8902172 and CONICIT Proyecto S1-2147 of Venezuela.

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MYCOTAXON

Volume XLIV, no.1, pp. 127-136 April-June 1992

TYPE STUDIES IN THE POLYPORACEAE - 23
SPECIES DESCRIBED BY C.G. LLOYD IN LENZITES, POLYSTICTUS, PORIA AND TRAMETES

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Abstract. 181 species described by C.G. Lloyd in Lenzites, Polystictus, Poria and Trametes have been reviewed and the type specimens examined. 130 names are synonyms of existing names, 26 are accepted, 15 names are illegitimate being homonyms of older names, the types for 9 names are sterile and two types are lost. The following new combinations are proposed: Skeletocutis biformis, Skeletocutis sensitivus, Climacodon dubitativus and Trametes glabrata.

Keywords. Basidiomycetes, Polyporaceae, C.G. Lloyd.

Introduction. This is the final paper in a series of papers treating the species C. G. Lloyd described in Polyporaceae s. lato. The reader is referred to the two published parts (Ryvarden 1989, 1990) for a general introduction to the series. As in the previous parts I have followed the Index of Stevenson and Cash (1936) which lists all his new names and combinations. In the Index there are references to the place of publication, Lloyd's collection number and other pertinent data concerning the types. To save space, this information is not repeated here although the country from where the species was described, is given after an abbreviated reference to where the name was published. L.M.W. means Lloyd Mycological Writings and the next digit refers to the volume of the bound version followed with a reference to the pertinent page and year.

In this paper the species are treated in the same way as in the Stevenson and Cash Index (1936), i.e. alphabetically according to specific epithet. The names of the accepted species have been written in bold face indicating the taxonomic disposition according to the author's opinion.

When a species is accepted taxonomically, it is cited in the appropriate genus with a reference to a recent description, or the species is described if no modern description seems to exist.

LENZITES

This name is now, according to the changes in the International Code of Botanical Nomenclature, article 76.4, to be treated as masculine. Thus, many familiar specific epithets in the genus have changed their conjugation. However, I have not changed Lloyd's original spelling.

abietis, L. LMW 6:909, 1920. USA
= Trichaptum laricinum (Karst.) Ryv.
albolutea, L. LMW 6:879, 1919. Java, Indonesia.
= Lenzites acutus Berk.
alborepanda, L. LMW 7:1224, 1923. South Africa.
= Trametes elegans (Spreng.:Fr.) Fr.
clelandii, L. LMW 6:887, 1919. Australia.
= Gloeophyllum trabeum (Fr.) Murr.
glabra L. LMW 5:811, 1918. Solomon Islands.
= Trametes elegans (Spreng.:Fr.) Fr.
huensis L. LMW 7:1106, 1922. China.
= Lenzites acutus Berk.
isabellina, L. LMW 7:1156, 1922. Philippine Islands.
= Lenzites betulinus (Fr.) Fr.
ochracea, L. LMW 7:1106, 1922. Brazil.
= Lenzites betulinus (Fr.) Fr.
pertenuis, L. LMW 7:1106, 1922. Philippine Islands.
= Lenzites betulinus (Fr.) Fr.
saepiformis, L. LMW 7:1273, 1924. Honduras.
= Gloeophyllum mexicanum (Mont.) Ryv.
yoshingae, L. LMW 7:1108, 1922. Japan.
= Lenzites vespaceus (Pers.) Ryv.

POLYSTICTUS

adustus, P. LMW. 5:659, 1917. USA.
= Trametes suaveolens (L.:Fr.) Fr.
aequus, P. LMW. 6:933, 1920. Tasmania.
= Trametes versicolor (L.:Fr.) Pil.
affinis-luteus, P. LMW. 7:1239, 1924. Papua.
= Microporus affinis (Blume & Nees:Fr.) Kunt.
affinis-microloma, P. LMW. 7:1239, 1924. Philippine Islands.
= Microporus affinis (Blume & Nees:Fr.) Kunt.
The type collection has not been found. The following collection, determined by Lloyd, is selected as neotype: Philippine Islands, Laguna, Los Banos Falls, Leg. O. Ocfemina Feb. 1919 (BPI - Lloyd collection).
albo-badius, P. LMW. 6:1038, 1921. Malaysia
= **Trametes albobadia** (Lloyd) Corner. For a description, see Corner 1989:66. Macroscopically this species resembles

Datronia caperata (Berk.) Ryv., but has much shorter spores.
albo-regularis, P. LMW. 7:1145, 1922. Japan.
= Trametes pocas (Berk.) Ryv.
albo-vestidus, P. LMW. 7:1192, 1923. Australia.
= Trichaptum biforme (Fr. in Kl.) Ryv.
anomalosus, P. LMW. 6:1007, 1920. Malaysia.
= nomen dubium. The type consists of a few small pieces of a sterile brown pileate species. It is badly contaminated by many foreign spores and bears all indications of being old and dead or treated with some chemical. Its identity is unknown to me and the name should be dropped from consideration.
anomalus, P. LMW 5:651, 1917. Sydney, Australia.
= Trichaptum byssogenum (Jungh.) Ryv.
arenicola, P. LMW. 5:651, 1917. USA
= Coltricia focicola (Berk. & Curt.) Murr.
argenteus, P. LMW. 7:1112, 1922. Zimbabwe.
= Coriolopsis floccosa (Jungh.) Ryv.
ater, P. LMW. 7:1314, 1924. Malaysia.
= Microporellus obovatus (Jungh.) Ryv.
bicolor, P. LMW. 6:1001, 1920. Singapore.
= **Skeletocutis bicolor** (Lloyd) Ryv. comb nov. Basionym as cited above.
Basidiocarp effused reflexed, pileus up to 4 mm wide, smooth, glabrous and pale brown, pore surface pale straw-coloured, pores small and angular, 6-7 per mm, margin white in parts cobwebby and 2-4 mm wide, tubes fragile concolorous with pore surface, 200 um deep, subiculum white cottony, less than 5o um thick.
Hyphal system dimitic, generative hyphae with clamps, hyaline and 2-4 um wide, skeletal solid to thick-walled, hyaline and in parts densely covered with crystals, especially in the dissepiments, cystidia not seen, basidiospores globose, hyaline, thin-walled and IKI-, 2.5-3 um in diameter. Known only from the type locality.
The dimitic hyphal system with clamped generative hyphae and encrusted skeletal hyphae and small spores, place this species in Skeletocutis as circumscribed in moderns floras.
conglomerus, P. LMW. 5:706, 1917.USA
= Trametes versicolor (L.:Fr.) Pil.
cuneato-brunneus, P. LMW 6:1005, 1917. Philippines.
= The type is lost.
decurrens, P. LMW. 3:12, 1908. USA
= Coltricia perennis (L.:Fr.) Murr.
doidgei, P. LMW. 7:1329, 1924. South Africa
= Trametes versicolor (L.:Fr.) Pil.
dubitativus, P. LMW. 7:1111, 1922. Philippine Islands.
= **Climacodon dubitativus** (Lloyd) Ryv. comb nov. Basionym as

cited above.
This species was later described by Maas Geesteranus (1971:135) as Climacodon efflorescens. The reader is referred to his detailed descriptions and illustrations.
eburneus, P. LMW 7:1331, 1924. Malaysia.
= The type is lost.
felipponei, P. LMW. 5:842, 1919. Uruguay
= Datronia caperata (Berk.) Ryv.
ferruginosus, P. LMW. 7:1242, 1924. Indonesia.
= Coltricia cinnamomea
flabellaris, P. LMW. 7:1316, 1924. Philippine Islands.
= Trametes menziesii (Berk.) Ryv.
flexibilis, P. LMW. 7:1111, 1922. Brazil
= Coriolopsis cf. telfarii (Kl.) Ryv. The type is sterile and there is of course a possibility that the American taxon has spores different from that of the paleotropics. C. telfarii was originally described on basis of a collection from Mauritius in the Indian Ocean.
formosae, P. LMW. 5:632, 1917. Taiwan.
= Earliella scabrosa (Pers.) Gilbn. & Ryv.
fusco-zonatus, P. LMW. 5:69, 1919. West Africa.
= Coriolopsis asper (Jungh.) Teng.
gilvocolor, P. LMW. 7:1239, 1924. Indonesia.
= Coriolopsis sanguinaria (Kl.) Ryv.
glabratus, P. LMW. 5:626, 1917. Japan.
= **Trametes glabrata** (Lloyd) Ryv. comb. nov. Basionym: Polystictus glabratus Lloyd, Lloyd Mycol. Writ. 5:626, 1917.
Basidiocarps annual, fanshaped to spatulate, up to 3 cm wide and long tapering to a semi-stipitate base, 1-4 mm in diameter, coriaceous when fresh, fragile when dry, upper surface glabrous, faintly zonate and somewhat radially furrowed in dry specimens, probably smooth when fresh, white when fresh, in the type ochraceous to wood-coloured, pore surface concolorous, uneven and larger pores subdivided into smaller, thin-walled and angular, approximately 2-3 per mm, context thin, whitish.
Hyphal system trimitic, generative hyphae with clamps, 2-4 um wide, skeletal hyphae thick-walled to solid, hyaline, 3-5 um wide, binding hyphae solid, tortuous, 1-3 um wide, cystidia and basidia not seen, basidiospores allantoid, hyaline and negative in Melzers reagent, 1-1.5 x 4-5 um.
Macroscopically this species is very similar to Trametes membrancea (Fr.) Kreisel from America, which however have wider and longer spores besides much smaller pores. It also resembles old glabrous specimens of Trichaptum biforme which have similar macroscopical characters. However, it is easily separated by having much larger spores and abundant cystidia

in the hymenium.
The whitish fanshaped basidiocarps with angular pores should make this species easy to recognize in the field.
glabro-rigens, P. LMW. 7:1145, 1922. Borneo.
= Coriolopsis sanguinaria (Kl.) Ryv.
glauco-effusus, P. LMW. 7:1152, 1922. South Africa.
= Coriolopsis floccosa (Jungh.) Ryv.
glaucoporus, P. LMW. 7:1334, 1925. Zimbabwe.
= Coriolopsis floccosa (Jungh.) Ryv.
hexagonoides, P. LMW. 5:820, 1919. Brazil.
= Datronia cf. stereoides (Fr.) Ryv. The type is sterile and badly developed, but macroscopically it may represent and old and dead specimen of this species.
houstonii, P. LMW. 6:897, 1919.USA.
= Phylloporia chrysita (Berk.) Ryv.
hunteri, P. LMW. 7:1315, 1924. Ghana.
= Trametes menziesii Berk.) Ryv.
hutchingsii, P. LMW. 7:1316, 1924 India.
= Trametes menziesii (Berk.) Ryv.
imbricatus, P. LMW. 5:791, 1918. Australia.
= Trametes membranacea (Sw.:Fr.) Kreisel
immaculatus, P. LMW. 7:1110, 1922. Ecuador.
= Trametes sp. sterile and badly developed.
incisus, P. LMW. 7:1155, 1922. Philippine Islands.
= Microporellus obovatus (Jungh.) Ryv.
lamii, P. LMW. 7:1240, 1924. Indonesia.
= Trametes menziesii (Berk.) Ryv.
lavendulus, P. LMW. 7:1121, 1922. USA.
= Trichaptum biforme (Fr. in Kl.) Ryv.
lignicola, P. LMW. 5:696, 1917. Brazil.
= Amauroderma sp., an immature and sterile specimen.
luteo-affinis, P. LMW. 6:1001, 1920. Angola.
= Microporus affinis (Blume & Nees:Fr.) Kunt.
macuonii, P. LMW. 4:53, 1914. Canada.
= Trametes versicolor (L.:Fr.) Pil.
minutoporus, P. LMW. 7:1317, 1924. Japan.
= Trametes versicolor (L.:Fr.) Pil.
oblectabilis, P. LMW. 3: 164, 1912. Brazil.
= **Coltricia oblectabilis** (Lloyd) Ryv. For a description, see Ryvarden & Johansen 1980.
oblivionis, P. LMW. 3:164, 1912. Brazil.
= Coltricia hamata (Rom.) Ryv.
ochraceo-stuppeus, P. LMW. 5:63, 1916. Australia.
= Bjerkandera adusta (Fr.) Karst.
ochrohirsutus, P. LMW. 7:1233, 1923. Japan.
= Trametes hirsuta (Fr.) Pil.
ochrotenuis, P. LMW. 7:1318, 1924.Malaysia.

= Trametes menziesii (Berk.) Ryv.
pallidus, P. LMW. 7:1006, 1920. Malaysia.
= Microporus microloma (Lév.) Kunt.
This is a species related to M. affinis and mainly separated by a much paler pileus and more allantoid spores, i.e. 4.5-5 x 1.2 um (M. affinis: 3-4 x 1.5-2 from African sporeprint).
proliferus, P. LMW. 3:8, 1908. Ohio.
= Coltricia perennis (L.:Fr.) Murr.
prosector, P. LMW. 7:1147, 1922. China
= Trichaptum biforme (Fr.) Ryv,
pseudoperennis, P. LMW. 3:53, 1910. Philippine Islands.
= Microporus affinis (Blume & Nees:Fr.) Kunt.
purus, P. LMW. 7:1158, 1922. Indonesia.
= Trametes marianna (Pers.) Ryv.
rarus, P. LMW. 6:997, 1920. USA.
= Trametes conchifer (Schw.:Fr.) Pil.
roseoporus, P. LMW. 7:1331, 1924. Malaysia.
= Microporus affinis (Blume & Nees:Fr.) Kunt.
rufo-rigidus, P. LMW. 7:1330. 1924. Australia.
= Polyporus grammocephalus Berk.
scopulosus, P. LMW. 5:843, 1919. Japan.
= Microporus microloma (Lév.) Kunt.
sebesiei, P. LMW. 7:1240, 1924. Indonesia
= Microporus microloma (Lév.) Kunt.
semiincrustans, P. LMW. 7:1236, 1923. USA.
= Trichaptum abietinum (Fr.) Ryv.
semisanguineus, P. LMW. 4:39, 1912. Singapore.
= Pycnoporus puniceus (Fr.) Ryv.
sepia, P. LMW. 7:1155, 1922. Philippine Islands.
= Microporus xanthopus (Beauv.: Fr.) Kunt.
similis, P. LMW. 7:1159, 1922. Indonesia
= Earliella scabrosa (Pers.) Gilbn. & Ryv., a badly developed specimen.
striatulus, P. LMW. 6:890, 1919. Philippine Islands.
= Microporus microloma (Lév.) Kunt.
subaffinis, P. LMW. 4:550, 1916. Japan.
= Microporus microloma (Lév.) Kunt.
subcaperatus, P. LMW. 6:996, 1920. Australia
= Datronia daedaleoides (Berk.) Ryv.
subiculoides P. LMW. 7:1331, 1924. South Africa.
= Schizopora flavipora (Cooke) Ryv.
subochraceus, P. LMW 7:1191, 1923. Brazil.
= Trametes cotonea (Pat. & Har.) Ryv.
subpictus, P. LMW. 4:43, 1912. Japan.
= Coltricia cinnamomea (Pers.) Murr. infected by an imperfect fungus.

subreflexus, P. LMW. 6:884, 1919. Philippine Islands.
= Protomerulius substuppeus (Berk. & Curt.) Ryv.
tenuiculus, P. LMW. 7:1155, 1922. Sri Lanka.
= Polyporus philippinensis Berk.
turgidus, P. LMW. 7:1193, 1923. Borneo.
= Mollicarpus cognatus (Berk.) Ginns.
xantho-concinnus, P. LMW 5:618, 1916. South Africa.
= **Podoscypha xantho-concinna** (Lloyd) Reid.
For a description, see Reid 1975:80.

PORIA
cylindrospora, P. LMW. 5:65, 1917. USA.
= Phellinus ferreus
orchidaceae, P. LMW 7:1241, 1924. Indonesia.
= Sterile and infected.
pulvinata, P. LMW. 7:1196, 1923. Zaire.
= Loweporus inflexibilis (Berk.) Ryv.
xylina,P. LMW 5:630, 1917. Japan.
= Leucophellinus irpicoides (Pil.) Bond.

TRAMETES
albotexta, T. LMW. 5:614, 1916.
= **Ischnoderma albotexta** (Lloyd) Reid.
For a description, see Reid 1975.
borneoensis, T. LMW. 7:1113, 1922. Sarawak
= Coriolopsis sp. The type is sterile. It may represent a prior name for one of the many species in Trametes (s. lato) recently described by Corner from South-East Asia (Corner 1989).
brunneo-flava, T. LMW 7:1113. Costa Rica
= Trametes cubensis (Mont.) Sacc.
farcta, T. LMW. 4:?, 1915. Brazil.
= Phellinus viticola (Schw.) Donk
gilvoides, T. LMW. 4:520, 1912. USA.
= Phellinus viticola (Schw.) Donk
guatemalensis, T. LMW. 6:1091, 1921. Guatemala.
= Trametes elegans (Spreng.:Fr.) Fr.
karii, T. LMW. 7:1148, 1922. India.
= Trametes lactinea Berk.
krekei, T. LMW. 5:69, 1919. USA
= Spongipellis delectans (Pk.) Murr.
lacerata, T. LMW. 5:604, 1916. USA
= Irpex lacteus Fr.
morganii, T. LMW. 5:69, 1919. USA
= Antrodia serialis (Fr.) Donk.
nigroaspera, T. LMW. 7:1272, 1924. Japan.
= Daedaleopsis confragosa (Bolt.: Fr.) Schroet.
nigro-plebeia, T. LMW. 7:1113, 1922. Sarawak.

= Fomitopsis dochmius (Berk.) Ryv.
obscurotexta, T. LMW. 7:1271, 1924. Angola.
= Coriolopsis floccosa (Jungh.) Ryv.
ochrolignea, T. LMW. 5:63, 1916. South Africa.
= Coriolopsis polyzona (Pers.) Ryv.
pusilla, T. LMW. 5:774, 1918. USA.
= Trametes pubescens (Fr.) Pilat.
quercina, T. LMW. 7:1114, 1922. USA.
= Trametes pubescens (Fr.) Pilat.
retropicta, T. LMW. 7:1113, 1922. Malaysia.
= Coriolopsis sanguinaria (Kl.) Teng.
roseoporus, T. LMW. 7:1116, 1922. Brazil.
= Loweporus roseo-albus (Jungh.) Ryv.
roseo-zonata, T. LMW. 7:1144, 1922. Japan.
= Fomitopsis cajanderi (Karst.) Kotl. & Pouz.
rufescens, T. LMW. 5:69, 1919. USA.
= Trametes cubensis (Mont.) Sacc.
rugoso-picta, T. LMW. 6:1039, 1921. Ecuador.
= Trametes cubensis (Mont.) Sacc.
sensitiva, T. LMW. 5:710, 1917. Japan.
= **Skeletocutis sensitiva** (Lloyd) Ryv. comb. nov. Basionym: Trametes sensitiva Lloyd, Lloyd Mycol. Writ. 5:710, 1917.
Basidiocarp effused reflexed to resupinate,adnate and tough when dry, up to 10 cm in diameter in effused specimens, up to 10 mm thick, pileus usually narrow, 1 cm wide, smooth, glabrous, margin lifted in dry specimens, distinct and rounded, pore surface cream to beige with a slight rosy tint, pores round 4-5 per mm, tubes concolorous, context white and very thin.
Hyphal system di to trimitic, generative hyphae with clamps, 2-3 um in diameter, skeletal hyphae dominating, solid, hyaline, 3-4 um in diameter, in the dissepiments heavily encrusted with fine grainy crystals, a few sparingly branched binding hyphae observed, solid and hyaline, 2-3 um wide.
Basidia and cystidia not seen, basidiospores ellipsoid, smooth, thin-walled, negative in Melzers reagent, difficult to observe in most specimens, 3-3.5 x 4-4.5 um.
Causes a white rot in hardwoods. Widespread in Japan.
The species is placed in Skeletocutis because of the hyphal structure with encrusted skeletal hyphae, the small hyaline spores and the white rot.
stowardii, T. LMW. 5:683, 1917. Australia.
= Trametes lilacino-gilvus Berk.
subflava, T. LMW. 5:66, 1917. South Africa.
= **Oxyporus subflava** (Lloyd) Reid.
For a description, see Reid 1973.
submínima, T. LMW. 6:1060, 1921. Australia.

= Trametes sp. The type is sterile and immature.
sulcata, T. LMW. 7:1146, 1922. Brazil.
= **Navisporus sulcatus** (Lloyd) Ryv.
For a description, see Gilbertson & Ryvarden 1987:451.
tenuo-rosea, T. LMW. 7:1193, 1923. Malaysia.
= Fomitopsis feeii (Fr.) Kreisel.
transmutans, T. LMW. 6:996, 1920. Singapore.
= Lenzites acutus Berk.
truncata, T. LMW. 7:1156, 1922. Philippine Islands.
= **Perenniporia truncata** (Lloyd) Ryv.
Basidiocarps pileate, sessile, effused, reflexed, individual pilei small imbricate, up to 2 cm wide and 4 cm long along the substrate, pilei triquetrous in section, up to 1 cm thick at the base, woody, upper surface glabrous, warted to scrupose, black at the base, olivaceous towards the margin, margin along effused part narrow and black, pore surface ochraceous to pale dirty brown, pores round and entire on horizontal parts, 3-4 per mm, elongated and partly sinuous on sloping parts, tubes concolorous, up to 8 mm deep, context dense, ochraceous, up to 4 mm thick.
Hyphal system trimitic, generative hyphae with clamps, 2-3 um wide, binding hyphae of the Bovista type, arboriform, solid to thick-walled, slightly dextrinoid, 3-6 um wide, cystidia and basidia not seen, basidiospores truncate, subglobose, thick-walled, slightly dextrinoid, 6-7.5 x 4.5-5.5 um.
This is a highly characteristic species with the partly black pileus and the strongly branched arboriform binding hyphae. The spores are close to those seen in Perenniporia medulla-panis (Fr.) Donk, which however is a strictly resupinate species and with rather narrow, and non-dextrinoid, sparingly branched skeletal hyphae.
truncatospora, T. LMW. 5:853, 1919. Japan.
= **Perenniporia truncatospora** (Lloyd) Ryv.
For a description, see Ryvarden, Liang-Wang, Ji-ding 1986:228.
varia, T. LMW. 7:1114, 1922. Australia.
= Polyporus fusco-lineatus Berk. & Broome.
violacea, T. LMW. 4:342, 1915. South Africa.
= Nigroporus vinosus (Berk.) Murr.
vitrea, T. LMW. 5:69, 1919. Singapore.
= Fomitopsis feeii (Fr.) Kreisel.

Acknowledgements
I am grateful to Dr. T. Niemelä of the Helsinki University, Finland, who has critically read the manuscript and suggested improvements. I also express my thanks to Dr. T. Hattori of the Forest and Forestry Products Research Institute, Tsukuba, Japan who has supplied recent collections of Trametes sensitiva Lloyd.

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Maas-Geesteranus, R. 1971: Hydnaceous fungi of the eastern old world. Kon. Nederl. Akad. Wetens. Afd. Naturk. Ser. 2, part 60, no 3:1-176.
Reid, D. 1975: Type studies of the larger Basidiomycetes described from Southern Africa. Contr. Bolus Herb.7:1-255.
Ryvarden, L. Liang-Wang, X. & Ji-ding, Z. 1986: A note of the Polyporaceae in the Chang Bai Shan forest reserve in Northeastern China. Acta Mycol. Sinica 5:226-234.
Ryvarden, L. 1989: Type studies in the Polyporaceae 21. Species described by C. G. Lloyd in Cyclomyces, Daedalea, Favolus and Hexagonia. Mycotaxon 35:229-236.
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MYCOTAXON

Volume XLIV, no. 1, pp. 137-154 April-June 1992

REDISPOSITION OF APOSPHAERIA AMARANTHI IN MICROSPHAEROPSIS[1]

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ABSTRACT

Isolates of *Aposphaeria amaranthi* Ell. & Barth., from *Amaranthus* species, are compared with the type species of the genus, *Aposphaeria pulviscula* (Sacc.) Sacc., and with *Phoma betae* Frank, *Phoma herbarum* Westd., *Microsphaeropsis centaureae* Morgan-Jones, and *Microsphaeropsis olivacea* (Bonorden) Höhnel. *Aposphaeria amaranthi* is reclassified in the genus *Microsphaeropsis* and renamed *Microsphaeropsis amaranthi* (Ell.& Barth.) Heiny & Mintz with a complete description.

INTRODUCTION

The genus *Aposphaeria* Sacc. includes approximately 200 species (Sutton, 1980), most of which grow on woody plants. Many of the species included are poorly described and may not be congeneric with the type, *Aposphaeria pulviscula* (Sacc.) Sacc. (Saccardo, 1880). Thaxter (1922) and Sprague (1962) both commented on the need for a revisionary treatment, but many *Aposphaeria* species must be studied in greater detail to facilitate any future revision.

In September 1987, a fungus (isolate #843; IMI #327754) was isolated from a diseased *Amaranthus* species (pigweed), collected by A. S. Mintz at the University of Arkansas

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Agricultural Experiment Station Farm, Fayetteville, Arkansas, and was subsequently determined to have potential as a biocontrol agent on pigweed species, especially *Amaranthus albus* L. (Mintz, 1991; Mintz *et al.*, 1992). The fungus was identified as *Aposphaeria amaranthi* Ell. & Barth., previously collected in Rooks County, Kansas, June 21, 1895, on dead stems of *Amaranthus retroflexus* L. (Ellis and Bartholomew, 1896). The type specimen of *A. amaranthi* from the Bartholomew collection was loaned to us by the Farlow Herbarium (FH) of Harvard University, Cambridge, Massachusetts. To our knowledge, *A. amaranthi* has not been discussed in the literature since Saccardo (1899) listed the species with a Latin description, and no illustrations exist in the literature. *Aposphaeria amaranthi* was probably assigned to the genus initially because its pycnidia are superficial on plant tissue, a criterion employed to distinguish some pycnidial fungi from *Phoma* and *Phyllosticta* (Sprague, 1962). Modern taxonomic standards for distinguishing *Phoma* species are based on morphological and cultural characteristics (Sutton, 1980). We believe that *A. amaranthi* closely matches the characteristics of *Phoma* species, a heterogeneous group, but is more appropriately classified in *Microsphaeropsis*. In this report we present a comparison of our *A. amaranthi* isolates to the type collected nearly a century earlier, and propose a new name combination for the species.

MATERIALS AND METHODS

Two isolates of *A. amaranthi* (private collection #843 and #969) were used to demonstrate variation within the species. Other cultures studied included *Phoma betae* Frank (ATCC #24635) (Boerema and Dorenbosch, 1973), *Phoma herbarum* Westd. (ATCC #12569), the type species of the genus (Morgan-Jones, 1988), *Microsphaeropsis centaureae* Morgan-Jones (ATCC #32058), and *Microsphaeropsis olivacea* (Bonorden) Höhnel (ATCC #62198), the type species for the genus. Cultures of the *A. amaranthi* isolates were grown on three replicate plates of each of five media at 20 or 25°C with 12 hours of fluorescent light each day (General Electric Cool White, lighted incubator Model 1-35VL, Percival Mfg. Co., Boone, IA) or in darkness in ventilated black boxes in the same incubator. The media included the following: oatmeal agar (Difco Laboratories), prepared one-half strength, replacing the agar; potato dextrose agar (Difco Laboratories), acidified with four to five

drops of 25% lactic acid per 100 ml of melted media (Tuite, 1969); malt extract agar (Difco Laboratories); cellulose agar (Eggins and Pugh, 1962), substituting Sigmacell Type 20 microcrystalline cellulose (Sigma Chemical Company) for cotton cellulose powder (Morgan-Jones and White, 1983) and doubling the agar; and pea juice agar (Weidemann *et al.*, 1988) using only 18 g agar per liter. Agar disks, 5 mm in diameter, were taken from 7-day-old oatmeal agar spread plate cultures and inverted in the center of each plate. Colony characteristics and radial growth rates were observed at 7 and 14 days. Lesions on stems of *Amaranthus albus* inoculated with conidia of *A. amaranthi* were surface-sterilized and incubated as above in a humid chamber for 7 to 10 days to promote pycnidial development. Pycnidia from oatmeal agar cultures were also air-dried for comparison to the dried type specimen of *A. amaranthi*. Dried specimens of *A. pulviscula* (#1546, #1299) were obtained from the Royal Botanic Gardens at Kew, England, and dried specimens of *P. betae* (IMI 70665, 193078, 297878) were loaned from the International Mycological Institute, England. Pycnidia were fixed in Karnovsky's fixative (Karnovsky, 1965), embedded in JB-4 resin (Polysciences, Inc., Warrington, PA), sectioned with a glass knife, stained with Lugol's iodine (Tuite, 1969) followed by 1% aniline blue in 90% ethanol, washed, and mounted in Plastic Mount Mounting Media (Polysciences, Inc.).

Dimensions of at least 15 conidia and pycnidia mounted in lactophenol were measured from cultures grown in light as described above at 25°C on oatmeal agar for each isolate of *A. amaranthi*. Agar blocks of cultures were exposed to ammonia vapors or treated with 1 N NaOH for observation of pigment change, a defining characteristic for some *Phoma* species (Dorenbosch, 1970). To study conidial germination, conidia diluted in water were spread over a washed cellulose membrane on 1.5% water agar and incubated at 20 or 25°C with light for intervals as indicated in the figures.

RESULTS AND DISCUSSION

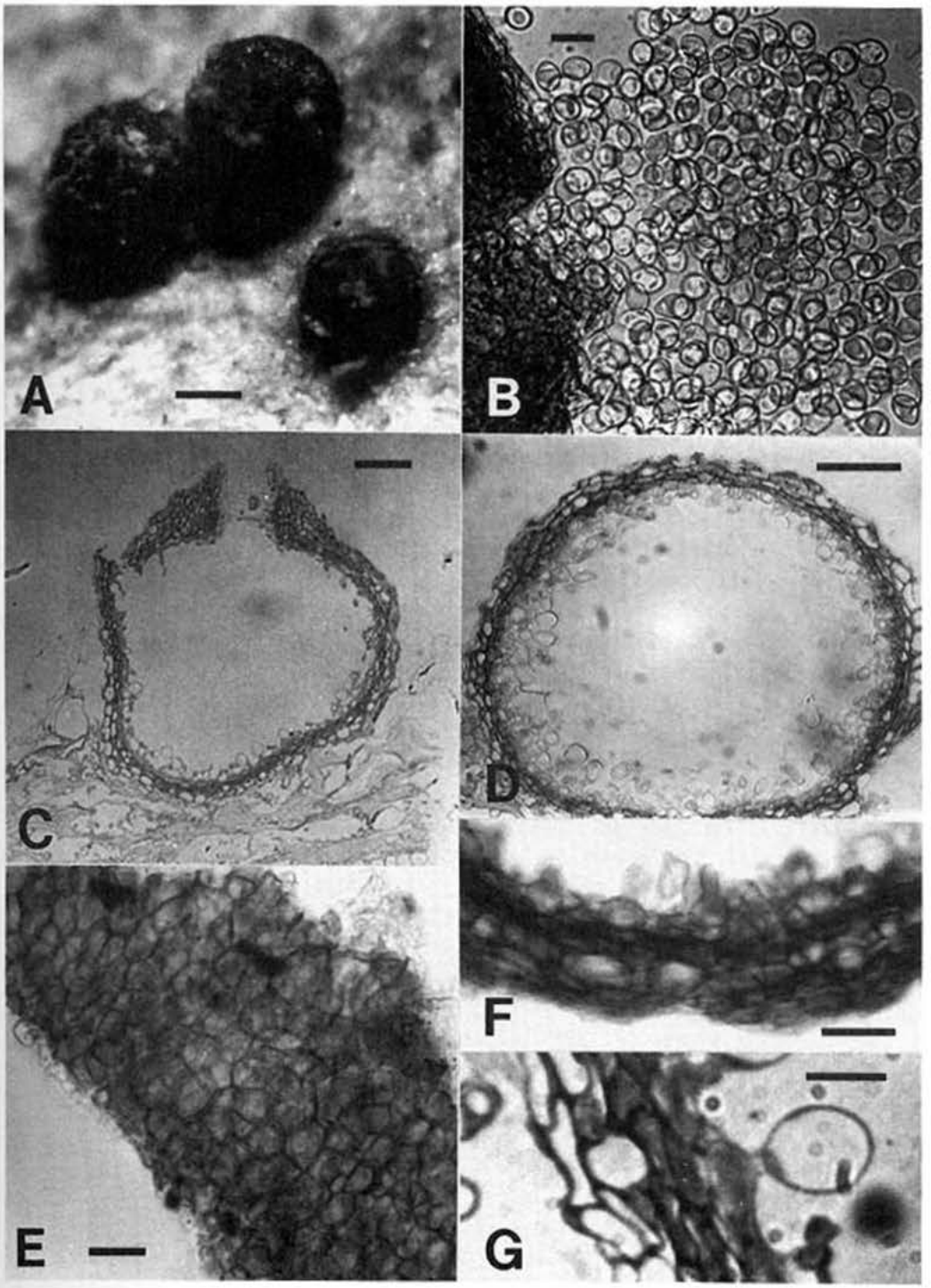
Morphological characteristics of isolate #843, which were similar to characteristics of #969, closely matched those of the type of *A. amaranthi* (Figs. 1, 2). Dried pycnidial cells of #843 (Fig. 2) were more similar to the pycnidial cells from the *A. amaranthi* type specimen (Fig. 1) than cells from fresh pycnidia of #843. Slight

differences in the appearance of pycnidial walls of isolate #843 compared to the type of *A. amaranthi* were probably due to differences in maturity and melanization dependent on substrate and environment, since the type specimen was preserved on mature, dead pigweed stems collected in nature. Relative hydration at the time of fixation was also a factor in cell appearance (Figs. 1, 2).

The morphology of *A. amaranthi* differs from the type, *A. pulviscula* (Sutton, 1980), in several respects. Conidiophores, which are branched and septate in *A. pulviscula*, are absent in *A. amaranthi* and are replaced by phialidic conidiogenous cells. The outer pycnidial wall is more organized and smooth in *A. amaranthi*, the inner layer of hyaline cells is not pronounced, and the inner-layer cell size is not substantially different from the outer-layer cell size (Figs. 1, 2). In contrast, the inner layer of the pycnidial wall of *A. pulviscula* has distinctly smaller cells than the outer layer (Fig. 3; Sutton, 1980). The hyaline conidia of *A. pulviscula* are nearly cylindrical, whereas conidia of *A. amaranthi* are oval or almost spherical. Because we were unable to obtain living cultures of *A. pulviscula* and published accounts are incomplete, we cannot comment on spore color in mass for this species. However, cultures of other species of *Aposphaeria* reportedly produce yellowish cream-colored masses of conidia (Chesters, 1938).

Dennis (1946) first noted the need for comparison of *Phoma*-like species under uniform conditions on artificial media and began the tradition, followed by subsequent authorities (Boerema and Dorenbosch, 1973; Morgan-Jones and White, 1983), of publishing photographs of colonies on media. Oatmeal agar and malt extract agar were favored by Boerema for study of *Phoma*-like species, while Morgan-Jones routinely used potato dextrose agar, malt extract agar and cellulose agar at 20 and 25°C for cultural

FIGURE 1. *Aposphaeria amaranthi* type specimen. A. Pycnidia on pigweed stem. Bar = 100 μm. B. Conidia mounted in lactophenol. Bar = 20 μm. C. Longitudinal section of pycnidium on pigweed stem. Bar = 50 μm. D. Section of pycnidium. Bar = 50 μm. E. Textura angularis in pycnidial wall. Bar = 20 μm. F. Cross section of pycnidial wall revealing conidiogenous cell layer. Bar = 20 μm. G. Conidiogenous cell and developing conidium. Bar = 10 μm.


A
B
C
D
E
F
G

comparisons. In this paper, pea juice agar was included because it promoted abundant sporulation (Table 1).

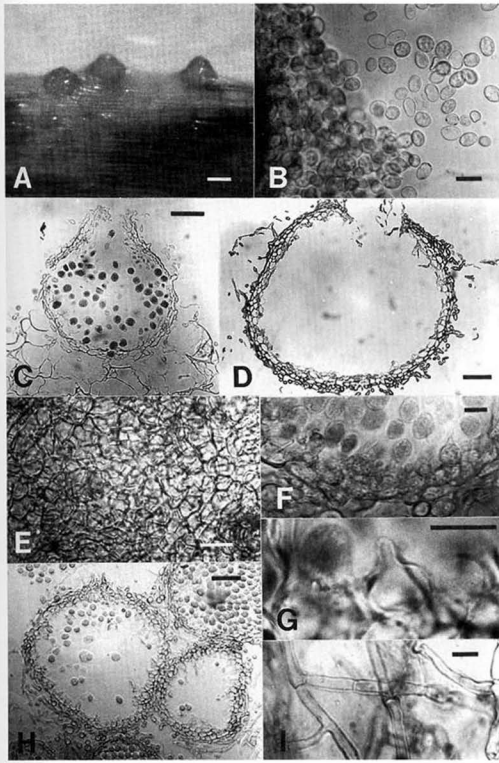
Aposphaeria amaranthi sporulated on several media in 5 to 9 days. Colonies generally grew faster at 25°C than at 20°C (Table 1) and varied in appearance on different media (Fig. 4). Cultures of *A. amaranthi* were similar in pigmentation and general appearance to cultures of *P. betae*, especially on oatmeal agar (Fig. 5) and pea juice agar, but *P. betae* conidia in mass remained beige or pastel orange rather than darkening to buff or green as observed for *A. amaranthi* (Table 2). Exposure to light generally increased pigmentation. *Microsphaeropsis centaureae* developed slowly at 25°C (Fig. 5). However, after 2 weeks on oatmeal agar at 23°C, *M. centaureae* cultures were similar in appearance to *A. amaranthi* cultures, except that conidia in mass were much darker in *M. centaureae* cultures.

The two isolates of *A. amaranthi* differed slightly in appearance on the various media (Table 2). Isolate #843 cultures frequently sectored or developed with uneven margins or at different rates.

Overall, conidia of isolate #969 were slightly smaller than conidia of isolate #843 (Table 2). *Phoma amaranthi* Brun. and *Phoma amaranthicola* Brun. were previously listed on *Amaranthus albus* and *Amaranthus spinosus* L., respectively (Saccardo, 1895). Conidial dimensions for *P. amaranthi* (7-8 × 3 μm) and *P. amaranthicola* (2-3 × 1.5-2 μm) eliminate any possibility of either of these being conspecific with *A. amaranthi*. Conidia of *A. amaranthi* were similar in shape to conidia of *P. betae*, *M. olivacea*, and *M. centaureae*, but were distinctly larger (Fig. 6).

As described for *P. betae* (Booth and Cornford, 1959), conidia of *A. amaranthi* often germinated by first forming a subglobose vesicle that later produced a germ tube or a second vesicle (Fig. 6). Sometimes a septum developed

FIGURE 2. Isolate #843. A. Pycnidia developing on pigweed stem. Bar = 100 μm. B. Conidia mounted in lactophenol. Bar = 20 μm. C. Longitudinal section through pycnidium on pigweed stem. Bar = 50 μm. D. Section of air-dried pycnidium from oatmeal agar. Bar = 50 μm. E. Textura angularis in pycnidial wall. Bar = 20 μm. F. Cross section of pycnidial wall. Bar = 10 μm. G. Conidiogenous cell. Bar = 10 μm. H. Section of pycnidia from culture. Bar = 50 μm. I. Hyphae from culture. Bar = 10 μm.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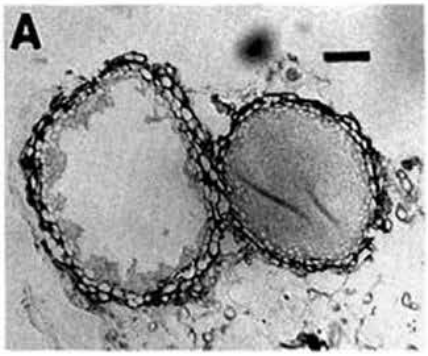


FIGURE 3.
A. Section through *Aposphaeria pulviscula* pycnidia. Bar = 20 μm.

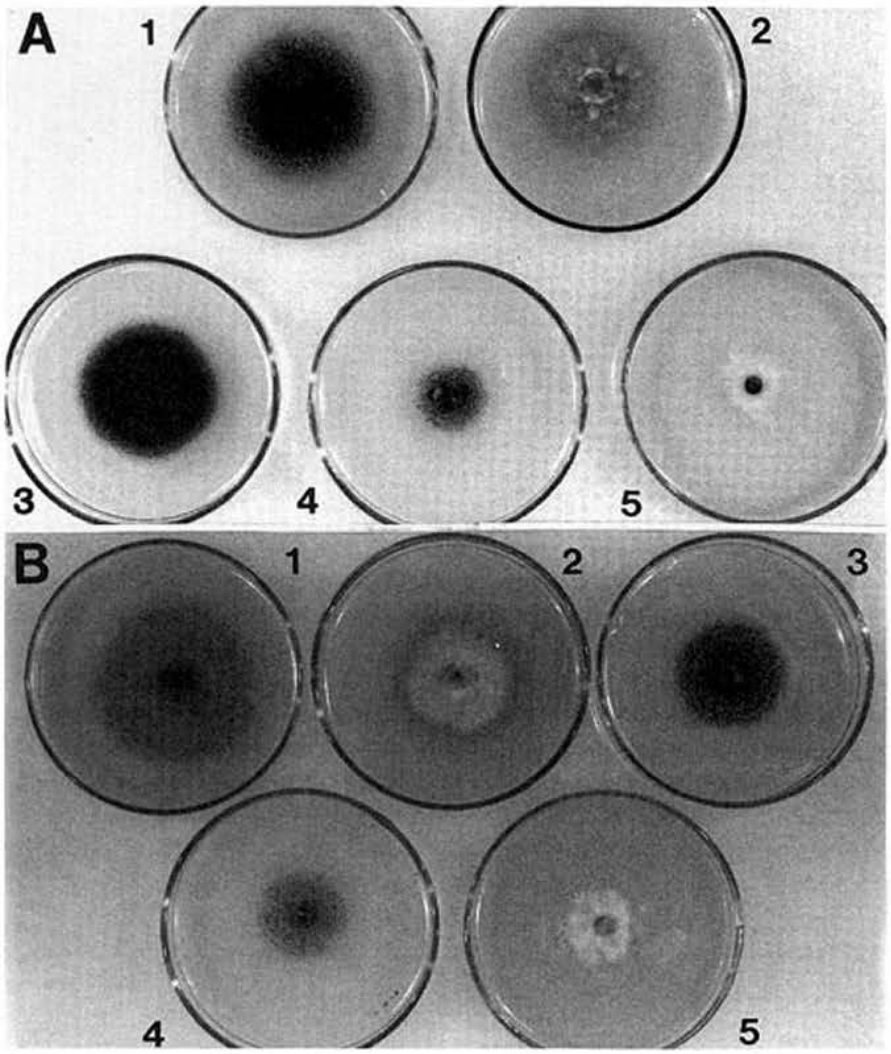


FIGURE 4. A, B. Isolate #969 incubated in darkness for 7 days at 20°C (A) and 25°C (B). 1. Oatmeal agar. 2. Pea juice agar. 3. Potato dextrose agar. 4. Malt extract agar. 5. Cellulose agar.

TABLE 1

Mean colony diameters of two *Aposphaeria amaranthi* isolates at 20 or 25°C in darkness or with 12 hours of light per day.

		Oatmeal Agar[a]		Malt Extract Agar[a]		Potato Dextrose Agar[a]		Cellulose Agar[b]		Pea Juice Agar[c]	
		light	dark	light	dark	light	dark	light	dark	light	dark
		(cm)		(cm)		(cm)		(cm)		(cm)	
20°C											
Isolate #969	1 wk	5.2	4.5	3.0	2.7	4.9	4.9	2.6[d]	2.4[d]	3.7	3.4
	2 wk	9.0	8.8	5.6	5.6	8.8	8.5	6.3[d]	4.1[d]	6.5	6.0
Isolate #843	1 wk	3.2	2.2[d]	2.2	1.7[d]	2.5	2.1[d]	0.9[d]	1.8[d]	3.2[d]	3.5[d]
	2 wk	3.4	4.0[d]	4.8	3.1[d]	5.9	5.5[d]	1.5[d]	2.0[d]	5.4[d]	5.8
25°C											
Isolate #969	1 wk	5.7	5.5	3.9	3.3	5.1	4.9	2.2	3.1[d]	4.3	4.3
	2 wk	9.0	9.0	7.0	6.4	7.4	8.5	6.1	6.9[d]	7.7	7.7
Isolate #843	1 wk	2.5	2.5	2.0	1.7[d]	2.8	1.8[d]	0.6[d]	0.8[d]	3.1	3.0[d]
	2 wk	5.8	4.9	4.9	2.2[d]	6.3	4.8[d]	1.4[d]	2.2[d]	6.2	5.6[d]

[a]Difco Laboratories, Detroit, MI 48232. Oatmeal agar prepared one-half strength and agar replaced. Potato dextrose agar acidified with lactic acid (Tuite, 1969).

[b]Eggins and Pugh (1962), substituting Sigmacell Type 20 microcrystalline cellulose (Sigma Chemical Company, St. Louis, MO) for ball-milled Whatman's cotton cellulose powder and doubling the agar.

[c] 400 ml of liquid from commercial, salt-free, canned peas, and 18 g agar per liter of medium (modified recipe of Weidemann *et al.*, 1988).

[d] No sporulation.

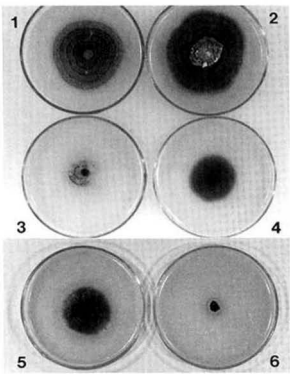


FIGURE 5.
Cultures on oatmeal agar incubated in light at 25°C for 7 days.

1. *Phoma betae*.
2. Isolate #969.
3. Isolate #843.
4. *Phoma herbarum*.
5. *Microsphaeropsis olivacea*.
6. *Microsphaeropsis centaureae*.

within the conidium during or following germination, and germ tubes were septate. *P. herbarum* also produced a vesicle similar to the conidium in size and shape prior to germ tube formation (Fig. 6). However, conidia of *M. olivacea*, and, less frequently, *M. centaureae* produced vesicles in the same manner, so the process suggests similarities rather than differences between the two genera. Conidia of *M. centaureae* typically did not germinate on the cellulose membrane, but germinated on agar media.

Conidia and hyphal strands of *A. amaranthi* produced fusion pegs with each other and with hyphae. Brown extracellular deposits were produced in older cultures of isolates #843 and #969, especially on hyphae immersed in malt extract agar or pea juice agar (Fig. 7). Extracellular deposits were not observed in cultures of the other species in the study. Isolates #843 and #969 also produced occasional intercalary chlamydospore-like cells within hyphae immersed in media (Fig. 7).

The thin-walled pycnidia, lack of conidiophores, and phialidic conidiogenous cells of *A. amaranthi* suggest closer affiliation with *Phoma* or *Microsphaeropsis* species

TABLE 2

Cultural and morphological characteristics of two *Aposphaeria amaranthi* isolates.

	Pycnidia Diameter* (μm)	Range (μm)	Conidia Dimensions* (μm)	Range (μm)	Colony Pigment (25°C, Darkness)[b]	Spore Color in Mass	Ammonia or NaOH Effect on Pigment in Agar
Isolate #969	273	200-400	12.6 × 11.3	8.0-15.9 × 8.0-11.8	yellowish olive green	beige, becoming greenish with age on oatmeal agar	changes from mustard to red, then dark brown
Isolate #843	351	140-480	15.4 × 12.2	10.2-22.0 × 9.1-15.6	white to pale pastel orange on pea juice agar or at 20°C; gray to olive green on other media	beige to yellow; pale buff on pea juice agar	changes from colorless to yellow or pale brown

* Average of fifteen.

[b] Pigment intensifies when cultures are grown in light.

than with *A. pulviscula*. The relatively large pycnidia (133-567 μm) and broad conidia (Byford and Gambogi, 1985) of *P. betae* suggest relatedness with *A. amaranthi*. Conidia of *Phoma capitulum* Pawar, Mathur & Thirum. are also subglobose to ellipsoid (Sutton, 1980). *Aposphaeria*

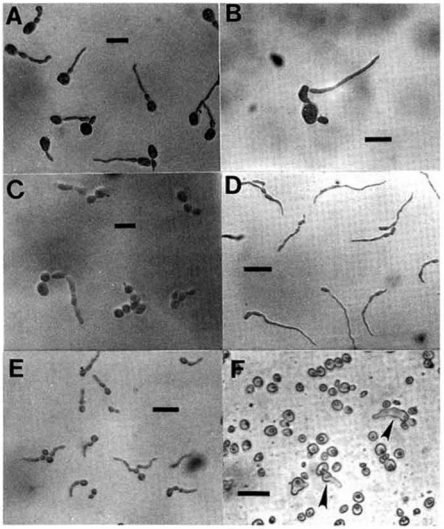


FIGURE 6. Germination of conidia. A-E: Conidia and hyphae incubated on cellulose membrane over water agar, stained with lactophenol cotton blue. A. Isolate #969, 5 hours, 25°C. Bar = 20 μm. B. Isolate #843, 8 hours, 20°C. Bar = 20 μm. C. *Phoma betae*, 8 hours, 20°C. Bar = 10 μm. D. *Phoma herbarum*, 8 hours, 20°C. Bar = 20 μm. E. *Microsphaeropsis olivacea*, 29 hours, 25°C. Bar = 20 μm. F. *Microsphaeropsis centaureae*, 18 hours, 23°C, unstained on potato dextrose agar. Bar = 20 μm.

amaranthi also shares characteristics with *Microsphaeropsis*, another genus undergoing revision (Morgan-Jones and White, 1987). Pycnidial fungi with small, pigmented, unicellular conidia produced from phialides are classified in *Microsphaeropsis* (Morgan-Jones, 1974). Conidia of *A. amaranthi* appear hyaline and lack the dark pigmentation of species such as *Microsphaeropsis concentrica* (Desm.) Morgan-Jones, which produces conidiomata that exude blackish conidial masses (Morgan-Jones and White, 1987). However, the conidia of *A. amaranthi* appear to have slightly thickened walls with a yellowish pigmentation. The pale green pigmentation in mass indicates greater similarity to *Microsphaeropsis* than to *Phoma*. *Microsphaeropsis centaureae*, for example, has conidia described as pale brown to yellowish-brown (Morgan-Jones, 1974). The conidia of many *Microsphaeropsis* species have surface ornamentation, but the type, *M. olivacea*, produces conidia with smooth walls

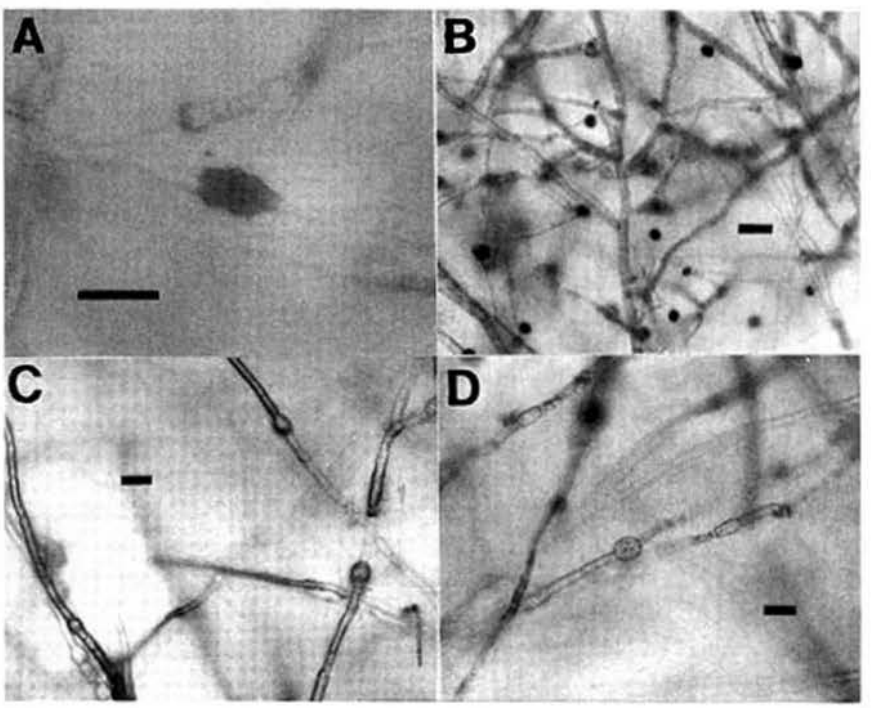


FIGURE 7. A. Extracellular deposit on hypha of isolate #969 immersed in malt extract agar. Bar = 20 μm. B. Abundance of extracellular deposits in culture of #969 on malt extract agar. Bar = 20 μm. C, D. Unicellular, intercalary chlamydospore-like cells in malt extract agar, produced by isolate #843. Bars = 20 μm.

(Morgan-Jones, 1974). The ovoid to subglobose shape of the conidia of *A. amaranthi* is consistent with the shapes of conidia of several *Microsphaeropsis* species (Morgan-Jones, 1974; Morgan-Jones and White, 1987; Sutton, 1980).

Aposphaeria amaranthi does not fit other Coelomycete genera because of pycnidial wall structure or the presence of conidiophores typifying the other genera. *Phyllosticta* is not an appropriate genus for *A. amaranthi* because the conidiogenous cells of *A. amaranthi* are not cylindrical or lageniform, and the conidia neither bear an appendage nor have a gelatinous coat (van der Aa, 1973; Yip, 1989).

Description:

Microsphaeropsis amaranthi (Ellis & Barth.) Heiny & Mintz comb. nov. (Fig. 8)

Syn.: *Aposphaeria amaranthi* Ell. & Barth., *Erythea* 4:4 (1896).

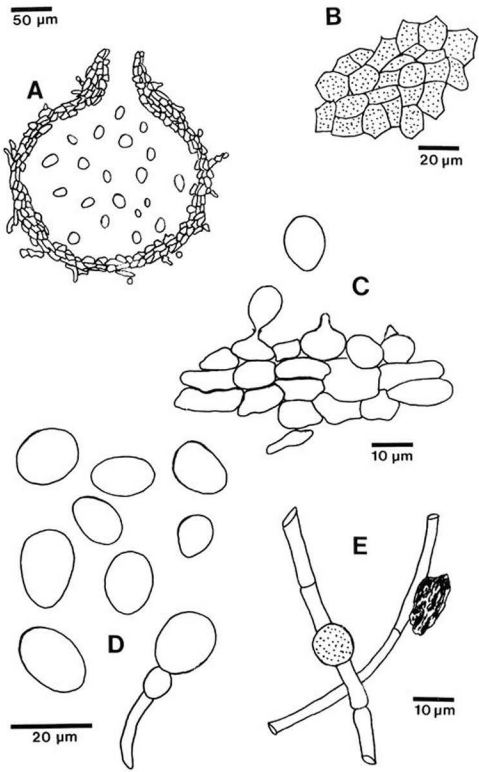
On dead stems of *Amaranthus retroflexus*, Rockport, Rooks Co., Kansas, June 21, 1895, collected by Elam Bartholomew, FH, type.

Causing ellipsoidal and elongated stem lesions on older *Amaranthus* species, especially *Amaranthus albus* L., often girdling the stem and comprising as much as one-third of the stem length, dark brown, surrounded by a blackish margin. Petiole lesions causing defoliation. Leaf lesions usually restricted, circular, about 2 mm in diameter, dark brown. Blighting of lateral branches. Seedlings killed.

Pycnidia superficial or semi-immersed, solitary, unilocular, olive green to brown or black, 140-480 μm in diameter, globose, thin-walled, ostiolate with a single circular pore of 30-45 μm in diameter. Wall with 2-4 cell layers, 11-22 μm thick, of textura angularis, covered with loose pseudoparenchymatous hyphae. Conidiogenous cells broadly simple, ampulliform, approximately 10 μm in diameter, phialidic.

Conidia one-celled, ovate to ellipsoidal or subglobose,

FIGURE 8. *Microsphaeropsis amaranthi* (=*Aposphaeria amaranthi*). A. Pycnidium. B. Surface view of cells in pycnidial wall. C. Conidiogenous cells. D. Conidia, including one germinated conidium with vesicle and germ tube. E. Intercalary chlamydospore-like cell (left) and extracellular deposit (right).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hyaline or yellow, pale buff to light olive green in mass, smooth-walled, 8-22 × 8-16 μm, mostly 15 × 12 μm. Multiple and variously sized guttules, randomly distributed, develop only in conidia from older cultures (3 weeks old). Cells of hyphae mostly straight-cylindrical, 3-9 μm in diameter, often bulging on either side of a septum. Colonies sparsely woolly, smooth on all media, with aerial mycelium less frequent when grown with illumination. Colony pigment white to pale pastel orange when young or at cooler temperatures (20°C), or on cellulose agar or pea juice agar. Mycelium ranging from white to gray to yellowish olive green on oatmeal, malt extract, and potato dextrose agars. The presence of numerous dark pycnidia on oatmeal agar and potato dextrose agar lends a dark appearance to cultures. Crystal formation was not observed. Extracellular, brown deposits are produced in malt extract agar and pea juice agar after 3 weeks. Occasional intercalary, unicellular chlamydospore-like cells develop in media.

Microsphaeropsis amaranthi is pathogenic to varying degrees on several *Amaranthus* species in addition to *A. albus*, including *A. retroflexus*, *A. spinosus*, and *A. hybridus* L. (Mintz *et al.*, 1992).

ACKNOWLEDGMENTS

Our thanks to the Farlow Herbarium for the loan of specimens of *Aposphaeria amaranthi*, and to B. C. Sutton, IMI, for examining photographs and slide mounts of the 1895 and 1987 isolates. We are grateful for the loan of specimens of *Phoma betae* (IMI 70665, 193078, 297878) from the International Mycological Institute, England and *Aposphaeria pulviscula* (#1546, #1299) from the Royal Botanic Gardens at Kew, England.

Our thanks to G. Morgan-Jones, Auburn University, for reviewing the manuscript and advising us on the appropriateness of *Microsphaeropsis* for this species.

This research was supported in part by USDA/CSRS Special Grant No. 89-34195-4378.

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MYCOTAXON

Volume XLIV, no. 1, pp. 155-195 April-June 1992

LACTARIUS sect. LACTIFLUUS AND ALLIED SPECIES

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Key words: *Lactarius*, section *Lactifluus*, taxonomy, phylogenesis.

Abstract: Twenty-seven taxa, all of them ascribable to the section *Lactifluus* of the genus *Lactarius*, have been taken into account. Many have been excluded, without absolute certainty at times, others put into synonymy mainly as a result of the microscopical analysis of the relative exsiccata. Those remaining have been divided into three subsections on the basis of their hypothesized phylogenetic relationship. A new species is also proposed, *Lactarius pegleri*, very similar to *L. hygrophoroides*, but separated by the pileipellis structure which unmistakably points to its placing in section *Allardi* Hesler & Smith.

INTRODUCTION

It was FRIES (1821) who first subdivided the genus *Lactarius*, but the circumscription of his taxonomic categories is too wide to define the group of fungi dealt with by us. The Swedish author established the groups *Galorrhei*, *Russulares* or *Subdulces* to include all the Lactarii exhibiting "pileus siccus, margine nudus. Lamellae confertae juniores albidae, dein lutescentes vel rufescentes. Substantia laxior," but distinguishes four species "dulces, pileo laevi," namely *Agaricus volemus*, *A. mitissimus*, *A. quietus*, and *A. subdulcis*. FRIES (1838) widens the group *Russulares* to eight species, including *Lactarius volemus* and its variety *oedematopus*, and defines it "lacte albo miti, pileo sicco glabro". Fries's system is followed by SACCARDO (1887), who numbers *L. volemus* with its varieties *oedematopus* and *subrugosus*, *L. princeps*, *L. hygrophoroides*, *L. distans*, *L. corrugis*, *L. lividatus* and *L. luteolus* among the *Russulares* "pileo polito, glabro". The same pattern will be followed by RICKEN (1910), who in the *Russularia* recognizes four groups among which the *'miti'*, by LANGE (1935) who reckons *L. volemus* in the *Russularia*, *Glabrati*, *Lactosi* and by quite a few other authors. QUÉLET (1888) proposes an infrageneric subdivision at

variance with Fries, is essentially based on pileus characters and includes *L. lactifluus*, a synonym of *L. volemus*, among the *'pruinosi'* with "voile pruineux, rarement visqueux", more precisely among the *'cyathiformes'* with "peridium charnu et ample, convexe, puis en coupe". BATAILLE (1908) and KONRAD (1935) rely heavily on Quélet's taxonomy, the latter subdivides Quélet's *'pruinosi'* into *Piperati* and *Dulces* and the second group is further subdivided into *Olentes*, *Subdulces* and finally *Volemi* which includes only *L. volemus* and are defined as follows "Chapeau charnu. Lait doux, blanc, très abondant. Chair et lamelles brunissant à l'air et au froissement". KUEHNER & ROMAGNESI (1953a), HEINEMANN (1960) and BLUM (1976) are in line with Konrad and place *L. rugatus* in the *Volemi*. As a matter of fact, Kuehner & Romagnesi include also *L. rubrocinctus* which, however, was transferred into the *Umbonati* soon after (1953b). NEUHOFF's taxonomy (1956), for the first time, focuses on microscopic characters, however their importance is over-estimated and as a consequence very closely related species like *L. volemus* and *L. rugatus* are accomodated into two different subsections of *Rhysocybe*, namely *Dictyosporini* and *Heterosporini*. BON (1980) turns many elements of Neuhoff's classification to good account integrating them into Quélet's frame-work, as a result his groupings are much more natural. SINGER (1975) includes a subsection *Lactifluini*, in section *Dulces* but its circumscription is slightly larger than that of the group under investigation. HESLER & SMITH (1979) name section *Lactifluus*, upgrading it, subsection *Lactifluae* by BURLINGHAM (1908), a group perfectly coextensive to the one we are going to discuss and define: "Pileus colored and the subcuticular or cuticular layer consisting of inflated cells or inflated cells numerous in the region; pileus dry, velutinous to unpolished, colors generally bright (yellow, orange and red), not dull as in *Plinthogalus*". We would like to make a separate mention of HEIM's systematic arrangement (1937, 1955), who inserted many tropical species into Quélet's system. The phylogenetical information drawn from these species persuaded him into giving the genus a sectional subdivision which was as natural as possible, taking into account not only morphological affinities but also evolutive ones. Heim declared his classification to be regarded as provisional, none the less the importance of his systematic method still holds good. According to the rules of the I.C.B.N. the correct name of the section under study is *Lactifluus* (Burlingham) Hesler & Smith, in fact it is the first that has been validly published at such a rank. We have also to hint at the name *Volemi* Konrad which, even though not validly published at the section rank, is currently used by most European authors.

Section *Lactifluus* (Burlingham) Hesler & Smith 1979, North American Species of *Lactarius*, Ann Arbor = *Volemi* Konrad 1935, Les Lactaries, Bull. Soc. Myc. Fr., **51**: 160-191, sensu Auct. pl.. Sporophore size medium to medium-large. Pileus with orange-tawny or brown-tawny colours, sometimes lighter (yellow-ochre to whitish) or darker (brick-red brown), always dry, finely velutinous, almost smooth, to velvety. Lamellae medium to very spaced. Stipe same colour as pileus or slightly paler. Latex copious, generally mild, often staining lamellae and context brown. Odour often

herring-like (trimethylamine), taste mild. Pileipellis made up of a layer of subglobose cells bearing a turf of hairs. Spores globose reticulate, or ellipsoid, verrucose or reticulum more or less complete. Cystidia and hair-like marginal cells sometimes peculiar, subulate and very thick-walled or flexuose and capitate, more often than not clavate. Type species: *Lactarius volemus* (Fries) Fries 1838.

Key to species

1 Hymenial cystidia numerous, prominent, lanceolate and very thick-walled, spores globose or subglobose with a complete reticulum **2**
- Cystidia with walls thin or only slightly thickened, spores more or less elongated, verrucose or with an incomplete reticulum **6**
2 Cuticular cells small and dense, about 10 /um, pileal margin with plain concentric wrinkles ..... *L. corrugis*
- Cuticular cells large, about 20 /um **3**
3 Lamellae spaced ..... *L. austrovolemus*
- Lamellae somewhat crowded **4**
4 Pileus buff yellow ..... *L. volemus* var. *flavus*
- Pileus with orange, brown-red colours **5**
5 Pileus orange tawny or orange brown ..... *L. volemus*
- Pileus brick-red, with copper shades ..... *L. volemus* var. *oedematopus*
6 Spores with a more or less complete reticulum, pileus with brown and orange colours, often with red shades **7**
- Spores dotted, pileus generally with light colours, white, yellow, ochre, seldom with orange or brown shades **8**
7 Context pink with FeSO4, lamellae moderately spaced ..... *L. rugatus*
- Context unchanged with $FeSO_4$, lamellae distant ..... *L. hygrophoroides*
8 Cuticle structure typical, hair-like cells perpendicular to pileus surface, long, threadlike, only rarely slightly capitate **9**
- Cuticle structure not typical **11**
9 Hymenial cystidia hair-like, more or less capitate, spores 7.0-8.0x5.0-6.0 /um ..... *L. luteolus*
- Hymenial cystidia clavate, spores 8.5-10.0x6.5-7.5 /um **10**
10 Pileus buff ochre with orange and cinnamon shades, under *Leptospermum* ..... *L. clarkei*
- Pileus orange brown or red orange, under *Nothofagus* ..... *L. clarkei* var. *aurantioruber*
11 Cuticular hairs tangled to form a trichodermium parallel to pileus surface before turning upwards ..... *L. caribaeus*
- Cuticular hairs short, up to 16 /um wide, often capitate or vesiculate ..... *L. putidus*

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HERBARIA

AQUI: Herbarium Aquilanum, Università degli Studi, 67100 L'Aquila, Italy.
BCC: Departamento de Botanica, Facultad de Biologia, Universitad de Barcelona, Av. Diagonal 645, 08028 Barcelona, Spain.
FH: Farlow Reference Library and Herbarium of Cryptogamic Botany, Harvard University, 20 Divinity Avenue, Cambridge, Massachusetts 02138, USA.
FLAS: Herbarium, Departement of Botany, University of Florida, Gainesville, Florida 32611, USA.
K: The Herbarium, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AB, England, Great Britain.
MICH: Herbarium of the University of Michigan, North University Building, Ann Arbor, Michigan 48109, USA.
MPU: Institut de Botanique, 163 rue Auguste Broussonnet, 34000 Montpellier, France.
NYS: Herbarium, New York State Museum, Biolog. Survey, 3132 CEC, Albany, New York 12230, USA.
PACA: Herbarium Anchieta, Instituto Anchietano e Unisinos, 93000 Sao Leopoldo, Rio Grande do Sul, Brasil.
PAV: Botanical Institute, The University, P.O. Box 99, 27100 Pavia, Italy.
PC: Muséum National d'Histoire Naturelle, Laboratoire de Cryptogamie, 12 rue de Buffon, 75005 Paris, France.
PDD; Herbarium, Plant Diseases Division, Departement of Scientific and Industrial Research, Mt. Albert Research Centre, Private Bag, Auckland, New Zealand.
PI: Herbarium Horti Pisani, via L. Ghini 5, 56100 Pisa Italy.
RO: Erbario dell' Istituto Botanico dell' Università di Roma, Città Universitaria, 00100 Roma, Italy.
SP: Herbario do Estado "Maria Eneyda P. K. Fidalgo", Instituto de Botanica, Caixa Postal 4005, 01000 Sao Paulo, Sao Paulo, Brazil.
TENN: Herbarium, Department of Botany, University of Tennessee, Knoxville, Tennessee 37916, USA.
UPS: The Herbarium, University of Uppsala, P.O. Box 541, S-751 21 Uppsala, Sweden.

The herbarium directors' willinguess to provide us with the loan of exsiccata is aknowleged. A special thank is due to Dr D.N. Pegler of Kew Herbarium (GB) for sending us slides of *Lactarius caribaeus* and *L. putidus*. Dr T. Hongo (Shiga University, Otsu, Japan) and Dr J. Llistosella (Barcelona, Spain) are also entitled to our gratitude for supplying specimens from their personal herbaria.

LACTARIUS CORRUGIS Peck 1879, Ann. Rep. N.Y. State Mus., **32**: 31.
Lactarius volemus var. *subrugosus* Peck 1885.
Etymology: lat., corrugis, e = wrinkled.
Iconography: Atkinson 115; Hard 118; Hesler & Smith 28 & 151; Miller 61; Smith & Weber 239.
Illustrations: fig. 1, pl. 1a.
Pileus (4)-5-12-(20) cm wide, convex to depressed, dark vinaceous brown at centre, paler at margin, sometimes orange-cinnamon to ferruginous, dry, conspicuously velvety, concentric wrinkles quite obvious near margin. Lamellae adnate-subdecurrent, pale ochre to buff, brown when broken, close, medium broad, sometimes forked. Stipe 5-11 cm long, 1.5-2.5(-3) cm thick, equal, grey-brown, sometimes with red-brown shades, paler than pileus. Context white staining brown, taste and odour slight; latex white, unchanging, copious, staining tissues brown. Spores globose or subglobose, (7.4)7.9-10.5(12.1)x(6.8)7.5-9.7(10.9) µm, vol. 358.4 µm^3, Q = 1.07, reticulum more or less complete made up of medium marked connectives and some thinner lines; spore print white. Basidia four-spored, 55-60x9-11.5 µm. Cystidia numerous, 70-80x6.5-8 µm, lanceolate, thick-walled, conspicuous. Pileipellis with very long hairs, about 120-150x4 µm, rising from a dense layer of small, irregularly roundish cells.
Habitat and distribution: on soil in deciduos and mixed woods, June-September; United States, Mexico, Japan and China.
TYPE: C. H. Peck, New York, USA (NYS).

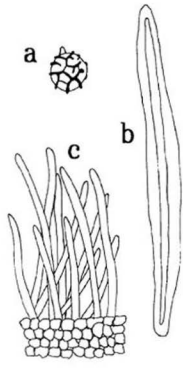


Fig. 1 - *Lactarius corrugis*: a) spore, b) cystidium, c) pileipellis structure.

COLLECTIONS EXAMINED: **AQUI**: G. Pacioni, 7/8/1983, Michigan, USA. **K**: D.A. Reid, 4260/80-6, Tennessee, USA; A. H. Smith, 4260/80-6, Michigan, USA. **MICH**: G.S. Burlingham, 13/8/1907, North Carolina, USA; W.B. & V.G. Cooke, 35486, Ohio, USA; F. Hosency, 912, Michigan, USA; B. Isaacs, 2527, Florida, USA; C.H. Kauffman, 13/9/1926, Pennsylvania, USA; L.C.C. Krieger, Kelly 134, Maryland, USA; D. Lewis, 516, Texas, USA; G.W. Martin, 14/6/1939, Iowa, USA; A.H. Smith, 10200, Tennessee, USA; N.S. Weber, 4451, Georgia, USA; R.Mc. Vaugh, 241, Mexico.
OBSERVATIONS: Very similar to *Lactarius volemus* (Fr.) Fr., this species is distinguished by a series of characters which nevertheless, according to SMITH (1977) and HESLER & SMITH (1979), are very variable in fruit-bodies of the same species and sometimes present in fruit-bodies of the other species, so

that a number of collections look as if intergrading occurs. However, *L. corrugis* is distinguished by the bigger spores, the striking wrinkling of pileus and the darker colours. In our opinion the structure of the pileipellis appears sufficiently different to separate the two species. In *L. corrugis* the cuticular hairs are much longer and more numerous and often apparently woven into a trichodermium, and are borne by a very compact layer of cells which, contrary to what is observed in *L. volemus*, is made up of relatively small, very irregularly roundish cells. This kind of structure is hardly to be included in our definition of sect. *Lactifluus*, but we think that the striking similarity both in field characters and microscopically with *L. volemus* is essential for inclusion in the group under investigation. For what concerns *L. volemus* var. *subrugatus* we believe, in line with HESLER & SMITH (1979), that it has to be placed in synonymy with *L. corrugis*. LANGE (1935), who collected it in North America, regards it as a transitional form between *L. volemus* and *L. corrugis*.

LACTARIUS VOLEMUS (Fries) Fries 1838, Epicr. Syst. Mycol., 344
Agaricus lactifluus Linneo 1753, Species plantarum, 1172.
Agaricus volemus Fries 1821, Syst. Mycol., Vol. 1, 69.
Agaricus lactifluus aureus Hoffmann 1789, Nomenclator fungorum.
Agaricus dycmogalus Bulliard 1791, Hist. Champ. France.
Agaricus testaceus Albertini & Schweinitz 1805, Conspectus fungorum, 209 (non Krombholz 1831/47).
Agaricus ruber Secretan 1833, Mycographie suisse, 89 (non Persoon 1801 et Trattinick 1809).
Agaricus ichoratus Krombholz 1831, Natur. Abbil..
Lactarius lactifluus Quelet 1886, Enchiridion fungorum, 131.
Lactaria volema Schroet. 1889, Pilze Schles. I, 535
Lactaria lactiflua Burlingham 1908, Mem. Torrey Bot. Club, **14** (1): 90.
Etymology: lat., volemum pirum = pear which fits into a hand palm. Same size as a pear.
Popular names: lattario volemo, peveraccio giallo, vacchetta (Italy); lactaire grosse poire, lactaire à lait abondant, lactaire orange doré, lamburon, rougeole à lait doux, vache, vachette, vachotte, velo, vio (France); orange-brown Lactarius (Great Britain); kenyérgomba (Hungary); syrovinka (Czechoslovakia); kultariska (Finland); milda brotlingen, mandelriska (Sweden); spiselig maelkehat (Denmark); bratling, bradling, gold-pratling, gold-brotling, milch-brotchen, brotpilz, milch-bratling, birnen-milchling, semmerfarbener milchling, bruckling, sussling (Germany).
Iconography: Blum 16; Bresadola 390; Britzelmayr 6; Bulliard 584; Cetto 176; Cooke 999; Fries 10; Gillet 170; Gramberg 14; Hesler & Smith 29 & 56b; Imazeki & Hongo 23, 248; Korhonen p.184-185; Krombholz 39, 1-4; Lange 176g; Marchand 147; Michael & Hennig 5, 54a; Miller 62; Neuhoff 13, 51; Pacioni (1981) 127; Patouillard 323; Peck (1897) 30; Phillips p. 88; Ricken 14, 3; Rolland 72; Romagnesi 17; Smith & Weber 240; Svrcek & Kubicka p. 257; and quite a few others.

Illustrations: fig. 2, pl. 1b & 1d.

Pileus 5-15 cm wide, convex, then expanding to plane, depressed at centre, at times funnel-shaped, orange-tawny to orange-brown, at time paler with ochre or yellow shades, generally darker at centre with reddish shades, dry, more or less velvety, surface rimose in old specimens. Lamellae adnate subdecurrent, whitish, then pale ochre-cream, medium broad and crowded, sometimes forked, staining brown when touched. Stipe 5-12 cm long, 1-2.5 cm thick, equal, slightly tapering at base, sometimes swollen in the middle, concolorous with the pileus or paler, ochre-cream, pruinose. Context whitish, slowly staining brown, taste mild, odour strong, peculiar, herring-like or similar to topinambur; latex white, mild, very copious. Spores globose to subglobose, (7.1)7.8-9.7(11.1)x(6.7)7.4-9.1(9.9) /um, vol. 309.4 /um^3, Q = 1.06, ornamentation made up of a complete, medium-sized mesh, resulting from somewhat marked lines and a few thinner ones; spore print white. Basidia 4-spored, 50-70x9-11 /um. Cystidia 50-80x7-9 /um, characteristic, quite prominent, lanceolate and very thick-walled. Pileipellis made up of a layer of roundish cells which bears quite a few hairs, 3-5 /um wide and up to 90 /um long; thick-walled pileocystidia similar to hymenial ones also present. Stipe cuticle structure the same as in the pileus.

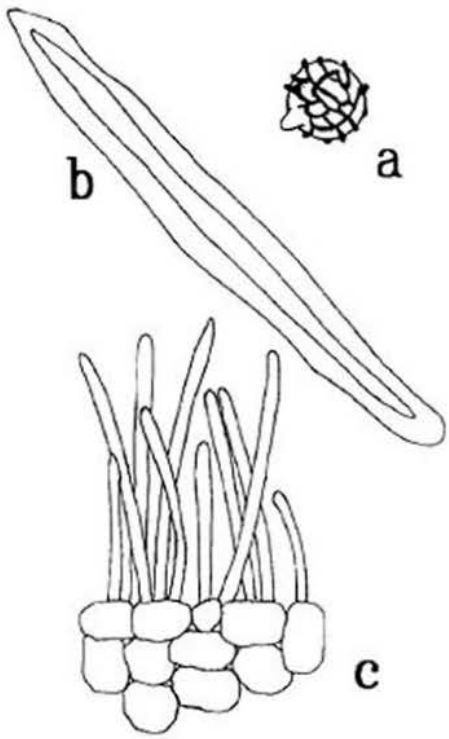


Fig. 2 - *Lactarius volemus*: a) spore, b) cystidium, c) pileipellis structure.

Habitat and distribution: on soil, under various broad-leaved trees, especially oaks, chestnut-trees, beeches and hornbeams, but under conifers as well, June to September; widespread in Europe even though uncommon in Northern regions, common and wide-spread also in Central-Northern America, rare in Northern Africa where apparently it is substituted by *Lactarius rugatus* K. & R., present also in Japan, China and Asia Minor.

TYPE: lacking.

COLLECTIONS EXAMINED: **AQUI**: G. Lalli, 19/7/1979, L'Aquila, Italy; G. Lalli, 8/8/1979, L'Aquila, Italy; G. Lalli, 14/9/1979, Trento, Italy; G. Lalli, 18/9/1980, Trento, Italy; G. Lalli, 25/6/1981, L'Aquila, Italy; G. Lalli, 21/9/1981, Ceva, Italy; G. Pacioni, 25/7/1983, Michigan, USA; G. Pacioni, 1/8/1983, Michigan, USA. **BCC**: Cotxet, 85-491, Spain; Vigueras, 84-228, Spain. **K**: F. Baglietto, 4260/80-1, Italy; J.B. Barla, 4260/80-3, Alpes Maritimes, France; Bloxam, 4260/80-4; C.E. Brome, 4260/80-5, Great Britain (unidentified species); R.W.G. Dennis, 4260/80-5, Great Britain; E. E. Green,

4260/80-5, Great Britain; G. Herpell, 4260/80-2, St. Goarshausen; T.G. Lea, 4260/80-2, Ohio, USA; J.A. Lee, 4260/80-5, Great Britain; A. Melderis, 4260/80-2, Sweden; W. Phillips, 4260/80-5, Great Britain; H.W. Ravenell, 4260/80-2, South Carolina, USA; H.W. Ravenell, 4260/80-4, Georgetown, USA; D.A. Reid, 4260/80-2, Tennessee, USA; D.A. Reid, 4260/80-3, Bulgary; R.J. Shittleworth, 4260/80-1; C.J. Sprague 4260/80-3, New England (unidentified species); P. Sydow, 4260/80-1, Berlin, Germany (unidentified species); De Theumen, 4260/80-1, Bohemia; J.G. Trog, 4260/80-1; 4260/80-2, Carol. Sup., USA; 4260/80-3, Baumwald. **MICH**: J. Ammirati, 2487, Michigan, USA; W.B. & V.G. Cooke, 4288, Tennessee, USA; W.B. & V.G. Cooke, 35576, Ohio, USA; K.A. Harrison, 12271, Nova Scotia, Canada; E. Hillhouse, 132, Texas, USA; H.P. House, 4/8/1945, New York, USA; B. Isaacs, 2160, New York, USA; B. Isaacs, 2526, Florida, USA; C.H. Kauffman, 3/9/1924, Pennsylvania, USA; L.C.C. Krieger, Kelly 70, Maryland, USA; L.C.C. Krieger, Kelly 81, Maryland, USA (as *L. luteolus*); D. Lewis, 1064, Texas, USA; S.J. Mazzer, 6710, Wisconsin USA; R. Mc Vaugh, 364, Mexico; R.L. Shaffer, 4160, France; R.L., Shaffer, 4852, France; R. L. Shaffer, 5627, Quebec, Canada; R.L. Shaffer, 6160, North Carolina, USA; R.L. Shaffer, 6194, North Carolina, USA; R.L. Shaffer, 6359, Indiana, USA; A.H. Smith, 30/7/1931, Nova Scotia, Canada; A.H. Smith, 57182, Michigan, USA; A.H. Smith, 80252, Belgium; R. Zehner, 72, Michigan USA. **MPU**: P.O. Shallert, 14/8/1959, Florida USA (unidentified species). **PAV**: F. Baglietto, june 1860, Genoa, Italy. **RO**: F. Baglietto, june 1860, Genoa, Italy. **SP**: O. Fidalgo, 22/8/1958, Indiana, USA. **UPS**: S. Lundall & J. Stordal, 6068, 4/9/1949, Sweden.

OBSERVATIONS: This is one of the most wide-spread and well-known fungi, hunted and prized as food in many areas. Concerning its distribution we have made mention of its rarity in Northern Africa (BERTAULT, 1978) where as *L. rugatus* is common and abundant. The situation is similar in Italy, in the National Park of Circeo (LALLI & PACIONI, 1981), where in a strictly Mediterranean habitat, *L. volemus* is absent while *L. rugatus* is likely to represent the most wide-spread species in the genus. *L. volemus* exhibits a remarkable variability in some of its characters as observed by SMITH (1977) and HESLER & SMITH (1978). In some collections, gills are forked dichotomously, latex turning yellow, as already noted by FRIES (1838), REA (1922) and BRESADOLA (1928), latex whey-like and other characters not fitting in with the type but uncorrelated with each other.

LACTARIUS VOLEMUS var. OEDEMATOPUS Scopoli: Fries 1838 Epicr. Syst. Mycol., 345

Agaricus lactifluus Schaeffer 1762, Fungorum Icones, 5 (non Linneo 1753).

Agaricus oedematopus Scopoli 1772, Flora Carniolica, II, 453.

Agaricus ruber Trattinick 1809, Die Essb. Schw. des Osterr. Kais., 89 (non Secretan 1883).

Agaricus volemus b Fries 1821, Systema Mycologicum, 69.

Agaricus ruber lactifluus Secretan 1833, Mycographie suisse, 451.

Agaricus volemus Barla 1859, Les Champignon de la province de Nice, 36.

Etymology: gr.oidema = swelling; gr. pous, podos = foot. With a swollen foot.

Iconography: Barla 20, 1-3; Cetto 1053; Krombholz 34, 2-3; Michael & Hennig 5, 54b; Nehuoff 13, 51a; Schaeffer 5; Trattinick 20.

Illustrations: fig. 3.

Pileus 4-8 cm, convex, then applanate, depressed at centre, of a typical red-brown colour with some shade of copper or chestnut, dry, tomentose, with an olive-grey frosted covering, margin long in-rolled. Lamellae adnate-subdecurrent, at first light ochre, later more saturated with orange shades, not forked, staining brown. Stipe 3-6 cm long, about 2 cm thick, equal, sometimes swollen in the middle, ochre cream towards apex, concolorous to the pileus towards base, squat like the whole sporophore. Context whitish, slowly turning brown, same odour as type; latex white, mild, very copious. Spores globose to subglobose, (7.4)8.2-9.8(10.2) x (7.0)7.8-9.3(9.8) /um, vol. 334.9 /um^3, Q = 1.06, reticulum complete with medium-marked lines and a few thinner ones, spore print white. Basidia four-spored, up to 70 /um long and 9-11 /um wide. Cystidia 50-80x7-9 /um lanceolate and very thick-walled.

Habitat and distribution: on soil, under various broad-leaved trees but also in coniferous woods; rather wide-spread in Central-Southern Europe even though not very common.

TYPE: lacking.

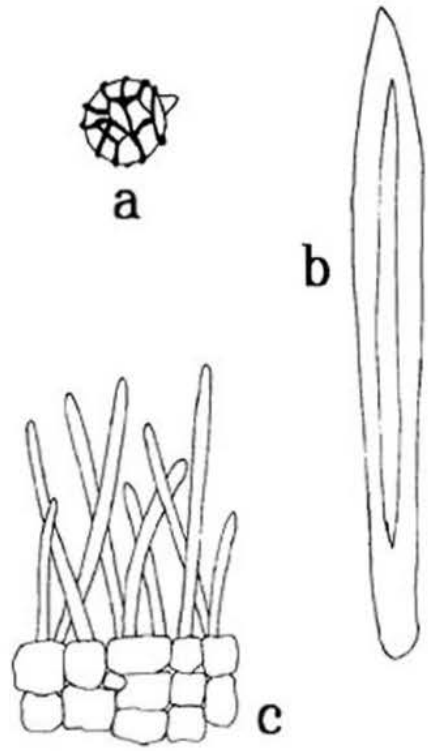


Fig. 3 - *Lactarius volemus* var. *oedematopus:* a) spore, b) cystidium, c) pileipellis structure.

COLLECTIONS EXAMINED: **AQUI**: G. Lalli, 14/9/1979, Trento, Italy; G. Lalli, 3/7/81, Marana, Italy; G. Lalli, 15/9/1981, Borgotaro, Italy; G. Lalli, 21/9/81, Ceva, Italy. **RO**: F. Baglietto, luglio 1860, Valle della Polcevera, Italy; O. Comes, Portici, Italy.

OBSERVATIONS: This variety is not accepted by a number of authors probably because in their opinion the forms with dark pilei are to be included in the colour range of *Lactarius volemus* (Fr.) Fr.. Other authors, from FRIES (1838) to MOSER (1978) and BON (1980) keep the forms sharply separated. It was NEUHOFF (1956) who reevaluated Fries' taxon on the grounds of specimens collected in Germany under beech, even if he considered whether actually the fungus is any more than a variant of *L. volemus*. Microscopically there is no difference between the two forms and also field characters are not always distinct; in particular the "swollen stem", which justifies its name, is not a constant character of dark forms. On the contrary, we happened to note it in fruit-bodies referred to typical *L. volemus* for all other characters. In addition we have collected the two forms together in oak and chestnut woods in the neighbourhood of L'Aquila, so they have not even a different habitat. The only distinguishing characters left are stature and colours, perhaps

too little to recognize this entity at varietal rank. Probably it would be better to regard it as a simple form.

LACTARIUS VOLEMUS var. **FLAVUS** Hesler & Smith 1979 North American Species of *Lactarius*, 165.
Lactarius volemus var. *subrugatus* Neuhoff 1956, Die Milchlinge, 188 (ad interim).
Lactarius volemus var. *aberrans* Bouchet 1959 Bull. Fed. Fr. Soc. Sc. nat., **17**: 51 (nomen nudum).
Etymology: lat., flavus = bright yellow.
Iconography: Bull. Fed. Fr. Soc. Sc. nat. **17**: 51; Michael & Hennig 5, 54c; Neuhoff 13, 51b.
Pileus (2)-5-9 cm wide, plano-convex then depressed, ivory-yellow to buff-yellow, dry, velvety, bruising brown. Lamellae adnate, whitish, later cream colour, crowded, narrow to medium broad, often forked near stipe. Stipe (3)-5-10 cm long (0.4)-0.8-1.6 cm thick, cream to maize-yellow, equal, dry and velvety. Context whitish, taste mild, odour strong and fetid, at times lacking; latex white, unchanging, mild, staining every part of the fruit-body brown. Spores (6.5)-7-8.5-(9)x6-7.5-(8) /um globose to subglobose or broadly ellipsoid, reticulum more or les complete; spore print white. Basidia two- and four-spored, 36-40x7-8 /um. Cystidia 40-70-(92)x5-10 /um, lanceolate, thick-walled, obtuse to acute at apex. Pileipellis a layer of roundish cells bearing thin-walled hairs measuring 22-34x3-6 /um.
Habitat and distribution: on the ground in deciduous and coniferous (Picea) woods, rare, June to September; United States (Alabama, Mississipi and Tennessee) and Europe.
TYPE: L. R. Hesler 26934, Tennessee, USA (TENN).
OBSERVATIONS: HESLER & SMITH (1979) recognize this variety by the slightly smallers spores (according to them the type variety has spores measuring 7.5-9-(10)x7.5-8.5-(9) /um), a mainly southern distribution and the yellow colour of the pileus which is constant throughout the development of fruit-bodies and within the populations. NEUHOFF (1956) reports collecting a close ally of *Lactarius volemus* (Fr.) Fr. with pileus more or less yellow under spruce only once. Having kept only its drawing he names it *L. volemus* var. *subrugatus* ad int. recommending further field investigations. Judging by the plate it is safe to conclude that a light form of *L. volemus* or an especially yellow one of *L. luteolus* Peck are out of question, as a consequence, pending new collections, we suggest a synonymy with Hesler & Smith's variety. The single clashing character which remains is the pileus "concentrically wrinkled" of Neuhoff's description, however this character is not particularly evident in his plates. Another fungus which might be placed in synonymy with *L. volemus* var. *flavus* is *L. volemus* var. *aberrans*, which has not been published validly though.

LACTARIUS AUSTROVOLEMUS Hongo 1973, Rept. Tottori Mycol. Inst., **10**: 357-364.

Etymology: lat., australis, e = southern. A *L. volemus* from the southern hemisphere.
Illustrations: fig. 4, pl.1c.
Pileus 4-6 cm wide, convex to subdepressed, golden yellow to brown-orange, dry, finely pruinose. Lamellae adnate-subdecurrent, cream colour, distant, bruising brown. Stipe 5-6 cm long, 1-1.7 cm thick, equal, paler than pileus, finely pruinose. Context whitish, becoming slowly brown, taste mild, odour herring-like; latex white, mild, very abundant. Spores globose or subglobose (7.0)7.4-9.3(10.8)x(6.5)7.0-8.8(10) /um, vol. 270.2 /um^3, Q = 1.06, ornamentation of warts and ridges connected to form a complete reticulum; spore print white. Basidia four-spored 35-42x11-15 /um. Cystidia 50-95x6-8 /um, lanceolate, with very thick walls. Pileipellis a layer of roundish cells from which rise hairs 28-52 /um long and 3.3-4.7 /um thick.
Habitat and distribution: on soil, in *Castanopsis* woods; New Guinea.
TYPE: T.Hongo, 6129, New Guinea (Herb. Hongo).
COLLECTIONS EXAMINED: Herb. Hongo: T. Hongo, 6129, New Guinea (isotypus).
OBSERVATIONS: This species bears a strong resemblance to *Lactarius volemus* (Fr.) Fr.. Micro-characters are hardly different, only spores are slightly smaller and with some raised warts in addition to ridges. Rather easily distinguished in the field by its distant gills, character conspicuous even in exsiccata, and by its tall habitus, more similar to that of *L. hygrophoroides* Berk. & Curt. than to of *L. volemus*.

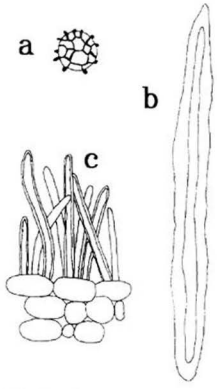


Fig. 4 - *Lactarius australivolemus*: a) spore, b) cystidium, c) pileipellis structure.

LACTARIUS RUGATUS Kuehner & Romagnesi 1953, Bull. Soc. Mycol. France, **69**: 362.
Lactarius hygrophoroides Berkeley & Curtis sensu Bresadola in Martelli 1903.
Lactarius volemus var. *bourquelotii* Boudier (in herbario, fide Blum 1976).
Lactarius hygrophoroides var. *rugatus* Hesler & Smith 1979.
Etymology: lat., rugatus, a, um = wrinkled.
Iconography: Cetto 1504; Corrias & Corrias 2; Marchand 569; Michael & Hennig 5, 54 a; Pacioni (1980) 65.

Illustrations: fig. 5, pl. 2a.

Pileus 4-9 cm wide, convex, then plane, more or less depressed at centre, orange red-brown, darker at centre, pruinose, velvety, dry, concentrically wrinkled towards margin. Lamellae slightly decurrent, cream colour, later with ochraceous and orange shades, bruising slightly brown, distant. Stipe 3-7 cm long, 1-2 cm thick, fulvous, darker, orange red towards base, equal, pruinose or minutely velvety, dry. Context whitish, staining faintly brown when exposed, taste mild, odour similar to that of *Lactarius volemus* (Fr.) Fr. but less strong, pinkish with $FeSO_4$; latex white, unchangeable, copious. Spores ellipsoid bean-like, (7.8)8.1-9.5(9.9) x (5.6)5.9-6.6(6.8) /um, vol.173.1 /um^3, Q = 1.41, ornamentation of crests and warts forming an almost complete reticulum; spore print white. Basidia 4-spored, 40-60x8-10 /um. Cystidia of the common type, clavate, 50-65x6-8 /um, with more or less minute granular contents. Pileipellis a lower layer of roundish cells giving rise to an upper one of thin-walled hairs 3-4.5 /um wide.

Habitat and distribution: terrestrial under various broad-leaved trees, September-November; France Italy, Algeria, Tunisia and Marocco.

TYPE: Romagnesi, 22/9/45, Oise, France (Herb.Romagnesi).

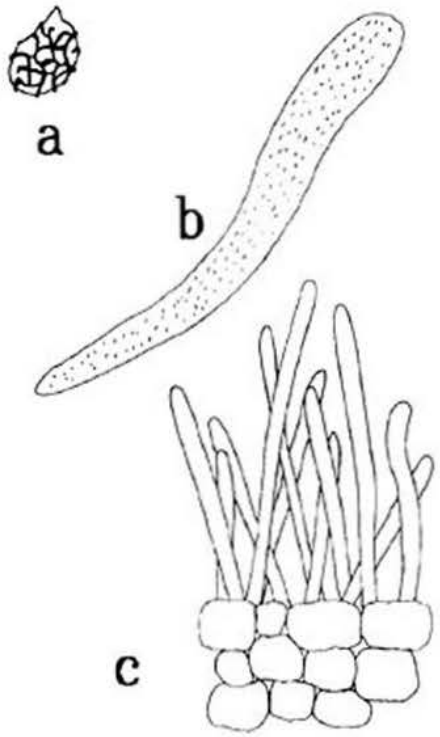


Fig. 5 - *Lactarius rugatus*: a) spore, b) cystidium, c) pileipellis structure.

COLLECTIONS EXAMINED: **AQUI**: G. Lalli, 3/11/81, National Park of Circeo, Italy; G. Lalli, 27/10/82, Cecina, Italy; G. Pacioni, 28/9/78, National Park of Circeo,Italy; G.Pacioni, 27/10/79, National Park of Circeo, Italy; G. Pacioni, 9/12/82, Tunisia; G. Pacioni, 22/12/82,Marocco. **BCC**: Llistosella, 83-20, Spain; Llistosella, 84-254, Spain. **K**: H.W. Ravenel, 4360/80-4 (as *L. volemus*). **MICH**: R.L. Shaffer 4780, France (as *L. hygrophoroides* var.*rugatus*). **PC**: H. Romagnesi 55152, Oise, France; Exposition mycologique du Museum, octobre 1959, Paris, France (as L. volemus). **PI**: E. Barsali 16/11/1903, Tombolo, Pisa, Italy (as *L. hygrophoroides*).

OBSERVATIONS: HESLER & SMITH (1979) regard this taxon as a variety of *L. hygrophoroides* Berk. & Curt. based on the almost absolute similarity of microscopical characters. On the other hand, the two authors have not observed fresh material but only European or North American exsiccata. We cannot accept this disposition since there are numerous differences in field characters between the two fungi, accordingly we consider them distinct species. First and foremost the habit: *L. hygrophoroides* is more slender, while generally *L. rugatus* K. & R. has a stipe shorter than the pileus diametre. The colour, also, is different, lighter and

often with yellow tinges in *L. hygrophoroides*; in addition *L. rugatus* has a pileus concentrally wrinkled near margin, gills less distant and not interveined flesh staining brown and pinkish with $FeSO_4$ and a herring-like smell. Above all the spores, also, prove diagnostic in the separation of the entities. In *L. rugatus* they are slightly longer and with ornamentation forming a more complete reticulum. BLUM (1976) reports having found this species in Boudier's herbarium as *L. volemus* var. *bourquelotii*, while KUEHNER & ROMAGNESI (1953b) have found it in Maire's herbarium as *L. volemus* (Fr) Fr, which demonstrates that *L. rugatus* even though fairly common in southern Europe has been misidentified for a long time. As already reported (PACIONI & LALLI, 1981) this species is rather widespread in Mediterranean areas. MARTELLI (1903) had already collected it at the beginning of the century and Bresadola determined it as *L. hygrophoroides*.

LACTARIUS HYGROPHOROIDES Berkeley & Curtis 1859, Ann. Mag. Nat. Hist., 3rd ser., **4**: 293.
Lactarius distans Peck 1872, Ann. Rep. N.Y. State Cab., **23**: 117.
Lactarius subvelutinus Peck 1904, Bull. N.Y. State Mus., **75**: 18.
Lactarius cystidiosus Thiers 1957, Mycologia, **49**: 714.
Lactarius hygrophoroides var. *odoratus* Hesler & Smith 1979 North American species of *Lactarius*, 173.
Lactarius hygrophoroides var. *rugatus* (Kuehner & Romagnesi) Hesler & Smith 1979 North America Species of *Lactarius*, 175.
Lactarius hygrophoroides var. *lavandulaceus* Hesler & Smith 1979 North American species of *Lactarius*, 176 (as *lavendulaceus*).
Misapplied names: *Lactarius hygrophoroides* sensu Bresadola in Martelli 1903, Bull. Soc. Bot. Ital., 307-309 (= *Lactarius rugatus* K.& R.).
Etymology: gr., eidos = resemblance. Like an *Hygrophorus*.
Iconography: Groves 62; Miller 52; Murril 187, 2; Peck (1901) 53, 7-11 (*L. distans*); Pegler & Fiard 10, e & f.
Illustrations: fig. 6, pl. 2b.
Pileus 3-10 cm wide, at first convex, then plane more or less depressed at centre, cinnamon-orange to darker, with reddish, brown or even yellow tinges, dry, pruinose or finely velutinous. Lamellae adnate-subdecurrent, white, then yellowish-cream, broad, very distant, intervenose, not forking. Stipe 3-5 cm long, 0.5-1.5 cm thick, equal, concolorous with the pileus but paler, dry and pruinose. Context white, taste mild and odour slight; latex white, unchangeable. Spores ellipsoid, (7.5)7.9-9.2(9.9)x(5.5)5.8-6.8(7.1) /um, vol.174.3 /um^3, Q = 1.35, ornamentation of moderately marked lines forming a very broken reticulum; spore print white. Basidia 4-spored, 50-60x8-9 /um, with fine internal dots. Marginal and facial cystidia hardly differentiated, cylindrical-clavate, 55-65 /um long and 8-9 /um wide, with thin walls and fine internal granulations. Pileipellis made up of a lower layer of roundish cells up to 25 /um broad giving rise to numerous hairs up to 70 /um long and 3-4.5 /um wide, with thin or sometimes slightly thickened walls. Stipitipellis with structure similar to that of the pileus.

Habitat and distribution: on soil, under various broad-leaved trees, June to September; United States, Canada, Mexico and Japan.

TYPE: C.J. Sprague, 6194, Maine, USA (K).

COLLECTIONS EXAMINED: **AQUI**: G. Pacioni, 24/7/1983, Michigan, USA; G. Pacioni, 31/7/1983, Michigan, USA. **K**: J.W. Groves 33905, 4260/80-8, Quebec, Canada; C.J. Sprague 6194 (typus), Maine, USA, 4260/80-9; Underwood 4260/80-10 (as *L. distans*). **MICH**: K.A. Harrison 11668, Nova Scotia, Canada (as *L. hygophoroides* var. *rugatus*); R.L. Homola 5676, Maine, USA; F. Hoseney 17/8/1973, Michigan, USA; B.F. Isaacs 2344, Florida, USA; C.H. Kauffman, 16/9/1924, Pennsylvania, USA; J. Kimbrough & A.H. Smith, 3/5/72, Florida, USA (as *L. hygrophoroides* var. *rugatus*); R. Mc Vaugh 568, Mexico; C. Nimke 578, Michigan, USA (paratypus of *L. hygrophoroides* var. *rugatus*); P.M. Rea 804, Michigan, USA; R.L.Shaffer 3149, Vermont, USA; R.L. Shaffer 5942, Quebec, Canada; R.L. Shaffer 6226, North Carolina, USA.; R.L. Shaffer 6339, Indiana, USA; A.H. Smith 716, Nova Scotia, Canada; A.H. Smith 7325, Tennessee, USA; A.H. Smith, 78477, Michigan USA (as *L. hygrophoroides* var. *rugatus*); A.H. Smith, 84285, Michigan, USA (isotype of *L. hygrophoroides* var. *lavandulaceus*); H.D. Thiers, 1670, Texas, USA, (holotypus of *L. cystidiosus*); H.D. Thiers 4710, Texas, USA. **NYS**: Peck, Albany country, August, New York, USA (typus of *L. subvelutinus*). **PC**: P.O. Shallert, 25/7/1957, Florida, USA (as *L. volemus*). **SP**: G.W. Martin, 9/8/1946, Iowa, USA (unidentified species). **TENN**: L.R. Hesler, 23378, North Carolina, USA (isotypus of *L. hygrophoroides* var. *odoratus*).

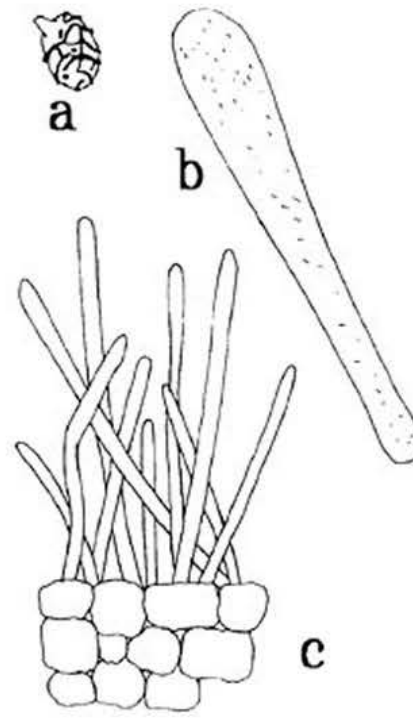


Fig. 6 - *Lactarius hygrophoroides*: a) spore, b) cystidium, c) pileipellis structure.

OBSERVATIONS: After studying Peck's type, HESLER & SMITH (1979) place *Lactarius distans* in synonymy with *L. hygrophoroides*. Further, the collection of *L. distans* examined by us agrees in all respects with this species. Regarding the three varieties proposed by HESLER & SMITH (1979), we have ascertained a complete microscopic identity with the type. Accordingly they cannot be considered autonomous entities, and there are additional reasons. *L. hygrophoroides* var. *rugatus* is based on a European collection which we have examined and found to be true *Lactarius rugatus*, and on some American collections mostly with unknown $FeSO_4$ reaction. *L. hygrophoroides* var. *lavandulaceus* is separated on the basis of the vinaceous or lavender colour-change of lamellae, the yellowish spore-deposit, the green reaction with $FeSO_4$, the browning of latex and context, but the authors note the possibility of collections with white spore-deposit and absence of reactions. The original spelling *lavendulaceus* from "lavender" in English, is to be replaced by the correct *lavandulaceaus*

from Latin "lavandula". *L. hygrophoroides* var. *odoratus* would be separated only for the strong alkaline odour or similar to that of *Lactarius volemus*, which, however is finally present in all exsiccata of *L. hygrophoroides*. Therefore it is conclused that *L. hygrophoroides* should be regarded as a single entity, with some variability in smell, latex and context colour-change, variability which is confirmed in some of our North American collections. One problem remains unsolved, that posed by the few collections exhibiting a pinkish or greenish reaction with $FeSO_4$. These reactions need be reassessed on fresh material and possibly coupled with other field characters to be able, eventually, to distinguish one or more varieties in the complex *hygrophoroides*. *L. cystidiosus*, also, put into synonymy with *L. hygrophoroides* var. *odoratus*, by HESLER & SMITH (1979), exhibits no difference as compared to the type, lacking even the macrocystidia reported in the original description. Only with difficulty have confirmed the synonymy with *L. subvelutinus*. Our study of Peck's type revealed that the gills were little spaced indeed, but in all other respects the exsiccatum is like the ones ascribed to *L. hygrophoroides*. On the other hand the description by PECK (1904) and HESLER & SMITH (1979), point out that the difference in gill-spacing is the single character separating the two species. It was the microscopic identity of the two types which allowed synonymy between the two entities, in particular S.E.M. samples of the spores revealed the same ornamentation and their statistically-processed size overlapped perfectly. It is our opinion that the difference in gill-spacing could be a consequence of the condition of early developpemental stages of sporophores.

LACTARIUS CLARKEI Cleland 1927, Trans. R. Soc. S. Austr., **51**: 302.
Etymology: from proper noun. Named after Miss Phyllis Clarke.
Iconography: Cleland, 6.
Illustrations: fig. 7.
Pileus 5-8-(12.5) cm wide, convex, then plane and depressed at centre, sometimes funnel-shaped, buff-ochre with orange and cinnamon shades, dry, tomentose-shaggy. Lamellae adnate-subdecurrent, white to pale cream colour, suffused with brown, narrow, medium crowded, at times forked near stipe. Stipe 2-3-(5) cm long, 1.5-2.5 cm thick, paler than pileus, short, equal, tapering at base, dry, velutinous to tomentose. Context white, becoming slowly brown, taste mild, with $FeSO_4$ rapidly green-grey; latex white, mild. Spores ellipsoid, (7.5)8.7-9.9(10.5)x(6.6)6.8-7.2(7.5) /um, vol. 227.7 /um^3, Q = 1.33, warts neither very high nor marked, isolated or rarely connected by a few short, thin lines; spore print white. Basidia 4-spored, 50-60x8-11 /um with internal granulations not conspicuous. Pileipellis with a layer of roundish cells giving rise to a great number of long and crowded hairs, 50-60 /um long and 8-11 /um thick, septate, with thin or thick walls.
Habitat and distribution: terrestrial, solitary or occasionally gregarious, under *Leptospermum*; Australia and New Zealand.
TYPE: J.B. Cleland, 16/6/1917, Australia (PC).
COLLECTIONS EXAMINED: **PC**: J.B. Cleland, 16/6/1917, Australia (typus). **PDD**: V.C. Haydon, 23/5/1974, New Zealand; R.F.R. McNabb 6/4/1967, New Zealand; R.F.R. McNabb 10/11/1971, New Zealand; G.J. Samuels, 23/5/1973, New Zealand; E.P. White 20/12/1969, New Zealand.

OBSERVATIONS: KUEHNER & ROMAGNESI (1953b), citing a report by Heim, regard *Lactarius clarkei* and *L. rugatus* K.& R. as probable synonyms. HEIM (1955) placed the two species into synonymy crediting both with reticulate spores, and consequently reports *L. clarkei* both from Australia and Europe. McNABB (1971) states that various topotype collections identified by Cleland as *Lactarius clarkei* should be attributed to two distinct species, one with warted and the other with reticulate spores which, according to the New Zealand author, would be the one accounted for by Heim. Type examination showed us spores plainly dotted and a pileal cuticle with clearly septate hairs which unmistakably identify Cleland's species. The problem posed by the reticulate-spored species remains. It might be likened to *L. rugatus* whose distribution would be extended to Australia as well. However, this possibility needs confirmation. SINGER (1975), based on CLELAND's descriptions (1927 and 1934), doubtfully placed this taxon in subsect. *Lactifluini* (Burl.) Singer of sect. *Dulces* Heim ex Singer. McNABB (1971) erected the new section *Tomentosi* which includes the new subsection *Clarkeini* and the subsection *Rubroviolascentini* Singer 1942, with *L. clarkei* and *L. rubroviolascens* Heim as the only species, based on pileal, thick-walled hairs.The peculiar characters of *L. rubroviolascens* (see excluded taxa), the presence of thick-walled hairs even in other species of the section and the great similarity in micro and field characters of *L. clarkei* with the *Lactifluus*, make us discard this solution.

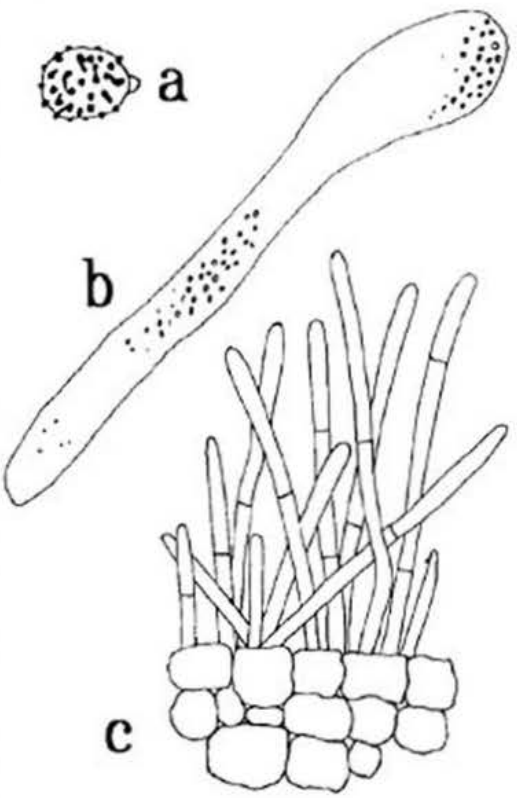


Fig. 7 - *Lactarius clarkei*: a) spore, b) cystidium, c) pileipellis structure.

LACTARIUS CLARKEI var. **AURANTIORUBER** McNabb 1971, New Zealand Journal of Botany, **9**: 60.

Etymology: lat., aurantius, a, um = having the colour of an orange; lat., ruber, rubra, rubrum = red.

Pileus 5.5-10 cm wide, centrally depressed when mature, brownish-orange or red-orange, paler in dry weather, orange-grey, pruinose to subtomentose. Lamellae adnate-subdecurrent, white to pale cream colour with pink shades, subdistant, at times forked near stipe. Stipe 2-5.5 cm long, 1-3 cm thick, same colour as pileus or slightly paler, equal or tapering at base, pruinose-subvelutinous. Context

pale orange-yellow, mild, with $FeSO_4$ green-grey; latex white. Spores ellipsoid, 8-10.5x6-7.5 /um, ornamentation of isolated warts; spore print white. Basidia 4-spored, 55-85x7-12.5 /um. Cystidia cylindrical-clavate, slightly differentiated, 42-130x3.5-7 /um. Pileipellis a layer of roundish cells bearing hairs up to 400 /um long and 3-6 /um wide, with thick walls.
Habitat and distribution: on the ground, gregarious under *Nothofagus*; New Zealand.
TYPE: R.F.R McNabb, 26381, 14-4-68, Springs Junction, New Zealand (PDD).
OBSERVATIONS: McNABB (1971) distinguished this variety by a series of characters which are constant in collections under *Nothofagus*, whilst the type from New Zealand grows exclusively under *Leptospermum*. The specimens under *Nothofagus* exhibit pilei with brighter orange colours and pruinose-subvelutinous instead of tomentose-shaggy, with hairs up to 150 /um long rather than up to 400 /um long, lamellae with pink shades and context pale orange-yellow. The epithet *aurantiorubra* with a feminine ending as used by its author, must be corrected to show concord with the masculine gender of the generic name, in compliance with the articles 24.2 and 32.5 of the ICBN (1983).

LACTARIUS PUTIDUS Pegler in Pegler & Fiard 1979, Kew Bulletin **33** (4): 620
Etymology: lat., putidus, a, um = stinking.
Iconography: Pegler & Fiard 10, b.
Illustrations: fig. 8.
Pileus 5.7-7.5 cm wide, convex to plane, depressed at centre, buff-brown, dry, finely velutinous, with strong wrinkles when mature. Lamellae decurrent, yellowish,

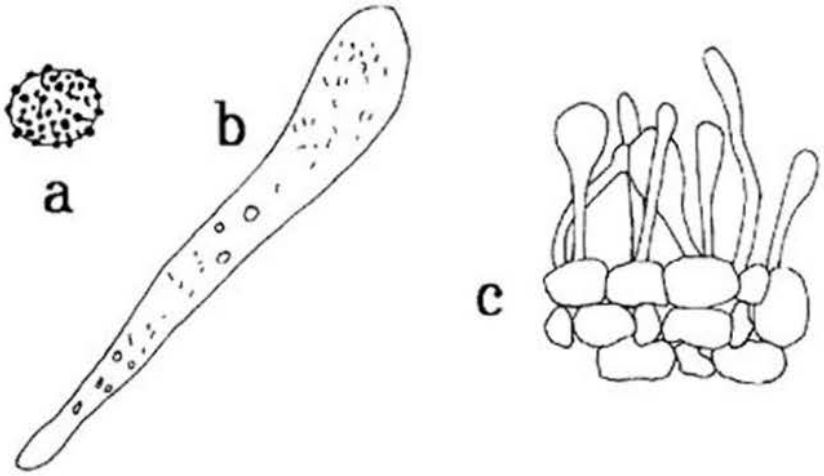


Fig. 8 - *Lactarius putidus:* a) spore, b) cystidium, d) pileipellis structure.

staining brown, subdistant, seldom forked. Stipe 3-4 cm long, 0.8-1.4 cm thick, white later straw colour, staining dingy brown, equal or obconical. Context yellowish, dark brown on cutting, taste mild, odour disagreeable like rotten fish, with $FeSO_4$ immedi-

ately green grey; latex very copious, white-opalescent. Spores ellipsoid, (8.5)8.9-9.6(10.0)x(7.5)7.8-8.5(9.0) /um, vol. 306.7 /um^3, Q = 1.13, ornamentation of small and isolated warts, sometimes with short crests; spore print not indicated. Basidia 4-spored, 55-60x10-11 /um, sterigmata about 7 /um, content granular. Cystidia cylindrical-clavate, tapering at apex, 60-100x7-9 /um, with granular content. Pileipellis a layer of roundish cells and flexuose thin-walled hairs, vesciculous or capitate at apex, up to 13 /um long.

Habitat and distribution: on soil, in mesophytic forest, July-August; Martinique.

TYPE: J.P. Fiard, 625D, 4260/80-14, Martinique (K).

COLLECTIONS EXAMINED: K: J.P. Fiard 625 A, 4260/80-14, Martinique; J.P. Fiard 625 C,4260/80-14, Martinique; J.P. Fiard 625 D, 4260/80-14, Martinique(typus); J.P. Fiard 625 E, 4260/80-14, Martinique; D.N. Pegler 2819, 4260/80-15; D.N. Pegler 2918, 4260/80-15, Martinique.

OBSERVATIONS: Field characters viz dry velutinous pileus, context and lamellae staining brown, latex white and abudant, taste mild and smell of rotten fish, apparently impose its inclusion in sect. *Lactifluus*, but for this species in the same way as for *Lactarius caribaeus* Pegler's doubts arise because of the structure of the pileal cuticle. In fact it is made up of capitate and vesiculous hairs different from the ones of all other species, and its layer is not always clearly separated from the one of swollen cells.

LACTARIUS CARIBAEUS Pegler in Pegler & Fiard 1979, Kew Bulletin, 33 (4): 617

Etymology: from a geographical name, Caribees.

Iconography: Pegler & Fiard 10, g & h.

Illustrations: fig. 9.

Pileus 4-7.5 cm wide, plano-convex or depressed, then subinfundibuliform, pale ochre, with cinnamon stains, subvelutinous, dry. Lamellae clearly decur-

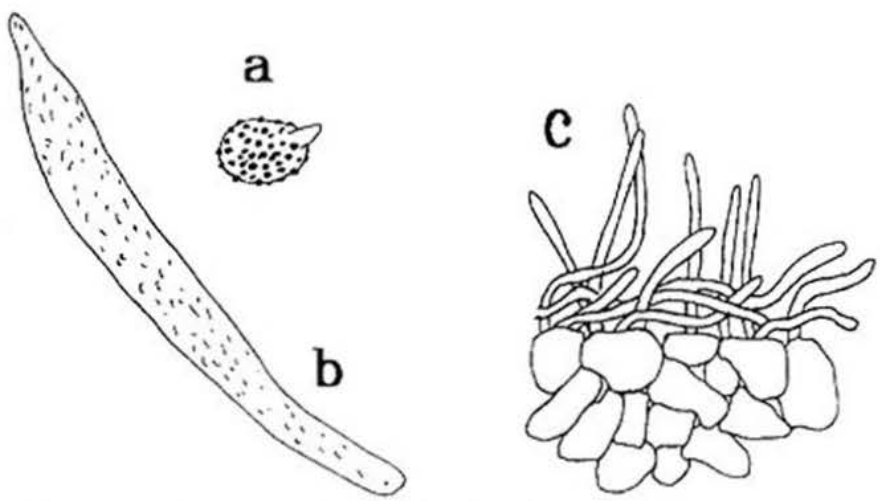


Fig. 9 - *Lactarius caribaeus:* a) spore, b) cystidium, c) pileipellis structure.

rent, cream colour, subdistant, occasionally anastomosing. Stipe 2-4 cm long, 1-2 cm thick, pure white, staining cinnamon on touching or with age, smooth. Context white, then staining cinnamon, taste mild, odour strong, disagreeable, nitrous, with $FeSO_4$ soon dark green; latex white, cinnamon on drying. Spores ellipsoid, (7.2)7.9-8.6(8.7)x(5.8)6.1-6.8(7.2) /um, vol.174.1 /um^3, Q = 1.28, ornamentation of isolated medium marked warts, at times with very short crests; spore print not indicated. Basidia 4-spored, 45-55x8-9 /um. Cystidia cylindrical-clavate, tapering at apex, sometimes digitate, 50-90x5-9 /um with granular-vermiform content. Pileipellis a lower layer of roundish cells bearing an upper one composed of thin-walled hairs tangled to form a trichodermium parallel to the pileal surface before turning upwards.

Habitat and distribution: on the ground, in xerophytic forest, September to December; Martinique.

TYPE: J.P. Fiard 818A, 4260/80-12, Martinique (K).

COLLECTIONS EXAMINED: K: J.P. Fiard 818 A, 4260/80-12, Martinique (typus); J.P. Fiard 827 A, 4260/80-13, Martinique; J.P. Fiard 827 B, 4260/80-13,Martinique; J.P. Fiard 842 A, 4260/80-12, Martinique; D.N. Pegler2822, 4260/80-13, Martinique.

OBSERVATIONS: PEGLER & FIARD (1979) place this entity in sect. *Dulces* Heim ex Singer subsect. *Lactifluini* (Burl.) Singer for "the pale lamellae, the subvelutinate pileal surface which lacks a virescens- structure, the heterotropic spores, and the mild taste". However, there is room for doubt on placing it in sect. *Lactifluus*, as we define it. The stature, velutinate pileus, mild taste, staining of context and spore ornamentation are characters which suggest a close affinity to *Lactarius luteolus* Peck but the structure of pileal cuticle is a little different from the one typical in the species of this section. The hairs which rise from the layer of roundish cells, before turning upwards, tangle in fact into a rather clear cut trichodermium, parallel to the pileal surface.

LACTARIUS LUTEOLUS Peck 1896, Bull. Torrey Bot. Club, **23**: 412.
Lactarius foetidus Peck 1902, Ann. Rep. N.Y. State Mus., **54**: 949. 33
Lactaria luteola Peck, Burlingham 1908, Mem. Torrey Bot. Club, **14** (1): 95.
Lactarius volemus var. *albus* Maire 1937, Fungi maroccani, 9.
Lactaria praeseriflua Murrill 1938, Mycologia, **30**: 361.
Lactarius scoticus Bk. & Br. sensu Romagnesi 1956, Bull. Soc. Mycol. Fr., **72**: 333-335.
Lactarius echinatus Thiers 1957, Mycologia, **49**: 716.
Lactarius brunneoviolascens Bon 1970, Doc. Mycol., **2**: 45-48.
Lactarius kuhnerianus Malençon 1974, Bull. Soc. Linn. Lion, **43**, special number, 245-252.
Lactarius luteolus f. *euluteolus* Bertault 1980, Bull. Soc. Myc. Fr., **96** (3): 285-86.
Lactarius luteolus f. *kuhnerianus* (Malençon) Bertault 1980, Bull. Soc, Myc. Fr., **96** (3): 285-86.
Etymology: lat., luteolus, a, um = yellowish.

Iconography: Bertault 216; Boll. gr. mic. Bres. **20**: 24; Cetto1054; Hesler & Smith 30; Marchand 507; Peck (1903) 83, 7-11.
Illustrations: fig. 10, pl. 2c.
Pileus 3-7-(12) cm wide, convex, then applanate, slightly depressed at centre, off-white with straw-yellow tint, staining brown when touched or with age, dry, tomentose. Lamellae adnate, white then straw-yellow, bruising brown, medium broad, rather crowded, at times forked near stipe. Stipe 3-6 cm long, 1-2.5 cm thick, white to off-white, staining brown when touched, equal tapering at base, pruinose-velvety, dry. Context whitish, grey-brown when broken, taste mild, odour almost the same as in *L. volemus* but less strong, $FeSO_4$ gives a clear blue-green reaction; latex copious, white or whey-like with white flocci in suspension, mild. Spores ellipsoid, (6.7)7.0-8.2(8.6)x(5.0)5.2-6.0(6.5) /um, vol.120.1 /um^3, Q = 1.36, with isolated warts or rarely connected into short segments; spore print white to cream. Basidia 4-spored, 55-60x9-11 /um. Pleurocystidia cylindrical, with rounded apex, septate and clamped, at times branched, in thick palisade, 30-40 /um long and 6-7 /um wide. Cheilocystidia hair-like, flexuous with thin or moderately thick walls, 40-70 /um long and 2.5-4 /um wide, often capitate. Pileipellis a layer of roundish cells bearing hairs up to 70 /um long and 4-5 /um.

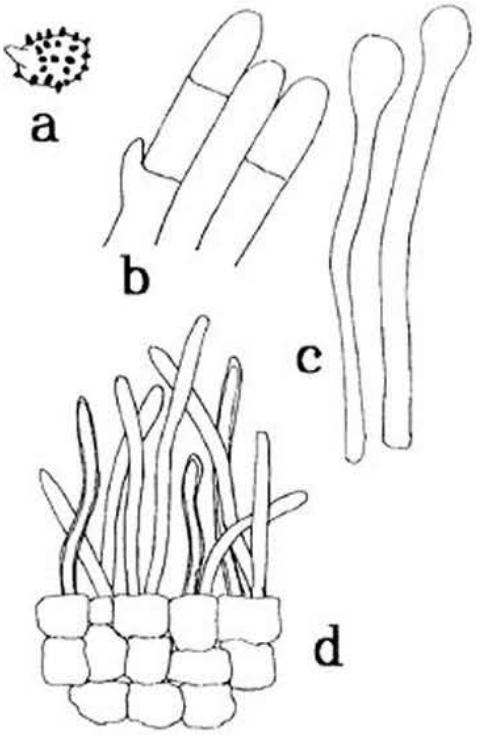


Fig. 10 - *Lactarius luteolus*: a) spore, b) pleurocystidia, c) cheilocystidia, d) pileipellis structure.

Habitat and distribution: on soil, in the plane in deciduous woods, especially oak, June to November; United States, Italy, France, Spain, Algeria, Marocco and Japan.
TYPE: Webster, East Milton, Massachussetts, USA (NYS).
COLLECTIONS EXAMINED: **AQUI**: G. Lalli, 3/11/1981, National Park of Circeo, Italy; G.Lalli, 11/11/1982, National Park of Circeo, Italy; G. Pacioni, 26/11/1981, Sardinia, Italy; G. Pacioni, 7/8/1983, Michigan, USA. **BCC**: Llistosella, 84-410, Spain. **FLAS**: W.A. Murrill, 16020, Gainesville, Florida, USA (isotypus of *L. praescriflua*). **MICH**: H.C. Beardslee Jr., 20/11/1935, Florida, USA (as *Lactaria luteola*); R.G. Benedict, A 7348, Illinois, USA; G.S. Burlingham, august 1918, Vermont, USA (as *Lactaria luteola*); A.H. Smith,6804, Michigan, USA; A.H. Smith, 9651, Tennessee, USA; H.D. Thiers, 1700, Texas, USA (holotypus of *L. echinatus*). **MPU**: G. Malençon, 257, Mamora, Maroc (as *L. kuehneri*, typus of *L. kuehnerianus*); G. Malençon, 299, Mamora, Maroc (as *L. kuehneri*); G. Malençon, 4162, Mamora, Maroc (as *L. kuehneri*).

OBSERVATIONS: Species originally described by PECK (1896) from North America. According to HESLER & SMITH (1979) who examined their types, *Lactarius foetidus* and *Lactaria praeseriflua* are to be considered later synonymys. We think that *Lactarius echinatus,* also, should not be regarded as a separate entity because the latex, which THIERS (1957) defines acrid and disagreeable, is the single clashing character. A statistical comparison of spore size shows complete similarity. The remaining micro- and macroscopic characters perfectly agree. Moreover, to the best of our knowledge, this entity has been collected only once. Synonyms of *L. luteolus* are also two species collected in Europe: *L. scoticus* sensu Romagnesi e *L. brunneoviolascens*. The same entity was subsequently named *L. kuehnerianus* by MALENÇON (1974) who regards it as intermediate between *L. volemus* (Fr.) Fr. and *L. rugatus* K.& R. and reports it from Algeria, Marocco and Spain. Algerian and Maroccan collections of this fungus had been named *L. volemus* var. *albus* by MAIRE (1937). The microscopical examination has showed us an absolute identity of American and Mediterranean collections. BERTAULT (1978) points out its copious fruiting in Marocco as *L. kuehnerianus*, but later (1979) considers it a synonym of *L. luteolus* which in its turn is eventually split (1980) into two forms: *euluteolus*, American with yellow pileus and *kuehnerianus*, Mediterranean, with pure white pileus in young specimens. Our own findings from the National Park of Circeo and Sardinia never showed a pure white pileus, not even at the beginning of the development, on the other hand also American authors, like for example HESLER & SMITH (1979), credit *L. luteolus* with a pileus "white or whitish to buff". As the geographical separation no longer holds good Bertault's two form cannot be considered valid. Concerning Italy the taxon has already been reported from Lombardy on the Bollettino del Gruppo Micologico G. Bresadola (1977) as *L. kuehnerianus*, while Cetto (1979) reports it even from Canton Ticino in Switzerland. This entity fruits also in Japan as reported by HONGO (1960).

DOUBTFUL ENTITIES

LACTARIUS PRINCEPS Berkeley 1852.Hook. London Journ. Bot., **4**: 135.
Etymology: lat., princeps = prince.
Illustrations: fig. 11.
Pileus 10 cm across, irregular infundibuliform, dry, opaque, subfarinaceous, of a deep rich blood red. Gills moderately broad, very pale, but concolorous with stem, decurrent. Stem 9 cm high, more than an inch thick, straight, attenuated downwards, blunt, more tawny than the pileus, solid, white within, except towards the edges, odourless; latex white. spores globose or subglobose, (8.0)8.1-9.0(9.5) x(8.0)8.1-8.8(9.2) /um, vol. 304.4 /um^3, ornamentation in the form of a complete, wide-meshed reticulum, made up of medium marked or rarely thinner connecting lines; spore print not indicated. Basidia 4-spored, size not obtained. Cystidia numerous, 55-70x6-7 /um, with sharp tips and very thickwalls. Pileipellis a layer of roundish cells bearing short, thin-walled hairs, thick-walled pileocystidia present. Habitat and distribution: in woods; India.

TYPE: J.M. Berkeley, 16, 4260/80-11, Kullung, Khassya, India (K).

COLLECTIONS EXAMINED: K: J.M. Berkeley, 12, 4260/80-11, Myrung, Khassya, India; J.M.Berkeley, 16, 4260/80-11, Kullung, Khassya, India (holotypus).

OBSERVATIONS: The above macroscopical account is drawn almost literally from BERKELEY's original description (1852), while the microscopical details are the result of our personal observation of two collections dating back to July 1850 from two different localities of Khassya, India. They are the ones cited by Berkeley in his work. We do not know of any other report on this species. Microscopically the two collections are identical, in confirmation of Berkeley's impression who had considered them probably the same notwithstanding the very poor condition of collection n.12. The poor state of the specimens did not allow us to study them thoroughly. The species is very similar to *Lactarius volemus* (Fr) Fr, but a few characters press us to regard it as distinct: the complete lack of smell, the colour of pileus (in Berkeley's latin diagnosis we have "sanguineo-rubro") and size and ornamentation of spores (slightly smaller and with wider meshes on average). However, the difference in spore size and ornamentation is truly slight and for what concerns the colour also *L. volemus* var. *oedematopus* Scop.: Fr. sometimes exhibits brown hues with reddish shades. Consequently there is still some doubt concerning the validity of this species and only further collections will answer the questions about its true identity.

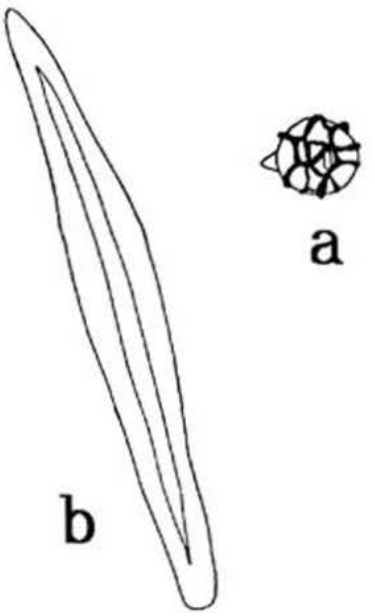


Fig 11 - *Lactarius princeps*: a) spore, b) cystidium.

LACTARIUS BRAUNII Rick 1930, Broteria, **24**: 118.

Etymology: from proper noun.

Pileus lemon yellow, granulose, with red spots, dry, brittle, 4 cm wide.Lamellae long decurrent, very spaced, ventricose, with serrate edge, fragile, concolorous. Stem white, tomentate towards apex, short, 3 cm long, thick. Latex white.Spores 7-8.2 x 5.5-7 /um, their ornamentation projecting 0.2-0.5/um, warty-reticulated, some spore with short ridges and catenulations; spore print not indicated. Basidia 4-spored, about 55x7 /um. Cystidia none seen except for inconspicuous cystidia at the edge of the lamellae, much like those of *Lactarius hygrophoroides* Berk. & Curt.. Epicutis of the pileus formed by slightly thick-walled, yellow hyphae forming a trichodermium; these hyphae are smooth, filamentous, with rounded tips and 2.5-4.5 /um diameter.Habitat and distribution: On the ground; Brazil.

TYPE: A.C.H. Braun 13751, Porto Alegre, Brazil (PACA).

OBSERVATIONS: We did not succeed in obtaining any specimen of this species in spite of Singer's personal accurate information on the location of the type. In dealing with this entity we have consequently to rely on the work by RICK (1930) from which the short account given above is derived. The microscopical characters are taken from SINGER (1953). His study is based on examination of the type which in exsiccate condition is said to be at first sight identifiable with *L. hygrophoroides*. Such an impression is confirmed by the similarity of the microscopical characters. The pileus and stipe colours in Rick's description, the probable absence of Fagales in the area where the type was collected (*L. hygrophoroides* grows mainly under *Quercus*) and finally Rick's reference also to *L. distans* Peck (a synonym of *L. hygrophoroides*) would suggest that the two entities are separate. Singer concludes by saying that only further collections of fresh material can clarify possible differences between *L. hygrophoroides* and *L. braunii*. Later SINGER *et al.* (1983), in a key to neotropical species of section *Dulces*, include also *L. braunii* without giving any comment.

LACTARIUS CALCEOLUS Berkeley 1847, London J. Bot., **6**: 315.
Etymology: lat. calceolus = tiny shoe.
Pileus 7.5 cm across, thin, arched so as to present a half-ovate form, brown-buff, smooth, not viscid; epidermis cracked, flesh white. Stem short, 1.3 cm in height and thickness, brown-buff, like the pileus. Gills white, decurrent, 1.3 cm broad, extremely distant, more or less connected by transverse veins or plates, forked near the edge, exuding a mild milky juice.
Habitat and distribution: On the ground in woods; United States (Ohio).
TYPE: T.C. Lea, 31 August and 10 September, Ohio, USA (K).
OBSERVATIONS: BERKELEY (1847), whose original description we have reported, defines this species "extremely singular", noteworthy for the very distant gills and the colour contrast between gills and stipe. Another feature which according to Berkeley contributes to make this entity unmistakable is the pileus laterally confluent. BURLINGHAM (1910) and HESLER & SMITH (1979) interpret this peculiar habit as an abnormality in the growth. Therefore, excluding lateral pileus and squat stipe as specific characters, BURLINGHAM (1908) arrived at the conclusion that *Lactarius calceolus* is the same as *L. hygrophoroides* Berk. & Curt. HESLER & SMITH (1979), who found it impossible to obtain sections of the pileus from the type, rank this entity among the doubtful species, but they declare for a conspecificity with *L. rugatus* K.& R. or *L. hygrophoroides* if ever it were to be recollected and exhaustively studied. We have not studied any collection of *L. calceolus* but, from the foregoing notes and on the basis of its gills being characterized as "extremely distant" and "intervenose", the synonymy with *L. hygrophoroides* appears probable. The impossibility of examining the type forces us to range this species among the doubtful ones, all the more so as a synonymization would bring about the priority of the epithet *calceolus* over *hygrophoroides*.

LACTARIUS LIVIDATUS Berk. & Curt. 1860, Proceedings of American Academy of Arts and Sciences, **4**: 1019.
Etymology: lat., lividatus, a, um = made to appear livid. Because of the colour of the gills.
Illustrations: fig. 12.
Pileus slightly depressed, fulvous. Lamellae narrow, quite serrate, dingy leather yellow then livid. Stem enlarged at the apex, fulvous. Spores elliptic, (7.0)8.1-9.0 x (6.5)6.9-7.5 /um, ornamentation consisting of lines of average thickness forming a more or less complete reticulum; spore print not indicated. Cystidia club-shaped, of the common type, small. Basidia not observed. Pileal cuticle not observed.
Habitat and distribution: on the ground; Japan.
TYPE: 4260/80-7, Japan (K).
COLLECTIONS EXAMINED: **K**: 4260/80-7, Japan (typus).

Fig. 12 - *Lactarius lividatus* : spore.

OBSERVATIONS: We could not observe the structure of the pileal cuticle because of the poor condition of the exsiccatum, spores and cystidia are of the same type as those of *Lactarius hygrophoroides* Berk. & Curt. BERKELEY & CURTIS (1860) conclude the short description of this fungus that we have reported by saying "has somewhat the habit of *L. volemus*". We do not have other characters available to arrive at a precise identification. It might be *L. hygrophoroides* or even a good species in its own right, but its position in the section is doubtful, supported only by the resemblance with *L. volemus* (Fr.) Fr. New collections are needed in order to reach a final conclusion.

LACTARIUS PURGATORII Singer 1948, Sydowia, **2**: 42 (ad interim).
Etymology: from geographical name, Purgatory Swamp.
A *Lactario hygrophoroide*, cui proximus, differt carne oleo anilinico reactionem rubram et $FeSO_4$ reactionem constantem viridem subeunte et autoxydatione brunnescente Lactarii volemi modo. Ab hoc lamellis distantibus differt. Sub quercubus et pinibus in palude "Purgatory Swamp" prope Norwood, Massachusetts, USA.
TYPE: R. Singer, July 1941, Purgatory Swamp, Massachusetts, USA (FH).
OBSERVATIONS: SINGER's description (1948) states that *Lactarius purgatorii* bears a strong resemblance to *L. hygrophoroides* Berk. & Curt. from which differs only by the flesh reacting red with anilin oil and green with $FeSO_4$ and by the brown staining pattern. The short Latin diagnosis lacks, in addition, data about microscopical characters.. Singer (pers. comm.) says that probably *L. purgatorii* has been identified by HESLER & SMITH (1979) as a variety of *L. hygrophoroides*. Subsequently SINGER *et al.* (1983) considered it synonymous whith *L. austrovolemus* Hongo, of the group with sphaerical, reticulated spores, but no microscopical comparison is cited in support of this hypothesis. The impossibility of examining the type prevented us from confirming this synonymy.

EXCLUDED SPECIES

LACTARIUS ALLOCHROUS Singer 1948, Sydowia, **2**: 41. 33
Etymology: gr., allokhroos = which takes another colour.
Illustrations: fig.13.
Pileus 5-12 cm wide, convex-depressed, brown with olive shades, finely velvety. Lamellae subdecurrent, whitish, at times intervenose, distant. Stipe 2-5 cm long, up to 2.5 cm thick, equal, olive-brown,glabrous. Context white, unchanging or changing to brown; latex white,mild. Spores ellipsoid, (9.1)9.8-11.4(12.4)x(7.4)7.8-9.0(9.8) /um, vol. 379.2 /um^3, with more or less marked warts rarely connected by some thin lines; spore print not indicated. Basidia 4-spored, 70-80x10-11 /um. Cystidia fusoid with rounded apex, 90-120x8-9 /um with granular-vermiform content. Pileipellis consisting of a trichodermium of hairs about 4 /um wide on a lower layer of more compact hyphae.
Habitat and distribution: on soil, under oak; United States (Florida).
TYPE: R. Singer, F 714, Florida, USA (F.H.).
COLLECTIONS EXAMINED: F.H.: R. Singer, 714, Florida, USA (typus).
OBSERVATIONS: SINGER (1948) states that this entity is in every respect close to *Lactarius hygrophoroides* Berk. & Curt. and later SINGER (1975) placed it in subsection *Lactifluini* (Burl.) Singer of section *Dulces* Heim ex Singer. Also HESLER & SMITH (1979) regard the two species as "closely related", but claim that *L. allochrous* Sing. is distinguished by the olive-brown colour and the wider spores in addition to the completely different structure of the pileal cuticle. On the grounds of this last feature they place *L. allochrous* Singer and *L. hygrophoroides* into two separate sections, section *Allardii* Hesler & Smith and section *Lactifluus* respectively. The study of the type revealed a cuticle with filamentous structure lacking roundish cells, which brings about the exclusion of this species from the section *Lactifluus* in our restricted sense.

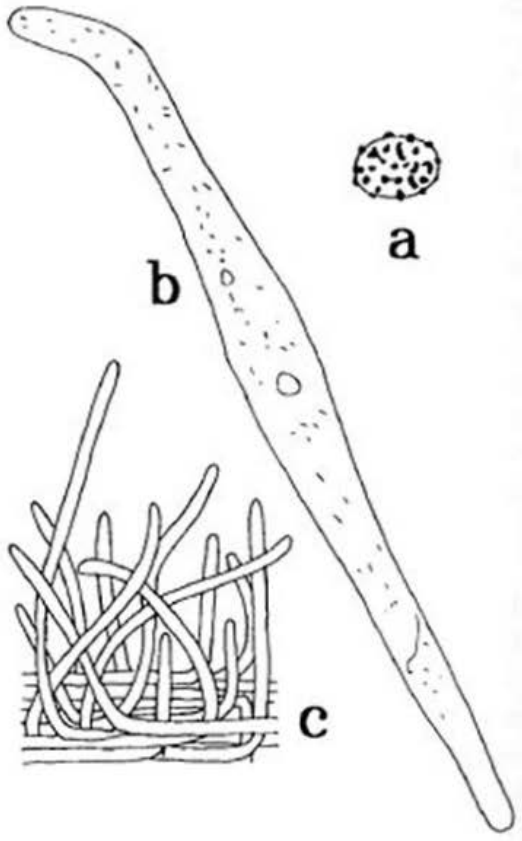


Fig. 13 - *Lactarius allochrous*: a) spore, b) cystidium, c) pileipellis structure.

LACTARIUS ANGUSTUS Heim & Gossens 1955, Bull. Jard. Bot. État, **25** (1): 67.
Etymology: lat., angustus, a, um = narrow. Because of the crowded gills.

Iconography: Heim (1955) 3, 3a & b.
Pileus 5-8 cm wide, plano-convex, later depressed at centre, bright reddish ochraceous, very finely velvety. Lamellae nearly free, white, close and narrow. Stipe 4-6.5 cm long, 1-1.8 cm thick, equal, slightly thickened at base, concolorous with pileus. Context white, becoming brown when exposed, taste at the same time acrid and bitter, odour fetid; latex white, very copious, peppery. Spores broadly ovoid to subglobose, 8-9x7.5-8.3 /um, with tuberculate warts rarely connected by thin trabeculae; sporeprint white.Basidia relatively long and gradually tapering towards base, size not indicated. Cystidia not differentiated. Pileipellis made up of erect, cylindrical or more or less ventricose hairs with rounded tips, rising from swollen or subglobose cells which may be likened to sphaerocysts, 10-20 /um wide.
Habitat and distribution: gregarious in dry forest, April; Zaire.
TYPE: Goossens Fontana, 713, avr. 1928, Binga, Belgian Congo (Herb. Heim).
OBSERVATIONS: We could not obtain any exsiccata of *Lactarius angustus*, as a consequence we rely for our considerations on the exhaustive description by HEIM (1955) who placed this taxon in the group *Volemi*. We are inclined to exclude this species from the section under study. The cuticle exhibits similar cells which are more elongated towards the surface, irregular in shape, originating directly from swollen cells; consequently it does not have the two distinct layers typical of the section. Moreover both the warty, subglobose spores and the peppery latex are incongruous to its definition.

LACTARIUS MARUIAENSIS McNabb 1971, New Zealand Journal of Botany, **9**: 54.
Etymology: from geographical name, Maruia.
Illustrations: fig. 14.
Pileus 7.5 cm wide, depressed at centre when mature, pale yellow or yellow, staining dark yellowish-brown, finely pruinose to subvelvety, slightly viscid in wet weather. Lamellae adnate to subdecurrent, pale cream colour with yellowish-brown edge, moderately distant. Stipe 4.5 cm long and 2.5 cm thick, almost equal, concolorous with the pileus, whitish at base, dry finely pruinose to velvety. Context white, taste mild, odour not peculiar, with $FeSO_4$ rapidly salmon pink; latex white, unchangeable. Spores ellipsoid, (7.8)8.6-9.9(11.0)x(6.6)7.2-8.1(8.5) /um, vol.274.1 /um^3, ornamentation of crests forming an almost complete reticulum; spore print not obtained. Basidia 4-spored, 60-70x9-11.5 /um, hyaline or with hardly visible granular content, sterigmata 4-4.5 /um long. Cystidia cylindric-clavate, 45-60x7-9 /um, with thin walls and vermiform content. Pileipellis consisting of septate thin-walled hairs 4-6 /um wide, borne by an epithelium of small irregular cells; mucus also present.
Habitat and distribution: solitary under *Nothofagus*; New Zealand.
TYPE: R.F.R. McNabb, 26531, Maruia, New Zealand (PDD).
COLLECTIONS EXAMINED: **PDD**: R.F.R. McNabb, 26531, Maruia, New Zealand (isotypus).
OBSERVATIONS: McNABB (1971) states that his species may be included, even though with some difficulty, in section *Dulces* in the sense of Singer (1975). Pegler

& Fiard (1979) regard a similarity between McNabb's species and *Lactarius caribeus* Pegler as possible even though they separate *L. maruiaensis* on account of the

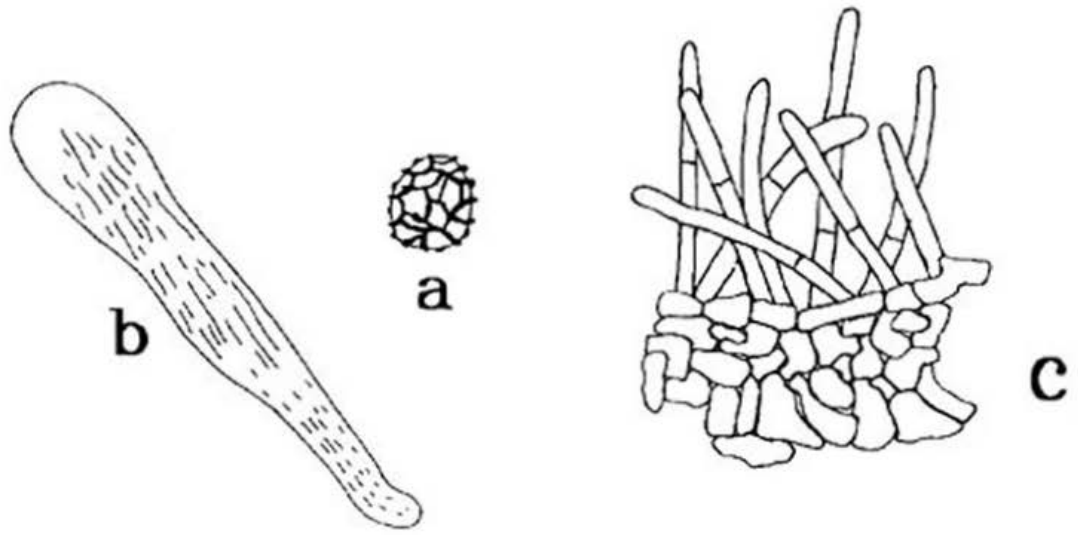


Fig. 14 - *Lactarius maruiaensis* : a) spore, b) cystidium, c) pileipellis structure.

reticulate spores and the cuticular septate hairs. The structure of the cuticle and the presence of mucus on the pileus, in agreement with McNabb's description who characterizes it as viscid in wet weather, are decisive as for its exclusion from section *Lactifluus*.

LACTARIUS PEGLERI Pacioni & Lalli sp. nov.
Lactarius hygrophoroides Berkeley & Curtis sensu Pegler & Fiard 1979.
Etymology: from proper noun.
Iconography: Pegler & Fiard 10, e & f.
Illustrations: fig. 15, pl. 2d.
Fungus statura media. Pileo aurantiaco-ochraceo, depresso vel subinfundibuliformi, sicco, tomentoso, 2.5-5.7 cm lato, margine mox explanato. Lamellis alutaceis, distantibus, decurrentibus. Stipite ochraceo-incarnato, cilindrico, 2.5-3-8 cm longo, 0.6-1.2 cm crasso. Carne pallida, immutabile, odore non peculiari; latice albo, dulci. Sporis ellipsoideis, echinatis vel cristatis, (7.0)7.5-8.2(8.5)x(5.8)6.1-6.9(7.2) /um; cystidiis anguste clavaeformibus; epicute trichodermiali, hyphis 3-5 /um crassis. Habitat in xerophyticis silvis, sub *Coccoloba pubescens*. Holotypus ex Martinica, prope La Caravelle collectus, oct. 1977, Pegler legit, in kewensis herbario servatus. Species *Lactario hygrophoroidi* relata, sed epicutis structura et fere solitariis sporarum verrucis certe distincta est.
We give the description by Pegler & Fiard:"Pileus 2.5-5.7 cm diam., fleshy subglobose to convex then expanding, depressed to subinfundibuliform; surface brownish orange, 'Grenadine' (M. 10R/6.7/10.5) to 'Ochraceous-Tawny' (M.7.5YR/5.5/6.7) or 'Ochraceous-Salmon' (M. 4YR/7.0/7.5), finally fading to 'Sal-

mon Color' (M. 4YR/7.1/5.5) to 'Flesh Color' (M.1YR/7.0/6.0), dry, finely tomentose to velutinate, smooth or rugose particularly towards the margin, azonate; margin obtuse, entire, regular, somewhat plicate-sulcate, at first involute. Lamellae adnatae-decurrent to deeply decurrent, 'Cartridge Buff'(M. 2.5Y/8.8/2.0) to 'Creamy Buff' (M. 2.5Y/8.0/4.5), finally'Chamois' (M. 2.5Y/7.0/6.0), thick 5-6 mm wide, rather distant, intermixted with lamellulae of two lengths. Stipe 2.5-3.8 cm x 6-12 mm, robust, cylindric, solid; 'Light Ochraceous Salmon' (M. 5YR/7.7/3.0) becoming 'Strontian Yellow'(M. 7.5Y/8.0/9.0) at the base, finely pruinose. Context 4-7 mm thick at the disk but much thinner at the margin, whitish to pale yellowish, unchanging, heteromerus, of thin walled, narrow hyphae, 2-5 /um diam., groups of sphaerocytes,7-24 /um diam., and scattered laticiferous elements, 5-9 /um diam.; odour not distinctive; taste mild. Latex abundant, pure white, unchanging. Spores 7-8.5x6-7 (8 + 0.38x6.64 + 0.36) /um, Q = 1.20, subglobose to short ellipsoid, hyaline, with an amyloid ornamentation of numerous, small verrucae, 0.2-0.4 /um high, occasionally linked into small groups by short connectives; suprahilar plage depressed, inamyloid, smooth, poorly delimited; hilar appendix small, 0.6-1.3x0.5-0.8 /um. Basidia 48-60x8-9 /um, elongate clavate, bearing four sterigmata, up to 8 /um long. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia 20-30x2.5-5 /um, cylindric with obtuse apex, hyaline, thin-walled, resembling elements of the pileipellis. Pseudocystidia abundant, 65-85x5-6.5 /um, cylindric to narrowly clavate, with obtusely rounded apex, subhyaline with somewhat refractive contents, thin walled, not staining in sulphovanillin. Hymenophoral trama intermixed and interwoven, with numerous laticiferous elements and narrowed hyphae, but lacking sphaerocytes. Subhymenial layer well delopped, pseudoparenchymatous, 35-40 /um wide. Pileipellis a compact trichodermial palisade borne on a well developped hypodermium. Trichodermial palisade 55-75 /um thick, of hyaline thin-walled, cylindric elements 20-50x3-5 /um, with obtusely rounded apices, lacking dermatocystidia. Hypodermium 35-50 /um thick, of tightly interwoven hyphae with short, almost isodiametric elements. Chemical tests on the stipe: tincture of gaiac-positive, green; ferrous sulphate-negative."

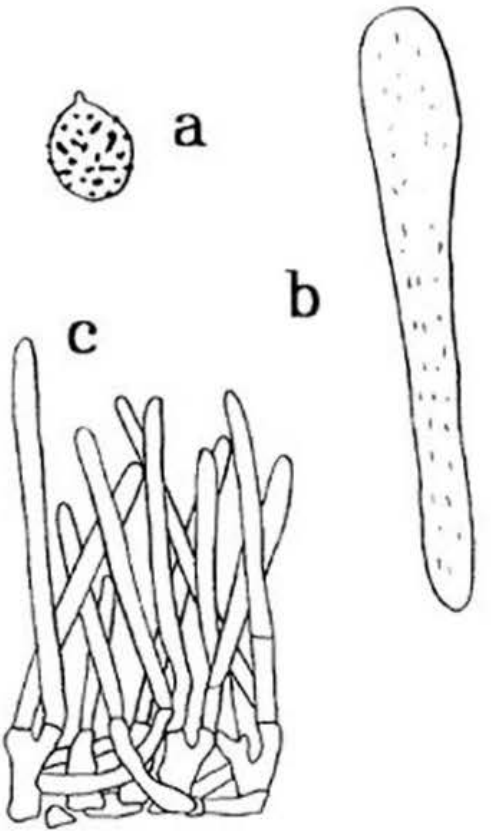


Fig. 15 - *Lactarius pegleri:* a) spore, b) cystidium, c) pileipellis structure.

Habitat and distribution: on soil in secondary xerophytic forest, at the base of *Coccoloba pubescens*, October-December; Martinique.

TYPE: D.N. Pegler 2924, 4260/80-8, Martinique (K).

COLLECTIONS EXAMINED: K: J.P. Fiard 821 A, 4260/80-8, Martinique; J.P. Fiard 821 B, 4260/80-8, Martinique; D.N. Pegler 2924, 4260/80-8, Martinique (typus).

OBSERVATIONS: The examination of three collections of *Lactarius hygrophoroides* from Martinique, showed us a perfect agreement of field characters, colour and tomentosity of cuticle, gill spacing and stature, but a surely different microscopy. The spores (our measures are (7.0)7.5-8.2(8.5)x(5.8)6.1-6.9(7.2) /um, vol. 167.9 /um, Q = 1.20) are similar to those of *L. hygrophoroides*, but slightly shorter and smaller, with an ornamentation made up of warts and short ridges, more like to that of *L. luteolus* Peck and, above all, the pileal cuticle lacks the layer of roundish cells completely, being exclusively composed of a rather dense trichodermium. These same microscopic characters are reported by PEGLER & FIARD (1979) in the description and drawings of their collections from Martinique. There is all evidence that we are faced with a perfectly distinct entity which is to be accommodated in section *Allardii* Hesler & Smith 1979, the closest to section *Lactifluus*. No species among those belonging in this section is a match of the one under scrutiny, accordingly we have thought it proper to propose it as a new species.

LACTARIUS PERVELUTINUS Hesler & Smith 1979, North American Species of *Lactarius*, 170.

Etymology: lat., per, prefix forming superlatives; late latin,velutum = velvet. Very velvety.

Iconography: Hesler & Smith 32.

Illustrations: fig. 16.

Pileus 4-4.5 cm wide, convex-depressed, ferruginous brown to reddish orange, ochraceous at margin, dry, velvety. Lamellae broadly adnate, cream colour, later staining slowly and slightly vinaceous-pink to lilac brown due to latex, subdistant. Stipe 3 cm long, 1.8 cm thick, equal, pale cream, more or less concolorous with the gills, dry. Context yellowish white, taste mild, odour slight, slowly green-grey with $FeSO_4$; latex white, becoming yellow on paper. Spores broadly ellipsoid, (6.5)6.9-8.1(8.8) x (4.8)5.1-5.7(6.0) /um, vol. 109.3 /um^3, ornamentation made up of crests and warts at times connected into a broken reticulum, looking mostly dotted; spore print creamy-

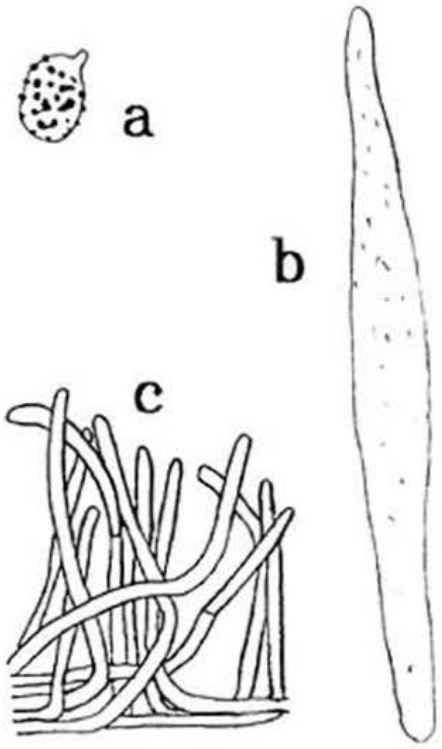


Fig. 16 - *Lactarius pervelutinus*: a) spore.

white. Basidia 4-spored, 40-50x6-8 /um. Cystidia subfilamentous or narrowly fusoid ventricose, 26-40x3-8 /um. Pileipellis filamentous, a trichodermium of thickly woven hairs becoming parallel at the surface.
Habitat and distribution: on soil, under broad-leaved trees; United States (Michigan).
TYPE: A.H. Smith, 84431, Michigan, USA (MICH)
COLLECTIONS EXAMINED: **MICH**: A.H. Smith, 84431, Michigan, USA (holotypus).
OBSERVATIONS: Species recently erected by HESLER & SMITH (1979), who place it in the group of *Lactarius hygrophoroides* Berk & Curt. It is recognized by the small-sized spores (the smallest in the section), latex turning yellow on paper and the green reaction of flesh with $FeSO_4$. The structure of the cuticle, as we were able to observe when examining the type, forces us into excluding this species from the section. We think that the species should be placed in section *Allardii* Hesler & Smith, in close proximity to *L. allochrous* Singer which has the same type of cuticle and spores with the same ornamentation, even though larger.

LACTARIUS PSEUDOVOLEMUS Heim 1938 Candollea, **7:** 378.
Etymology: gr., pseudos = false. Likely to confuse with *L.volemus*.
Illustrations: fig. 17.
Pileus 5-6 cm wide, convex, then deeply depressed at centre, red brown at disc, orange brown elsewhere, dry, minutely tomentose-granulose. Lamellae arcuate-decurrent, light orange, narrow. Stipe 3-3.5 cm long, 0.8-0.9 cm thick, equal, orange brown, slightly paler than pileus, minutely tomentose-granulose. Context cream colour, odour and taste none; latex white, copious, slightly astringent. Spores subglobose, (7.5)7.6-8.2(8.5)x(6.5)6.7-7.5(8.0) /um, vol.201.7 /um^3, ornamentation of warts and short crests connected by thinner lines; spore print white. Basidia 4-spored, 40-45 /um long and 10-11 /um wide. Cystidia clavata or lanceolate-clavate, at times digitate at apex 60-80x8-10 /um, with granular-vermiform content. Pileipellis a turf of thick-walled, often branched hairs up to 150 /um long and about 4.5 /um wide, rising from a compact layer of interwoven hyphae. Habitat and distribution: on soil, isolated; Madagascar.
TYPE: R. Heim, G. 61, Madagascar, 7/12/1934 (PC).

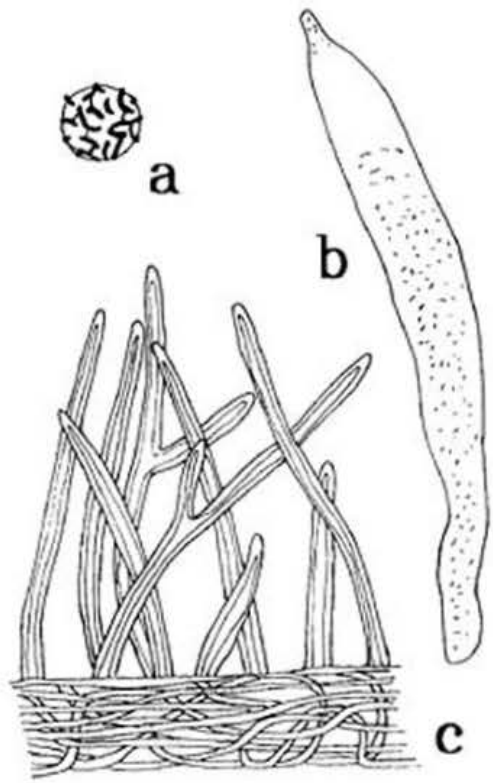


Fig. 17 - *Lactarius pseudovolemus*: a) spore, b) cystidium, c) pileipellis structure.

COLLECTIONS EXAMINATED: **PC**: R. Heim, G. 61, Madagascar, 7/12/1934 (typus).
OBSERVATIONS: The unchangeable context, the slightly astringent latex and the cuticle structure are characters which prevent this species from being included in the section under study. Our own microscopical observations carried out on the type are partly at variance with HEIM's (1937), who does not report thick-walled elements in the cuticle. HEIM (1937) places this entity in section *Dulces*, along with *Lactarius rubroviolascens*, and later (HEIM, 1955) in the *volemi* group. It should be noted that the French author published the descriptions of this and of *L. rubroviolascens* in 1937 and the Latin diagnoses in 1938.

LACTARIUS RUBROVIOLASCENS Heim 1938, Candollea, **7**: 377.
Etymology: lat., ruber, rubra, rubrum = red; lat., viola = violet. Due to the colour-change of context and gills alike.
Iconography: Heim (1937) 1,C.
Illustrations: fig. 18.
Pileus 6-8 cm wide, convex-deformed, irregular, ochre-brown with orange shades, dry, wholly tomentose, with thick cuticle, easily peelable. Lamellae adnate, cream colour, blackening then becoming violet blue, broad, not very crowded. Stipe about 4 cm long, 1.8-2 cm thick, orange at apex, lighter in the middle, orange red-brown towards base, white and tomentose at base, completely and minutely velvety. Context white, slowly blackening in the pileus then becoming red ,unchangeable in the stipe, tasteless and odourless, pink with agreen ring with $FeSO_4$; latex copious, whey-like, light pinkish-grey, mild. Spores broadly reniform obovoid, (7.0)8.5-9.7(10.0)x(6.2)6.5-7.1(7.5) /um, vol.210.9 /um^3, ornamentation in the form of fine-dot-like warts; spore print white. Basidia 4-spored, 48-54x9-10.5 /um, sterigmata about 6 /um long. Cystidia elongated rhombic, up to 160 /um long and 14 /um wide,with very thick walls. Pileipellis made up of hairs 4-8 /um wide, cylindrical, here and there constricted, often sinuous, with rare septations, at times with swollen tips, with thick walls, rising from a layer of binding hyphae which sit on a zone of broader often allantoid cells.

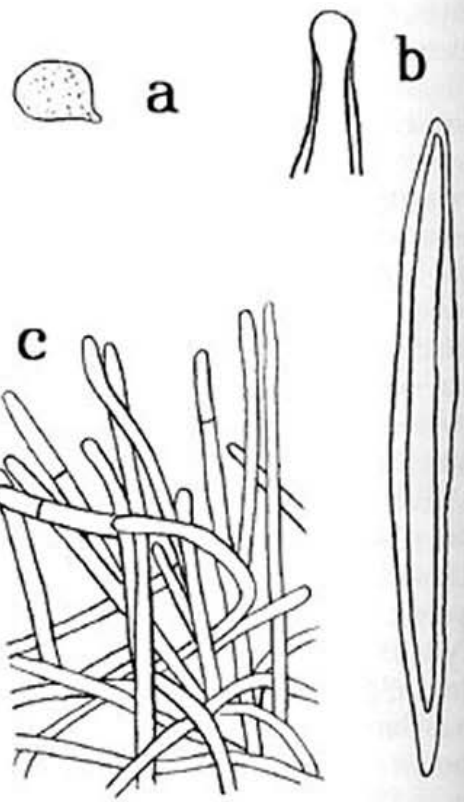


Fig. 18 - *Lactarius rubroviolascens*: a) spore, b) cystidium, c) pileipellis structure.

Habitat and distribution: on the ground, in small groups or solitary; Madagascar.

TYPE: R. Heim, G.85, Madagascar, 9/12/1934 (PC).

COLLECTIONS EXAMINED: PC.: R. Heim, G.85, Madagascar, 9/12/1934 (typus).

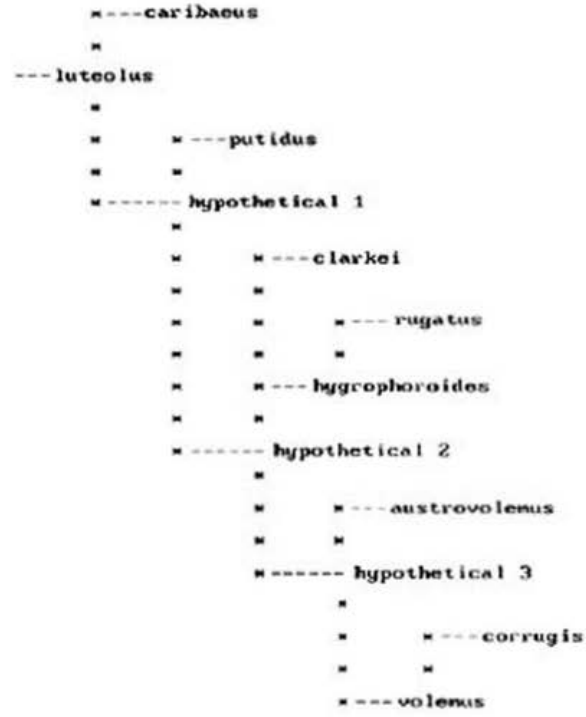
OBSERVATIONS: The context slowly becoming black then red, the light pinkish-grey whey-like latex and above all the filamentous structure of the cuticle which is also easily separable and tomentose, strongly suggest excluding this species from section *Lactifluus* in spite of the presence of very thick-walled hymenial cystidia much resembling those of *Lactarius volemus* (Fr) Fr.. The problem posed by tropical Lactarii is very complex. Nearly always the species cannot be inserted in the traditional groups and are often intermediate between two of them.The existence of species with remarkably visible velar remnants or having a lignicolous habitat as well as the exsistence of species exhibiting quite a few characters intergrading with the genus *Russula*, especially with section *Compactae*, raises a series of questions the answers to which might shed new light on *Lactarius* phylogenesis. HEIM (1937,1955) has included the species from the tropics in the taxonomy of Lactarii which, according to him, is closely related to that of *Russula*. In any case he regards it as provisional on account of its being founded on practical rather than natural principles.

CONCLUSIONS

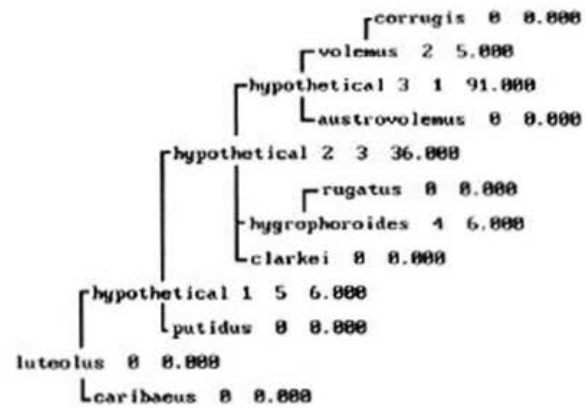
In our study we have examined 171 exsiccata of 27 different taxa which, in the light of the literature we have consulted, belong in sect. *Lactifluus* or have some affinity with it. The investigation was intended, above all, to highlight the structure of the pileipellis, a key sectional character, as well as that of the hymenium. Spore size, in particular, has been assessed statistically, accordingly, in the data reported, in addition to the highest and lowest values in parenthesis, the mean value plus or minus the standard deviation is given. Other sporal parameters accounted for are volume and Q value (ratio between length and width). Further examinations have been carried out by means of a scanning electron microscope, which proved invaluable to the comparison of spore ornamentation. The twenty-seven taxa investigated did not always exhibit microscopical characters perfectly in agreement with the restricted conception of section *Lactifluus* as understood by us. Some of these had been placed by other authors in this same group but it was meant in a broader sense, as a consequence we have had to exclude six species: *Lactarius allochrous*, *L. angustus*, *L. maruiaensis*, *L. pervelutinus*, *L. pseudovolemus* and *L. rubroviolascens*. A seventh species, *L. pegleri*, described as new by us on the basis of some atypical collection of *L. hygrophoroides*, is to be included in the close section *Allardii*. Such a conclusion rests mainly upon the nature of the cuticle structure which in the excluded species does not fit in with the pattern typical in the section, i.e. a clear-cut layer of roundish cells bearing numerous hairs with an anticlinal orientation. Five more species,

L. princeps, *L. braunii*, *L. calceolus*, *L. lividatus* and *L. purgatorii* may only doubtfully be included in the section, not so much for real inconsistencies in the field characters reported in the original descriptions or in the microscopical ones observed by us as for the fact that they probably have to be reduced to synonymy under other taxa of the same section. Unfortunately one goes to great pains to acquire certainty about these synonymies either for lack of exhaustive original descriptions, or for the poor condition of type specimens which do not allow a conclusive study or, finally, also because the species dating from last century are unreported since their publication. Only additional topotype collections might prove crucial to a final clarification. Leaving on one side the excluded and doubtful species we recognize in sect. *Lactifluus* nine species and three varieties among those as yet described from all over the world. The macroscopical and microscopical characters are homogeneous enough, but there is no shortage of differencies, on the contrary, especially in the tropical and neo-tropical species these are so remarkable that they occupy a rather peripheral position in the section. In any case, it is apparent that all species in the section share a common pattern of basic morphological features, and that they fall naturally into three groups. This subdivision was arrived at taking into account macro and micro-characters alike, both processed with statistic and cladistic methods. Three species and two varieties belong in the first group: *L. volemus*, *L. volemus* var. *oedematopus*, *L. volemus* var. *flavus*, *L. corrugis* and *L. austrovolemus*. These entities have a great likeness in habitus and colour pattern and, what is more, exhibit almost identical microscopic structures. The spores are globose or subglobose, with an ornamentation in the form of a marked and complete reticulum and the cystidia, especially peculiar, numerous and obvious, are lanceolate and very thick-walled. The second group is characterized by spores elongated and ornamented with isolated spines or warts; colours are generally light, off-white to yellowish or ochre, rarely with some shade of brown. In this group we have included three species: *L. caribaeus*, *L. putidus* and *L. luteolus*. It is a far less homogeonus group than the previous one, in fact in this case the hymenial cystidia are rather variable and moreover the two neotropical species *L. caribaeus* and *L. putidus* reveal a cuticle structure slightly differing from the typical one. The third group encompasses three species, *L. hygrophoroides*, *L. rugatus*, *L. clarkei* and one variety, *L. clarkei* var. *aurantiorubra*. The spores are of the elongate type as in the second group, but bearing an ornament consisting of an almost complete reticulum. From a microscopical view point the group is homogeneous enough, cuticle, spores and clavate cystidia are more or less the same as to structure and size, also the colour pattern is very similar, orange-brown often with some shade of brick-red. As to the statistical and information technology processes which have substantiated these subdivisions, we want to add that the mean volume has proved to be a datum particularly significant in all the programmes in which it was included. Most instrumental in our evaluating any possible specific identity, it was a confirmation in itself of the grouping hypotheses, except for the atypical tropical species and *L. corrugis*, which statistically is far removed from *L. volemus* and *L. austrovolemus*. In any case, the "Clinch, version 6.2 - 1984, by K. L. Fiala", a Fortran program for cladistic inference by compatibility of hypothesized

character state trees, has turned out the most complete; processing a number of characters it has given the following phylogenetic tree:



The "Conphen, version 2.0 - 1990, by G. F. Estabrook", a program to create evolutionary classifications, with classes monophyletic on a specified phylogenetic tree, using convex phenetix, on the basis of the same characters and data, quantifies the distances among the species which, as a result, are subdivided into the same three groups as hypothesized on the grounds of morphological characters; consequently these groups should be natural:



The distance numerically most significant is between hypothetical 2 and hypothetical 3, the next between hypothetical 1 and hypothetical 2. The distances between the other phylogenetic branchings show much lower values. Hence, we think it proper to assign the groups subsectional rank, not so much for sistematic necessity as to stress the two outstanding jumps in the phylogenetic tree.

Subsectio *Luteoli* Pacioni & Lalli subsect. nov.:
pileus sine colore fulvo vel aurantiaco; sporae ellipsoideae, echinatae vel echinatae et cristis tenuibus praeditae; cystidia tenuitunicata, interdum capitulata; pili pileici interdum capitulati.
Typus: *Lactarius luteolus* Peck.

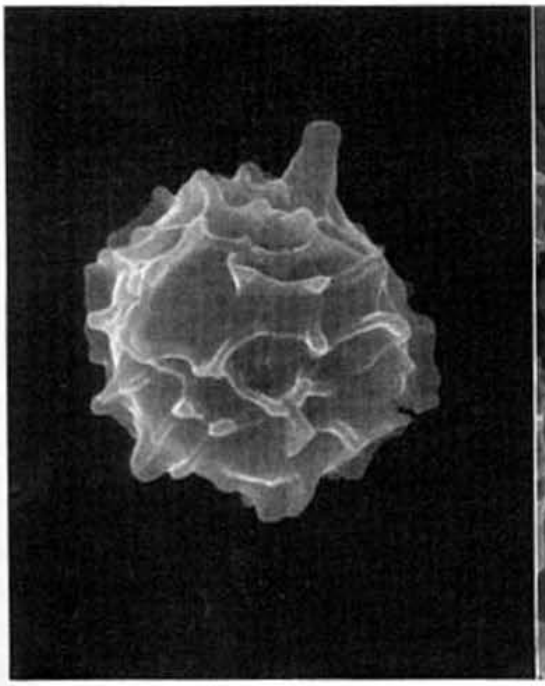
Subsectio *Rugati* Pacioni & Lalli subsect. nov.:
pileus cum colore fulvo vel aurantiaco; sporae ellipsoideae, reticulatae vel echinatae-cristatae; cystidia tenuitunicata, clavaeformia.
Typus: *Lactarius rugatus* Kuehner & Romagnesi.

Subsectio *Volemi* Pacioni & Lalli subsect. nov.:
pileus cum colore fulvo vel aurantiaco; sporae globosae, reticulatae; cystidia crasse tunicata, lanceolata..
Typus: *Lactarius volemus* (Fries) Fries.

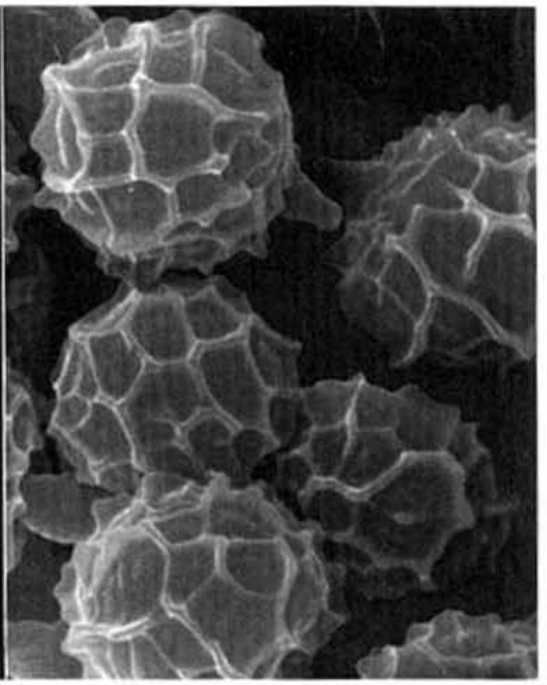
As a conclusion we can add that the Section, with reference to its various species, has an almost world-wide distribution. Most species exhibit very similar characters while a few, especially those from the tropics, show remarkable variations in the structure. This phenomenon is observed also in other species and sections throughout the genus *Lactarius*. The placing of these entities often brings about great problems and brings into question the traditional taxonomic arrangement of the genus based as it is mainly on European and North-American species.

AKNOWLEDGEMENTS

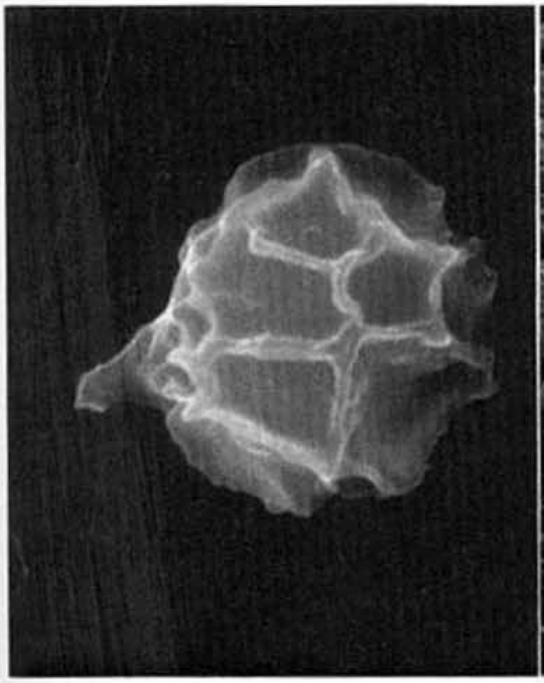
Gratitude is expressed to the Directors of herbaria from all over the world who with great courtesy made available to us the material requested. We are also very grateful to Dr. Ernesto Rebaudengo for providing us with "Les Lactario-russulés du domaine orientale Madagascar" of Heim and to Dr. Maria Giammatteo and Luisa Corona of the Electron Mycroscopy Centre of L'Aquila University. Finally we are indebted to Dr. Edmondo Grilli for the English translation of the text.



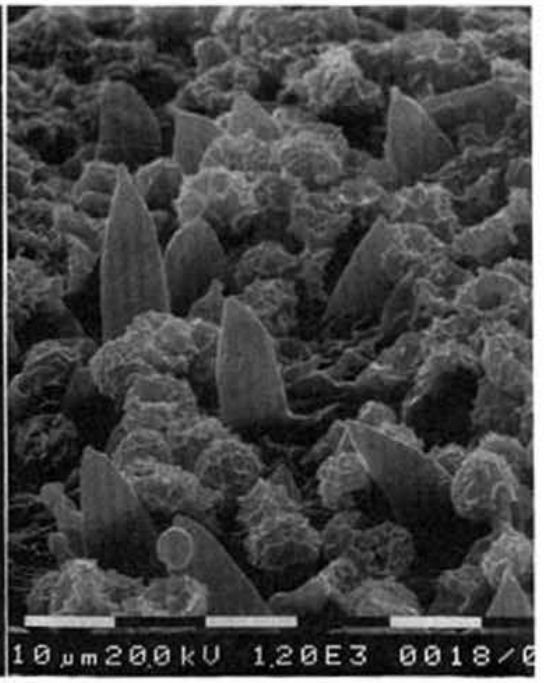
a) *Lactarius corrugis*: spore.



b) *Lactarius volemus*: spores.

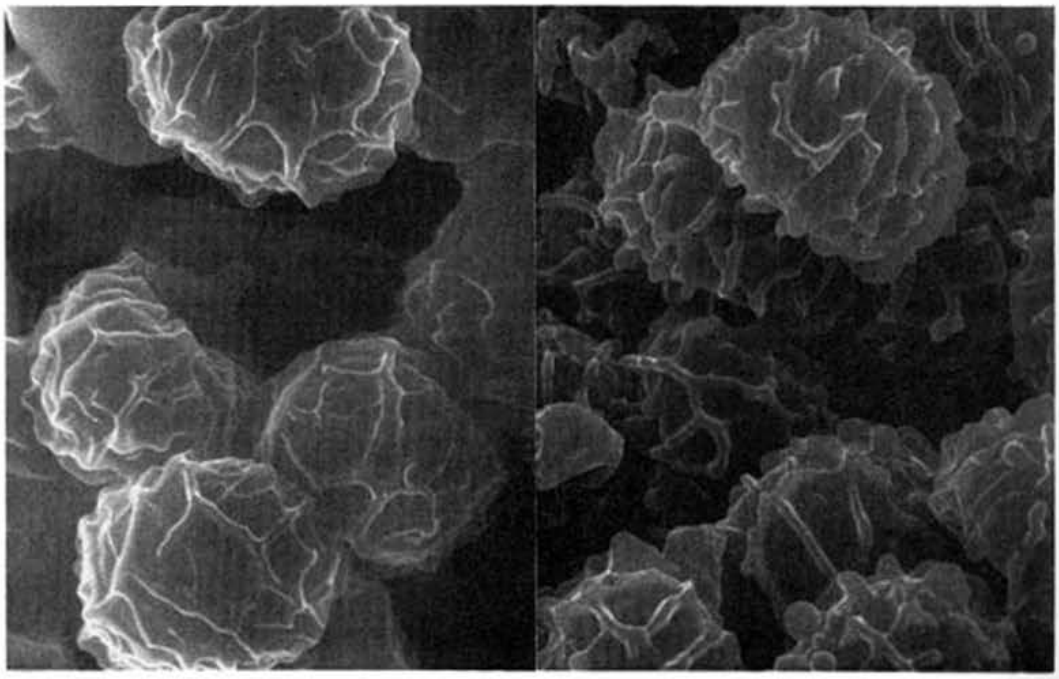


c) *Lactarius austrovolemus*: spore.



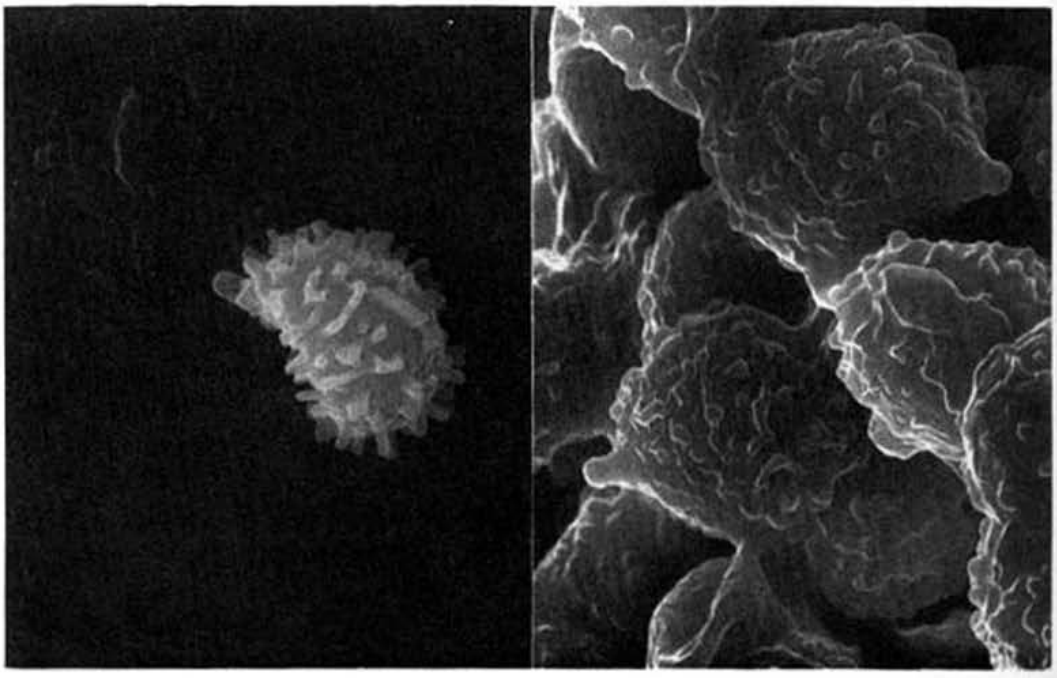
d) *Lactarius volemus*: cystidia (x900).

Plate 1: scanning electron micrographs (x 3.750).



a) *Lactarius rugatus*: spores.

b) *Lactarius hygrophoroides*: spores.



c) *Lactarius luteolus*: spore.

d) *Lactarius pegleri*: spores.

Plate 2: scanning electron micrographs (x 3.750).

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MYCOTAXON

Volume XLIV, no. 1, pp. 197-217 April-June 1992

REEVALUATION OF REPORTS OF 15 UNCOMMON SPECIES OF CORTICIUM FROM CANADA AND THE UNITED STATES

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Abstract: - Fifteen species, most of which were treated in the 1926 monograph by E.A. Burt in the genus *Corticium*, have been reevaluated. Most of the specimens cited by Burt were restudied and many were found to have been misdetermined. Four fungi (*C. auberianum*, *C. debile*, *C. subcontinuum*, *C. subochraceum*) are extralimital and no longer considered as part of the mycoflora of Canada and the United States. The remaining eleven species are excluded from *Corticium*. New combinations proposed are: *Athelia maculare* (Lair), *Ceraceomyces subapiculatus* (Bres.), *Clavulicium venosum* (Berk. & Rav.), *Hyphoderma leptaleum* (Ellis & Ev.), *Hyphoderma rubropallens* (Schw.), and *Hypochnicium versatum* (Burt). Four names are placed in synonymy: *Corticium epigaeum* Ellis & Ev. is *Gloeocystidiellum lactescens*, *C. ochraceum* (Fr.) Fr. is *G. ochraceum*, *C. ravum* Burt is *G. karstenii*, and *C. rubrocanum* Thümen is *C. albido-carneum* (Schw.) Massee which is a *nomen dubium*.

In preparation for the publication of a synopsis of the corticioid fungi of North America (in press) disposition of a number of reported species could not be found in recent monographs. Fifteen of these are treated here. E.A. Burt (1926) recognized just over 100 species in his North American monograph of the genus *Corticium*. Most of these were reported from the United States and Canada. Subsequently the circumscription of the genus *Corticium* has been much reduced with the result that many species formerly in *Corticium* have been placed in other genera and the necessary new combinations proposed. Two studies have concentrated on revising the *Corticium* names treated by Burt (Liberta 1969, Rogers and Jackson 1943). However, types or vouchers for several species of *Corticium* have not been reevaluated and these fungi remain, perhaps misplaced, in *Corticium*.

The collections that Burt cited represent the known geographic distribution and substrate preferences for most of the species treated below. The type specimens and most other collections cited by Burt for these fungi have been restudied to determine whether the name should remain in *Corticium*, whether all specimens are conspecific, and to confirm the published distribution and substrate records.

Burt, for most of his career, worked at the Missouri Botanical Garden (MBG). However, the mycological collections, which he cited by MBG accession number are now housed at the National Fungus Collection, U.S. Department of Agriculture, Beltsville, Maryland (BPI). Burt's private herbarium, containing some type specimens and specimens he cited, is now at the Farlow Cryptogamic Herbarium, Cambridge, Massachusetts (FH).

METHODS

The standard mounting media for examination of specimens of the Corticiaceae were used, i.e., Melzer's reagent, 2% potassium hydroxide, cotton blue in lactic acid, and sulfobenzaldehyde. The formulae for these can be found in Boidin (1958), Hawksworth *et al.* (1983) and Hjortstam *et al.* (1987). The codes in parentheses represent colours from the *Munsell Book of Color* (Anon., 1929-1942). The abbreviations for herbaria where specimens examined are permanently housed are from Holmgren *et al.* (1990). The epithets are treated in alphabetical order.

RESULTS

***Corticium albido-carneum* (Schw.) Massee**
J. Linn. Soc., Bot. 27: 142, 1890.
Basionym: *Thelephora albido-carnea* Schw., Amer. Philos. Soc. Trans., n.s. 4: 169, 1832.

Citation of type: "*passim in cortice Vitis obvia*, Bethlehem", fide Schweinitz.

Basidiomes effuse, crustose, 45 x 15 mm and about 150 μm thick; hymenial surface smooth, dull, glabrous, pale brown with a greyish

white bloom on the surface and heavily fissured into 1 x 1 mm frustules; subiculum yellow brown, firm; margin white, adnate, sparse, cottony, 1 mm wide.

Hyphal system monomitic; generative hyphae 3.0-4.0 (-5.0) μm diam, with clamp connections, the walls hyaline, thin, nonamyloid; cystidia (probably gloeocystidia) imbedded in the subiculum, cylindrical-clavate, sulfo-negative, 40 x 9 μm; botryose dendrophyses much branched with the ultimate branches 1 μm diam, projecting 5-10 μm, soluble in 2% KOH; hymenial layer of cylindrical-clavate immature basidia, 20 x 6 μm, neither mature basidia nor basidiospores seen.

The preceding description was taken from the neotype (PH). Specimens, presumably parts of the neotype, in the Michener Collection (BPI) and the Curtis Collection (FH) are the same fungus and they too are sterile.

Burt (1926:278) cited three collections, one each from Pennsylvania (the type), Michigan and Virginia. The Michigan and Virginia collections are not conspecific with the type collection. The Virginia collection matches the description published by Burt. It has simple-septate hyphae and broad vesicles 10-15 μm diam, but neither basidiospores nor mature basidia were seen. Another collection of this fungus from Maryland is also sterile. The Michigan collection is a third fungus, characterized by thick-walled subicular hyphae 2.0-3.5 μm diam with clamp connections and ellipsoid spores 10.5 x 5.5 μm, which was not further identified. The fact that all collections were from *Vitis* suggests that the mycoflora of corticioid fungi on that genus is varied and poorly known.

The name cannot be adequately characterized, because neither mature basidia nor basidiospores are known, and is declared a *nomen dubium*. *Corticium rubrocanum* is the same fungus and specimens of it are sterile also (see below).

Specimens examined: Maryland: Takoma Park, March 1900, on *Vitis* sp., C.L. Shear, det. D.P. Rogers (BPI 283839). Michigan: Paw Paw, 9 May 1908, on cultivated grape vine, L.A. Hawkins (FH). Pennsylvania: Bethlehem, on *Vitis* sp., ex Herb. Schweinitz, as *Thelephora albido-carnea* (PH herein designated neotype, presumed isotypes BPI: Michener Collection 15:17 and FH: Curtis Herb.).

Virginia: Arlington Farm, 28 Feb. 1915, on dead bark of grape, C.L. Shear 2810, MBG 15310 (BPI 283842).

***Corticium auberianum* Mont.**
In: La Sagra, Hist. de Cuba 9 (2): 226, 1845.

Citation of type: "*Ad ramulos in Cuba insula prope* Alquizar *a cl. Auber inventum*", fide Montagne.

Burt (1926:199) cited ten collections from the United States. All have been studied by me. Both Arkansas collections are a *Peniophora* sp., the Florida collection is a *Phanerochaete* sp., the Georgia collection and the Louisiana collections, cited as Q and R, appear to be sterile specimens of a *Scytinostroma* sp., the North Carolina collection is a *Hyphoderma* sp., the South Carolina collection is a *Corticium sensu stricto* but no spores were seen, and the two Vermont collections are two species of *Grandinia.*

The heterogeneity of the specimens that Burt in some instances referred to one epithet has been reported by Rogers and Jackson (1943). They concluded that of 17 paratypes of *Corticium abeuns* Burt "only three resemble the type at all closely."

There is a packet (BPI 280382) which may contain part of the type, but the fungus has been almost entirely devoured by insects and could not be adequately characterized. Also three additional collections at BPI are labelled *C. auberianum*. One (BPI 280385) is *Phanerochaete velutina* (DC.:Fr.) Karst., the second (BPI 280387) is unknown to me and is sterile, and the third (BPI 280386) is unidentifiable due to its poor condition. Finally, the Bermuda collection, cited by Burt, is *Grandinia* sp. but the hymenium is poorly preserved.

I have not seen the type of *C. auberianum* at Kew, from Cuba, but the variety of species represented in the United States collections cited by Burt suggests that none may be conspecific with the type. Until the type has been adequately characterized, *C. auberianum* should not be considered as part of the mycoflora of the United States.

Specimens examined: Arkansas: Womble, W.H. Long, MBG 8633 (BPI 280388) and MBG 17801 (BPI 280389). Georgia: Tallulah Falls, A.B. Seymour, MBG 44595 (BPI 280381). Florida: Sands Key, R.A. Harper 6, MBG 54537 (BPI 280380). Louisiana: St. Martinville, 14 Mar. 1899, A.B. Langlois "R" (FH), near St. Martinville, 28 Nov. 1899, ABL "Q" (FH), presumably St. Martinville, ABL 2970 (BPI 280385), and ABL, s.n. (BPI 280387). North Carolina: Blowing Rock, on decayed, decorticated branches of a hardwood on the ground, G. Atkinson 4330 (BPI 280384, FH). Pennsylvania (presumably), on dead *Crataegus*, ex E. Michener, M.D., MBG 63748 (BPI 280386). South Carolina: Society Hill, Jan. 1848, M.A. Curtis 2497 (FH Burt Herb. and Curtis Herb.). Vermont: Middlebury, 23 Sept. 1898, E.A. Burt (FH) and Middlebury: Chipman's Hill, 13 Aug. 1896, EAB (FH). Bermuda: Walsingham, H.H. Whetzel, MBG 58718 (BPI 280390). Cuba, ex Montagne, ex Bresadola herbarium (BPI 280382).

***Corticium debile* Berk. & Curt. ex Massee**
J. Linn. Soc., Bot. 27: 131, 1890.

Citation of type: "(Type in Herb. Berk. n. 4065). On wood. Venezuela; United States", fide Massee.

A presumed isotype lacks any structure. No details could be discerned. I have not seen specimens, if any exist, from Kew.

Burt (1926:274) cited three collections from the United States. The features of the California collection match Burt's description very closely. Burt did not describe the basidia, but I found them to be tremellaceous, and the collection to be *Basidiodendron eyrei* (Wakef.) Luck-Allen. One (BPI 281076) of the two Louisiana collections is *Cystostereum murraii* (Berk. & Curt.) Pouzar. I have not seen the other Louisiana collection which Burt cited as "Langlois, bb".

Until the features characterizing this name are clarified it should not be considered as part of the mycoflora of the United States.

Specimens examined: California: Palo Alto, 25 Nov. 1911, W.A. Murrill & L.S. Abrams 1195, MBG 55709 (BPI 281068). Louisiana: St. Martinville, 12 Jan. 1890, A.B. Langlois 2674, MBG 58327 (BPI 281076). Venezuela, coll. Fendler, (204) (presumed isotype FH).

***Corticium epigaeum* Ellis & Ev.**
J. Mycol. 1: 88, 1885.

Citation of type: "Oregon: *Carpenter, 100,* type (in N.Y. Bot. Gard. Herb.)", fide Burt.

Basidiomes in pieces, about 20 x 20 mm; hymenial surface smooth to tuberculate, pallid, not cracked; margin white, appressed, to 5 mm wide.

Hyphal system monomitic; subicular hyphae distinct, woven, with clamp connections, 2.0-3.5 μm diam, the walls hyaline, thin, nonamyloid, acyanophilous; hyphidia numerous, vertically oriented, 2.4-3.4 μm diam, but the apical features obscure; gloeocystidia (Fig. 2) common, cylindrical, up to 120 x 7-12 μm, the contents granular in 2% KOH and in Melzer's, staining grey black in sulfobenzaldehyde, the walls hyaline, thin, smooth, nonamyloid, acyanophilous; basidia not found; basidiospores (Fig. 1) broadly ellipsoid to subglobose, 6.0-7.0 x 4.4-5.2 μm, the walls weakly amyloid, hyaline, smooth, acyanophilous, with a large, broad, blunt apiculum.

The tuberculate nature of the hymenial surface seemed to be caused by the irregular surface of the soil over which it grew. The basidiospores were scattered throughout the thickness of the basidiomes, suggesting that hymenial thickening had occurred progressively. The lack of cracks in the basidiome suggests it was a young specimen when collected.

This specimen is *Gloeocystidiellum lactescens* (Berk.) Boidin as described in Eriksson and Ryvarden (1975) and the name *Corticium epigaeum* is placed in synonymy. Burt (1926) cited the type and seven additional collections as *C. epigaeum*, but I have studied only the type.

Specimen examined: Oregon, on the ground over soil, July 1884, W.C. Carpenter, 100 (NY).

Hyphoderma leptaleum* (Ellis & Ev.) Ginns, *comb. nov.
Basionym: *Corticium leptaleum* Ellis & Ev. in C.F. Millspaugh and L.W. Nuttall, Field Columbian Mus. Publ. 9, Bot. Ser. 1:170, 1896.

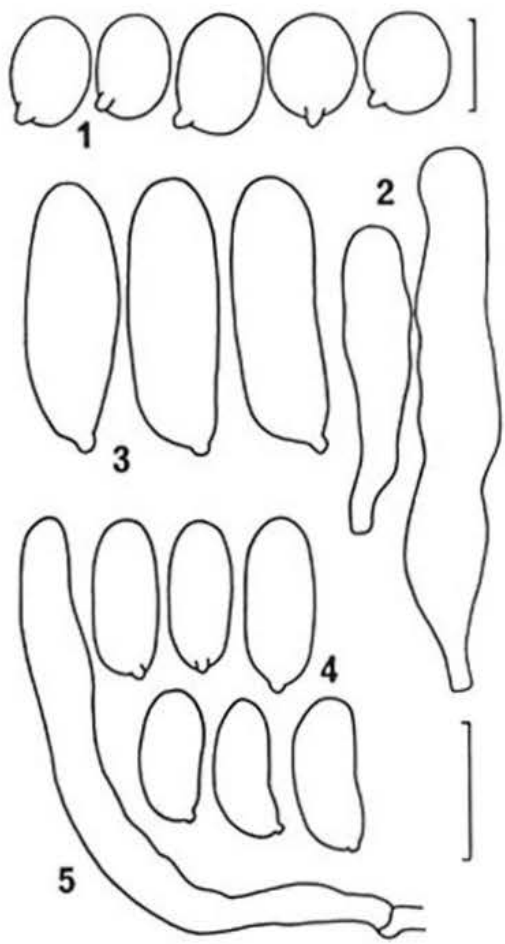
Citation of type: "On under side dead sapling *Magnolia Fraseri*, alt. 1,800 ft. April 11, 1895 (*Nuttall*, discov. 1803, 690)", fide Ellis and Everhart.

Basidiome effuse, about 88 x 30 mm, when fresh it was apparently a membrane which, upon drying, shrunk and cracked, leaving irregular shaped pieces often several millimeters from adjacent pieces; hymenium smooth, translucent, corneus, grayish tan.

Hyphal system monomitic; subicular hyphae 3-6 μm diam, with clamp connections, the walls hyaline, thin, nonamyloid; lamprocystidia imbedded, scattered, with a conical, encrusted apex 40 x 17 μm; basidia slenderly clavate, 40-50 x 7-10 μm with four sterigmata; basidiospores (Fig. 3) cylindrical, 14.6-15.4 x 4.4-4.8 μm, the walls hyaline, thin, smooth, nonamyloid.

Known only from the type collection. The original description appears to cite two collections, but the labelling on the packets indicate that 690 is an Ellis number. Burt (1926: 280) attributed number 690 to Nuttall. I could find no explanation for the meaning of "discov.", although it appears several times in the paper. The two packets I examined are presumed to be isotypes.

The microscopic features are similar to *Hyphoderma mutatum* (Peck) Donk and the combina-



Figs. 1-5. *Corticium epigaeum*. Fig. 1. Basidiospores. Fig. 2. Gloeocystidia. From Carpenter 100 (NY type). *Hyphoderma leptaleum*. Fig. 3. Basidiospores. From Ellis 690 (BPI type). *Hyphoderma rubropallens*. Fig. 4. Basidiospores. Fig. 5. Cystidium. From Bethlehem (PH). Scale in 1 = 5 μm, and applies to 1, 3, and 4. Scale in 5 = 20 μm, and applies to 2 and 5.

tion is proposed to align this fungus with allied species.

Specimens examined: West Virginia: Fayette Co., on bark attached to rotted wood of dead, small *Magnolia fraseri*, 11 April 1895, (254), 1803, J.B.E. 690, "Type material" (BPI 296883), and a second packet with the same data but lacking the number 254 (BPI 282001).

Athelia maculare* (Lair) Ginns, *comb. nov.

Basionym: *Corticum maculare* Lair, J. Elisa Mitchell Sci. Soc. 62: 216, 1946.

Citation of type: No type specimen was designated and no specimens were cited.

Basidiomes effuse, in pieces 10 x 10 mm and 80 μm thick, crustose, adnate, fissured into irregular polygons 0.5 mm diam; margin white, thin, granulose, to 0.5 mm wide; hymenial surface smooth, pale yellow brown (10YR7/6), glabrous; subiculum very thin, white.

Hyphal system monomitic; subicular hyphae (Fig. 10) short celled (about 20 μm long), much branched, contorted, closely packed, 2.8-4.4 μm, a few heavily encrusted (Fig. 8) and 3-5 μm diam, with clamp connections, the walls hyaline, thin, nonamyloid, acyanophilous; in 51001 there was a layer 10 μm thick of parallel, horizontally arranged hyphae next to the substrate which were heavily encrusted and 4-6 (-9) μm diam; vesicles (Fig. 9) uncommon, globose, 8 μm diam, the walls hyaline, thin, smooth; hymenium and subhymenium with numerous globose granules; immature basidia (Fig. 7) slenderly clavate, 15-22 x 4 μm, with a basal clamp connection; basidia apparently narrowly clavate, 15-20 x 4-4.8 μm, with four sterigmata on each; basidiospores (Fig. 6) cylindrical-ellipsoid, (4.0-) 4.4-4.8 (-5.2) x 2.4-2.6 μm, the walls hyaline, thin, smooth, nonamyloid, with a blunt apiculum.

Mature basidia were rare and were collapsed. This and the numerous granules made it difficult to determine basidial shape and number of sterigmata. Lair described the basidia as "cuboidal", and illustrated them in her figures 11-12, but I did not see any like these.

The hymenium is thicker and the subiculum denser and more adnate than is typical of species of *Athelia*. However, I do not see a better genus for this fungus.

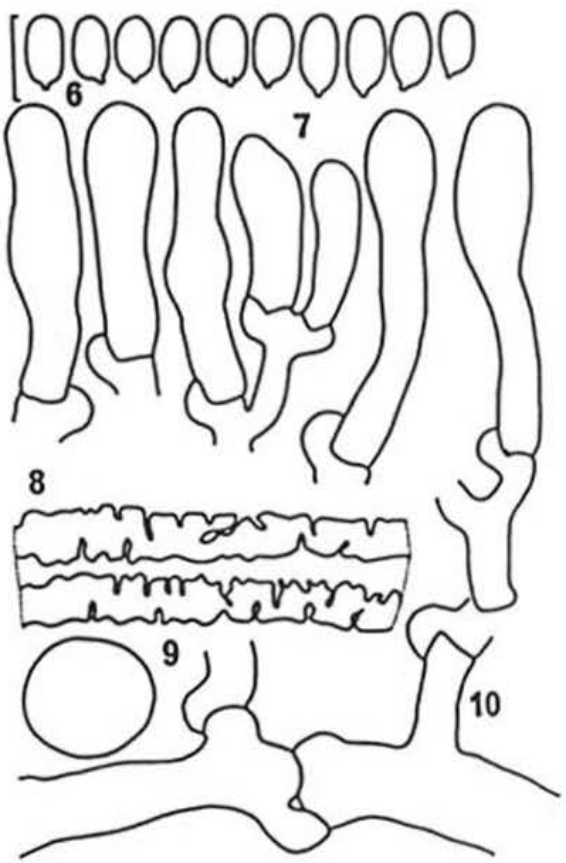
Although reported by Lair to cause Smooth Patch disease of oak, no further reports of the fungus or its disease have been found.

Specimens examined: North Carolina, Durham, 28 Aug. 1945, F.A. Wolf (TRTC), Sept. 1945, FAW (TRTC 51002 herein designated neotype), 25 May 1946, E.D. Lair (TRTC 51001); Chapel Hill, 18 Oct. 1945, J.L. Lowe 2921 (TRTC).

***Corticium ochraceum* (Fr.) Fr.**
Epicrisis, p. 563, 1838.

It is perplexing that Burt did not cite the basionym, in this instance *Thelephora ochracea* Fr., Syst. Mycol. 1:446, 1821, because he usually did. Perhaps he thought *C. ochraceum* to be a distinct species from *T. ochracea*. This fungus is now named *Gloeocystidiellum ochraceum* (Fr.) Donk.

Burt (1926:242) cited seven collections from North America, i.e. Alabama, Idaho, Montana, Vermont and Washington. Five were misdetermined. The Alabama and Idaho collections are in poor condition but they are not species of *Gloeocystidiellum*, the Montana collection is a *Phanerochaete*



Figs. 6-10. *Athelia maculare*. Fig. 6. Basidiospores. Fig. 7. Immature basidia. Fig. 8. Segment of encrusted hypha. Fig. 9. Globose vesicle. Fig. 10. Segment of subicular hypha. From TRTC 51002. Scale = 5 μm.

sp., the Vermont collection is a *Hyphoderma* sp., one Washington collection (Humphrey 1454, miscited as 6454) appears to be a species of *Peniophora*. Two Washington collections (Murrill 135 & Humphrey 1373, miscited as 6373) are similar to *G. ochraceum* but with larger and somewhat differently shaped spores than shown by Eriksson and Ryvarden (1975). For the present I accept these (Murrill 135 & Humphrey 1373) as *G. ochraceum*.

Specimens examined: Alabama: Montgomery, Burke 606, MBG 57471 (BPI 282275). Idaho: Priest River, J.R. Weir 59 (FH). Montana: Rexford, E.E. Hubert, JRW 12017, MBG 63373 (BPI 282290). Vermont: Middlebury, on charred *Pinus strobus*, coll. E.A. Burt (BPI 282292). Washington: Seattle, Murrill 135, MBG 55737 (BPI 282274), also 10 Oct. 1909, C.J. Humphrey 1454 (FH); Hoquaim, 22 Oct. 1909, CJH 1373 (FH).

In addition, at BPI there are twelve other collections from the United States labelled *C. ochraceum*, three were determined by Burt. None are, in my opinion, *G. ochraceum*, i.e., BPI 282269 and 282288 are *Resinicium furfuraceum* (Bres.) Parm., BPI 282273 and 282289 are in very poor condition, BPI 282279 is *Coniophora puteana* (Schum.:Fr.) Karst., BPI 282283, 282293, 282296 and 282297 are several species of *Hyphoderma*, BPI 282287 is a *Phanerochaete* sp., BPI 282295 is a *Grandinia* sp., and BPI 282297 is a *Phlebia* sp.

***Corticium ravum* Burt**
Ann. Missouri Bot. Gard. 13: 251, 1926.

Citation of type: "Louisiana: St. Martinville, *A.B. Langlois, 1765* and *N*, type", fide Burt.

Burt cited collections from Brazil and Cuba, and five collections from the Gulf Coast-Lower Mississippi River area of the United States, i.e., Alabama, Florida, Louisiana, and Missouri.

The holotype (Langlois N) is a specimen of *Gloeocystidiellum karstenii* and the name *C. ravum* is placed in synonymy. The paratype from Alabama and a South Carolina collection labelled *C. ravum*, but not cited by Burt, are also *G. karstenii*. Some spores in the three collections were up to 1 μm longer and 0.5 μm wider than the sizes given for collections from Europe (Eriksson and Ryvarden

1975). The gloeocystidia in the holotype were sulfo-negative but in the other two collections some gloeocystidia stained grey black.

The remaining collections, all paratypes, cited by Burt are not conspecific. The Florida collection is similar to *G. karstenii* but has larger spores (8-) 10 (-12) x 4.5-5.0 (-6.0) µm, slightly larger verrucae on the spores, slightly broader hyphae 3-5 µm diam and broader basidia 10 µm diam. The part at BPI was probably not seen by Burt. The second collection from Louisiana (Langlois 1765) Burt cited is *G. clavuligerum*. The Missouri collection is sterile but is not *G. karstenii* because it lacks sulfo-positive gloeocystidia and the hyphae have clamp connections. Finally, the Cuban collection is a *Gloeocystidiellum* with small, smooth spores, 5.2-5.6 x 4.0-4.4 µm, which are significantly smaller than the spores in the holotype.

Specimens examined: Cuba: Omaja, 20 Dec. 1914, on lower half of prostrate hardwood log, C.J. Humphrey 3056 (FH). USA: Alabama: Montgomery, on bark of hardwood twigs 15 mm diam, R.P. Burke 126, MBG 5282 (BPI 282695). Florida, Feb. 1899, on bark of hardwood twigs about 10 mm diam, C.G. Lloyd 4832 (BPI 330512 = Lloyd Herb. 46057, FH). Louisiana: near St. Martinville, 23 Nov. 1899, on bark of 20 mm diam hardwood branches, A.B. Langlois N (FH holotype) and 22 Aug. 1898, on bark of a hardwood, ABL 1765 (FH). Missouri: Creve Coeur, Oct. 1913, coll. E.A. Burt, MBG 44045 (BPI 282693). South Carolina: St. Stephens, 26 Oct. 1923, on bark of branch of *Nyssa* sp. 20 mm diam, C.L. Shear, FP 71137, det. H.S. Jackson (BPI 282696, DAOM 31352).

***Corticium rubrocanum* Thümen**

Mycotheca Univ. Exs. 409, 1876 and Torrey Bot. Club. Bull. 6: 95, June 1876.

Citation of type: "Newfield, N.J. ad *Quercus coccineae* ramos emortuos. Vere 1875. Leg. T. (sic) B. Ellis. (no. 2248)", fide Thümen.

The type collection was distributed in Thümen's exsiccatae as number 409. I have studied four copies of 409 but no spores were seen. The most distinctive features of this fungus are the botryose dendrophyses (Fig. 11), hyaline hyphae with clamp connections, clavate hymenial elements with brown walls, and the occasional

globose vesicle. The dendrophyses dissolve in 2% KOH, do not stain in Melzer's, are common in the hymenial area, have the terminal branches 0.5 μm diam, and the stem is 1.6 μm diam.

Burt (1926:231) cited, in addition to the type, five specimens. He did not find spores. These collections and several others also labelled *C. rubrocanum*, were studied by me. All the collections, except 5111, are conspecific with the type but no basidiospores were seen. Collection 5111 from Louisiana lacks dendrophyses, apparently has sulfo-negative gloeocystidia and has smooth, amyloid spores about 6 x 3 μm.

Although *Corticium rubrocanum* is known from several collections, in the absence of basidiospores it is not possible to concisely characterize this fungus. However, the available features of *C. rubrocanum* are the same as those of the type specimen of *C. albido-carneum* (see above), and the name *C. rubrocanum* is placed in synonymy.

Specimens examined: Alabama: Montgomery, on bark of *Quercus* branch 15 mm diam, R.P. Burke 105, MBG 11280 (BPI 282822). Louisiana: St Martinville, on bark of dead twigs of *Quercus* 10 mm diam, 11 April 1898, A.B. Langlois 1993 (FH); no location, on bark of *Quercus* branch 20 mm diam, 28 Nov. 1899, B. Labbe, Herb. Langlois (BPI 282817); Natchitoches, Feb. 1899, G.D. Harris, Cornell U. 5111 (FH). New Jersey: Newfield, on dead branches to 10 mm diam of *Quercus*, coll. Ellis, s.d., Herb. Eugene A. Rau (BPI 282807); on bark of underside of dead limbs of *Q. coccinea*, "Ver. E.A.B." script. E.A. Burt, North American Fungi 22 (BPI 282819); 24 April 1876, ex Herb. Ellis, MBG 44638 (BPI 282814); on *Quercus* limbs, April 1888, J.B. Ellis, MBG 4846 (BPI 282811); on twigs to 10 mm diam of *Q. coccinea*, Vere 1875, JBE 2248, Mycotheca Univ. 409 (BPI 282818, DAOM and two packets in the BPI exsiccatae collection, all isotypes). South Carolina, on bark of rotten limb of *Quercus*, Feb., H.W. Ravenel 377 (FH).

Hyphoderma rubropallens* (Schw.) Ginns, *comb. nov.

Basionym: *Thelephora rubropallens* Schw., Amer. Philos. Soc. Trans., n.s. 4: 168, 1832.

Synonym: *Corticium rubropallens* (Schw.) Massee, J. Linn. Soc., Bot. 27: 145, 1890.

Citation of type: "longe lateque effusa in corticibus et lignis Bethlehem", fide Schweinitz.

Basidiome effuse, only small patches about 5 x 5 mm remain, up to 200 μm thick, adnate, at 10x pale violet grey (near 10YR8/4) to pale greyish brown (10YR7/4), somewhat ceraceous but softening immediately when wetted; hymenial surface smooth; margin no longer extant.

Hyphal system monomitic; generative hyphae distinct, randomly woven, except next to the substrate where they are horizontally arranged in a layer about 20 μm thick, not encrusted, short-celled, frequently branched, with clamp connections, 3-4.6 μm diam with some inflations to 7 μm, the walls hyaline, thin, nonamyloid; cystidia (Fig. 5) uncommon, originating in the subiculum, apparently terminating in the hymenium but the apices poorly preserved, cylindrical, 70-100 x 8-10 μm, the walls hyaline, thin, smooth, nonamyloid, the contents sulfo-negative, in Melzer's with granular or oily patches (all other cells have homogeneous contents); mature basidia not seen with certainty, immature basidia somewhat shrunken, clavate, 17 x 6 μm; basidiospores (Fig. 4) rather common on top of the hymenium, cylindrical-ellipsoid, adaxially flattened to slightly concave, (8.0-) 8.4-9.4 (-9.6) x 3.2-4.0 μm, the walls hyaline, thin, smooth, nonamyloid, with a broad, blunt apiculus.

This description was taken from the collection in the Schweintiz Herbarium (PH). It has been about 90% devoured by insects. This packet contains two pieces, one wrapped in rather heavy paper and the other glued to blue-lined paper. The description was taken from the part on the blue-lined paper. A presumed piece of the type in the Michener Collection could not be adequately characterized because it had been devoured by insects.

Burt (1926:230) cited only two collections, the type in the Schweinitz Herbarium and a collection from Alabama. Burt's description is a composite. The Alabama collection is a species of *Scytinostroma* but no spores were found.

The Schweinitz collection has shorter and narrower spores, and a somewhat denser, more adnate basidiome but in other respects is very similar to *Hyphoderma roseocremeum* (Bres.) Donk, according

to specimens from Alberta (DAOM 142404) and Sweden (DAOM 68628), hence the transfer to *Hyphoderma* is proposed.

Specimens examined: Alabama: Montgomery, June 1910, on board of hardwood, R.P. Burke 118, MBG 19557 (BPI 282823). Pennsylvania: Bethlehem (PH herein designated neotype), ex Herb. Schweinitz, Michener Collection 13:18 (BPI).

Ceraceomyces subapiculatus* (Bres.) Ginns, *comb. nov.

Basionym: *Corticium subapiculatum* Bres., Mycologia 17: 69, 1925.

Citation of type: "ad truncos *Pini*, Idaho. (*Weir 16928.*)", fide Bresadola.

Basidiomes effuse, in pieces, the largest being 100 x 30 mm and 300 μm thick, athelioid; hymenial surface smooth, delicate, crustose, pastel yellow to cream color; margin not extant; subiculum very thin, white to pallid.

Hyphal system monomitic; subicular hyphae loosely woven, with clamp connections, 3.2-7.5 μm diam, the walls hyaline, thin to 0.8 μm thick, nonamyloid, acyanophilous; all cells in the hymenium have a basal clamp connection; cystidia (Fig. 13) scattered in the marginal area, cylindrical, with a broadly rounded apex, septate with a clamp connection at each septum, 3.6 μm diam, projecting to 16 μm; basidia (Fig. 14) cylindrical-clavate, 28-30 x 5-7 μm, with four sterigmata, when mature projecting 10-15 μm; basidiospores (Fig. 12) cylindrical-ellipsoid, (6.0-) 6.2-8.0 (-10.0) x 3.0-3.6 μm, the walls hyaline, thin, smooth, nonamyloid, acyanophilous, with a rather broad blunt apiculus. Spore print pallid to white when dry and on black paper.

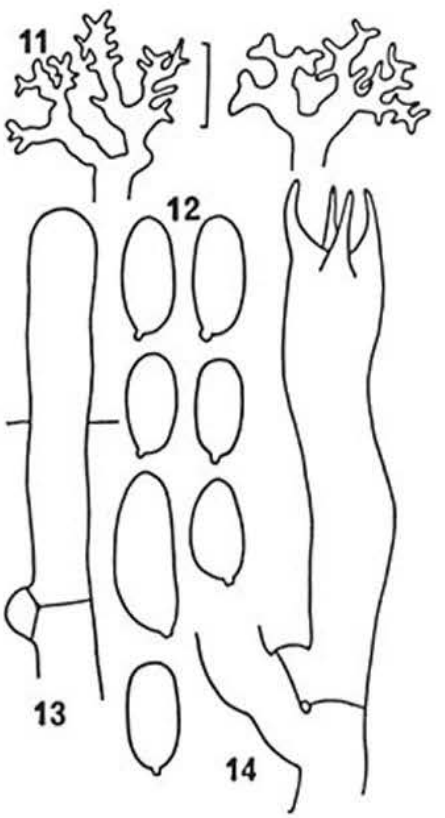
Burt (1925:280) transferred the epithet to *Peniophora* and cited eight collections from British Columbia, Idaho and Montana. Five, including the type, have been studied by me. One (BPI 283100) of the Montana collections is identical with the type, but the other (BPI 289035) is a specimen of *Grandinia alutaria* (Burt) Jülich. Two Idaho collections (BPI 289034 & 289037) are specimens of *Fibricium rude* (Karst.) Jülich.

My observations agree with the comments by Rogers and Jackson (1943) who studied the type and all other specimens, with one exception, cited by Burt. They stated "All of the six (sic) additional collections assigned to this species by Burt have been examined. Three of them prove to be *Peniophora greschikii* (Bres.) Bourd. & Galz. ..., and two are *Peniophora pallidula* Bres., neither of which resembles *C. subapiculatum* at all closely. Only one (Weir 414) from Evaro, Montana, is like the type."

Although Burt described cystidia as "hair-like, not encrusted, cylindric, obtuse, 3-4½ μ in diameter, protruding 10-40 μ beyond the basidia", Rogers and Jackson stated, "An examination of the type fails to reveal any cystidia." Perhaps Rogers and Jackson were expecting to find differentiated cystidia, for I found structures that fit Burt's description of cystidia.

The type is similar to *Ceraceomyces tessulatus* (Cooke) Jülich, hence the transfer to *Ceraceomyces* is proposed.

Specimens examined: Idaho: Clarkia, 23 Jan. 1920, on underside of charred, decorticated log of *Pinus monticola*, A.S. Rhodes, J.R. Weir 16928 (BPI 289032); Coolin, 18 Sept. 1919, on *Thuja plicata*, JRW 11086, MBG 63245 (BPI 289037); Priest River, 30 July 1919, on conifer bark, twigs and needles, E.E. Hubert, JRW 12020, MBG 63375 (BPI 289034). Montana: Evaro, 17 Sept. 1915, on decorticated wood of *Pinus ponderosa*, JRW 414, MBG 63720 (BPI 283100); Kalispell, 20 Sept. 1919, on bark of *P. monticola*, E.E.



Figs. 11-14. *Corticium rubrocanum*. Fig. 11. Dendrophyses. From Thümen, 409 (BPI Exsiccatae Collection). *Ceraceomyces subapiculatus*. Fig. 12. Basidiospores. Fig. 13. Cystidium. Fig. 14. Basidium. From Weir 16928. Scale in 11 = 5 μm, and applies to 11-14.

Hubert, JRW 11957 (BPI 289035).

***Corticium subcontinuum* Berk. & Curt.**
J. Linn. Soc., Bot. 10: 337, 1868.

Citation of type: Cuba, Charles Wright 537, on bark, fide Berkeley and Curtis.

Burt (1926:288) cited four collections from the United States, three from Louisiana and one from Texas. All have been studied by me. The Texas collection is a *Phanerochaete* sp. One Louisiana collection (BPI 283118) is a *Hypochniciellum* sp.; the second (BPI 283116), although sterile, represents another species; and the third (Langlois 1761a at FH) is indeterminable.

A collection from British Columbia determined by Burt as *C. subcontinuum*, but not cited, is an athelioid fungus, which I did not attempted to identify further.

The type (at K) lacks basidia and spores, but may be a species of *Duportella*, fide Hjortstam (1989). Although Burt (1926) stated that part of the type was at FH it was not found in 1990.

The occurrence of this fungus in Canada and the United States could not be substiantiated, thus it is not accepted as part of the mycoflora.

Specimens examined: Canada: British Columbia: Salmo, on bark of *Larix occidentalis*, Sept. 1915, J.R. Weir 1832, det. Burt 511 (BPI 283119). USA: Louisiana: Ruston, beneath rotten prostrate sapling of *Pinus echinata*, 16 July 1914, C.J. Humphrey 2532, MBG 12495 (BPI 283118); St. Martinville, A.B. Langlois 1761a (FH) and 1761b, MBG 42598 (BPI 283116). Texas, Ch. Wright, as *Corticium calceum* Fr. (BPI 283114).

***Corticium subochraceum* Bres.**
Hedwigia 35: 290, 1896.

Citation of type: "ad cortices arborum >Blumenau< Braziliae (n. 274)", fide Breasdola.

Basidiome fragmented, the piece studied 20 x 15 mm and about 70 μm thick, adnate; margin white to concolorous, at 10x finely granulose, to 0.5 mm wide; hymenial surface smooth, dull, crustose, yellow brown (near 7.5YR6/6); subiculum very thin, white.

Hyphal system monomitic; subicular hyphae closely packed, woven, frequently branched and septate, with clamp connections, 4-5 (-6) μm diam, the walls thin to 0.5 μm thick, nonamyloid, acyanophilous; subhymenial hyphae mostly encrusted with 1 μm diam, pale yellow, acyanophilous granules; lamprocystidia imbedded, scattered, the encrusted apex conical, 28 x 12 μm; basidia in a tight palisade and detail obscure; basidiospores (Fig. 19) numerous, cylindrical-ellipsoid, 4.8-5.6 x (2.4-) 2.8 μm, the walls hyaline, thin, smooth, nonamyloid, acyanophilous, with a small, blunt apiculum.

The above description was taken from the Brasilian isotype. The six collections from the United States cited by Burt (1926:290) represent five or six species, and none is conspecific with the isotype. The fungus is not part of the mycoflora of the United States.

Specimens examined: Brazil, 1892, Dr. Möller, ex Herb. Bresadola (FH-Burt Herb. isotype). USA: Alabama: Montgomery Co., Sept. 1917, Herb. Burke 338, BG 57212 (BPI 283168), Auburn, 1897, on *Melia*, F.S. Earle & C.F. Baker, MBG 58325 (BPI 283173). Louisiana: St. Martin[ville], A.B. Langlois 1345, MBG 42603 (BPI 283174), 7 May 1899, ABL "ab" (FH), 19 May 1899, ABL "W" (FH). Nebraska: Lincoln, May 1895, C.L. Shear 1341 (BPI 283170).

Clavulicium venosum* (Berk. & Rav.) Ginns, *comb. nov.

Basionym: *Corticium venosum* Berk. & Rav., Grevillea 1: 177, 1873.

Citation of type: "Rav. No. 1321", fide Berkeley and Ravenel.

Basidiome effuse, in pieces about 30 x 30 mm and 400 μm thick, horny, membranous; margin pallid (near 2.5Y8/4), fimbriate to reticulose, adnate, thin, up to 1 mm wide; hymenial surface smooth but with faint branched ridges which suggests it was rugose when fresh, pallid (near 2.5Y8/4) to blackish grey (near 2.5Y6/2); subiculum concolorous with hymenium, horny.

Hyphal system monomitic; subicular hyphae (Fig. 18) in some sections apparently in a gelatinized matrix, branched, 2-3 μm diam, with frequent clamp connections, the walls thin, hyaline, nonamyloid, acyanophilous; gloeocystidia (Fig. 16) scattered, originating in the subiculum next to the subhymenium, cylindrical, curved into the hymenium, imbedded or rarely projecting to 15 μm, 70-100 x 4-7 μm, the contents granular, refractive, and yellow-brown in Melzer's and 2% KOH, dark blue in cotton blue, sulfo-negative; hymenium and subhymenium about 70 μm thick; basidia (Fig. 17) cylindrical, about 35 x 5-7 μm, with two sterigmata, each about 8μm long; basidiospores (Fig. 15) cylindrical-ellipsoid, 11.2-16.0 x 5.0-6.0 (-7.0) μm, the contents finely granular and subhyaline in KOH, the walls hyaline, thin, nonamyloid, cyanophilous, with a prominent, broad, blunt apiculum.

The only specimen known of this fungus is the type. Burt (1926) mentioned that the specimen at Kew had "*Auricularia*" written on the label, but he was not able to confirm that the fungus had auricularioid basidia. Hjortstam (1989) after examining the part at Kew stated "an auriculariaceous species", but gave no supporting facts. I found, with difficulty, only a few two-spored holobasidia and no auricularioid basidia.

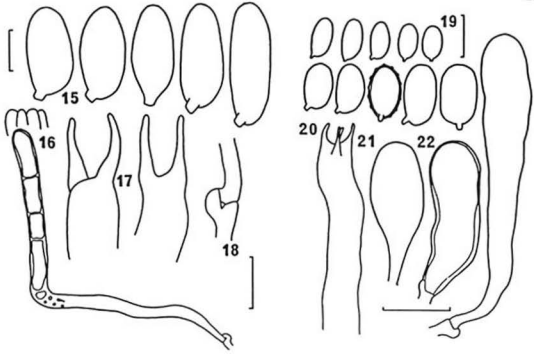
In addition to the two sterigmate basidia this fungus has other features similar to those of *Clavulicium macounii* (Burt) Parm. Both have gloeocystidia which are similar in size, shape and contents, both have narrow hyphae, both have relatively large spores with granular or oily contents, and both have pale yellow, globular deposits, 15-20 μm diam in the basidiomes. The two are congeneric, hence the transfer to *Clavulicium* is proposed.

Specimen examined: South Carolina: Black Oak, Sept., on carious logs (very rotten), Ravenel 1321 (FH, Curtis Herb.).

Hypochnicium versatum* (Burt) Ginns, *comb. nov.

Basionym: *Peniophora versata* Burt, Ann. Missouri Bot. Gard. 12: 305, 1925.

Synonym: *Corticium versatum* (Burt) Rogers & Jackson, Farlowia 1: 326, 1943.



Figs. 15-18. *Clavulicium venosum*. Fig. 15. Basidiospores. Fig. 16. Imbedded gloeocystidium. Fig. 17. Two sterigmate holobasidia. Fig. 18. Segment of subicular hypha. From Ravenel 1321. Scale in 15 = 5 μm, and applies to 15, 17 and 18. Scale in 16 = 20 μm.

Figs. 19-22. *Corticium subochraceum*. Fig. 19. Basidiospores. From Brazil, 1892. *Hypochnicium versata*. Fig. 20. Basidiospores, one drawn in median view to show wall thickness and ornamentation. Fig. 21. Apical portion of basidium. Fig. 22. Gloeocystidia. From Humphrey 7623. Scale in 19 = 5 μm, and applies to 19, 20 and 21. Scale in 22 = 20 μm.

Citation of type: Washington: "Edmonds, *C.J. Humphrey, 7623,* type", fide Burt.

Basidiomes effuse, up to 50 x 15 mm and up to 250 μm thick; margin indistinct, determinate, about 0.5 mm wide; hymenial surface smooth, dull, pale yellow (near 2.5Y8/4); subiculum thin, white, fibrous when wetted.

Hyphal system monomitic; subicular hyphae closely packed, woven, 2.5-3.0 (-5.0) μm diam, with clamp connections, the walls thickened, gelatinized, hyaline, nonamyloid, acyanophilous; subhymenium occupying most of the thickness of the basidiome, with hyphae vertically oriented and similar to subicular hyphae; gloeocystidia (Fig. 22) numerous, imbedded or some projecting to 10 μm, clavate to

broadly clavate, 35-100 x 8-15 μm, the contents granular, pale yellow in KOH, sulfo-positive, the walls hyaline, smooth, thin or, in a few, thickened to 1.5 μm; lamprocystidia lacking; basidia (Fig. 21) slenderly clavate, about 40 x 6.0-6.5 μm, with four sterigma each 4 μm long; basidiospores (Fig. 20) broadly ellipsoid, (6.5-) 6.8-8.2 (-8.4) x 4.0-4.8 μm, the walls hyaline, most thickened to 0.4 μm, most finely roughened with warts to 0.2 μm diam, nonamyloid, acyanophilous, with a blunt apiculum.

The above description was taken from the holotype. The sulfo-positive gloeocystidia, the finely warted, slightly thick-walled basidiospores, and the thick-walled, gelatinized, narrow hyphae are the principal features of this fungus. These features exclude it from the genera *Corticium* and *Peniophora*, where it has been previously placed. *Hypochnicium analogum* (Bourd. & Galzin) Eriksson with its thick-walled, ornamented basidiospores and sulfo-positive gloeocystidia is similar, hence the transfer to *Hypochnicium* is proposed.

Burt (1925: 305) cited two collections, the holotype (7623) and Humphrey 6285. They are specimens of the same species. Both are on conifer lumber that shows little sign of decay. The report (Conners 1967) from British Columbia was based on F9820 which is *Gloeocystidiellum ochraceum*.

Specimens examined: USA: Washington: Edmonds, 25 Sept. 1910, underside of old (conifer) plank, C.J. Humphrey 7623 (FH Burt Herb.); Chehalis, 15 Oct. 1909, underside of slightly decayed red fir tie, CJH 6285 (FH Burt Herb.). Canada: British Columbia: Saanichton, 26 Nov. 1939, on bark of dead sapling of *Pseudotsuga menziesii*, J.E. Bier (DAOM F9820).

ACKNOWLEDGMENTS

The study of specimens discussed in this paper was essentially completed during a visit to the National Fungus Collections (BPI) in March 1990. Drs. Amy Rossman and David Farr, and the staff provided valuable assistance that made the visit profitable and enjoyable. Dr. D.H. Pfister (FH) kindly loaned specimens from the Burt Herbarium and the Curtis Collection. Ms. Louise Lefebvre completed the layout and inking of the plates.

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MYCOTAXON

Volume XLIV, no. 1, pp. 219-233 April-June 1992

A LIST OF SPECIES NAMES ASSIGNED TO THE GENUS *CATACAUMA*

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ABSTRACT

Because of the lack of keys, identification of nongraminicolous species of *Phyllachora* from the tropics can be accomplished only by searching out descriptions in the literature. Although *Catacauma* has long been regarded as a synonym of *Phyllachora*, a number of *Catacauma* species have not been transferred to *Phyllachora*, where they presumably belong. Consequently, species described under *Catacauma* also must be considered when identifying *Phyllachora* species. A search of the literature revealed 112 species assigned to *Catacauma*, 42 of which were originally described in that genus. A complete list of species names in *Catacauma* has been compiled, including data on the basionym of species transferred to the genus. The host, and locality where found, are also listed.

Keywords: Ascomycotina, *Catacauma, Phyllachora*, tar spot, tropical ascomycetes.

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INTRODUCTION

The genus *Catacauma* was erected by Theissen and Sydow (1914, 1915) to accommodate species of *Phyllachora* Nitschke ex Fuckel in which the perithecia form between the host epidermis and the subepidermal tissues. *Phyllachora* was restricted to those species in which the perithecia were immersed in the interior tissues of the leaf. A few years later, Petrak (1927) pointed out that the location of the perithecium in phyllachoroid fungi was a variable characteristic and that it was not a suitable taxonomic criterion at the generic level. He reduced *Catacauma* to synonymy with *Phyllachora*, a move supported by most subsequent taxonomists. Despite Petrak's opinion, however, *Catacauma* continued to be used for some time by several collectors of tropical fungi.

During the past few years numerous *Phyllachora* species on nongraminicolous hosts have been collected in Brazil and Venezuela. In attempting to identify these fungi, it has been necessary to compile descriptions of tropical *Phyllachorae* from the literature. It was discovered while doing this that a number of species originally described in *Catacauma* have never been transferred to *Phyllachora*. While it would be premature to do this without first examining type specimens to be certain the species belong in *Phyllachora*, the names nevertheless must be considered when attempting to identify *Phyllachora* species. Consequently, a list of species names described in or transferred to *Catacauma* has been compiled from the literature. Of the 112 species names assigned to the genus, 42 were originally described as *Catacauma*. No species of *Catacauma* has been described on a graminicolous host, and only a few were described from monocotyledons. Most species occur on hosts with leaves that are thick and leathery, and Petrak (1927) believed that this was responsible for the formation of the perithecia between the epidermis and subepidermal tissues. In hosts with softer textured tissues, the perithecia can form readily within the leaf tissues.

This list is presented here to assist others who may have a need to identify tropical *Phyllachora* species. It contains all names assigned to *Catacauma*, the literature reference, and the host and locality cited in that reference. Since not all of the data have been checked for accuracy against the original publications, it must be regarded as a preliminary listing of species.

CATACAUMA Theiss. et H. Syd. - Ann. Mycol. 12:280. 1914.
(*Catacauma* = Brandblase)

Stroma zwischen Epidermis und Palissaden, von der stromatisierten Epidermis bedeckt, aus senkrechten Hyphen gebildt. Loculi eingesenkt. Asken paraphysiert. Sporen farblos, einzellig.
Typus: *C. exanthematica* (Lév.) Theiss. et H. Syd.
Basionym: *Dothidea exanthematica* Lév.

CATACAUMA Theiss. et H. Syd. - Ann. Mycol. 13:371. 1915.
Stroma applanatum, inter epidermidem et stratum subepidermalem, clypeo epidermali tectum, verticaliter prosenchymatice constructum (typice); loculi immersi; asci paraphysati octospori; sporidia hyalina simplicia.

acaciae Theiss. et H. Syd. - Ann. Mycol. 13:389. 1915.
On *Acacia leucophloea*, Madras, India.

acaenae (Henn.) Theiss. et. H. Syd. - Ann. Mycol. 13:387. 1915.
Basionym: *Phyllachora acaenae* Henn.
On *Acaena ovalifolia*, Concepción, Chile.

aloeticum (Berk. et M. A. Curtis) Theiss. et H. Syd. - Ann. Mycol. 13:399. 1915.
Basionym: *Dothidea aloetica* Berk. et M. A. Curtis
On leaves of unindentified plant, Cuba.

alpiniae (Sacc. et Berl.) Theiss. et H. Syd. - Ann. Mycol. 13:375. 1915.
Basionym: *Phyllachora alpiniae* Sacc. et Berl.
On *Alpinia coerulea*, Brisbane, Australia.

amyridis (Seaver) Chardon. - J. Dept. Agric. Puerto Rico 16(2):170. 1932.
Basionym: *Phyllachora amyridis* Seaver
On *Amyris elemifera*, Hispaniola and Puerto Rico.

apoense (H. Syd. et P. Syd.) H. Syd. - Ann. Mycol. 13:379. 1915.
Basionym: *Phyllachora apoensis* H. Syd. et P. Syd.
On *Ficus sibulanensis* and *F. apoensis*, Mindanao, Philippines.

aspideum (Berk.) Theiss. et H. Syd. - Ann. Mycol. 13:380. 1915.
Basionym: *Dothidea aspidea* Berk.
On *Ficus repens*, Sri Lanka (Ceylon).

aspideum (Berk.) Theiss. et H. Syd. forma ***fici-albae*** (Koord.) Theiss. et H. Syd. - Ann. Mycol. 13:381. 1915.
Basionym: *Phyllachora fici-albae* Koord.
On *Ficus alba*, Java.

aspideum (Berk.) Theiss. et H. Syd. forma ***fici-fulvae*** (Koord.) Theiss. et H. Syd. - Ann. Mycol. 13:381. 1915.
Basionym: *Phyllachora fici-fulvae* Koord.
On *Ficus* sp., Luzon, Philippines.

aspideum (Berk.) Theiss. et H. Syd. forma ***spinifera*** (Karst. et Har.) Theiss. et H. Syd. - Ann. Mycol. 13:380. 1915.
Basionym: *Phyllachora ficuum* Niessl var. *spinifera* Karst. et Har.
On *Ficus rideli*, Africa, and on *Ficus odorata*, Luzon, Philippines.

aspideum (Berk.) Theiss. et H. Syd. forma ***urostigmatis-tomentosi*** Theiss. et H. Syd. - Ann. Mycol. 13:380. 1915.
On *Ficus sp.*, Sri Lanka.

biguttulatum (Theiss.) Theiss. - Ann. Mycol. 13:396. 1915.
Basionym: *Phyllachora biguttulata* Theiss.
On *Campomanesia rhombea*, Rio Grande do Sul, Brazil.

brittoniana Chardon - Mycologia 19:298. 1927.

On *Ficus subscabrida*, Isle of Pines, Cuba.

cabalii Garces - Caldasia 1941:79. 1941.

On *Pouteria cainito*, Colombia.

caracaense (Rehm) Theiss. et H. Syd. - Ann. Mycol. 13:389. 1915.

Basionym: *Phyllachora pestis-nigra* Speg. var. *caracaensis* Rehm

On Malpighiaceae, Caraca, Minas Gerais, Brazil.

caseariae (Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:393. 1915.

Basionym: *Phyllachora caseariae* Henn.

On *Casearia* sp., Manaos, *Casearia silvestris* and *C. inaequilateralis*, Rio Grande do Sul, Brazil.

centrolobiicola (Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:389. 1915.

Basionym: *Phyllachora centrolobiicola* Henn.

On *Centrolobium* sp., Tarapoto, Peru.

circinata (H. Syd. et P. Syd.) H. Syd. - Ann. Mycol. 13:377. 1915.

Basionym: *Phyllachora circinata* H. Syd. et P. Syd.

On *Ficus* sp., Luzon, Philippines.

contractum H. Syd. - Ann. Mycol. 23:365. 1925.

On *Gouania tomentosa*, La Caja, Costa Rica.

copaiferiicola Chardon - Mycologia 32:185. 1940.

On *Copaifera* sp., Brazil.

costaricense Chardon - J. Dept. Agric. Porto Rico. 13(1):8. 1929.

On *Xylosma velutina* and *X. oligendri*, Costa Rica, and on *Xylosma* sp., Honduras.

costaricensis Stevens - Illinois Biol. Monogr. 11(2):184. 1927.

On *Myrcia costaricensis*, Costa Rica.

cubense Theiss. et H. Syd. - Ann. Mycol. 13:391. 1915.

On Sapindaceae, Cuba.

dalbergiicola (Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:388. 1915.

Basionym: *Phyllachora dalbergiicola* Henn.

On *Dalbergia variabilis*, Matto Grosso, Brazil.

dalbergiicola (Henn.) Theiss. et H. Syd. var. ***philippinensis*** Theiss. et H. Syd. - Ann. Mycol. 14(1- 2):447. 1916.

On *Dalbergia ferruginea*, Philippines.

dalbergiicola (Henn.) Theiss. et H. Syd. var. ***philippinensis*** Theiss. et H. Syd. forma ***conidiifera*** H. Syd. - Fungi Exotici Exsiccati Fasc. X-XI (Nos. 451-550): No. 518. 1923.

On *Dalbergia ferruginea*, Philippines.

davillae Viégas - Bragantia 7:108. 1947.

On *Davilla rugosa*, Brazil.

decaisneanum (Lév.) Theiss. et H. Syd. - Ann. Mycol. 13:384. 1915.

Basionym: *Dothidea decaisneana* Lév.

On *Ficus lacta*, Timor, Indonesia.

distinguendum (Rehm) Theiss. et H. Syd. - Ann. Mycol. 13:397. 1915.

Basionym: *Phyllachora distinguenda* Rehm

On Myrtaceae, Minas Gerais, Brazil.

dothidea (Moug.:Fr.) Höhn. - Ann. Mycol. 20:4. 1922.
Basionym: *Sphaeria dothidea* Moug.:Fr.
On *Rosa* sp., Sarajevo, Yugoslavia.

dussiae H. Syd. et P. Syd. - Ann. Mycol. 18:159. 1920.
On *Dussia martinicensis*, Guadaloupe.

egenulum H. Syd. - Leafl. Philipp. Bot. 9:3129. 1925.
On *Eugenia everettii*, Philippines.

egregium (Rehm) Theiss. et H. Syd. - Ann. Mycol. 13:391. 1915.
Basionym: *Phyllachora phyllanthophila* Henn. var. *egregia* Rehm
On *Phyllanthus* sp., São Paulo and Rio Grande do Sul, Brazil.

elaeocarpi T.S. Ramakrishnan et K. Ramakrishnan - Proc. Indian Acad. Sci., Sect. B, 28:57. 1948.
On *Elaeocarpus munroi*, India.

elettariae T.S. Ramakrishnan et K. Ramakrishnan - Proc. Indian Acad. Sci., Sec. B, 32:99. 1950.
On *Elettaria cardamomum*, Madras, India.

elmeri (H. Syd. et P. Syd.) H. Syd. - Ann. Mycol. 13:378. 1915.
Basionym: *Phyllachora elmeri* H. Syd. et P. Syd.
On *Ficus manilensis*, Mindanao, Philippines.

eugeniicola Chardon - Mycol. Explor. Venezuela, Monogr. Univ. Puerto Rico, Ser. B, 2:143. 1934.
On *Eugenia* sp., Venezuela.

euryae (Racib.) Theiss. et H. Syd. - Ann. Mycol. 13:392. 1915.
Basionym: *Myocopron euryae* Racib.
On *Eurya acuminata*, Java.

exanthematica (Lév.) Theiss. et H. Syd. - Ann. Mycol. 13:371. 1915.
Basionym: *Dothidea exanthematica* Lév.
On leaves of unidentified plant, Marquesas.

feijoae (Rehm) Theiss. et H. Syd. - Ann. Mycol. 13:397. 1915.
Basionym: *Phyllachora feijoae* Rehm
On *Feijoa* sp., Minas Gerais, Brazil.

fici-obscurae (Koord.) Theiss. et H. Syd. - Ann. Mycol. 13:378. 1915.
Basionym: *Phyllachora fici-obscurae* Koord.
On *Ficus obscura*, Java.

flabellum (Schwein.) Theiss. et H. Syd. - Ann. Mycol. 13:372. 1915.
Basionym: *Sphaeria flabella* Schwein.
On *Pteris aquilina*, North America.

flavo-cinctum (Rehm) Theiss. et H. Syd. - Ann. Mycol. 13:399. 1915
Basionym: *Phyllachora flavo-cincta* Rehm
On leaves of unidentified tree, Tubarao, Santa Catharina, Brazil.

forsteroniae (Rehm) Theiss. et H. Syd. - Ann. Mycol. 13:398. 1915.
Basionym: *Physalospora forsteroniae* Rehm
On *Forsteronia pubescens*, Rio de Janeiro, Brazil.

fructigenum (Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:386. 1915.
Basionym: *Phyllachora fructigena* Henn.
On *Nectandra* sp., Goyas, Brazil.

galactiae Stevens - Ann. Mycol. 29:102. 1931.
On *Galactia speciosa*, Peru.

garciae Theiss. et H. Syd. - Ann. Mycol. 13:381. 1915.
On *Ficus garciae*, Puerto Princesa, Palawan, Philippines.

glaziovii (Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:374. 1915.
Basionym: *Phyllachora glaziovii* Henn.
On *Dioscorea pachycarpa*, Rio de Janeiro, Brazil.

gouaniae (Stevens) Viégas - Bol. Soc. Bras. Agron. 7(4):374. 1944.
Basionym: *Catacaumella gouaniae* Stevens
On *Gouania virgata*, Brazil.

goyazense (Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:396. 1915.
Basionym: *Phyllachora goyazensis* Henn.
On Myrtaceae, Minas Gerais, Brazil.

gracillimum (Speg.) Theiss. et H. Syd. - Ann. Mycol. 13:373. 1915.
Basionym: *Phyllachora gracillima* Speg.
On *Isolepis capillaris*, Brazil.

grammicum (Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:382. 1915.
Basionym: *Phyllachora grammica* Henn.
On *Ficus sp.*, Kisantu, Congo.

hammari (Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:389. 1915.
Basionym: *Phyllachora hammari* Henn.
On *Machaerium* sp., São Paulo, Brazil.

himalayanum Padwick - Mycol. Pap., Imp. Mycol. Inst. 12:4. 1945.
On *Ficus faveolatus*, India.

huberi (Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:390. 1915.
Basionym: *Phyllachora huberi* Henn.
On *Hevea brasiliensis, H. nivea, and H. pauciflora*, Brazil.

infectorium (Cooke) Theiss. et H. Syd. - Ann. Mycol. 13:384. 1915.
Basionym: *Phyllachora infectoria* Cooke
On *Ficus infectoria*, India.

ingae Chardon - J. Dept. Agric. Porto Rico 13(1):9. 1929.
On *Inga vera*, Puerto Rico.

irregulare (Welw. et Curr.) Theiss. et H. Syd. - Ann. Mycol. 13:377. 1915.
Basionym: *Isothea irregularis* Welw. et Curr.
On *Ficus* sp., Angola.

kambachii (Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:376. 1915.
Basionym: *Phyllachora kambachii* Henn.
On *Ficus* sp., New Guinea.

lagunense (H. Syd. et P. Syd.) H. Syd. - Ann. Mycol. 13:378. 1915.
Basionym: *Phyllachora lagunensis* H. Syd. et P. Syd.
On *Ficus hauili*, Luzon, Philippines.

lindmani (Starb.) Theiss. et H. Syd. - Ann. Mycol. 13:395. 1915.
Basionym: *Phyllachora lindmani* Starb.
On Myrtaceae, Sa~o Paulo, Brazil.

lonchothecum (Speg.) Theiss. et H. Syd. - Ann. Mycol. 13:392. 1915.
Basionym: *Phyllachora lonchotheca* Speg.
On *Condalia lineata*, Argentina.

macroloculatum Chardon - Ann. Mycol. 32:113. 1934.
On *Ternstroemia* sp., Colombia.

macrosiphoniae (Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:397. 1915.
Basionym: *Phyllachora macrosiphoniae* Henn.
On *Macrosiphonia* sp., São Paulo, Brazil.

maquilingianum H. Syd. et P. Syd. - Ann. Mycol. 14:364. 1916.
On *Ficus* sp., Mt. Maquiling, Philippines.

merrillii H. Syd. - Ann. Mycol. 21:101. 1923.
On *Ficus luchanensis*, Mt. Pukis, Bontoc, Philippines.

microcentum (Berk. et Broome) Theiss. et H. Syd. - Ann. Mycol. 13:384. 1915.
Basionym: *Phyllachora microcenta* Berk. et Broome.
On *Ficus mysorensis*, Mysore, India.

microcentum (Berk. et Broome) Theiss. et H. Syd. var. ***graphica*** Theiss. et H. Syd. - Ann. Mycol. 13:385. 1915.
On *Ficus mysorensis*, Mysore, India.

microplacum Syd. - Philipp. J. Sci. 21(2):138. 1922.
On *Ficus sp.*, Amboina, Indonesia.

miryense (Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:386. 1915.
Basionym: *Phyllachora myriensis* Henn.
On Annonaceae, Amazonas, Brazil.

mucosum (Speg.) Theiss. et H. Syd. - Ann. Mycol. 13:373. 1915.
Basionym: *Phyllachora mucosa* Speg.
On *Cocos australis*, Guarapi, Brazil.

myrciae (Lév.) Theiss. et H. Syd. - Ann. Mycol. 13:393. 1915.
Basionym: *Dothidea myrciae* Lév.
On *Myrcia* sp., Brazil.

myrrhinii (Theiss.) Theiss. - Ann. Mycol. 13:395. 1915.
Basionym: *Phyllachora myrrhinii* Theiss.
On *Myrrhinium rubriflorum*, Rio Grande do Sul, Brazil.

nigerrimum Viégas - Bragantia 4:139. 1944.
On *Campomanesia caerulea*, Brazil.

nipponicum H. Syd. et P. Syd. - Ann. Mycol. 13:40 et 379. 1915.
On *Ficus nipponica*, Amayi, Japan.

nitens (Lév.) Theiss. et H. Syd. Ann. Mycol. 14:447. 1916.
Basionym: *Sphaeria nitens* Lév.
On *Psoralea sp.*, Peru.

nitidissimum (Berk. et M. A. Curtis) Theiss. et H. Syd. - Ann. Mycol. 13:398. 1915.
Basionym: *Dothidea nitidissima* Berk. et M. A. Curtis.

On leaves of unidentified plant, Cuba.

ocoteae Stevens - Bot. Gaz. 69:251. 1920.
On *Ocotea leucoxylonis*, Mt. Alegrillo, Puerto Rico.

palmicola Stevens - Bot. Gaz. 69:251. 1920.
On *Thrinacis ponceanae*, Vega Baja, Puerto Rico.

panamensis Chardon - J. Dept. Agric. Porto Rico. 14:251. 1930.
On *Bauhinia* sp., Panama.

paramoense Chardon - Ann. Mycol. 32:113. 1934.
On *Vaccinium floribundum*, Colombia.

patouillardii Theiss. - Verh.-zool.-bot. Ges. Wien 69:13. 1919.
On coriaceous leaves of unidentified plant, Venezuela.

paulense (Rehm) Theiss. et H. Syd. - Ann. Mycol. 13:388. 1915.
Basionym: *Phyllachora paulensis* Rehm
On Leguminosae, São Paulo, Brazil.

peglerae Doidge - Bothalia 1(1):25. 1921.
On *Eugenia capensis*, South Africa.

phyllanthophillum (Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:390. 1915.
Basionym: *Phyllachora phyllanthophila* Henn.
On *Phyllanthus* sp., Peru.

portoricensis Chardon - Mycologia 19:297. 1927.
On *Ficus stahlii*, Puerto Rico.

pterocarpi (H. Syd. et P. Syd.) H. Syd. - Ann. Mycol. 13:387. 1915.
Basionym: *Phyllachora pterocarpi* H. Syd. et P. Syd.
On *Pterocarpus angolensis*, Africa, on *P. saxatilis*, Java, and on *P. indicus*, Philippines.

puiggarii (Speg.) Chardon - J. Dept. Agric. Puerto Rico. 16(2):171. 1932.
Basionym: *Phyllachora puiggarii* Speg.
On Leguminosae ("folia parvula imparipinnata"), Apiahy, São Paulo, Brazil.

punctum (Cooke) Theiss. et H. Syd. - Ann. Mycol. 15:141. 1917.
Basionym: *Dothidea puncta* Cooke
On *Dalbergia armata*, Inanda, Natal, South Africa.

qualeae Viégas - Bragantia 4:141. 1944.
On *Qualea sp.*, Brazil.

ravenalae (Pat. et Har.) Theiss. et H. Syd. - Ann. Mycol. 13:283. 1915.
Basionym: *Phyllachora ravenalae* Pat. et Har.
On *Ravenala madagascariensis*, Madagascar.

renealmiae (Rehm) Theiss. et H. Syd. - Ann. Mycol. 13:375. 1915.
Basionym: *Phyllachora renealmiae* Rehm
On *Renealmia sp.*, Sta. Catharina, Brazil.

repens (Corda) Theiss. et H. Syd. - Ann. Mycol. 13:383. 1915.
Basionym: *Sphaeria repens* Corda
On *Ficus religiosa*, India.

rhopalinum (Mont.) Theiss. et H. Syd. - Ann. Mycol. 13:385. 1915.
Basionym: *Dothidea rophalina* Mont.

On *Rhopala guyanensis*, Cayenne, on *Rhopala sp.*, Brazil, Peru, and on *Rhopala brasiliensis*, Brazil.

rhopographiodes (G. Wint.) Viégas - Bragantia 4:143. 1944.
Basionym: *Phyllachora rhopographioides* G. Wint.
On *Pteris aquilina*, Brazil.

rimulosa (Speg.) Chardon - J. Dept. Agric. Puerto Rico 16(2):171. 1932.
Basionym: *Phyllachora rimulosa* Speg.
On *Myrcia oerstediana*, Costa Rica.

robinsonii H. Syd. - Philipp. J. Sci. 21(2):138. 1922.
On *Ficus sp.*, Amboina, Indonesia.

sabal Chardon - Farlowia 2:461. 1946.
On *Sabal sp.*, Dominican Republic.

sanguineum (Rehm) Theiss. et H. Syd. - Ann. Mycol. 13:379. 1915.
Basionym: *Phyllachora circinata* H. Syd. et P. Syd. var. *sanguinea* Rehm
On *Ficus heterophylla*, Los Banos, Luzon, Philippines.

schotiae Doidge - Bothalia 1(2):65. 1922.
On *Schotia speciosa*, South Africa.

schweinfurthii (Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:377. 1915.
Basionym: *Phyllachora schweinfurthii* Henn.
On *Ficus palmata*, Erythrea, Ethiopia.

selenospora (Speg.) Chardon - Mycologia 32:188. 1940.
Basionym: *Phyllachora selenospora* Speg.
On Myrtaceae, Minas Gerais, Brazil.

semi-lunata Chardon - J. Dept. Agric. Porto Rico. 13:9. 1929.
On *Eugenia sp.*, Puerto Rico.

serjaniae (Speg.) Chardon - J. Dept. Agric. Puerto Rico. 16(2):170. 1932.
Basionym: *Phyllachora serjaniae* Speg.
On *Serjania caracasana*, Argentina.

serra-negrae Viégas - Bragantia 4:144. 1944.
On *Croton floribundus*, Brazil.

strychni H. Syd. - Leafl. Philipp. Bot. 9:3125. 1925.
On *Strychnus multiflora*, Irosin, Sorsogon, Philippines.

subcircinans (Speg.) Theiss. et H. Syd. - Ann. Mycol. 13:394. 1915.
Basionym: *Phyllachora subcircinans* Speg.
On Myrtaceae, Brazil, and on *Psidium cattleyanum*, Puerto Leon, Misiones, Argentina.

tephrosiae Chardon - Mycologia 32:188. 1940.
On *Tephrosia sp.*, Brazil.

torrendiella Batista - Bol. Agric. Pernambuco 15:132. 1948.
On *Cocos nucifera*, Viçosa, Brazil.

tropicalis (Speg.) Chardon - J. Dept. Agric. Puerto Rico 16(2):172. 1932.
Basionym: *Phyllachora tropicalis* Speg.
On *Psidium thea*, Argentina.

truncatisporum Viégas - Bragantia 4:145. 1944.
On Myrtaceae, Brazil.

ulceratum (Massee) Theiss. et H. Syd. - Ann. Mycol. 13:399. 1915.
Basionym: *Phyllachora ulcerata* Massee
On leaves of unidentified plant, New Guinea.

urbanianum (Allesch. et Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:394. 1915.
Basionym: *Phyllachora urbaniana* Allesch. et Henn.
On Myrtaceae, Goyaz, Brazil.

urbanianum (Allesch. et Henn.) Theiss. et H. Syd. forma ***curvulispora*** (Henn.) Theiss. et H. Syd. - Ann. Mycol. 13:395. 1915.
Basionym: *Phyllachora curvulispora* Henn.
On Myrtaceae, Morro Pellado, São Paulo, Brazil.

urophyllum (Höhn.) Theiss. et H. Syd. - Ann. Mycol. 13:382. 1915.
Basionym: *Phyllachora urophylla* Höhn.
On *Ficus urophylla*, Tjibodas, Java.

valsiforme (Rehm) Theiss. et H. Syd. - Ann. Mycol. 13:379. 1915.
Basionym: *Phyllachora valsiformis* Rehm
On *Ficus crassitora*, Luzon, Laguna, Los Banos, Philippines.

venezuelensis (H. Syd.) Chardon - J. Dept. Agric. Puerto Rico. 16(2):170. 1932.
Basionym: *Phyllachora venezuelensis* H. Syd.
On *Machaerium humboldtianum, M. moritzianum*, and *M. robiniaefolium*, Costa Rica, Trinidad, and Venezuela.

weirii Chardon - J. Dept. Agric. Porto Rico. 13(1):8. 1929.
On *Bauhinia sp.*, Bolivia.

zanthoxyli Stevens - Illinois Biol. Monogr. 11(2):184. 1927.
On *Zanthoxylon sp.*, Costa Rica.

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zanthoxyli

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torrendiella
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aspideum f.
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venezuelensis
Venezuela
eugeniicola
patouillardii
venezuelensis
Yugoslavia
dothidea

ACKNOWLEDGMENTS

We thank Roger D. Goos and Mary E. Palm for reviewing the manuscript. This project was supported in part by funds from NSF Grant INT-8902172.

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MYCOTAXON

Volume XLIV, no.1, pp. 235-242 April-June 1992

AMANITA NEOOVOIDEA—TAXONOMY AND DISTRIBUTION

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Summary

An anatomical study of *Amanita neoovoidea* is reported. The range of the species is extended from central Japan to include Sichuan Province, China and Nepal. A summary of information about edibility of the species is provided.

Amanita neoovoidea Hongo. 1975. *Mem. Shiga Univ.* 25: 57, fig. 50.
Illus.: Hongo. 1978. *Trans. Myc. Soc. Jap.* 19: 456.
Illus.: Imazeki & Hongo. 1987. *Colored Illustrations.* 1: pl. 31, fig. 220.
Illus.: Imazeki, Otani & Hongo. 1988. *Fungi*: 160.

Amanita neoovoidea is a medium- to large-sized, mostly white to whitish mushroom the pileus of which is decorated with an unusual volva that includes a pulverulent layer upon which is superimposed a rather thick, membranous layer that has ochraceous or orangish tints. The greater part of this membranous volva is carried up by the expanding pileus leaving at most an irregular limb on the top of the stipe's basal bulb. The annulus is apical, rather thick, and friable.

PILEUS: 75 - 130* mm diam., white or off white becoming golden blonde (5C4[1]) in age, hemispherical to convex to planoconvex to depressed, at times with an umbo; margin appendiculate, slightly striate, at times rimose, slightly decurved; context white

1. Color codes of this form are from Kornerup & Wanscher (1978).

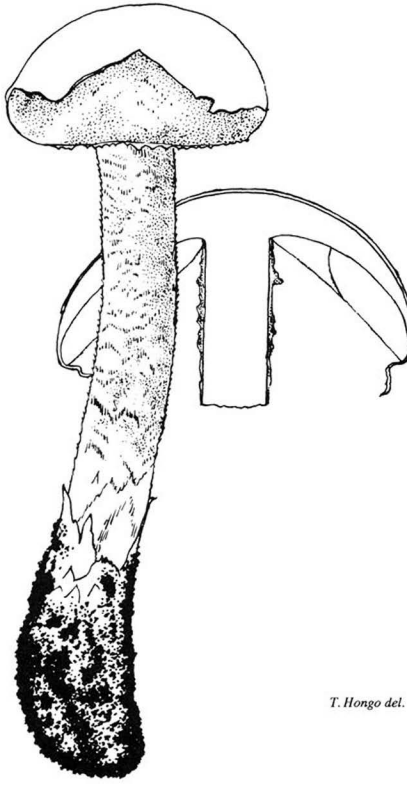
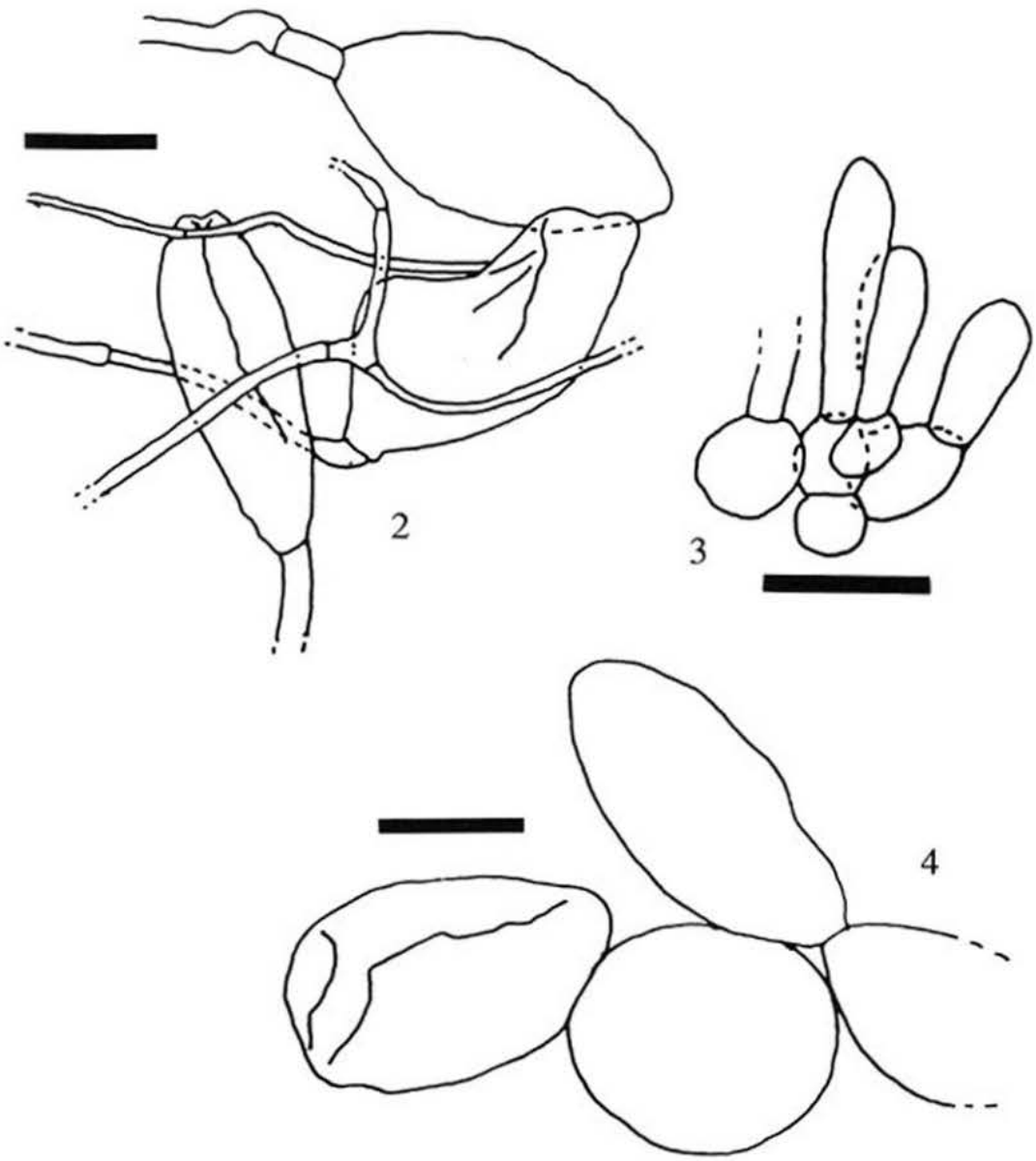


Fig. 1 *Amanita neoovoidea*. Habit: T. Hongo 6387 (complete specimen (×1.3)) and T. Hongo 4890 (in section (×0.85)).

to whitish, unchanging, somewhat tough, elastic, thinning gradually to margin; universal veil commonly as one or a small number of membranous patches, elastic, topaz to golden blonde to pale ochraceous (warm buff to cream-buff), occasionally lost, with underlying pulverulent layer adjacent to the pileipellis. LAMELLAE: pale cream to white to white with very slight rosy tint, free with decurrent line on stipe, close, thick, waxy, up to 7 - 10 mm broad, edges white and minutely flocculose to fibrillose becoming 5C4 in age, drying 6C7, crenate; lamellulae frequent, rounded attenuate. STIPE: 110 - 130 × 12 - 15 mm, white, becoming sordid on handling, flocculose-floccose-squamulose, narrowing upward, expanded at the apex; context white, solid; annulus white, rather thick, floccose-subfelted, friable, ephemeral, apical to superior, but collapsing down stipe; bulb ventricose to clavate to fusiform to napiform, often subradicating; universal veil membranous, in a few incomplete rings or limbate or entirely carried up on the pileus, pallid ochraceous (cream-buff) to orangish to deep orange on the outer surface. Odor penetrating, but agreeable. Taste mild. Popularly considered edible in both Japan and Nepal. Macrochemical spot tests: KOH - on universal veil, apricot; on stipe surface and flocculence, clay colored.

PILEIPELLIS: 30± µm thick; filamentous, undifferentiated hyphae 1.0 - 5.5 µm diam., subradially arranged, interwoven, partially to entirely gelatinizing; oleiferous hyphae 0.8 - 10.5 µm diam., relatively common locally—especially near surface. PILEUS CONTEXT: filamentous, undifferentiated hyphae 2.0 - 7.5 µm diam., branching, loosely interwoven, occasionally with slightly thickened walls, with some segments inflated partially up to 25 µm diam. (such segments may be intercalary and even branching); inflated cells broadly clavate to ovoid to ellipsoid, up to 105 × 52 µm, with walls sometimes slightly thickened; oleiferous hyphae 1.5 - 3.0 µm diam. LAMELLA TRAMA: bilateral; filamentous, undifferentiated hyphae 1.2 - 6.5 µm diam.; inflated cells plentiful, broadly clavate to elongate to ellipsoid, up to 44 × 28 µm, with walls 0.5 - 1.0 µm thick; oleiferous hyphae scarce to locally common, 1.5 - 6.8 µm diam., branching, sometimes penetrating the subhymenium. SUBHYMENIUM: dominantly cellular; composed of rather large cells; most basidia arising from these large cells, with a few arising from smaller cells or barely inflated very short hyphal segments; branching, filamentous, undifferentiated hyphae penetrating this region, arising (at times) roughly perpendicular to the central stratum. BASIDIA: 32 - 40 × (7.0-) 7.8 - 11.8 µm, 4- or occasionally 2- or 1-sterigmate, thin-walled or with walls slightly thickened; sterigmata prominent; clamps not observed. UNIVERSAL VEIL: On the pileus, exterior surface: extensively gelatinizing, loosely interwoven hyphae at surface, below this having a layer about 30 - 40 µm thick consisting of filamentous, undifferentiated hyphae 1.5 - 5.2 µm diam., compactly interwoven; oleiferous hyphae 2.2 - 10.0 µm diam., infrequently branching, locally common. On the pileus, interior layer: somewhat loosely interwoven, filamentous, undifferentiated hyphae 1.8 - 11.0 µm diam., dominant; inflated cells scattered, cylindric to clavate to ellipsoid, up to 96 × 29 µm, thin-walled or with walls very slightly thickened, terminal; oleiferous hyphae 1.8 - 9.2 µm diam. On the pileus, inner pulverulent layer: filamentous, undifferentiated hyphae 1.5 - 7.5 µm diam., branching; inflated cells terminal or in short chains, subglobose to ellipsoid to clavate, up to 67 × 60 µm, dominating; oleiferous hyphae 1.0 - 5.2 µm diam., locally plentiful. On the stipe base: similar to that on pileus. STIPE CONTEXT: acrophysalidic; filamentous,

undifferentiated hyphae 2.0 - 9.5 µm diam.; acrophysalides thin-walled, narrowly clavate, plentiful, up to 250 × 35 µm; oleiferous hyphae not common, 6.5 - 15.0 µm diam. PARTIAL VEIL: filamentous, undifferentiated hyphae 1.0 - 9.0 µm diam., loosely tangled, frequently branching, gelatinizing; inflated cells plentiful to dominant, terminal, clavate to ventricose, thin-walled, rather easily collapsing, up to 68 × 32 µm; oleiferous hyphae not observed. All tissues pale yellow in NH_4OH.



Figs. 2-4. *Amanita neoovoidea*. 2. Elements of partial veil (Hongo 5984). 3. Elements of hymenium and subhymenium from somewhat immature specimen (Hongo 3430). 4. Elements of pulverulent inner surface layer of universal veil from pileus (holotype). The bars in Figs. 2-4 represent 20 µm.

BASIDIOSPORES: [238 measured from 11 specimens from 9 collections] (5.8-) 6.8 - 9.8 (-12.0) × (4.2-) 4.8 - 6.5 (-7.5) µm, (average length per specimen = 6.9 - 8.9 (-9.8) µm; average length (overall) = 8.2 µm; average width per specimen = 5.3 - 6.1 (-6.4) µm; average width (overall) = 5.7 µm; Q = (1.19-) 1.25 - 1.64 (-2.25); average Q per specimen = (1.29-) 1.36 - 1.53; average Q (overall) = 1.43), hyaline, thin-walled, smooth, amyloid, occasionally adaxially flattened, broadly ellipsoid to ellipsoid to (occasionally) elongate or cylindric, occasionally pip-shaped; apiculus sublateral, small, truncate conic to cylindric; contents guttulate to granular; white in deposit.

Distribution and habitat: China: In mixed coniferous and broad-leaved forest in July at 700 m elev. Japan: In mixed forests of *Pinus densiflora* Sieb. & Zucc., *Quercus serrata* Thunb., etc., Ôtsu, July to October; in *Pinus-Quercus* forest, Takatsuki-city, September; in *Castanopsis cuspidata* (Thunb.) Schottky forest, Ise-Jingô, July; and in *Quercus* woods, Ôtani, Suzu-city, October. Usually associated with *Fagaceae*; Nagoya collection from *Pinus-Quercus* forest. Nepal: in troops in July in forest comprising *Symplocus pyrifolia* Wall., *Castanopsis tribuloides* A.DC., and *Quercus glauca* Thunb.

Hongo and Yokoyama (1978) divided Japanese Agaricales into nine groups based on global geographic distribution. *Amanita neoovoidea* clearly belongs to the Southeast Asiatic group which includes fungi occurring "in evergreen, broad-leaved,...warm temperate forests" ranging from western and central Japan (up to the northern limit of the ranges of deciduous members of the *Fagaceae*) to "highlands of Southeast Asia (including the mountain sides of the Himalayas)...." In the protologue of *A. neoovoidea*, Hongo lists Japanese sites (besides those represented by paratypes): Ôsaka, Shiga, Mie, Ishikawa, Tokyo, Miyagi, and Akita. Among presumed mycorrhizal symbionts are "evergreen oaks, *Quercus* (*Cyclobalanopsis*), *Castanopsis*, *Lithocarpus*, etc."

Collections examined: **CHINA**: SICHUAN—Weiyuan County - Xin Chang, 13.vii.1985 M. S. Yan 1040 (HKAS[2] 15868). **JAPAN**: *HONSHU*: AICHI-KEN—Nagoya-city - Meitô-ku, Makigaike-Ryokuchi, 7.ix.1975 T. Asai *s.n.* [Hongo 5392] (HONGO). ISHIKAWA-KEN—Suzu-city - Ôtani, 10.x.1974 Y. Ikeda *s.n.* [Hongo 5244] (paratype, HONGO). KYOTO-FU—Uji-city - Higashi-Kasadori, 13.viii.1982 T. Hongo 6387 (HONGO). MIE-KEN—Ise-city - Ise-Jingô (Naikô), 28.vii.1967 Hongo 3430 (paratype, TNS F-237227). SHIGA-KEN—Ôtsu-city - Ishiyama-Senjô, 24.viii.1973 Y. Sugiyama *s.n.* [Hongo 4890] (paratype, HONGO), 20.ix.1979 T. Hongo

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2. The herbarium name abbreviations used in this paper are

HKAS - Herbarium of Cryptogams, Kunming Institute of Botany, Academia Sinica, Heilongtan, Kunming, Yunnan, China.
HONGO - Personal herbarium of T. Hongo, Ôtsu-City, Japan
L - Rijksherbarium, Leiden, The Netherlands
NHMTU - Herbarium, Natural History Museum, Tribhuvan University, Kathmandu, Nepal.
RET - Personal herbarium of R. E. Tulloss
TNS - Herbarium, National Science Museum, Tokyo, Japan

5984 (HONGO); Nango-Imodani, 12.ix.1980 T. Hongo 6195 (HONGO); Ishiyama-Terabe, 25.vii.1967 Hongo 3423 (holotype, TNS F-237226), 24.viii.1973 Y. Sugiyama *s.n.* [Hongo 4890a & 4890b] (paratype, HONGO - in 2 packets). **NEPAL**: CENTRAL DEVELOPMENT REGION—Bagmati Zone - Bhaktapur District, 10 km E of Bhaktapur City, Nala, 19.vii.1989 H. R. Bhandary *s.n.* (NHMTU & RET).

DISCUSSION

The appendiculate pileus margin, amyloid spores, and membranous volval limb place this entity in *Amanita* section *Amidella* (Gilbert) Konrad & Maublanc. The type of section *Amidella* is *A. volvata* (Peck) Lloyd of North America (Corner & Bas, 1962).

The North American taxa of section *Amidella* all have the tendency to turn reddish-brown after bruising or exposure to air; several have a striate pileus margin or develop one at maturity; the inner layer or layers of the universal veil are at least somewhat friable while the external surface is sturdy and membranous; the stipe is totally elongating—lacking a truly bulbous base; and the lamellulae of these species are truncate. Most of the European taxa of section *Amidella* exhibit these characters as well.

The relatively strong discoloring, totally elongating stipe, and truncate lamellulae are not characters of *A. neoovoidea*.

Hongo 6195 consists of a single specimen just expanding out of the "button" stage; it illustrates very clearly the presence of a true bulb in this species. Tissues from the broadest portion of the bulb are typical of *Amanita* stipe tissue (having a longitudinal orientation) and distinctly different from the more disordered tissue of the universal veil. This stands in direct contrast with the tissue in the apparent bulbs of such members of section *Amidella* as *A. lepiotoides* Barla of Europe and *A. volvata*.

Among the described species of *Amanita*, *A. neoovoidea* appears to be closest to *Amanita ovoidea* (Bull.:Fr.) Link. *Amanita ovoidea* was placed by Gilbert (1940-41) in the genus *Amidella* in its protologue, and later authors have not altered this assignment. While many taxa in section *Amidella* have truncate lamellulae, *A. ovoidea* has lamellulae that vary from truncate to obliquely attenuate (Malençon and Bertault, 1970). See also the protologue of the recently described *A. chepangiana* Tulloss & Bhandary (1992) which shares color change and universal veil characters with *A. ovoidea* and *A. neoovoidea* and has subattenuate to attenuate lamellulae, a totally elongating stipe, and a rather strongly striate p ileus margin.

Considering the above and considering that a complete review of all taxa previously assigned to section *Amidella* has not been done, it seems unwise to emend the section piecemeal or to propose subsectional taxa in this paper. Therefore, we simply highlight some interesting apparent relationships within the section.

Hatanaka and Kawakami (1980) report that *Amanita neoovoidea* contains a free amino acid (2-amino-4,5-hexadienoic acid) in about the same proportion previously reported by North American workers for *A. smithiana* Bas (protologue (Bas, 1969)). This amino acid has been demonstrated to be fatal to guinea pigs in doses of 100 mg per kg of body weight (Chilton *et al.*, 1973). In spite of the fact that, in the protologue

of *A. neooovoidea*, Hongo notes that *A. neoovoidea* is popularly considered edible, Hatanaka and Kawakami recommend that it not be eaten. Bhandary has observed that the species is also considered edible in Nepal where it is cooked after removing the universal veil.

Since 1986, there have been several cases of suspected *A. smithiana* poisoning reported in the United States (Cochran, 1989; Lampe, 1989; Tulloss & Lindgren, ined.). In these poisonings, *A. smithiana* was occasionally eaten raw, but was often eaten after cooking (e.g., in a soup). Common factors in these cases include

— onset of symptoms in 4 to 10 hours including vomiting, diarrhea, and abdominal pain

— complete, but reversible, renal failure occurring within about two to three days of ingestion.

If indeed the free amino acid cited above is the toxic agent in *A. smithiana* and if it is also present in *A. neoovoidea*, why is it not toxic in *A. neoovoidea*? We considered the possibility that the means of preparation of *A. neoovoidea* might somehow remove or alter the toxic agent. However, it appears that no special preparations are taken against poison when *A. neoovoidea* is prepared for the table. For example, Shimizu (1988) describes experimentation by members of the Sendai amateur mycological club; their experience indicated the fungus was edible. Shimizu reports that a number of methods of preparation were found to be successful: sukiyaki, tenpura (frying), tsukeyaki (broiling), etc. Shimizu recommends that the fungus not be eaten in excess.

We were unable to examine one of the paratypes of *A. neoovoidea* (OSAKA-FU—Takatsuki-city - 29.ix.1974 T. Yokoyama *s.n.* [Hongo 5211] (TNS?)).

ACKNOWLEDGMENTS

We express our gratitude to the following persons who contributed to our ability to develop this paper: Dr. C. Bas (L) reviewed the paper and counseled us about sectional placement of *A. neoovoidea* (our conservative position on placement is directly due to his comments and advice); Dr. Y. Doi (TNS) for arranging loans of specimens; Ms. Mary A. King, Roosevelt, New Jersey, for assisting in preparing the paper for publication; Prof. Mu Zang and Dr. Zhu-Liang Yang (HKAS) for supporting us with a loan from their institution.

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MYCOTAXON

Volume XLIV, no. 1, pp. 243-250 April-June 1992

APHYLLOPHORALES ON PINUS AND EUCALYPTUS IN ZIMBABWE

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ABSTRACT

71 species in 38 genera and 11 families were recorded on *Pinus* and *Eucalyptus*. 41 and 17 species were restricted to *Pinus* and *Eucalyptus* respectively. 40 species are new records for Zimbabwe. 10 species are reported from Africa for the first time. 63 species are saprotrophic, 9 are parasitic and one was mycorrhizal. The new combination, *Abortiporus roseus* (Reid) Masuka & Ryvarden, is proposed.

INTRODUCTION

Pinus and *Eucalyptus* species were introduced in Zimbabwe in the 1890s to meet the country's demands for sawn timber, pulp and paper, and poles. Coordinated planting started only in the 1950s and 1960s. Over 90 000 ha are currently planted with *Pinus* and *Eucalyptus* in Zimbabwe. *Pinus* is also increasingly being used for the construction of buildings.

Collections of fungi on indigenous trees in Zimbabwe date back to 1905 (Cheeseman, 1909), but the first collection of Aphyllophorales on exotic tree species was probably in the 1940s (Doidge, 1950). No systematic collection and identification of wood-inhabiting fungi has been carried out in the country. The object of the study was to conduct an inventory of parasites and saprotrophs on *Pinus* and *Eucalyptus*.

Wood-inhabiting Aphyllophorales were collected in January and October, 1990, and January, 1991, from 11 localities (Fig. 1). A total of 990 collections were made, of which 911 were determined, the rest being sterile or immature. The collections are deposited in the National Collection of Macrofungi University of Zimbabwe (formerly at CAH).

We have followed Ryvarden & Johansen (1980) and Ryvarden (1991) for nomenclature of the polypores, Hallenberg (1985) for Lachnocladiaceae and Ginns (1982) for Coniophoraceae. Resupinate to hydnoid species of Corticiaceae *s. str.* will be treated separately in a later publication. In this paper we report only on the poroid representatives of this family and species from the other recorded families of Aphyllophorales.

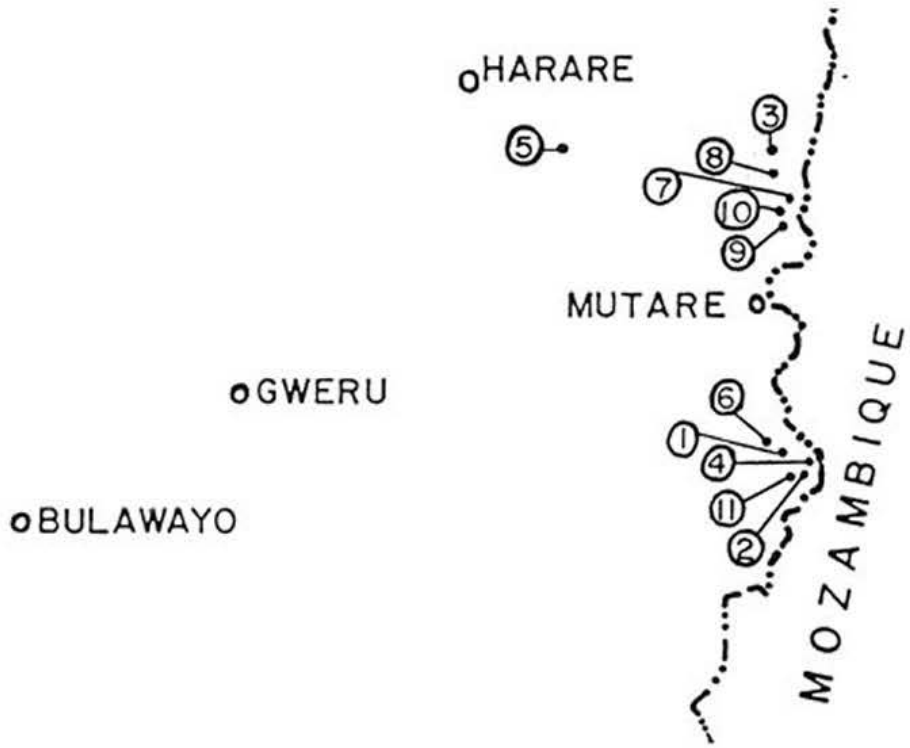

Fig. 1. Eastern Zimbabwe with the collection localities: 1 = Bridal Veil Falls; 2 = Chisengu; 3 = Erin; 4 = Forestry Services; 5 = Grasslands; 6 = Gwendingwe; 7 = Mukandi; 8 = Shamu; 9 = Sheba; 10 = Stapleford; 11 = Tarka.

LIST OF SPECIES, HOSTS, SUBSTRATA AND DISTRIBUTION

There is a paucity of Aphyllophorales records, apart from polypores, in Africa. Where we have not found records of the occurrence of a species, we assumed it to be previously unrecorded for the given area.

An asterisk following the name indicates that the species has not previously been recorded in Zimbabwe. Each name is followed by its host. The hosts are given in an alphabetical order, abbreviated as follows: Eg = *Eucalyptus grandis*; Em = *Eucalyptus maculata*; Ey = *Eucalyptus microcorys and* E = unidentified *Eucalyptus* sp.; Pp = *Pinus patula*; Pe = *Pinus elliottii*; Pt = *Pinus taeda.*

Coniophoraceae

Coniophora arida (Fr.) Karst. var. *arida* *
on bark, branches, logs: Pp 3 (AJM 476), 9 (AJM 162, AJM 552), 10 (AJM 265, AJM 816); Pe 2 (AJM 387); Pe, Pp, Pt timber used as stack stands: 2 (AJM 756).

Coniophora arida (Peck.) Ginns var. *suffocata* *
on branches, logs: Eg 3 (AJM 213); Pe 7 (AJM 306); Pp 2 (AJM 800), 9 (AJM 192b).

Coniophora fusispora (Cke. & Ell.) Sacc.
on Pp logs: 3 (AJM 870), 6 (AJM 422), 10 (AJM 04); new record for Africa.

Coniophora hanoiensis Pat. *
on logs: Pp 3 (AJM 207, AJM 869).

Coniophora olivacea (Fr.:Fr.) Karst. *
on branches, stems: Pp 3 (AJM 466), 6 (AJM 426), 7 (AJM 985), 9 (AJM 192a, AJM 564), 10 (AJM 522, AJM 815).

Coniophora submembranacea (Berk. & Br.) Sacc.
on log: Pp 7 (AJM 988); new record for Africa.

Coniophora puteana (Fr.) Karst. var. *incrustata* *
on burnt log: Pp 6 (AJM 420).

Coniophora puteana (Fr.) Karst. var. *puteana*
on branches, logs: Pp 10 (AJM 531); Pe 2 (AJM 801); Pt 8 (AJM 553).

Leucogyrophana pinastri (Fr.) Ginns & Weres. *
on logs in advanced decay: Pe 10 (AJM 533).

Serpula himantioides (Fr.:Fr.) Karst. *
on logs in advanced decay in humid environments: Pe 7 (AJM 297); Pp 10 (AJM 05, AJM 242, AJM 532, AJM 812).

Corticiaceae

Gloeoporus dichorus (Fr.) Bres.
on exposed stumps: Pp 3 (AJM 482, AJM 872).

Schizopora flavipora (Cooke) Ryv.
on bark, branches, stumps, logs: Em 4 (330, AJM 779); Ey 7 (AJM 966); Pt 11 (AJM 70); Pe 7 (AJM 517); Pp 2 (AJM 400), 3 (AJM 874), 9 (AJM 197, AJM 550), 10 (AJM 02, AJM 244a).

Schizopora paradoxa (Fr.) Donk
on bark, branches, stumps, logs: Em 4 (AJM 309, AJM 719); Ey 7 (AJM 496, AJM 986); Pp 2 (AJM 407, AJM 804), 3 (AJM 222, AJM 475), 10 (AJM 244b, AJM 809).

Sistotrema dennisii Malencon. *
on log in advanced decay: Pp 3 (R 23951).

Trechispora mollusca (Pers.: Fr.) Liberta *
on log in advanced decay: Em 4 (AJM 341).

Ganodermataceae

Ganoderma australe (Fr.) Pat.
on stumps: Pe 10 (AJM 262, AJM 806).

Hericiaceae
Laxitextum bicolor (Pers. : Fr.) Lentz *
parasitic on coppice stumps: Eg 5 (AJM 131); log: Em 4 (AJM 435); parasitic.

Hymenochaetaceae
Coltriciella dependens (Berk. & Curt.) Murr.
on buried logs: Pp 2 (AJM 372); new record for Africa.
Phellinus discipes (Berk.) Ryv.
parasitic on coppice stumps: Eg 5 (AJM 141), 8 (AJM 228, AJM 581); on debarked logs awaiting transportation to depot: Eg 4 (AJM 706); on logs: Em 4 (AJM 455, AJM 775); Ey 7 (AJM 279); E 1 (AJM 411).
Phellinus gilvus (Schw.) Pat.
parasitic on coppice stumps: Eg 5 (AJM 147, AJM 607); logs: Em 4 (AJM 311, AJM 626); causing heart-rot: Em 4 (AJM 328); on stump: Pp 10 (AJM 09).
Phellinus lamaensis (Murr.) Heim
underneath log: Pp 3 (R 23950)

Lachnocladiaceae
Asterostroma cervicolor (Berk. & Curt.) Mass. *
on bark, branches: Pt 2 (AJM 392).
Asterostroma ochroleucum Bres. & Torrend *
on burnt log: Eg 8 (AJM 234).
Asterostroma medium Bres. *
on branch: Pe 2 (AJM 379); new record for Africa.
Dichostereum effuscatum (Cke. & Ell.) Boid. & Lanq. *
on branch: Pe 2 (AJM 380, AJM 597).
Dichostereum kenyense Boid. & Lanq. *
on bark: Pe 2 (AJM 386).
Dichostereum orientale Boid. & Lanq. *
on logs: Em 4 (AJM 352); Pe 11 (AJM 86).
Dichostereum peniophoroides (Burt.) Boid. & Lanq.
on bark, branches: Pe 2 (AJM 393); new record for Africa.
Dichostereum ramulosum Boid. & Lanq. *
on branches, bark: Pp 2 (AJM 397, AJM 597); Pt 10 (AJM 259).
Scytinostroma ochroleucum (Bres. & Torrend.) Donk *
on log: Pt 11 (AJM 25).
Scytinostroma odoratum (Fr.) Donk *
on logs: Pt 2 (AJM 789), Pt 11 (AJM 43).
Vararia sphaericospora Gilbn. *
on bark, branches: Pe 7 (AJM 302); Pt 10 (AJM 807).

Polyporaceae
Abortiporus roseus (Reid) Masuka & Ryvarden comb. nov. *
Basionym: *Heteroporus roseus* Reid., Microscopy 32: 449, 1975
Abortiporus Murr., being based on a monstrosity, was an illegitimate name

up to the Botanical Congress in St. Petersburg (formerly Leningrad) in 1975. The article on monstrosities was then removed and *Abortiporus* regained its priority over *Heteroporus* Laz. Both genera are typified by the same species, viz. *A. biennis* (Bull.:Fr.) Singer. We confirm that the variation in the occurrence of gloeocystidia reported by Ryvarden & Johansen (1980) is a common feature among specimens of this species, parasitic: Eg 5 (AJM 16b); parasitic on coppice stumps: Eg 7 (AJM 493).
Amylonotus africanus Ryv.
on logs: Ey 7 (AJM 280).
Antrodia albida (Fr.) Donk
on logs: Pe 2 (AJM 383); Pt 3 (AJM 11).
Antrodia gossypina (Speg.) Ryv. *
on logs in advanced decay: Ey 7 (AJM 276); logs: Pp 6 (AJM 121).
Antrodia heteromorpha (Fr.) Donk *
on branch: Pp 3 (AJM 218).
Antrodia malicola (Berk. & Curt.) Donk *
parasitic on coppice stumps: Eg 8 (AJM 579); on dead stumps, logs: Eg 5 (AJM 130), Eg 8 (AJM 845); Em 4 (AJM 353, AJM 454); Pp 3 (AJM 14).
Antrodia oleracea (Davids. & Lombard) Ryv. *
on log: Pp 6 (AJM 118).
Antrodia sinuosa (Fr.) Karst. *
on burnt logs: Eg 8 (AJM 849); Pp 8 (AJM 156); on timber used as stack stands: Pe, Pp, Pt 2 (AJM 754); on logs: Pp 10 (AJM 263).
Antrodia vaillantii (Fr.) Ryv. *
on timber used as stack stands: Pe, Pp, Pt 2 (AJM 755).
Antrodia xantha (Fr.) Ryv.
on burnt log: Pp 3 (AJM 203); new record for Africa.
Ceriporia viridans (Berk. & Br.) Donk
on log: Pe 10 (AJM 245a).
Ceriporiopsis aneirina (Sommerf. : Fr.) Donk
on logs in advanced decay: Pp 8 (AJM 565, AJM 832); Pt 2 (AJM 374); new record for Africa.
Coriolopsis polyzona (Pers.) Ryv.
on log: Pt 7 (AJM 300).
Cristelloporia dimitica Johan. & Ryv. *
on bark in humid environment: Ey 7 (AJM 962).
Diplomitoporus lenis (Karst.) Gilbn. & Ryv. *
on logs in advanced decay: Pe 2 (AJM 375).
Flavodon flavus (Kl.) Ryv.
on debarked logs awaiting transportation to depot: Eg 4 (AJM 780).
Junghunia crustacea (Jungh.) Ryv.
on branch tip: Eg 8 (AJM 176).
Lentinus villosus Klotzsch
on log: Eg 8 (AJM 238).
Nigroporus vinosus (Berk.) Murr.
underneath logs: Pp 8 (AJM 182, AJM 557, AJM 828).
Perenniporia subacida (Peck.) Donk
parasitic on coppice stumps: Eg 8 (AJM 576, AJM 850).

Polyporus arcularius Batsch.: Fr.
on log: Pe 8 (AJM 181).
Polyporus virgatus Berk. & Curt.
on log: Ey 7 (AJM 964).
Pycnoporus sanguineus (Fr.) Murr.
on exposed logs, bark, branches: Em 4 (AJM 361, AJM 607); Pe 2 (AJM 405), 7 (AJM 298, AJM 516); Pp 10 (AJM 03).
Rigidoporus lineatus (Pers.) Ryv. *
on log ends: Pe 7 (AJM 289, AJM 514, AJM 984).
Rigidoporus vinctus (Berk.) Ryv. var. *vincta*
on logs, bark: Pt 10 (AJM 808).
Skeletocutis amorpha (Fr.) Kotl. & Pouz. *
on logs, bark: Pp 2 (AJM 431); new record for Africa.
Skeletocutis nivea (Jungh.) Kl.
on bark: Em 4 (AJM 339); logs: Pp 3 (AJM 871); Pt 11 (AJM 80).
Skeletocutis percandida (Malenc. & Berk.) Kl. *
on bark: Pp 10 (AJM 95).
Trametes menziesii (Berk.) Ryv.
on logs, branches: Ey 7 (AJM 281); Em 4 (AJM 632).
Trametes pocas (Berk.) Ryv.
on logs, branches: Eg 8 (AJM 171); Em 4 (AJM 354, AJM 741); variable morphology - pores 2-6 per mm -, and spore size - 4-6.5 x 2.5-3.5 -, probably a complex of species.
Trametes versicolor (L.:Fr.) Pil.
on logs, branches: Em 4 (AJM 310, AJM 609, AJM 746); Ey 7 (AJM 562); Pp 6 (AJM 125).
Wrightoporia africana Ryv.
on logs: Pe 2 (AJM 406).
Wrightoporia avellanea (Bres.) Pouz. *
on logs: Pp 3 (AJM 865).
Wrightoporia cinammomea Ryv.
on log: Pe 2 (AJM 388a); new record for Africa.

Schizophyllaceae
Schizophyllum commune Fr.
on bark, branches, logs (burnt or not): Eg 5 (AJM 416); Pp 6 (AJM 117), 9 (AJM 154), 10 (AJM 252).

Steccherinaceae
Steccherinum ochraceum (Fr.) S.F. Gray
on debarked logs awaiting transport to depot: Eg 4 (AJM 323, AJM 728); on logs: Pe 7 (AJM 295).

Stereaceae
Stereum hirsutum (Willd.:Fr.) S.F. Gray
on branch tips on living tree: Eg 5 (AJM 134); parasitic on coppice stumps: Eg 5 (AJM 144a), 8 (AJM 226, AJM 577); on branches, logs: Em 4 (AJM

308, AJM 452, AJM 611); Ey 7 (AJM 274, AJM 512).
Stereum illudens Berk.
on bark, branches: Eg 8 (AJM 172); Em 4 (AJM 307, AJM 610); E 1 (AJM 412); new record for Africa.
Stereum ostrea (Blume & Nees.: Fr.) Fr.
parasitic on coppice stumps: Eg 5 (AJM 133); on branches, logs: Eg 8 (AJM 225, AJM 578); Em 4 (AJM 612).
Stereum sanguinolentum (Alb. & Schw.: Fr.) Fr. *
on logs, bark, branches: Pe 7 (AJM 303); Pp 3 (AJM 206), 10 (AJM 246, AJM 814); Pt 2 (AJM 373).

Thelephoraceae
Thelephora terrestris Ehrh. : Fr.
on stumps: Pp 3 (AJM 211), 9 (AJM 186, AJM 558); on bases of seedlings: Pe, Pp 7 (AJM 990); mycorrhizal.

DISCUSSION

Among the polypores there is a much higher proportion of brown-rot fungi in the temperate and boreal zones than in the tropical zone (see Gilbertson & Ryvarden, 1986, and Ryvarden 1991). It the boreal to temperate zones the brown rotting polypores constitute from 18 to 25% of the total number, while the correspnding number is approximately 2% in East Africa. 65 to 75% of the brown rot polypores occur exclusively or predominantly on coniferous hosts (see Ryvarden 1991), varying somewhat variable from one continent to another.

If we look at the species reported in this paper, 16 species are brown rotting, i.e. 22% of the total number. The brown rotting species are found in Coniophoraceae and the polyporoid genus *Antrodia.*

It is remarkable to note that so many brown rotting species have been established in plantations in Zimbabwe, far away from their natural habitats, i.e. the circumpolar boreal to temperate zones. There are three possible explanations for this disjunct distribution.

The species are omnipresent as anamorphs, but only produce a teleomorphic stage on certain hosts when they are available, eventually correlated to some climatic conditions. This theory is purely speculative and unsubstantiated.

The spore dispersal mechanisms of these species are more effective than assumed. Thus, the African trees might have been infected through long distance dispersal from Europe, for example, where all the reported brown rot species occur in natural forests.

If this is true, it may be asked why all polypores, not just the brown rotting species, are not more or less cosmopolitan. All the spores of the reported *Antrodia* spp. are hyaline and thin-walled. Many white rot polypores have similar spores and have a far more restricted distribution. Many are not even circumpolar in the boreal zone where there is a more or less continuity with suitable hosts from Europe through Asia to North America. This question is discussed in detail by Ryvarden (1991) and the reader is referred to this paper for a detailed discussion of the mycogeography of the polypores.

We therefore find the long distance dispersal theory to be improbable and reject it. An establishment by such a dispersal mechanism would have taken place within 100 years since plantations were established in Southern Africa.

We believe that most probably, the brown-rot species were introduced with their hosts. *Pinus* species have an obligate mycorrhizal association. The first pine introductions in south Central Africa were unsuccessful until soil was brought in from mature plantations elsewhere (Mikola, 1980). Originally the soil came from the natural areas of distribution of the planted *Pinus* species, viz. Central and North America. Later plants were introduced from other tropical plantations which again had their plants from different parts of the world. The soil introduced with such plants have probably been contaminated by spores and/or hyphae of the brown-rot species mentioned above.

The recorded white-rot fungi are also present in indigenous forests and the majority were recorded on *Eucalyptus*, an angiosperm, just like the indigenous hosts. This is expected, being a reflection of a lack of host specialisation, and possession of a versatile metabolism seen in most tropical white-rot fungi.

ACKNOWLEDGEMENTS

Funding for these studies was provided by NORAD (The Norwegian Agency for International Development). We thank the individuals and organisations who gave us permission to collect samples from their private land. Dr. D. Pegler has kindly read the manuscript and suggested linguistic improvements for which we are grateful.

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MYCOTAXON

Volume XLIV, no. 1, pp. 251-256 April-June 1992

TAXONOMIC STUDY OF SOME SPECIES OF THE GENUS ERYSIPHE

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After analyzing the characteristics of the respective anamorphs and teleomorphs, fifteen from the most common species of the genus *Erysiphe* are submitted to a binary comparison using the Dice-Sørensen similarity index and then to processing with the cluster analysis. In the resulting dendrogram, it is possible to identify groups of species connected together by a high level of similarity. Based on such results, the following changes in status are proposed: *Erysiphe pisi* DC., *E. buhrii* U. Braun, *E. urticae* (Wallr.) Blumer, *E. cruciferarum* Opiz ex Junell, and *E. heraclei* DC. become varieties of *E. pisi* DC.; while *E. artemisiae* Grev., *E. cynoglossi* (Wallr.) Braun, and *E. sordida* Junell become varieties of *E. artemisiae* Grev.

Introduction

The classification of the genus *Erysiphe* DC., as obviously the classifications of the genera of the same family (*Erysiphaceae*), has suffered from either a "broadened" or a "narrowed" concept of species, adopted by individual authors ever since the classic monograph by Salmon (1900), in which the concept of "broadened" predominates, up to the very recent monograph by Braun (1987), in which, on the contrary, we find the concept of "narrowed".

Zheng and Chen (1981) recently stated that, although these pathogens are widely distributed and have been known for some time, their taxonomy is still rather confused.

Such different points of view are manifest in the shifting delimitations between the species comprised in a genus and in the different hierarchization of their morphological characteristics, which is subjective, even though some basic characteristics have prevailed (type of conidiophore, number of spores per ascus, in the case of the genus under study).

Such changes in the nomenclature have a negative effect on the interpretation of the literature, and the geographical, ecological, and matrical references of the individual systematic entities are often difficult to compare. Thus, any classification should, as far as possible, reduce subjectivity, simultaneously using and comparing as many characteristics as possible.

Finally, contrary to what occurs for other groups of fungi, *Erysiphaceae* have the advantage that, in the majority of cases, the whole cycle of the fungus is known, which facilitates inserting them in a taxonomic classification.

Aim

The aim of this work is to try and provide a basis for classification, taking into account the foregoing comments and using numerical taxonomy, i.e., submitting the following fifteen species of *Erysiphe*, selected from those most widely found (at least in Europe) on plants of interest to agriculture, to a phenetic analysis of similarity.

Materials and Methods

In order to know the characteristics of each of the species considered, the leading monographs on the family in general and on the genus in particular have been consulted. Reference has also been made to the original descriptions (when clear and useful), to the literature on the subject (when available), to a substantial amount of original material collected in Italy, in particular, but abroad as well and, finally, to herbarium collections of different origins. The quantitative characteristics of the original specimens have been obtained with a Kontron MOP Videoplan image analyzer connected to a Zeiss microscope.

As specified further, the characteristics used are both qualitative and quantitative, with the latter appropriately subdivided into classes.

The following species have been selected:

- *E. aquilegiae* DC. Taken, as per Braun (1987), i.e., from the union of *E. aquilegiae* s.s. and *E. ranunculi* Grev. On *Ranunculaceae* throughout Europe, Asia, America, Africa, and Australia.
- *E. artemisiae* Grev. Enucleated from the group of *E. cichoracearum*, and easily distinguishable from it. On *Artemisia* and other *Compositae* of Europe, Asia, and North America.
- *E. betae* (Vanha) Weltzien. On various species of the genus *Beta* throughout the world.
- *E. buhrii* U. Braun. A recently described species, distributed on *Caryophyllaceae* throughout Europe, Asia, North America, and North Africa. Enucleated from the large group of "*E. communis*".
- *E. cichoracearum* DC. Species having hundreds of hosts throughout the world.
- *E. circaeae* Junell. Limited species enucleated from the group of *E. communis* and only on the genus *Circaea* in almost all Europe and Asia.
- *E. convolvuli* DC. Very common on different species of the genus *Convolvulus* and distributed world-wide.
- *E. cruciferarum* Opiz *ex* Junell. Common on *Cruciferae* and in moderation on *Papaveraceae* and *Capparidaceae* throughout the world.
- *E. cynoglossi* (Wallr.) U. Braun (corresponding to *E. asperifolium* Grev. and *E. horridula* Lév.). On *Boraginaceae* throughout the world.
- *E. depressa* (Wallr.) Schlecht. Small species enucleated from the group of *E. cichoracearum* DC and only on some *Compositae* (particularly of the genus *Arctium*) throughout Europe, Asia, and North America.
- *E. heraclei* DC. Common on *Umbelliferae* throughout the world.
- *E. pisi* DC. A species widespread on very many species of *Leguminosae* throughout the world.

- *E. polygoni* DC. Widespread on *Polygonaceae* throughout the world.
- *E. sordida* Junell. Limited species enucleated from the group of *E. cichoracearum* DC. and only on the species of the genus *Plantago* throughout the world.
- *E. urticae* (Wallr.) Blumer. On *Urticaceae* of all Europe and Asia.

We thus have a total of fifteen species.

The characteristics used to build up the basic matrix of data are those normally considered in the description of the anamorphs (genus *Oidium* Link) and teleomorphs.

They are listed by group:

- mycelium (distribution on plant organs, density, and dimensions of the hyphae);
- appressoria (type);
- foot-cells of the conidiophore [distance of the basal septum from the carrier hypha, shape, width, and height (commonly called length)];
- successive cells of the conidiophore (number, their relative height and that with the basal cell, dimensions);
- conidia (length, width, l/w ratio, shape, distribution on the conidiophore);
- cleistothecia (distribution, density, diameter);
- peridium (shape and dimensions of cells);
- appendages [origin with respect to the carpophore, length, width, length relative to the respective carpophore, type, their interrelationship and relationship with the mycelium, their development, number, color, external surface (whether smooth or rough), wall thickness, number of possible septae, type of branching];
- asci (whether pedunculate or sessile, length, width, number per cleistothecium);
- spores (shape, color, length, width, l/w ratio, number per ascus).

With regard to the quantitative characteristics, the mean, minimum, and maximum values were considered, as well as the typical values in the case of the diameter of the cleistothecium.*

For each species, a total of 81 groups of characteristics (of which 29 on anamorph and 52 on teleomorph), with a total possibility of 399 single characteristics (of which 153 on anamorph and 246 on teleomorph), was examined.

Each species was compared with each one of the others, connecting them two-by-two using the Dice-Sørensen index of similarity, which, in this case, was considered the most suitable (Biondi, 1985), in relation to 100. Processing was then carried out using the cluster analysis of the 15 OTUs. The characteristics have not been weighted so as not to subjectively influence the analysis itself.

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* Typical values are those comprised between the two amounts obtainable by substracting and respectively adding the value of the standard deviation from the mean value (cfr. Blumer, 1967).

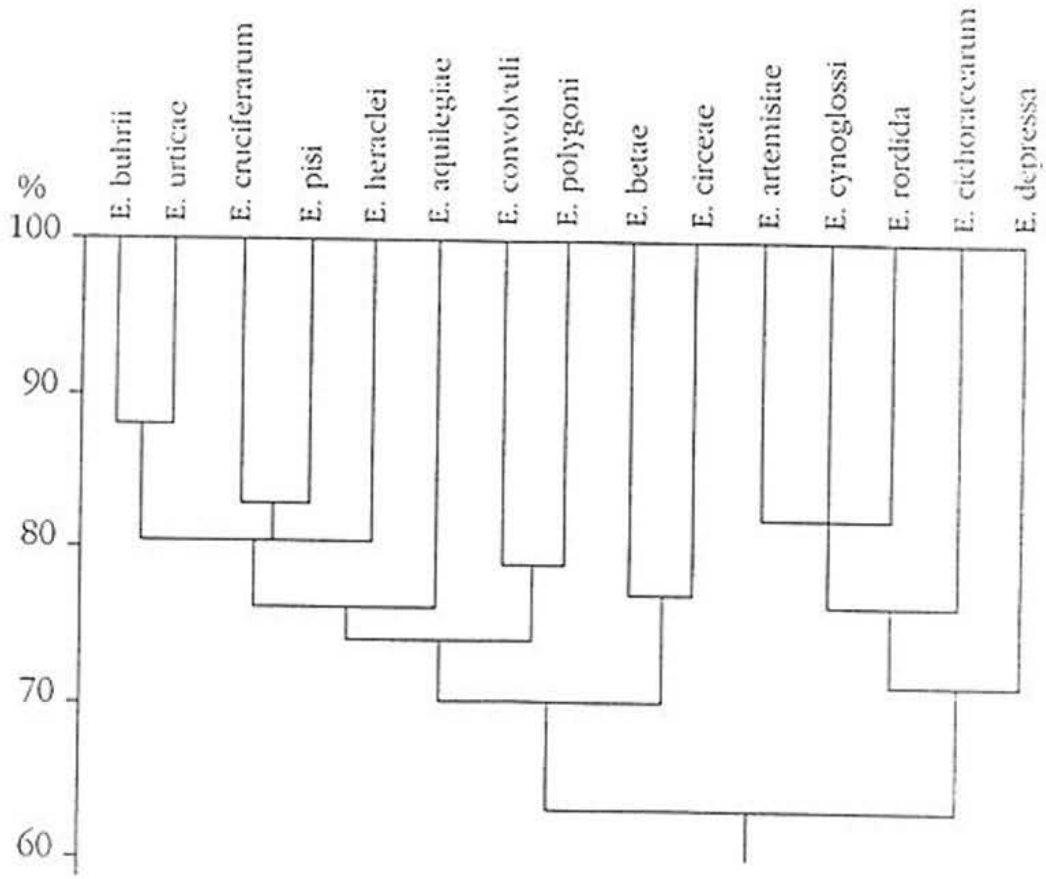

Fig.1 Dendrogram. The value of the similarity indices is shown on the left.

Results and Discussion

The dendrogram resulting from the comparison with the data collected and analyzed is reported in Fig. 1.

Beginning with the lowest phenetic levels of similarity (in this case 63%), the dendrogram is clearly divided into two clusters: the one on the left is formed of 10 species, the one on the right of 5 species. The 10 species on the left all belong to the section *Erysiphe*, the 5 on the right to the section *Golovinomyces* U. Braun. In other words, the numerical analysis confirms the usual subdivision of Blumer (1967) of the genus *Erysiphe* into the section *Linkomyces* and the section *Euerysiphe*.

After all, what Blumer realized practically on the basis of only two characteristics (type of conidiophore and number of spores per ascus) has now been confirmed by the whole collection of characteristics.

At the 70% level, in the group of the section *Erysiphe*, a cluster of two species (*E. betae* and *E. circeae*) breaks away. Such dichotomy merits separate study.

Going towards the highest levels, we obtain further confirmation: at the 71% level, *E. depressa* breaks away from the group of *E. cichoracearum*. For the former, Braun (1981) created a subsection of the section *Golovinomyces*, naming it, precisely, *subsection Depressa*.

A certain similarity can be noted (at the 77% phenon) between the two species *E. betae* and *E. circaeae*. Good similarity (79%) is clear between *E. convolvuli* and *E. polygoni*.

If we maintain that for a total of 399 possible characteristics, a similarity index higher than 80% makes it almost impossible to differentiate between two or more species, but only between simple varieties, the following synonymy is proposed:

In the left-hand cluster, there are five species connected together beyond such a level, specifically:

- *E. buhrii* U. Braun 1978;
- *E. urticae* (Wallr.) Blumer 1933;
- *E. cruciferarum* Opiz. *ex* Junell 1967;
- *E. pisi* DC. 1805;
- *E. heraclei* DC. 1815.

The species resulting from the fusion of the above five species will be named, in order of priority, *Erysiphe pisi* DC., while the five pre-existing species will be considered as varieties, according to the following division:

- var. *pisi*;
- var. *heraclei* (DC.) mihi stat. nov. [Syn.: *E. heraclei* DC., Fl. Fr. VI, p. 107 (1815)];
- var. *urticae* (Wallr.) mihi stat. nov. [Syn.: *E. urticae* (Wallr.) Blumer, Beitr. Krypt-Fl. Schweitz 7 (1), p. 224 (1933)];
- var. *cruciferarum* (Junell) mihi stat. nov. [Syn.: *E. cruciferarum* Opiz *ex* Junell, Sv. Bot. Tidskr. 61 (1), p. 217 (1967)];
- var. *buhrii* (U. Braun) mihi stat. nov. [Syn.: *E. buhrii* U. Braun, Ceska Myk. 32 (2), p. 80 (1978)].

Analogously, in the right-hand cluster there are three species connected together above 80%, specifically:

- *E. artemisiae* Grev. Fl. Edin. p. 459 (1924);
- *E. cynoglossi* (Wallr.) Braun 1982 (= *E. asperifolium* Grev., Fl. Edin. p. 461 (1824);
- *E. sordida* Junell, 1965.

The species resulting from the fusion will be named *Erysiphe artemisiae* Grev., while the three pre-existing species will be considered varieties, according to the following scheme:

- var. *artemisiae*;
- var. *cynoglossi* (Wallr.) mihi stat. nov. [Syn.: *E. cynoglossi* (Wallr.) U. Braun, Mycotaxon 15, p. 136 (1982)];

- var. *sordida* (Junell) mihi stat. nov. [Syn.: *E. sordida* Junell, Trans. Br. mycol. Soc. 48, p. 544 (1965)].

Conclusions

Applying the numerical taxonomy and the phenetic analysis on 15 species of *Erysiphe*, the following can be concluded:

1) Confirmation of two sections of the genus *Erysiphe*: *sectio Erysiphe* and *sectio Golovimomyces* U. Braun.

2) Confirmation of the *subsectio Depressa* U. Braun.

3) The species *E. buhrii* U. Braun, *E. urticae* (Wallr.) Blumer, *E. cruciferarum* Opiz *ex* Junell, *E. pisi* DC., and *E. heraclei* DC. are united in a single species, *E. pisi* DC. The species named are reduced to the rank of variety of the last species.

4) The species *E. artemisiae* Grev., *E. cynoglossi* (Wallr.) U. Braun and *E. sordida* Junell are united in a unique species, *E. artemisiae* Grev. The species named are reduced to the rank of variety of the last one.

The author wishes to thank Prof. A. Rambelli for kindly reviewing the manuscript.

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