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A PRELIMINARY DISCOMYCETE FLORA OF MACARONESIA: PART 5, SCLEROTINIACEAE*

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"Extreme remedies are very appropriate for extreme diseases."
Hippocrates [tr. William Henry Rich Jones]
APHORISMS, Sect. I, 6

Order HELOTIALES
Suborder HYMENOSCYPHINEAE
Family SCLEROTINIACEAE Whetzel 1945

KEY TO THE KNOWN MACARONESIAN GENERA

1. Apothecia cupulate, stipitate, on a distinct sclerotium with a well-differentiated rind and medulla ..2
1'. Apothecia cupulate, stipitate, on a substratal stroma, or stroma lacking (but if lacking, often with melanized cells at base of stipe) 3

2(1). Sclerotial medulla enveloping suscept tissues .....**Ciborinia**
2'(1). Sclerotial medulla free of suscept tissues. **Sclerotinia**

3(1'). Ascospores brown at maturity .....**Lambertella**
3'(1'). Ascospores hyaline at maturity 4

4(3'). Ectal excipulum composed of prosenchymatous cells bound in gel .....**Poculum**
4'(3'). Ectal excipulum composed of short cells, not bound in gel 5

* The parts of this flora will appear in irregular order. Reprints of individual parts will not be available for distribution.

5(4'). Ectal excipulum composed of brick-shaped cells. **Lanzia**

5'(4'). Ectal excipulum composed of globose cells 6

6(5'). Lignicolous; ascospores greater than 10 µm long .....**Ciboria**

6'(5'). Foliicolous, on herbaceous stems, or on mummified fruits; ascospores less than 10 µm long .....**Moellerodiscus**

Some taxa are identified here by the specimen number of a "typical representative," either because our collections are too scanty to serve as types, or because there are no comprehensive monographs of Sclerotiniaceous genera such as Ciboria, Lanzia, Moellerodiscus, and Poculum; too often type species are themselves doubtful.

CIBORIA Fuckel 1870

Key to the known Macaronesian species

1. Asci 4-spored, ascospores bearing a gel sheath. **1. Ciboria sp. 254**

1'. Asci 8-spored, ascospores without a gel sheath 2

2(1'). Ascospores (11.7-) 13.7-18.6 x 5.8-6.4 µm **3. Ciboria sp. 1182**

2'(1'). Ascospores 8.8-11.0 (-13.2) x (2.9-) 3.0-3.7 (-4.4) µm .....2. **Ciboria sp. 573**

1. Ciboria sp. 254

RECENT TAXONOMIC TREATMENTS: None.

PREVIOUS MACARONESIAN RECORDS: None.

KNOWN MACARONESIAN DISTRIBUTION

CANARY ISLANDS.

Tenerife. CUP-MM 254.

SUBSTRATUM: On twig.

Notes: This sparse collection is too meagre to constitute a type specimen. Although the tissue structure of the apothecia, composed of textura globulosa bound in gel, suggets affinities in Moellerodiscus, the substrate,

Ciboria sp. 254, 8 ascospores, CUP-MM 254, x 1000.

an unidentified twig, is anomalous for that foliicolous genus. There is no trace of a stroma except for some darkly pigmented cells at the base of the stipe. The asci are J+ and 4-spored. Ascospores are variable in shape, from irregularly ellipsoid to pyriform, though most frequently they are "slipper-shaped," uni- or biguttulate, (10.5-) 11.0-14.6 x 3.7-4.4 µm. Spore germination on water agar is uni- or bipolar.

2. Ciboria sp. 573

RECENT TAXONOMIC TREATMENTS: None.

PREVIOUS MACARONESIAN RECORDS: None.

KNOWN MACARONESIAN DISTRIBUTION

CANARY ISLANDS.
Tenerife. CUP-MM 573.

Ciboria sp. 573, 4 ascospores, CUP-MM 573, x 1000.

SUBSTRATUM: On branchlet in stream.

Notes: This small lignicolous collection also shows affinities in Moellerodiscus primarily on the basis of the microanatomy of the ectal excipulum, in this fungus composed of textura globulosa not bound in gel. Except for dark-walled cells at the base of the stipe, no stroma is evident. The asci are 8-spored and the pore J+. The ascospores are one- and two-celled, uni- or biguttulate, ellipsoid to fusoid to lacriform, 8.8-11.0 (-13.2) x (2.9-) 3.0-3.7 (-4.4) µm.

3. Ciboria sp. 1182

RECENT TAXONOMIC TREATMENTS: None.

PREVIOUS MACARONESIAN RECORDS: None.

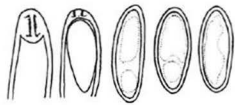
KNOWN MACARONESIAN DISTRIBUTION

CANARY ISLANDS.
Tenerife. CUP-MM 1182.

SUBSTRATUM: On wood.

Notes: APOTHECIA scattered, arising from wood; turbinate, buff, concolorous; disc up to 1.5 mm in diam

tapering to form a short stipe. ECTAL EXCIPULUM up to 80 µm wide along flanks and stipe, narrower at the margin, composed of hyaline textura globulosa arranged in chains perpendicular to the hymenial surface, cells up to 15 µm in diam, most cells under 10 µm, at margin composed of textura prismatica in chains parallel to asci. MEDULLARY EXCIPULUM a compact layer of hyaline textura intricata possibly bound in gel, cells up to 2.0 µm wide; medullary zone of stipe a compact textura porrecta oriented parallel to the stipe axis. SUBHYMENIUM poorly differentiated. ASCI clavate-cylindrical, 120-178 x 9-12 µm, apices thickened (up to 6.0 µm), pore channel walls strongly J+, 8-spored. ASCOSPORES hyaline, obliquely uniseriate, ellipsoid to allantoid, bi- or multiguttulate in youth, becoming one-septate, (11.7-) 13.7-18.6 x 5.8-6.4 µm. PARAPHYSES cylindrical, simple, septate, 1.0 µm wide, slightly inflated at the apices to 2.0 µm, not exceeding the asci.



Ciboria sp. 1182, apices of 2 asci, 4 ascospores, CUP-MM 1182, x 1000.

This description is based on a small collection. The turbinate apothecia and also the aseptate ascospores suggest this sparse material is also immature. No true stroma is in evidence; microscopically, the tissue subtending the base of the stipe is composed of host cells filled with hyaline hyphae. The apothecial microanatomy is most like that of Ciboria peckiana (Cooke) Korf although the spores in this collection are smaller and the apothecia (as we have them here) are much different macroscopically. This collection differs from Poculum firmum (Pers. : Fr.) Dumont, also on wood, in having an ectal excipulum composed of globose cells.

CIBORINIA Whetzel 1945

Key to the known Macaronesian species

1. Ascospores 10.6-13.8 x 4.8-6.4 µm, biguttulate, with a prominent gel sheath **1. Ciborinia sp. 1466**
1'. Ascospores (1.8-) 4.8-8.8 x (1.8-) 2.6-3.1 (-4.8) µm, usually eguttulate, without a gel sheath.
2. C. hirsuta

1. Ciborinia sp. 1466

RECENT TAXONOMIC TREATMENTS: None.

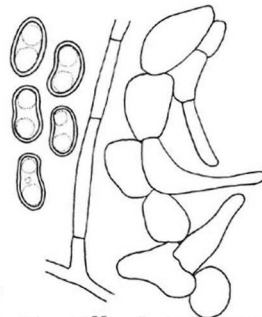
PREVIOUS MACARONESIAN RECORDS: None.

KNOWN MACARONESIAN DISTRIBUTION

CANARY ISLANDS.

Hierro. CUP-MM 1466.

SUBSTRATA: On sclerotia free in soil or attached to debris.



Ciborinia sp. 1466, 5 ascospores, brown-walled, rhizoidal hair from base of stipe, section through flank of apothecium showing outermost cells and tomentum hyphae, CUP-MM 1466, x 1000.

Notes: APOTHECIA solitary from tuberoid sclerotia; disc 0.9-1.1 mm in diam, hymenium buff, concolorous with excipular surface; stipe up to 5 mm long, 0.1 mm wide, reddish brown darkening to chestnut at the base. ECTAL EXCIPULUM 55-148 µm wide, of hyaline, thin-walled textura globulosa originating from cells of the medullary excipulum which "turn out" at a low angle to the surface and intergrade into the chains of globose cells perpendicular to the flank surface, cells up to 20 µm in diam with the largest cells along flanks; at margin outermost cells giving rise to some short tomentum hyphae; ectal excipulum of stipe composed of light brown-walled, finely superficially roughened textura porrecta, the outermost cells at the base of the stipe giving rise to brown-walled rhizoidal hairs. MEDULLARY EXCIPULUM up to 24 µm wide, narrowing toward the margin, of hyaline, thin-walled textura intricata, cells 4.0-6.5 µm broad; stipe medulla composed of hyaline, thin-walled textura intricata. SUBHYMENIUM 10.5 µm wide, a compact zone of light brown-walled textura intricata bound in gel, cells 2-3 µm broad. ASCI arising from croziers, columnar, 91-136 x 6.5-9.0 µm, pore faintly J+, asci containing a substance along the inside wall turning purple in Melzer's reagent, ascus apices thickened (3.5-4.5 µm thick), 8-spored. ASCOSPORES uniseri-

ate, ellipsoid to allantoid to subreniform, (10.6-) 12.0 (-13.8) x 4.8-6.4 µm, biguttulate, with a prominent gel sheath (easily seen in Melzer's reagent). PARAPHYSES simple, septate, filiform, slightly enlarged at the tips, 1.0 µm wide, not exceeding asci. STROMA consisting of tuberoid sclerotia, spherical with an irregular depression on dorsal surface, firmly attached to the host on ventral surface, 0.75-1.0 mm in diam; medulla of textura oblita with very heavily gelatinized walls, enveloping host vessel elements near site of attachment to host tissue.

The subreniform ascospores with gel sheaths and the purple reaction of the inner ascus wall in Melzer's reagent distinguish this small but interesting collection. Neither sclerotial nor Botrytis anamorphs were produced in cultures on DIFCO Corn Meal Agar, resulting in the assignment here to Ciborinia rather than Botryotinia, which was our field identification.

2. Ciborinia HIRSUTA Kohn & Korf, **sp. nov.**

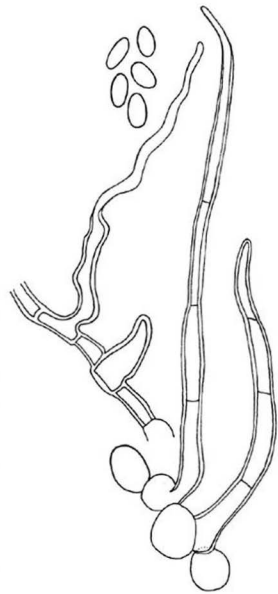
RECENT TAXONOMIC TREATMENTS: None.

PREVIOUS MACARONESIAN RECORDS: None.

Apothecia solitaria ex sclerotiis; discus rubrobrunneus, griseo-puberulentus, juventute crateriformis, deinde (sed non profunde) cupulatus, 1-2 mm in diam., stipite variabiliter ad 1 cm longitudine, ad 250 µ latitudine. Excipulum ectale ex cellulis formatum hyalinis, parietibus tenuibus praeditis, inflato-lateriformibus vel globosis, ordinatis in catenis 3-6 cellularibus ad superficiem perpendicularibus, cellulis ad 15 µ latis, eis extimis pilos saepe parientibus. Pili hyalini praebentes 3 formas fortasse gradus in progressu referentes: tomenti hyphas 1-2-cellulares ad 30 µ longas cellulis apicalibus clavatis instructas; pilos simplices multiseptatos columnares vel acuminatos ad 70 µ longos; pilos multiseptatos columnares vel acuminatos ad 100 µ longos, basi saepe ramosus. Asci ex crocis exorientes, cylindrici, 56-75 x 5-6 µ, pori canalis pariete J+, apicibus incrassatis. Ascosporae uniseriatae, hyalinae, plerumque eguttulatae, late ellipsoideae, in magnitudine valdissime variabiles, (1.8-) 4.8-7.0 (-8.8) x (1.8-) 2.6-3.1 (-4.8) µ; asci ex apotheciis sub conditionibus naturalibus collectis segregationem ascosporarum minorum (4.8-5.3 x 3.5-4.0 µ) et majorum (5.7-7.0 x 2.6-3.1 µ) in

rationibus 4:4, 6:2, 8:0 praebentes. Stroma sub conditionibus naturalibus sclerotium discretum ovale ca. 1-1.5 mm longum, elevatum sed siccitate collapsum; cortex superficiem et dorsalum et ventralem involvens, crassitie 1-2 cellularum, ex textura globulosa formatum, parietibus brunneis, eis exterioribus densius atratis; medulla ex textura oblita parietibus gelatinosis ex parte formata, hospitis telae vestigia includens.

APOTHECIA solitary from sclerotia, disc reddish brown, greyish-puberulent, goblet-shaped in youth, becoming shallowly cupulate, disc 1-2 mm in diam (apothecia produced in vitro larger than those collected in nature), stipe variable in length up to ca. 1 cm, 250 µm wide. ECTAL EXCIPULUM up to 35 µm wide along flanks, of hyaline, thin-walled, inflated, brick-shaped to globose cells arranged in chains 3 to 6 cells long, perpendicular to the flank surface, cells up to 15 µm broad, the outermost cells frequently giving rise to a smaller, globose cell (up to 10 µm in diam) in turn giving rise to hairs. HAIRS of three types possibly representing three phases of development: a one- to two-celled, hyaline tomentum hypha up to 30 µm long, with a clavate apical cell; a multiseptate, columnar to acuminate (but blunt-tipped) hair up to 5 µm broad and 70 µm long; a long, multiseptate, columnar to acuminate hair, often branched at the base,



Ciborinia hirsuta, 5 ascospores, non-septate hairs emerging from the outermost cells of the stipe, multiseptate hairs originating from the flanks, CUP-MM 2273, x 1000.

up to 100 µm long. MEDULLARY EXCIPULUM of two zones: the outer zone of thin-walled, hyaline textura intricata to textura prismatica with cells somewhat inflated, oriented parallel with the flank surface, giving rise to the inflated cells of the ectal excipulum, cells up to 14 µm broad; the inner zone composed of thin-walled, hyaline to light brown-walled, superficially granularly roughened textura porrecta oriented parallel to the hymenial surface, intergrading into textura intricata above stipe, cells 4-7 µm broad. SUBHYMENIUM a compact light brown textura intricata, cells 2.5-4.2 µm broad. ASCI arising from croziers, cylindrical, 56-75 x 5.0-5.8 µm, pore channel walls J+, apices thickened. ASCOSPORES uniseriate, hyaline, usually eguttulate, broadly ellipsoid, extremely variable in size, (1.8-) 4.8-7.0 (-8.8) x (1.8-) 2.6-3.1 (-4.8) µm; asci from apothecia collected in the field showing segregation of small ascospores (4.8-5.3 x 3.5-4.0) and large ascospores (5.7-7.0 x 2.6-3.1 µm) in 4:4, 6:2, and 8:0 ratios, with large ascospores often the basal ones in the chain of ascospores; asci from apothecia produced in vitro showing no segregation of large and small ascospores, producing irregular numbers of ascospores (up to 9 per ascus), ascospores iregular in size, some appearing to abort. PARAPHYSES filiform, simple, 0.8-1.0 µm wide, not exceeding asci. STIPE ectal excipulum of hyaline to brown, thin-walled textura porrecta with outermost cells somewhat inflated and giving rise to hairs as described for the receptacle and to much shorter, nonseptate to multiseptate, narrower hairs (25-30 x 2 µm) the contents of which stain deeply in phloxine/KOH; medullary excipulum of thin-walled, hyaline textura porrecta, becoming brown-walled at base of stipe, oriented parallel to stipe axis, cells 3-10 µm broad. STROMA in nature discrete oval sclerotia, ca. 1-1.5 mm long, raised, but collapsing on drying, brittle; rind enveloping both dorsal and ventral surfaces, one to two cells thick, of brown-walled textura globulosa, with the outer walls more heavily melanized, cells 7-10 µm in diam; medulla in two zones, the inner zone of hyaline, thin-walled textura intricata enveloping host vessel elements and incorporating some amorphous material, presumably remnants of digested host tissue, cells 4-5 µm broad; the outer zone composed of hyaline textura oblita with shorter cells than those in the inner zone and with thick, gelatinized walls, up to 5 µm thick where two adjacent walls coalesce.

CULTURE: Ascospores of CUP-MM 2273 were germinated

in mass on DIFCO Potato Dextrose Agar. Cultures were taken from the field to Cornell University, where they were transferred to 9 cm plastic petri dishes containing DIFCO Malt Agar, DIFCO Low pH Mycological Agar, and DIFCO High pH Mycological Agar. After three weeks of incubation at room temperature under ambient light conditions, large (0.5-2 cm long), discrete sclerotia were formed on malt agar, small sclerotia on Low pH agar, and no sclerotia on High pH agar; all cultures produced thick mats of white mycelium bearing a Myrioconium "microconidial" anamorph. In an attempt to induce formation of a conidial anamorph, cultures were incubated in a growth chamber at 15 C under ca. 21,000 lux mixed incandescent and flourescent light. While no conidial anamorph was produced, after approximately two months apothecia developed in the cultures on malt agar. Subsequent microanatomical study of the sclerotia showed marked dorsiventral differentiation; the dorsal rind is similar to that described from sclerotia found in nature, but the ventral rind is composed of a loose weft of dark brown-walled prosenchyma. The medulla is composed of textura oblita with thick, gelatinized walls, but is loosely interwoven in the area adjacent to the ventral rind. The entire sclerotium produced in culture is overlaid by a thick layer of white mycelium incorporating rhomboidal crystals and sporodochia of the Myrioconium anamorph.

HOLOTYPE: R.P. Korf, L.M. Kohn, N. Korf & A.Y. Rossman, under Vaccinium, Ribeiro Frio, Madeira, Portugal, 21.iv.1978. (CUP-MM 2273).

KNOWN MACARONESIAN DISTRIBUTION

MADEIRA.

Madeira. CUP-MM 2272, 2273 (holotype), 2349.

SUBSTRATA: Under Vaccinium (CUP-MM 2273, 2349); under lily (Liliaceae) (CUP-MM 2272).

Notes: On making these collections under Vaccinium and a lily in late spring, our initial identification as a species of Botryotinia awaited only development of a Botrytis conidial anamorph in cultures made from ascospores. Subsequent cultural studies have failed to yield a Botrytis anamorph, or any other conidial anamorph save the Myrioconium "microconidial" state ubiquitous among members of the Sclerotiniaceae. This species is consequently accommodated in the genus Cibo-

rinia, where it is described as new. Future collections of this species may establish the host/substrate relationship more clearly; unfortunately the host material in these collections is fragmentary and well-decayed.

LAMBERTELLA von Höhnel 1918

Key to the known Macaronesian species

1. On dead branches of Myrica faya ....2. **L. myricae**
1'. On other hosts 2

2(1'). Ascospores finely punctate, banded. **1. L. corni-maris**
2'(1'). Ascospores not ornamented, not banded ..3

3(2'). Apothecia bearing bulbous-based hairs with acuminate tips .....3. L. zeylanica
3'(2'). Apothecia not bearing such hairs 4

4(3'). Ascospores 13.3-16.1 x 3.7-5.9 µm, without a gel sheath **4. Lambertella sp. 1734**
4'(3'). Ascospores 8.0-9.5 x 3.2-4.2 µm, with a gel sheath .....**5. Lambertella sp. 1959**

1. Lambertella corni-maris Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 127: 375. 1918.

RECENT TAXONOMIC TREATMENTS: Dumont (1971).

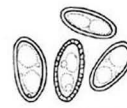
PREVIOUS MACARONESIAN RECORDS: None.

TYPE LOCALITY: Austria.

KNOWN MACARONESIAN DISTRIBUTION
CANARY ISLANDS.
La Palma. CUP-MM 671.

SUBSTRATUM: unidentified petiole.

Notes: Ascospores were yellow-brown and germinated on water agar by single germ tubes in 24 hrs.



L. corni-maris, 4 ascospores, CUP-MM 671, x 1000.

2. **Lambertella myricae** Dennis & Spooner in Dennis, Reid and Spooner, Kew Bull. **32**: 113. 1977.

RECENT TAXONOMIC TREATMENTS: Dennis & al. (1977).

PREVIOUS MACARONESIAN RECORDS: *Dennis & al. (1977).

KNOWN MACARONESIAN DISTRIBUTION

*AZORES.

***Terceira.** *Dennis & al., 26.iii.75 n.v.

SUBSTRATUM: Dead branch of Myrica faya Ait.

Notes: The type (only known) specimen was not available to us from Kew, where it is on deposit, since it had already been studied and annotated by Dr. K.P. Dumont at the New York Botanical Garden. Kew did not provide copies of his notes for our examination. Using the description and illustration of Dennis & al. (1977) and Dumont's (1971) classification, it would key out as L. viburni Whetzel & Dumont in Dumont. Dennis & al. note their species to be "evidently very close" to L. viburni.

3. **Lambertella** cfr. **zeylanica** Dumont, Mem. New York Bot. Gard. **22**: 167. 1971.

RECENT TAXONOMIC TREATMENTS: Dumont (1971).

PREVIOUS MACARONESIAN RECORDS: None.

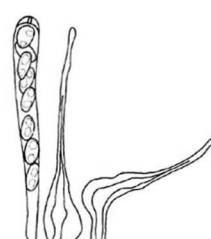
TYPE LOCALITY: Ceylon.

KNOWN MACARONESIAN DISTRIBUTION

CANARY ISLANDS.

Tenerife. CUP-MM 410.

SUBSTRATUM: On leaf blade.



Lambertella cfr. **zeylanica,** ascus with ascospores, 2 hairs from flank, CUP-MM 410, x 1000.

Notes: As in the type collection of Lambertella zeylanica, there are no brown ascospores within asci in this small collection. Having examined the holotype of L. zeylanica (CUP-SA 3215), we find the size of the hyaline spores in CUP-MM 410 similar to the hyaline spores in that type. The larger, brown, discharged ascospores in the type collection were not seen in our collection from Tenerife. The acuminate hairs borne on the apothecial flanks in CUP-MM 410 have much thicker walls than those in CUP-SA 3215 and some collapse of cell lumen is evident in phloxine/KOH mounts. Our determination can only be provisional.

4. Lambertella sp. 1734

RECENT TAXONOMIC TREATMENTS:
None.

PREVIOUS MACARONESIAN RECORDS:
None.

KNOWN MACARONESIAN DISTRIBUTION

AZORES.
São Miguel. CUP-MM 1734.

SUBSTRATUM: On Rubus sp. in spray.

Lambertella sp. 1734 1-septate hyaline ascospores and 3-septate, pale brown-walled germinating ascospore, CUP-MM 1734, x 1000.

Notes: APOTHECIA scattered; disc shallowly concave in youth, at maturity plane to somewhat convex, up to 1.3 mm in diam; hymenium warm reddish brown, margin darker than hymenium, somewhat raised, exciple concolorous; stipe concolorous with disc, 0.5 x 13 mm. STROMA an indeterminate blackened area; no stromatic cells were observed in sections. ECTAL EXCIPULUM up to 35 µm wide along flanks, of hyaline textura angularis to textura globulosa, cells up to 20 µm in diam, zone narrowing at margin and there composed of occasionally inflated textura prismatica; stipe of same tissue types as flanks, with fine, hyaline hairs produced at the base. MEDULLARY EXCIPULUM up to 328 µm wide at flanks, of hyaline textura intricata, cells 2-3 µm wide, stipe of hyaline textura porrecta oriented parallel to stipe axis, cells 2-3 µm wide. SUBHYMENIUM poorly differentiated. ASCI

arising from croziers, clavate, 80-85 x 7-10 µm, ascus pore channel strongly J+, apices thickened (2-3 µm), 8-spored. ASCOSPORES biseriate at first, then biseriate above and uniseriate below, finally uniseriate and filling most of the ascus, fusoid-ellipsoid with one or both ends tapering, 13.3-16.1 x 3.7-5.9 µm, one-septate and hyaline within asci, pale brown and 3-septate at germination. PARAPHYSES filiform, once-brnJanched, septate, 1.5 µm broad, not exceeding asci.

Although no brown ascospores were observed within asci, after discharge, at germination, ascospores become pale brown and three-septate. The ectal excipulum is composed of textura angularis with cells inflated but not quite globose. Apothecia do not appear to arise from a stroma, though the host surface is blackened; the blackened areas seem to be a rather superficial crust, with no stromatal cells in evidence at the junction of stipe and host. The brown-walled ascospores and subciborioid exciple suggest affinities in Lambertella, though this fungus does not fully conform to any species circumscription in that genus.

5. **Lambertella sp.** 1959

RECENT TAXONOMIC TREATMENTS: None.

PREVIOUS MACARONESIAN RECORDS: None.

KNOWN MACARONESIAN DISTRIBUTION

AZORES.

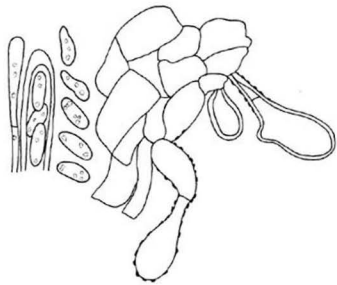
Terceira. CUP-MM 1959.

MADEIRA.

Madeira. CUP-MM 2355.

SUBSTRATA: On capsules of Eucalyptus spp.

Notes: APOTHECIA scattered, stipitate-cupulate, disc 2 mm in diam, hymenium umber, exciple darker ochraceous brown; stipe variable in length, up to 2 mm long, tortuous, ochraceous brown, bearing short hairs, dark brown at base. STROMA not observed on the host, the thick, waxy cuticle of the capsule ruptured only at the site of stipe attachment; the stipe base, composed of a medulla of textura intricata-textura oblita with gelatinized walls, enveloped by an ectal excipulum of dark brown-walled textura globulosa, may constitute the stroma. ECTAL EXCIPULUM 60 µm wide at the flanks,



Lambertella sp. 1959, paraphysis, ascus apex, 8 ascospores, section through flank of apothecium showing outermost cells of ectal excipulum giving rise to hairs, CUP-MM 1959, x 1000.

of pale brown-walled, minutely granularly roughened textura prismatica with cells somewhat inflated (barrel-shaped), at flanks cells arranged in chains perpendicular to face of receptacle, towards margin chains of cells at a more acute angle to the surface, cells up to 26.5 x 8.0 µm, outermost cells giving rise to hyaline to pale brown-walled, 2-3-celled, occasionally granularly roughened hairs up to 35 µm long, bearing a clavate, sometimes thick-walled apical cell; margin of dark brown-walled textura prismatica in chains at a low angle to the excipular surface, cells up to 5 µm broad. MEDULLARY EXCIPULUM a compact zone, up to 85 µm wide, of superficially granularly roughened, hyaline textura intricata, cells 2.7-5.3 µm broad. SUBHYMENIUM 48 µm wide, composed of hyaline, granularly roughened textura intricata, cells 1.6-2.7 µm broad. ASCI arising from croziers, clavate, (60-) 70-78 x (5.8-) 7.0-8.0 µm, pore channel wall J+, apices thickened (up to 4.2 µm), 8-spored. ASCOSPORES uniseriate (occasionally partially biseriate), narrowly ellipsoid to reniform to lacryform, 8.0-9.5 x 3.2-4.2 µm, hyaline within asci, golden brown at germination, bi- to multiguttulate, bearing a prominent gel sheath up to 0.5 µm thick. PARAPHYSES filiform, simple, septate, up to 1 µm

broad at apices, not exceeding asci. STIPE: ectal excipulum 3-4 cells thick, of brown-walled, brick-shaped to subglobose cells oriented parallel to stipe axis, cells up to 8 µm broad, outermost cells occasionally giving rise to clavate, 1-2-celled hairs 20-25 µm long; medullary excipulum of hyaline, thin-walled, superficially granularly roughened textura porrecta oriented more or less parallel to the stipe axis.

CUP-MM 2355, also on capsules of Eucalyptus but collected in Madeira, is similar to CUP-MM 1959 from the Azores, upon which this description is based, but differs in several important respects: (1) the apothecia are smaller (ca. 1 mm in diam), less robust, and grey when dry, though warm brown when rehydrated; (2) the cells of the excipulum are shorter, narrower, and except for the hairs are oriented parallel to the excipular surface; (3) the ascospores are larger (10 x 3 µm) and regularly biguttulate. Since both collections are small, it is questionable whether these differences fall within the range of variation of one species or serve to separate two distinct species.

LANZIA Saccardo 1884

Key to the known Macaronesian species

1. Asci 8-spored; on husks of Castanea ..... **1. Lanzia sp. 137**
1'. Asci 4-spored; on leaf blade. **2. Lanzia sp. 409**

1. Lanzia sp. 137

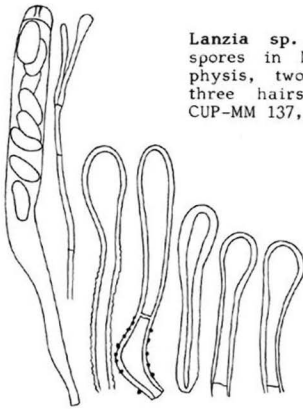
RECENT TAXONOMIC TREATMENTS: None.

PREVIOUS MACARONESIAN RECORDS: None.

KNOWN MACARONESIAN DISTRIBUTION:
CANARY ISLANDS.
Tenerife. CUP-MM 137.

SUBSTRATUM: On needles of the husks of Castanea sativa Mill.

Notes: APOTHECIA solitary, associated with stromatized patches on the host, deeply cupulate in youth, becoming



Lanzia sp. 137, ascus and ascospores in Melzer's reagent, paraphysis, two hairs from the stipe, three hairs from apothecial flank, CUP-MM 137, x 1000.

shallowly cupulate at maturity; disc reddish brown, up to 0.75 mm in diam; stipe reddish brown, black toward the base, up to 1 mm long. ECTAL EXCIPULUM composed of two zones: an outer zone 3-4 cells thick of hyaline to light brown-walled, occasionally granularly roughened, brick-shaped cells 3-6 µm broad, the outermost cells giving rise to hyaline to light brown-walled, septate hairs 20-40 µm long usually terminating in a clavate cell; the inner zone 20-30 µm wide, tapering off at the margin, of hyaline to light brown-walled brick-shaped to inflated (more or less globose) cells which are up to 10 µm in diam; ectal excipulum of the stipe composed of brick-shaped, brown-walled, granularly roughened cells oriented parallel to the stipe axis, cells up to 5 µm broad, outermost cells occasionally giving rise to one- to multicelled tomentum hyphae, cells at base of stipe globose, up to 10 µm in diam, with thick, brown walls. MEDULLARY EXCIPULUM a loose layer ca. 60 µm wide at flanks, of hyaline to light brown-walled textura intricata, coarsely granularly roughened, cells up to 7 µm broad; stipe of brown-walled, coarsely granularly roughened prosenchyma oriented parallel to the stipe axis, graduating into a compact

textura intricata at the stipe base. SUBHYMENIUM a compact layer 25 µm wide of hyaline textura intricata, cells 1-2 µm broad. ASCI arising from croziers, 40-60 x 6-7 µm, clavate, apices thickened (up to 3 µm), J+ with ascus pore channel wall turning pale blue (darker blue below and appearing as a dark blue ring or as two dots at the pore channel base), 8-spored. ASCOSPORES uni- or biseriate, hyaline, ovoid-ellipsoid, 7-9 (-10) x (2-) 3 (-4) µm, minutely biguttulate. PARAPHYSES filiform or with apices slightly swollen, 1 µm broad, simple or branched, septate, not exceeding asci. STROMA possibly limited to stipe base; stromatized patches on host of doubtful relationship to apothecia.

Unfortunately the collection upon which this description is based is too small to constitute a type specimen. We would have dedicated the new species to J. T. Palmer, whose research on chestnut-burr "Rustroemia" spp. in Europe has been so thorough. The distinctive thick-walled hairs, tiny biguttulate spores and granularly roughened medullary excipulum preclude assignment to any species presently described in Lanzia. On the assumption that spores in this collection may not have been mature enough to reveal pigmentation, accommodation in Lambertella was also considered, although no presently recognized species of that genus matches our collection either. Cultural studies are needed to elucidate the relationship of the stromata to the apothecia. It should be sought again in Tenerife.

2. Lanzia sp. 409

RECENT TAXONOMIC TREATMENTS: None.

PREVIOUS MACARONESIAN RECORDS: None.

KNOWN MACARONESIAN DISTRIBUTION
CANARY ISLANDS.
Tenerife. CUP-MM 409.

SUBSTRATUM: On leaf blade.

Lanzia sp. 409, 4-spored ascus, CUP-MM 409, x 1000.

Notes: APOTHECIA solitary from small stromata, disc reddish-brown, 0.5 mm in diam, darker at margin;

stipe reddish brown, 190 x 150 µm. STROMA a small, black, disc-shaped area on the adaxial leaf surface; rind covering the dorsal stromatal surface only, composed of a single layer of globose cells with outermost cell walls melanized; medulla poorly developed with minimal hyphal invasion of subtending host tissues. ECTAL EXCIPULUM of three layers: the outer layer ca. 6.4 µm wide along flanks, of light brown textura porrecta "turning out" at a high angle to the excipular surface, cells 1.0-1.6 µm broad; middle layer two cells thick of light brown textura prismatica, with cells somewhat inflated, 3.0-5.8 µm broad, oriented parallel to receptacle surface; inner layer 8 µm broad, of light brown textura porrecta, cells 2.7-3.2 µm broad; margin of dark brown-walled and somewhat interwoven textura porrecta; stipe composed of hyaline textura porrecta parallel to the stipe axis, cells 2.7-3.7 µm broad. MEDULLARY EXCIPULUM of loosely interwoven, light brown-walled textura intricata, cells 2-3.5 µm broad. SUBHYMENIUM poorly differentiated. ASCI from repeating croziers, clavate, 60-70 x 3-4 µm, pore channel wall faintly J+, apices thickened (up to 3 µm), 4-spored. ASCOSPORES uniseriate, hyaline, ellipsoid, 2-3-multiguttulate, 8.0-8.5 x 2.2-3.0 µm. PARAPHYSES filiform, septate, sparsely branched, 1 µm broad, not exceeding asci.

In the absence of pigmented ascospores, which may be due to immaturity of this collection, placement in Lambertella is ruled out and this species is provisionally accommodated in Lanzia. While the 4-spored asci and complex excipular structure set this species apart, the collection upon which this description is based is too meagre to constitute a type specimen. Identification of the host and cultural studies also await acquisition of additional material.

MOELLERODISCUS P. Hennings 1902

= Ciboriopsis Dennis 1962

Key to the known Macaronesian species

1. Excipular tissues of apothecia light blue in Melzer's reagent after pretreatment in 10% KOH 2
1'. Excipular tissues not so reacting 3

2(1). Ascus epiplasm purple in Melzer's reagent.
1. M. iodotingens subsp. **iodotingens**
2'(1). Ascus epiplasm not so reacting.
2. M. iodotingens subsp. **canariensis**

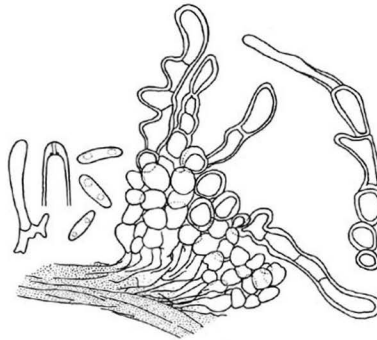
3(1'). Ascospores 3.7-5.9 (-6.6) x 1.5 µm; apothecia on line stromata on leaves of Hedera helix.
3. M. hederae
3'(1'). Ascospores (5.6-) 6.3-8.1 x 1.4-2.2 µm; apothecia on petioles, midribs, leaf blades, and mummied stone fruits. **4. Moellerodiscus sp. 1881**

1. Moellerodiscus IODOTINGENS Kohn & Korf, **sp. nov.** subsp. **IODOTINGENS**

RECENT TAXONOMIC TREATMENTS: None.

PREVIOUS MACARONESIAN RECORDS: None.

Apothecia solitaria vel dispersa, in foliorum laminis, venis, petiolisque putrescentibus stromate infectis; receptaculum cupulatum vel plano-convexum depressionem centralem praebens, 2-3 mm in diam., discus ochraceo-brunneis, in sicco brunneolescens; receptaculi parietes disco pallidius ochraceo-brunnei, furfuracei; stipes 1-2 mm longus, saltem ad basin atrobrunneus. Excipulum ectale 20-60 µ latum, in gelatina inclusum, ex zonis duabus compositum, zona interiore ex textura porrecta ad superficiem receptaculi parallela formata, parietibus tenuibus, cellulis 2-3 µ latis, zona exteriore ex textura globulosa vel angulari pallide brunnea formata in catenis ad superficiem receptaculi parallelis ordinata, cellulis 3-8 µ latis, gelatina in substantia reagente Melzerana coerulescente post usum 10% KOH antecedentum; cellulae extimae pilos moniliformes ad 70 µ longos hyalinos vel parietibus pallide brunneis praeditos, interdum granulari-incrustatos, efferentes, quibus pilis abundantissimis ad marginem ubi fere semper parietibus brunneis praediti sunt; stipitis cellulae ectales ad axin stipitis perpendiculariter extentae, in gelatina inclusae, pilos moniliformes parietibus brunneis praeditos efferentes, cellulis parietibus atrobrunneis praeditis ad basin stipitis repertis. Excipulum medullare in latitudi-variabile, ex textura intricata parietibus pallide brunneis praedita ad superficiem receptaculi plus minusve parallela, cellulis 1-2 µ latis, plerumque granulari-incrustatis, cellularum contento in substantia reagente Melzerana purpureo; stipitis excipulum medullare eo receptaculi simile,



M. iodotingens subsp. **iodotingens,** young ascus, with repeating crozier, CUP-MM 2091, x 1000; ascus apex showing blueing of ascus pore channel wall in Melzer's reagent after pretreatment in 10% KOH, 3 ascospores, excipulum near the margin, and a hair from lower on the receptacle, CUP-MM 1880, x 1000.

cellulis 2-3 µ latis exceptis. Asci clavati, ex uncis enati, 8-spori, 50-60 x 5-7 µ, epiplasmate in substantia reagente Melzerana purpureo, apice incrassato (3 µ), pori canalis pariete dilute J+ sine usu KOH antecedente, reactione aucta cum usu 10% KOH antecedente. Ascosporae ellipsoideae, hyalinae, biguttulati, 7-8.8 (-10.2) x 2-3 µ, biseriati, germinatione tubos germinales formantes in conformatione quae "crux coptica" dicitur. Paraphyses subclavatae, 1 µ latae, simplices, septatae, ascos in longitudine non excedentes.

APOTHECIA solitary to scattered on decaying stromatized leaf blades, veins, and petioles; receptacle cupulate to plano-convex with a central depression, 2-3 mm in diam; disc ochraceous brown drying to tan; surface of receptacle paler ochraceous brown than disc, furfuraceous; stipe 1-2 mm long, dark brown at least at base. ECTAL EXCIPULUM 20-60 µm wide, bound in gel, of two zones: the inner zone of thin-walled textura porrecta turning out perpendicularly to the surface of the receptacle, cells 2-3 µm broad; outer zone of pale brown

textura globulosa to textura angularis, oriented in chains perpendicular to the surface of the receptacle, cells 3-8 µm broad, gel turning blue in Melzer's reagent following pretreatment in 10% KOH; outermost cells giving rise to hyaline to light brown-walled moniliform hairs up to 70 µm long, occasionally granularly roughened, most abundant at the margin where hairs are almost always brown-walled; ectal cells of stipe turning out perpendicular to the stipe axis, bound in gel, giving rise to brown-walled moniliform hairs, dark brown-walled cells present at the base of stipe. MEDULLARY EXCIPULUM variable in breadth, of pale brown-walled textura intricata oriented more or less parallel to receptacle surface, cells 1-2 µm broad, usually granularly roughened, cell contents purple in Melzer's reagent; medullary excipulum of the stipe same as that of the receptacle except cells 2-3 µm broad. ASCI clavate, arising from croziers, 8-spored, 50-60 x 5-7 µm, epiplasm purple in Melzer's reagent, apex thickened (up to 3 µm), pore channel wall faintly J+ without KOH pretreatment, reaction enhanced with pretreatment in 10% KOH. ASCOSPORES biseriate, ellipsoid, hyaline, biguttulate, 7.0-8.8 (-10.2) x 2.0-3.0 µm, germinating in a "Coptic cross" configuration much later followed by production of a single germ tube. PARAPHYSES subclavate, 1.0 µm broad, simple, septate, not exceeding asci in length.

HOLOTYPE: R.P. Korf, L.M. Kohn, N. Korf & A.Y. Rossman, on decaying, stromatized leaf blades, veins, and petioles, cultivated garden, Cabo da Praia, Terceira, Azores, Portugal, 8.iv.1978. (CUP-MM 1880) (K, TFC: ISOTYPES.) (ISOTYPES will also be distributed in Korf & Gruff, Discomycetes Exsiccati.)

KNOWN MACARONESIAN DISTRIBUTION

AZORES.

Flores. CUP-MM 2070, 2091, 2146, 2188 (TFC).

São Miguel. CUP-MM 1739.

Terceira. CUP-MM 1880 (holotype, isotypes), 1883, 1923, 2062.

MADEIRA.

Madeira. CUP-MM 2271.

SUBSTRATA: on decaying, stromatized leaf blades, veins and petioles of Myrica faya, ? Pittosporum sp., Hedera helix, etc., and on herbaceous stems.

Notes: The tissues blueing in Melzer's reagent (at least after pretreatment in 10% KOH) and the biguttulate ascospores distinguish this species from M. tenuistipes (Schroet.) Dumont. The larger ascospores and abundant moniliform hairs easily distinguish it from M. musae Dumont. Reactions in Melzer's reagent are particularly striking in this species: with pretreatment in 10% KOH the ectal excipulum consistently turns light to medium blue in Melzer's reagent; without pretreatment cell contents of all tissue zones are purple-brown in that reagent.

The "Coptic cross" spore germination on agar was consistently noted for many of the collections that were cultured, both in this subspecies and in M. iodotingens subsp. canariensis (see photograph under that subspecies). We have no explanation for this elaborate form of germination, usually seen within 24 hours. Only after 48 to 72 hours (at ambient room temperatures in our field hotel/laboratories) does further hyphal development ensue, with usually a single, long germtube observed from any one spore. Except for melanized cells around the base of the stipe, association with stromatized substrata is purely circumstantial, since no stromatic tissue has been produced in our cultures derived from ascospores.

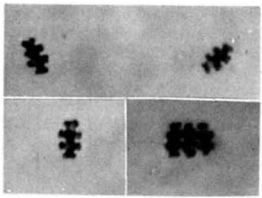
2. **Moellerodiscus iodotingens** Kohn & Korf in Kohn subsp. **CANARIENSIS** Kohn, **subsp. nov.**

RECENT TAXONOMIC TREATMENTS: None.

PREVIOUS MACARONESIAN RECORDS: None.

Subspeciei typicae fere omni ex parte conveniens, sed apotheciis aurantio-brunneis, excipulo ectali zona interiore carente, et contento cellularum in zonis omnibus receptaculi non purpurascente in substantia reagente Melzerana differt. Huius subspeciei distributio ad Insulas Canarienses limitata.

Agreeing with the description of Moellerodiscus iodotingens subsp. iodotingens in all respects except for the orange-brown color of the apothecia, lack of an inner zone of the ectal excipulum, and lack of a purple reaction in Melzer's reagent of cell contents in all zones of the receptacle. Distribution of the subspecies is confined to the Canary Islands.



M. iodotingens subsp. **canariensis**, 6 ascospores (3 separated, 3 discharged in a group) germinating on water agar in "Coptic cross" configuration 12 hours after being discharged, CUP-MM 1309, x 1000 (photo: R.P. Korf).

HOLOTYPE: R.P. Korf, W.C. Denison, L.M. Kohn & M.A. Sherwood, on leaf blades of Prunus lusitanica L., west of Fuente de las Pulgas, Las Yedras, Monte de las Mercedes, Tenerife, Canary Islands, Spain, 12.i.1976. (CUP-MM 545)

KNOWN MACARONESIAN DISTRIBUTION

CANARY ISLANDS.

La Palma. CUP-MM 670.

Tenerife. CUP-MM 296, 445, 446, 545 (holotype), 601 (TFC), 607, 608, 1181, 1186, 1309, 1310.

SUBSTRATA: On leaf blades and petioles of Prunus lusitanica L. and of undetermined hosts.

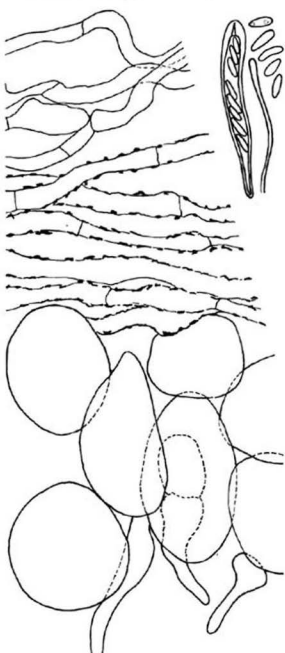
Notes: Our field notes for spore germination in the collection from La Palma indicate germination by a single germ tube in 24 hours. All other collections for which spore germination was observed showed the typical "Coptic cross" germination shown in the photograph above, just as in the typical subspecies. It is certainly possible that we overlooked "Coptic cross" germination in the La Palma collection, but normal germ tubes are not recorded by us for other collections until at least 48 to 72 hours after discharge. The possibility of MM-670 representing yet another taxon cannot be ignored.

3. Moellerodiscus HEDERAE Korf & Kohn, **sp. nov.**

RECENT TAXONOMIC TREATMENTS: None.

PREVIOUS MACARONESIAN RECORDS: None.

Stroma in materia viva stroma-lineare irregulare cum apothe-ciis associatum; cortes ex cellulis saturatae pigmentosis, aspectu frontali epidermoideis, composita. Apothecia solita-ria vel dispersa, in paginis foliorum et adaxialibus et ab-axialibus reperta, breviter stipitata; receptaculum patelli-forme, 1.25-2 mm in diam.; discus rufus, in sicco brunneo-lescens; margo integer, elevatus, disco obscurius brunneus; receptaculi parieties in sicco rufi, furfuracei; stipes brevissimus, denigratus. Excipulum ectale zona est 25-50 µ lata, composita ex textura globulosa parietibus tenuibus pal-lide brunneis praedita, cellulis 10-30 µ in diam.; continuum ad marginem ubi cellularum parietes saturatius pigmen-tosae sunt, cellulis exti-mis processus 2-cellulares vel pluricellulares, fili-formes vel clavatos, 10-20 µ longos et interdum aggre-gatos in fasciculos produ-centibus. Excipulum medul-lare ex stratis duobus com-positum, zone interiore 50-80 µ lata, ex textura in-tricata laxe intertexta formata, cellularum parie-tibus pallide brunnea ad superficiem receptaculi pa-rallela formata, cellulis 3-8 µ latis, grosse granu-lari-incrustatis. Subhyme-nium zona est mediocriter distincta, ex catenis unco-rum iteratorum maxima pro parte composita. Asci cy-lindrici vel subclavati, ex uncis enati, 8-spori, 36-44 x 2.9 µ, apice in-crassati, pori canalis pa-riete tenuiter J+ non nisi cum usu 10% KOH antecedente. Ascospori hyalini, an-guste ellipsoidei, 3.7-5.9



M. hederae, ectal and medullary excipulum, as-cus, paraphysis, 5 free ascospores, CUP-MM 2147, x 1000.

(-6.6) x 1.5 µ, oblique uniseriati vel biseriati. Paraphyses comparate paucae, filiformes, septatae, 0.5 µ latae, ascos longitudine non excedentes.

STROMA in fresh material an irregular line stroma associated with apothecia; rind composed of deeply pigmented cells which are epidermoid in face view. APOTHECIA solitary to scattered, occurring on both adaxial and abaxial sides of leaves, short stipitate; receptacle patelliform, 1.25-2.0 mm in diam; disc reddish brown drying to tan; margin entire, elevated, darker brown than disc; sides of receptacle reddish brown when dry, furfuraceous; stipe very short, blackened. ECTAL EXCIPULUM a zone 24.7-50 µm wide, of thin-walled, light brown-walled textura globulosa, cells 10-30 µm in diam, continuing to margin where cell walls are more deeply pigmented; outermost cells giving rise to 2- to several-celled filiform to clavate processes 10-20 µm long and occasionally grouped in fascicles. MEDULLARY EXCIPULUM composed of two layers: the inner zone, 50-80 µm broad, of loosely interwoven textura intricata, cell walls light brown, cells 3-4 µm broad; outer zone, 20-30 µm broad, of light brown textura porrecta oriented parallel to the surface of the receptacle, cells 3-8 µm broad with coarsely granular incrustations. SUBHYMENIUM a poorly differentiated zone composed primarily of chains of repeating croziers. ASCI cylindrical to subclavate, arising from croziers, 8-spored, 36-44 x 2.9 µm, ascus apex thickened, pore channel wall weakly J+ only after pretreatment with 10% KOH. ASCOSPORES obliquely uniseriate or biseriate, hyaline, narrowly ellipsoid, 3.7-5.9 (-6.6) x 1.5 µm. PARAPHYSES relatively few, filiform, septate, 0.5 µm broad, not exceeding asci in length.

HOLOTYPE: R.P. Korf, L.M. Kohn, N. Korf & A.Y. Rossman, on leaves of Hedera helix, Lajes das Flores, Flores, Azores, Portugal, 14.iv.1978. (CUP-MM 2147)

KNOWN MACARONESIAN DISTRIBUTION

AZORES.

Flores. CUP-MM 2147 (holotype).

Notes: The narrowly ellipsoid ascospores, lack of a strong ascus pore channel reaction in Melzer's reagent, and association with a line stroma with epidermoid cells in face view set this species apart from previously described species of Moellerodiscus. While the granular-

ly roughened textura porrecta just inside the globose cells of the ectal excipulum has been considered by others (Dumont, 1976; Spevak and Korf, 1966) to be an inner layer of the ectal excipulum, in this species the layer appears to be more continuous with the medullary excipulum and is described here as an outer layer of that zone. Further comments on the nature of the stroma await cultural studies from future collections, as unfortunately attempts to culture this material were unsuccessful: no germination was noted in 48 hours, and single, polar germ tubes only one to three times as long as the spore were noted after 7 days, and the cultures failed to grow further. Another species of this genus, M. iodotingens subsp. iodotingens, occurs on leaves of this host under the same conditions (CUP-MM 2091, 2146), but is readily distinguished on field and microscopic characters.

4. Moellerodiscus sp. 1881

RECENT TAXONOMIC TREATMENTS: None.

PREVIOUS MACARONESIAN RECORDS: None.

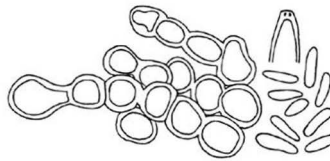
KNOWN MACARONESIAN DISTRIBUTION

AZORES.

Terceira. CUP-MM 1881 (K) (TFC), 1882.

SUBSTRATA: On midribs, petioles, and leaf blades, (CUP-MM 1881) and stone fruit mummies (CUP-MM 1882).

Notes: APOTHECIA stipitate, arising from stromatized petioles, midribes, leaf blades, and mummified fruits; disc shallowly cupulate to plane, hymenium orange-brown when revived, "rosy-vinaceous" to "flesh" (Raynor) when fresh, receptacle somewhat furfuraceous; stipe dark brown, tapering from the base of the receptacle, up to 4 mm long, thin. STROMA "mummioid," of indeterminate blackened patches of host tissue; medulla of narrow (less than 1.0 µm wide) hyaline prosenchyma disrupting host epidermal and cortical tissues (host cells displaced and/or broken down); rind composed of brown-walled textura angularis to textura globulosa, cells 4-10 µm in diam, covering only the dorsal surface of the stroma. ECTAL EXCIPULUM up to 30 µm wide



Moellerodiscus sp. 1881, section through flanks showing globose ectal excipular cells giving rise to tomentum hyphae, ascus apex showing J+ reaction in Melzer's reagent after pretreatment in 10% KOH, 9 ascospores, CUP-MM 1881, x 1000.

along flanks, narrowing to 16 µm at the margin; along flanks composed of hyaline, thin-walled textura globulosa, cells in chains perpendicular to the apothecial surface, cells up to 15 µm in diam, outermost cells giving rise to tomentum hyphae composed of chains of hyaline, globose to clavate cells; margin composed of prosenchyma parallel to the asci, giving rise to tomentum hyphae up to 15 µm long, made up of chains of brick-shaped to inflated, globose cells and terminating with a clavate cell. MEDULLARY EXCIPULUM a loose layer up to 440 µm wide along the flanks, of hyaline, pale brown-walled textura intricata, cells up to 4.0 µm broad; at margin a compact layer of textura porrecta parallel to the asci. SUBHYMENIUM poorly differentiated. ASCI arising from repeating croziers, cylindrical, 55-72 x 4-5 µm, ascus pore channel weakly J+ only after pretreatment with 10% KOH, 8-spored. ASCOSPORES obliquely uniseriate, narrowly ellipsoid, one-celled, hyaline, (5.6-) 6.3-8.1 x 1.4-2.2 µm. PARAPHYSES cylindrical, simple, septate, 1.0 µm wide, not exceeding asci. STIPE: ectal excipulum of light brown-walled textura prismatica, cells somewhat inflated, oriented parallel to the stipe axis, cells up to 6.0 µm broad; outermost cells giving rise to multicellular hairs, up to 45 µm long, with the ends at a high angle to the stipe axis, the apical cell clavate and sometimes umbonate, longer hairs produced at the stipe base with dark brown, granularly encrusted walls; medullary excipulum of hyaline textura intricata more or less parallel to the stipe axis, cells 2-4 µm broad.

Since some apothecia in these collections were associated with mummified fruits, our preliminary generic field identification was Monilinia. Isolates from a culture derived from a mass of ascospores grown on DIFCO Malt Agar, High pH Mycological Agar, Low pH Mycological Agar, and apples yielded no conidial anamorph except for a Myrioconium "microconidial state." Although the stroma is "mummioid" (Whetzel, 1945), the small, narrow ascospores are unlike those produced by species of Monilinia. In the absence of a Monilia anamorph this fungus must be accommodated in Moellerodiscus; its ascospores are unlike those of Ciboria, many species of which occur on fruits. It is unfortunate that the host is known only from fragments of leaf, stem and fruit which could not be identified. Despite the ample material, the lack of a comprehensive monograph of Moellerodiscus and some hesitancy in assigning it to that genus lead me to avoid describing it as a new species at this time.

POCULUM Velenovský 1934 emend. Dumont 1972

Key to the known Macaronesian species

(In cases where no stromatal tissue is apparent, the genus Crocicreas Fr. emend. Carpenter (Leotiaceae) should also be considered.)

1. Percurrently proliferating, thick-walled dark setae produced from the inner cells of the ectal excipulum ..... 4. **Poculum sp. 1385**

1'. No setae present 2

2(1'). Ascus pore channel J-, even after pretreatment in 10% KOH **1. "Phialea" calopus**

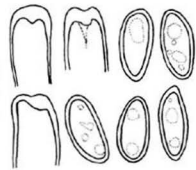
2'(1'). Ascus pore channel J+ 3

3(2'). On cupules of Castanea sativa. **3. P. sydowianum**

3'(2'). On wood .....**2. P. firmum**

1. **"Phialea"** cfr. **calopus** (Fr. : Fr.) Quél., Bull. Soc. Bot. France **26**: 234. 1879.

≡ Rutstroemia calopus (Fr. : Fr.) Rehm in Rabenh., Krypt.-Fl. Deutschl., Ed. 2, 1(3) [Lief. 39]: 768. 1893.



"Phialea" cfr. calopus, 3 irregularly thickened ascus apices, 5 ascospores, CUP-MM 1373, x 1000.

RECENT TAXONOMIC TREATMENTS: Carpenter (1981), Dennis (1956), White (1941).

PREVIOUS MACARONESIAN RECORDS: None.

TYPE LOCALITY: Sweden.

KNOWN MACARONESIAN DISTRIBUTION

CANARY ISLANDS.

Gomera. CUP-MM 1373.

SUBSTRATA: On herbaceous stems.

Notes: APOTHECIA solitary to scattered from blackened host tissue; disc up to 2.5 mm in diam, hymenium ochraceous brown, margin darker brown, excipular surface buff; disc narrowing to form a short stipe, 0.25-0.5 mm long, blackened at base. STROMA poorly differentiated although the surface of the host is blackened around the stipe base; hyphae penetrating the host epidermis of dark brown-walled prosenchyma. ECTAL EXCIPULUM up to 52 µm wide, bound in gel, of hyaline textura intricata, cells 1-4 µm broad, giving rise to a "covering layer" 2-4 cells deep of hyaline prosenchyma oriented parallel to the excipular surface; at margin zone narrowing, cells light brown-walled. MEDULLARY EXCIPULUM 315 µm wide at flanks, of hyaline, thin-walled textura intricata; cells 6-11.5 µm wide. SUBHYMENIUM poorly differentiated, possibly bound in gel. ASCI arising from repeating croziers, cylindrical, 85-150 x 8-12.4 µm, ascus pore channel J- even after pretreatment with 10% KOH, apices irregularly thickened (up to 3.2 µm thick), cytoplasm dextrinoid to purplish in Melzer's reagent after pretreatment in 2% KOH, 8-spored. ASCOSPORES biseriate, becoming uniseriate, hyaline, variable, broadly ellipsoid to fusoid-ellipsoid, occasionally flattened on one side, bi- or multiguttulate (but then often with two, prominent, larger guttules), (9.5-)

13.0 (-14.8) x (3.7-) 5.7 (-6.4) µm. PARAPHYSES filiform, 1 µm broad, with a tip 1.5 µm broad, exceeding asci up to 5.3 µm, branched, septate. STIPE: ectal excipulum of two zones: the outer zone a compact "covering layer" 3-5 cells deep of thin-walled, non-gelatinized hyaline to light brown-walled prosenchyma originating from cells of the inner ectal zone, arranged more or less parallel to the stipe axis, with hyphal tips occasionally turning out to form short, septate tomentum hyphae, at base of stipe cells dark brown-walled, embedded in brown, amorphous material; inner layer 50-80 µm wide, originating from medullary cells, of hyaline textura oblita with thick, gelatinous walls; medullary excipulum of hyaline, thin-walled textura intricata, not bound in gel, incorporating many rhomboidal crystals, cells up to 8 µm broad, at point of attachment to host the cells more compact, possibly bound in gel, continuous with hyphae disrupting the host epidermis and penetrating subtending host tissues.

The irregularly thickened ascus apices and J- ascus pore channel walls do not agree with the concept of this species as illustrated by Dennis (1956), and our determination is thus tentative. The taxonomic status of Peziza calopus Fr. : Fr. is still in doubt, and until a monograph of Poculum is completed, no transfer of that epithet to Poculum seems advisable (see also Carpenter, 1981).

2. **Poculum firmum** (Pers. : Fr.) Dumont, Mycologia **68**: 870. 1976.

≡ Rutstroemia firma (Pers. : Fr.) Karst., Bidrag Kännedom Finlands Natur Folk **19**: 108. 1871.

RECENT TAXONOMIC TREATMENTS: Dennis (1956), White (1941).

PREVIOUS MACARONESIAN RECORDS: *Berkeley (1874), †Beltrán Tejera (1980).

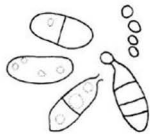
TYPE LOCALITY: Europe.

KNOWN MACARONESIAN DISTRIBUTION

*CANARY ISLANDS.

La Palma. CUP-MM 767, 790, 855 (TFC).

***Tenerife.** *Feb. 1873, on dead wood, 3500 feet (K: specimen lost) n.v.



P. firmum, ascospores at various stages of development, some producing spermatia, CUP-MM 767, x 1000.

SUBSTRATA: On twigs.

Notes: This species, common in Europe, is as yet unknown to us from North America or Asia.

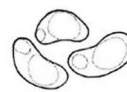
3. **Poculum sydowianum** (Rehm in Sydow) Dumont, Mycologia 68: 872. 1976.

= Rutstroemia sydowiana (Rehm in Sydow) White, Lloydia 4: 200. 1941.

RECENT TAXONOMIC TREATMENTS: Dennis (1956), Palmer (1964, 1968), White (1941).

PREVIOUS MACARONESIAN RECORDS: None.

TYPE LOCALITY: Germany.



P. sydowianum, ascospores, CUP-MM 874, x 1000

KNOWN MACARONESIAN DISTRIBUTION
CANARY ISLANDS.
La Palma. CUP-MM 874.

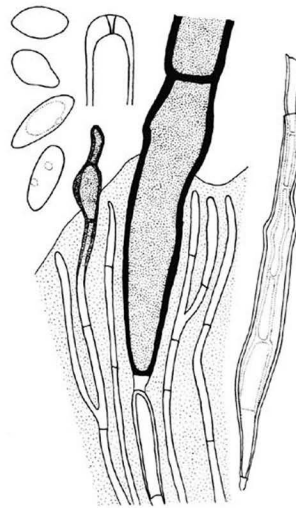
SUBSTRATUM: On cupules of Castanea sativa Mill.

Notes: Castanea burrs should be sought in Macaronesia, since not only this species but three others, all of which would have been referred to Rutstroemia in some treatments [Lanzia echinophila (Bull. : Fr.) Korf, Lanzia sp. 137 (above), and Ciboria americana Durand] are likely to occur wherever chestnut thrives. All four could be confused easily in the field.

4. **Poculum sp. 1385**

RECENT TAXONOMIC TREATMENTS: None.

PREVIOUS MACARONESIAN RECORDS: None.



Poculum sp. 1385, 4 ascospores, ascus apex showing blueing of pore channel wall in Melzer's reagent, section of ectal excipulum with seta in early, 2-celled stage of development, and base of multicellular seta, optical section of base of developing seta showing broken wall of original seta and percurrent proliferation of another seta, also with apex broken off, CUP-MM 1385, spores and ascus apex x 1000, others x 500.

KNOWN MACARONESIAN DISTRIBUTION

CANARY ISLANDS.

Gomera. CUP-MM 1385.

SUBSTRATUM: On dying stem of Rubus sp.

Notes: APOTHECIA solitary to scattered; receptacle deeply cupulate to goblet-shaped, 450 µm in diam; hymenium buff, margin chestnut brown, exterior of receptacle buff, margin and upper part of cup bearing chestnut brown setae; cup narrowing to form a short stipe 150 µm long, buff, clothed with chestnut brown hairs, especially at the base. ECTAL EXCIPULUM composed of two zones: a compact outer zone up to 50 µm wide of hyaline textura oblita to textura intricata with hyphae thin-walled, 2-3 µm broad and immersed in a copious gel, cells at margin brown-walled, giving rise to setae; inner zone up to 30 µm wide of hyaline textura porrecta more or less parallel to receptacle surface, cells up to

5 µm broad; towards margin inner zone merging with the outer zone to form a broad, gelatinized zone at the margin. SETAE originating from inner cells of the outer ectal excipulum, at first 1-3-celled with a clavate apical cell and with thin, light brown walls; walls appearing to thicken and darken as hair proliferates percurrently, ultimately becoming compound (ca. 3 µm thick); mature setae multiseptate, tapering at both ends, 200-500 µm long, up to 20 µm wide at the broadest point, with scars showing internal proliferation. MEDULLARY EXCIPULUM of loosely interwoven, hyaline, thin-walled textura intricata, cells up to 5 µm broad. SUBHYMENIUM up to 50 µm wide, of hyaline, thin-walled textura intricata possibly immersed in gel, cells 1-3 µm broad. ASCI arising from repeating croziers, clavate, 80-105 x 10-13 µm, apex thickened (up to 4 µm), pore channel wall J+, 8-spored. ASCOSPORES uniseriate at first, becoming biseriate, hyaline, ellipsoid to allantoid, usually uniguttulate, occasionally multiguttulate, one-celled, (12-) 15-17 (-18) x 6-7 µm. PARAPHYSES branched, filiform, 1 µm broad, not exceeding asci. STIPE tissues as in apothecium, outer ectal excipular cells giving rise to brown-walled, multiseptate, flexuous hairs ca. 50 µm long. STROMA extremely limited; gelatinized ectal excipular hyphae and non-gelatinized medullary hyphae ramify through host tissues, but are noticably more numerous and compact at the point of stipe emergence from host tissue, where fungal cells and host cuticle are covered by a localized melanized crust.

Unfortunately the collection upon which this description is based contains too few apothecia to constitute a suitable type specimen. While some germination of ascospores on agar was achieved, isolates failed to develop further.

There are perhaps a half dozen or more species that were formerly assigned to Rutstroemia with similar apothecial structure to this species. Drs. K.P. Dumont and R.P. Korf have had a joint project on these species for many years (pers. comm.), of which only one, Rutstroemia setulata (Dearness & House) White, appears to have been described. Other species have been collected in the southern US, in Mexico, in the neotropics and paleotropics. Whether these can be accommodated in Roculum, from which they differ mainly in the presence of setae, or constitute a separate genus has not yet been decided.

SCLEROTINIA Fuckel 1870, typus conservandus

≡ Whetzelinia Korf & Dumont 1972 (homotypic)

One known Macaronesian species

1. **Sclerotinia sclerotiorum** (Lib.) de Bary, Vergl. Morph. Biol. Pilze p. 22. 1884.

≡ Sclerotinia libertiana Fuckel, Jahrb. Nassauischen Vereins Naturk. **23-24**: 331. 1870 (nom. superfl.).

≡ Whetzelinia sclerotiorum (Lib.) Korf & Dumont, Mycologia **64**: 250. 1972.

RECENT TAXONOMIC TREATMENTS: Kohn (1979).

PREVIOUS MACARONESIAN RECORDS: †Bensaude (1926), †† Rosália de Sousa Dias and Lucas (1980).

TYPE LOCALITY: Belgium.

KNOWN MACARONESIAN DISTRIBUTION

†AZORES:

†**São Miguel.** Pereira, n.v.

††MADEIRA.

††**Madeira.** Pedrosa, December 1976, n.v.

SUBSTRATA: On cultivated beet (Bensaude, 1926) and on Salvia splendens Ker-Gawl. (Rosália de Sousa Dias and Lucas, 1980).

Notes: We have not collected this uniquitous pathogen of cultivated plants, but it must surely be widespread in Macaronesia. Neither of the reports in the literature from the region are backed up by specimens.

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STUDIES ON HYPHOMYCETES FROM WEST BENGAL, INDIA, I. CERCOSPORA AND ALLIED GENERA OF WEST BENGAL, 1.

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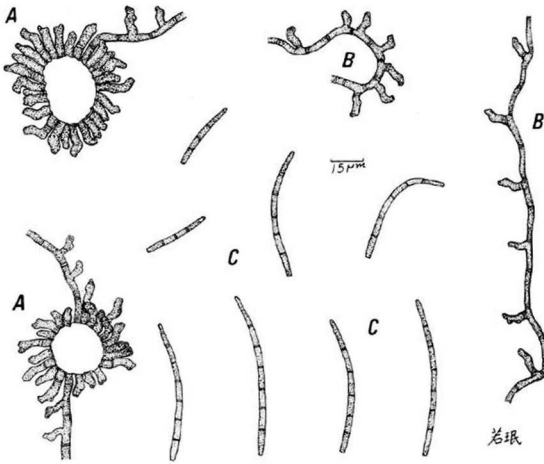
ABSTRACT

This study of 15 species of Cercospora and allied genera from West Bengal (India) includes descriptions and illustrations of ten new species and a new combination: Cercoseptoria vignicola sp. nov., on Vigna sp.; Phaeoisariopsis argyreiae sp. nov., on Argyreia roxburghii; Pseudocercospora alternantherae sp. nov., on Alternanthera sp.; P. euphorbiae-pilulliferae sp. nov., on Euphorbia pilulifera; P. polyalthiae sp. nov., on Polyalthia suberosa; P. vignigena sp. nov., on Vigna sp.; P. vitigena sp. nov, on Vitis sp.; Stenella canthii sp. nov., on Canthii dedymi; S. dioscoreicola sp. nov., on Dioscorea sp.; S. stephaniae sp. nov., on Stephania hernandifolia; and S. myxa (Sydow in Sydow & Mitter) comb. nov., on Cordia myxa.

1. Cercoseptoria vignicola Yen, Kar & Das, sp. nov. (Fig. 1)

Maculis indistinctis. Caespitulis hypophyllis, invisibilis. Mycelium primarium immersum: hyphis pallidissime olivaceis, septatis, ramosis, 2-3.5µm latis. Stomatibus aliquantum atro-brunneis, globosis 20-40µm diam. Conidiophoris primariis brevis, dense vel valde dense fasciculatis, ex stromatibus oriundis, simplicibus, flexuosis vel undulatis, 0-1 septatis, 0-2 geniculatis, ad apicem irregulariter rotundatis, cicatricibus conidialis indistinctis, 22-75 x 3-5µm. Mycelium secundarium superficiale: hyphis ex stromatibus oriundis, repentis, pallide olivaceis, septatis, ramosis, 2-3µm latis, laevis, conidiophoris secundariis ex hyphis secundariis lateraliter productis, solitariis. Conidiis anguste cylindraceis vel filiformibus, pallidissime brunneo-olivaceis, leniter curvatis, 3-6 septatis, ad apicem rotundatis, basi leniter truncatis, 30-60 x 2.5-3µm.

Habitat in foliis vivis Vigna sp. (Leguminosae), ad Raiganj, Dinajpur occidentalis, Bengal occidentalis, India, leg. B. K. Das, 3 XI 1980, No. Pcc4451 (Herb. LAM, Yen #10582), typus.


A
B
15μm
B
C
A
C
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Leaf spot indistinct. Caespituli hypophyllous, invisible even under the hand lens. Primary mycelium internal: hyphae very pale olivaceous, smooth, septate, branched, 2-3.5µm wide. Stromata well developed, dark brown, globular, 20-40µm in diameter. Conidiophores very short, numerous in a dense or very dense fascicle, simple, flexuous, 0-1 septate, 0-2 geniculate, apex irregularly rounded, conidial scars not visible, 22-75 x 3-5µm. Secondary mycelium superficial: hyphae pale brown-olivaceous smooth, septate, branched, 2-3µm wide, producing laterally the solitary, secondary conidiophores. Conidia narrowly cylindric or filiform, very pale brown-olivaceous slightly curved, 3-6 septate, with a rounded apex and a truncate base, not constricted, 30-60 x 2.5-3µm.

On Vigna sp. (Leguminosae), in Raiganj, West Dinajpur, West Bengal, India. Leg. B. K. Das, 3 November 1980, No. Pcc4451 (Herb. Lam, Yen #10582).

2. Phaeoisariopsis argyreiae Yen, Kar & Das, sp. nov. (Fig. 2)

Maculis primo indistinctis, deinde brunneis et visibilis, orbicularis vel suborbicularis, margine indistinctis, usque 7mm diam., dispersis vel confluentibus. Caespitulis districte hypophyllis, atro-hirsutis. Mycelium primarium immersum: hyphis pallidissime olivaceis, septatis, ramosis, 2-4µm latis. Stromatibus atro-brunneis, irregularis, 40-60µm altis, 25-40µm latis. Conidiophoris districte hypophyllis, pallide brunneo-olivaceis, laevis, 3-25 fasciculatis, synnematiforme aggregatis, multiseptatis, simplicibus, inferne leniter undulatis, superne leniter erectis et separabilis, ad apicem rotundatis, cicatricibus conidialis indistinctis, 60-350 x 4-5.5µm. Conidiis pallide olivaceis, cylindraceis, semper valide curvatis, 1-7 septatis, non constrictis, ad apicem rotundatis basi attenuatis et truncatis, 55-110 x 6-7µm.

Habitat in foliis vivis Argyreia roxburgnii Choisy (Convolvulaceae), ad Raiganj, Dinajpur occidentalis, Bengal occidentalis, India, leg. B. K. Das, 12 X 1980, No. Pcc4492 (Herb. LAM, Yen #10588), typus.

Leaf spot at first indistinct, only some rounded chlorosis area, later becoming brown and visible, orbicular or suborbicular, with an indistinct margin, up to 7mm in diameter, scattered or sometimes confluent. Caespituli strictly hypophyllous, visible under hand lens in dark hairy form. Primary mycelium internal: hyphae very pale olivaceous, septate, branched, 2-4µm wide. Stromata well-developed, dark brown, irregular, 40-60µm high and

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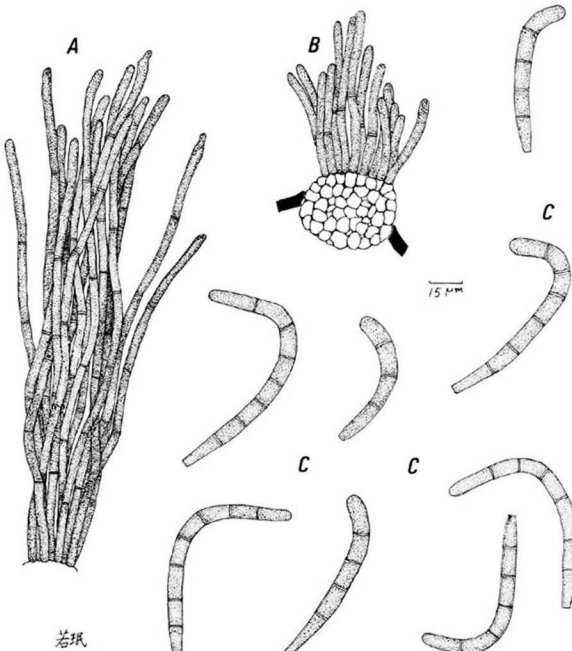
Fig. 1. Cercoseptoria vignicola Yen, Kar & Das: Fascicles of primary conidiophores and formation of external hyphae; B, External hyphae and formation of secondary conidiophores; C, Conidia.


A
B
C
C
C
15 MM
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25-40µm wide. Conidiophores strictly hypophyllous, pale to medium olivaceous, synnematous, 3-25 in loose or dense fascicles, smooth, multiseptate, simple, slightly sinuous below, substraight above, with a rounded apex, conidial cicatrices indistinct, 60-350 x 4-5.5µm. Conidia pale olivaceous, cylindric, always curved, smooth, with a broadly rounded apex, 1-7 septate, not constricted, base attenuate and truncate, 55-110 x 6-7µm.

On Argyreia roxburghii Choisy (Convolvulaceae), in Raiganj, West Dinajpur, West Bengal, India. Leg. B. K. Das, 12 October 1980, No. Pcc4492 (Herb. LAM, Yen #10588).

3. Pseudocercospora alternantherae Yen, Kar & Das, sp. nov. (Fig. 3)

Maculis amphiphyllis, ovoideis vel fusiformis, griseo-brunneis, margine aliquantum indistinctis, saepe dispersis vel confluentibus, 3-12mm longis, 2-4mm latis. Caespitulis amphigenis, autem plerumque hypophyllis, invisibilis. Mycelium primarium immersum: hyphis olivaceo-brunneis, septatis, ramosis 2-5µm latis. Stromatibus brunneis vel atro-brunneis, globosis 20-40µm diam. Conidiophoris primariis amphiphyllis, autem in hypophyllo plus abundis, 5-58 in fasciculo per stomatibus emergentis, pallide burnneo-olivaceis, simplicibus, fere flexuosis, laevis, 0-3 septatis, 0-2 geniculatis, ad apicem rotundatis vel attenuatis, 15-55 x 3-4.5µm. Mycelium secundarium superficiale: hyphis ex stomatibus oriundis vel cum conidiophoris primariis commixa in fasciculo per stomatibus emergentis, pallide brunneo-olivaceis, repentis, septatis, ramosis, 2-3.5µm latis, conidiophoris secundariis lateraliter gerentis. Conidiis obclaviformibus vel obclavato-cylindraceis, pallide brunneo-olivaceis, rectis vel leniter curvatis, laevis, 3-10 septatis, ad apicem rotundatis, basi obconico-attenuatis et truncatis, 32-90 x 2.5-4µm.

Habitat in foliis vivis Alternanthera sp. (Amarathaceae), ad Purulea, Bengal occidentalis, India, leg. B. K. Das, 7 I 1981, No. Pcc4483 (Herb. LAM, Yen #10583), typus.

Leaf spot amphigenous, ovoid or fusiform, brown grayish with an indistinct margin, scattered, but often confluent, 3-12mm long and 2-4mm wide. Caespituli amphiphyllous, but mostly hypophyllous, invisible even under hand lens. Primary mycelium internal: hyphae brown olivaceous, septate, branched, 2-5µm wide. Stromata brown or dark brown, globular, 20-40µm in diameter. Primary conidiophores amphigenous, but more abundant on the lower surface, 5-58 in fascicles emerging through the stomata, pale brown olivaceous, simple, generally flexuous, smooth, 0-3 septate, 0-2 geniculate, apex rounded or attenuate and shouldered,

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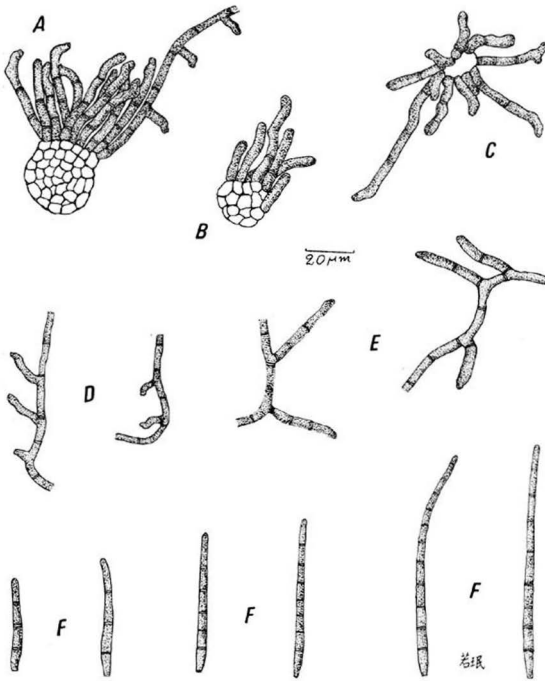
Fig. 2. Phaeoisariopsis argyreiae Yen, Kar & Das: A, Fascicles of old conidiophores; B, Stromata and young conidiophores; C, Conidia.


A
B
C
20μm
D
E
F
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若狭

15-55 x 3-4.5µm. Secondary mycelium external: hyphae arising from the stomata or from a stromata and mixed with the primary conidiophores in a regular fascicle, pale brown olivaceous, repent, septate, branched, 2-3.5µm wide, bearing the secondary conidiophores as lateral branches which are similar to the primary conidiophores. Conidia obclaviform or obclavato-cylindric, pale brown olivaceous, straight or slightly curved, smooth, 3-10 septate, apex rounded, base obconic-attenuate and truncate, 32-90 x 2.5-4µm.

On Alternanthera sp. (Amaranthaceae), in Purulea, West Bengal, India. Leg. B. K. Das, 7 January 1981, No Pcc4483 (Herb. LAM, Yen #10583).

Note: The Pseudocercospora alternanthericola (Pavgi & U. P. Singh) Deighton differs from this fungus by its mostly epiphyllous fruiting and thicker conidia (2.4-6.3µm compared with 2.5-4µm). On the other hand, the Cercospora alternantherae-nodiflorae Sawada differs from this species by its leaf spot indistinct or none.

4. Pseudocercospora daturina (Yen) Deighton. CMI Mycol. Pap. 140: 143, 1976.
=Cercospora daturina Yen. Rev. de Mycol. 30: 171, 1965.

Leaf spot indistinct, sometimes as chlorosis area without definite margin. Caespituli amphiphyllous, grayish, effuse. Primary mycelium internal: hyphae almost colorless, septate, branched, 1.5-2.5µm wide. Stromata absent. Primary conidiophores amphiphyllous, 12-40 in fascicles, simple when young, but generally branched when old, pale brown olivaceous, flexuous, 1-4 (rarely 5-6) septate, 1-3 geniculate, sometimes with constrictions at the septum, apex attenuate and decorated with a conidial cicatrice (1.5µm in diameter), 30-70 x 3.5-6µm (Yen: 30-80 x 4-6µm). Secondary mycelium superficial: hyphae arising from the stromata, pale olivaceous, repent, septate, branched, 2-3.5µm wide, bearing the solitary secondary conidiophores as lateral branches. Conidia obclavate-cylindric, pale brown olivaceous, straight or slightly curved, sometimes slightly sinuous, 3-10 septate, apex subconic, base attenuate-truncate, 50-117 x 3.5-5µm (Yen: 51-123 x 3.5-5µm).

On Datura atramonium L. (Solanaceae), in Baluhati, Hocorah, West Bengal, India. Leg. B. K. Das, 22 August 1980, No. Pcc4323 (Herb. LAM, Yen #10579).

Distribution: India and Singapore

Fig. 3. Pseudocercospora alternantherae Yen, Kar & Das: A, Fascicle of conidiophores and formation of external hyphae; B, Young conidiophores; C, Old conidiophores, D & E, Formation of secondary conidia; F, Conidia. 5.

5. Pseudocercospora euphorbiae-piluliferae Yen, Kar & Das sp. nov. (Fig. 4, A-D)

Maculis hypophyllis, minusculis, obscure brunneis, margine indistinctis, usque 2mm diam. in epiphyllo visibilis, in hypophyllo indistinctis. Caespitulis hypophyllis, raro amphiphyllis, non aspectabilis. Mycelium primarium immersum: hyphis subhyalinis, septatis, ramosis, 2-3.5µm latis. Stromatibus nullis. Conidiophoris plerumque hypophyllis, pallide brunneo-olivaceis, 2-5 in fasciculo per stomatibus emergentis, simplicibus vel ramosis, laevis, erectis vel leniter flexuosis, aliquandum undulatis, 0-6 septatis, non geniculatis, cicatricibus conidialis indistinctis, ad apicem rotundatis, 15-80 x 3.5-5µm. Conidiis obclaviformibus vel obclavato-cylindraceis, pallide brunneo-olivaceis, rectis vel leniter curvatis, 3-5 septatis, non constrictis, ad apicem rotundatis, basi truncatis, 38-74 x 3-5µm.

Habitat in foliis vivis Euphorbiae piluliferae L. (Euphorbiaceae), ad Mashlandapur, Nadia, Bengal occidentalis, India. Leg. B. K. Das, 13 VIII 1980. No. Pcc4305 (Herb. LAM, Yen #10584), typus.

Leaf spot small, brown with an indistinct margin, visible on upper surface, but invisible on lower surface, up to 2mm in diameter. Caespituli mostly hypophyllous, rarely amphiphyllous, invisible. Primary mycelium internal: hyphae almost colorless, septate, branched, 2-3.5µm wide. Stromata absent. Conidiophores generally hypophyllous, 2-5 in fascicles emerging through a stomata, pale brown olivaceous, simple or branched, smooth, with a slightly undulated membrane, straight or slightly flexuous, 0-6 septate, not geniculate, conidial scars indistinct, apex rounded, 15-80 x 3.5-5µm. Conidia obclavate or obclavate-cylindric, pale brown olivaceous, straight or slightly curved, 3-5 septate, not constricted, apex rounded, base truncate, 38-74 x 3-5µm.

On Euphorbia pilulifera L. (Euphorbiaceae), in Mashlandapur, Nadia, West Bengal, India. Leg. B. K Das, 13 August 1980, No Pcc4305 (Herb. LAM, Yen #10584).

Note: This fungus differs from others (Cercospora petila Thir. & Chupp, C. euphorbiae-pubescentis Unam. and C. euphorbiaecola Tharp.) on Euphorbia, by its small brown leaf spots, hypogenous caespituli, poor fascicles and absence of stromata.

6. Pseudocercospora pantoleuca (Saccardo) Deighton CMI Mycol. Pap. 140:53, 1976. (Fig. 5)
=Cercospora pantoleuca Saccardo, nom. nov. (as 'Syd. & Sacc.') in Saccardo & Trotter, Syll. Fung. 25:906, 1931.
=Cercospora pantoleuca H. Sydow & P. Sydow, Philipp. J. Sci. Sec. C (Bot.) 8:284, 1913.
NON Cercospora pantoleuca Saccardo, Michellia 1:268, 1879.

Leaf spot distinct, amphiphyllous, at first small (1-3mm in diam.), vein-limited, green brownish, soon becoming grayish-white in the center with a linear, slightly raised brown-purplish margin, often 3-5 confluent in large blotches, up to 5mm in diameter. Caespituli generally hypophyllous, sometimes slightly amphigenous, dark punctiform. Mycelium internal: hyphae very pale olivaceous, septate, branched, 2.5-4μm wide. Stromata not well-developed, dark brown, irregularly globular, 10-25μm in diameter. Conidiophores chiefly hypogenous, 5-15 in fascicles emerging through the stomata, pale brown olivaceous, simple, sometimes branched, flexuous or sinuous, 1-6 septate, 0-2 geniculate, not continuous, sometimes slightly constricted, apex rounded or attenuate and shouldered, conidial cicatrices indistinct, 25-55 x 3.5-4μm. Conidia obclavate-cylindric, straight or slightly curved, 3-11 septate, pale olivaceous, apex rounded, base obconic-truncate.

On Clitoria ternatea (Leguminosae), in Palpara, Nadia, West Bengal, India. Leg. B. K. Das, 25 August 1980, No Pcc4327 (Herb. LAM, Yen #10581).

Distribution: Philippines and India.

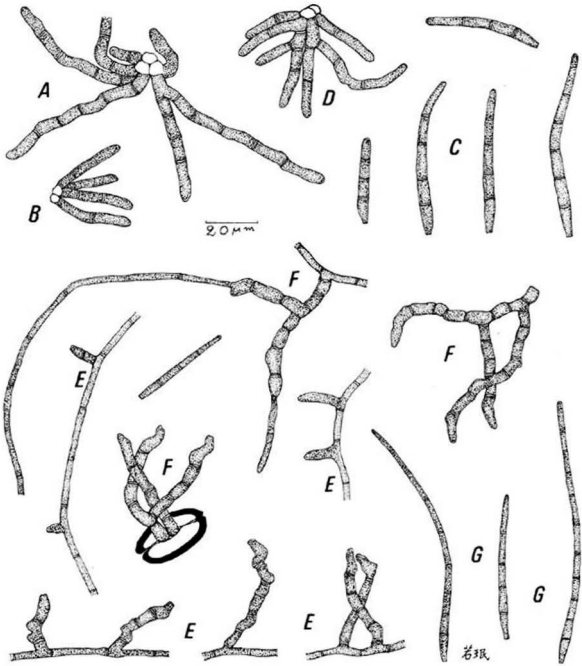
Note: The material of this species from West Bengal (India) differs from others from the Philippines by the largely hypophyllous fruiting and the conidiophores not being continuous.

7. Pseudocercospora polyalthiae Yen, Kar & Das, sp. nov. (Fig. 4, E-G)

Maculis indistinctis. Caespitulis hypophyllis, invisibilis. Mycelium primarium immersum: hyphis subhyalinis, septatis, ramosis, 1.5-3μm latis. Stromatibus nullis. Conidiophoris solitariis, non fasciculatis, pallide brunneo-olivaceis, sursum pallidioribus, plerumque simplicibus, interdum ramosis, 0-8 septatis, 0-3 geniculatis, apex attenuatis et truncatis, interdum irregulariter rotundatis, cicatricibus conidialis invisibilis, 12-70 x 3.5-5μm. Mycelium secundarium superficiale: hyphis repentis, pallide olivaceis, laevis, septatis ramosis, 1,5-3μm latis, conidiophoris lateraliter manifestibus. Conidiis gracilis, obclavato-cylindraceis, pallide brunneo-olivaceis, rectis vel leniter curvatis, 3-13 septatis, non constrictis, ad apicem rotundatis vel subconicis, basi obconico-truncatis, 40-156 x 2.5-3.5μm.

Habitat in foliis vivis Polyalthiae suberosa Benth. & Hooker (Annonaceae), ad Garia, 24-Parganas, Bengal occidentalis, India. Leg. B. K. Das, 15 XII 1979, No. Pcc4095 (Herb. LAM, Yen #10585), typus.

Leaf spot indistinct or none. Caespituli hypophyllous, invisible. Primary mycelium internal: hyphae very pale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若狭

olivaceous, septate, branched, 1.5-3μm wide. Stromata absent. Conidiophores solitary, not in fascicles, generally simple, sometimes branched, straight or flexuous, pale brown olivaceous, paler towards the tip, 0-8 septate, 0-3 geniculate, apex attenuate and shouldered, conidial scars not distinct, 12-70 x 3.5-5μm. Conidia narrowly obclavate-cylindric, pale brown olivaceous, straight or slightly curved, 3-13 septate, not constricted, apex rounded or subconical, base obconic-truncate, 40-156 x 2.5-3.5μm.

On Polyalthia suberosa Benth. & Hooker (Annonacae), in Garia, 24-Parganas, West Bengal, India. Leg. B. K. Das, 15 December 1979, No Pcc4095 (Herb. LAM, Yen #10585).

8. Pseudocercospora timorensis (Cooke) Deighton CMI Mycol. Pap. 140:154, 1976.
=Cercospora timorensis Cooke Grevillea 12:38, 1883.

On Ipomoea batatas Lamx. (Convolvulaceae), in Samali, 24-Parganas, West Bengal, India. Leg. B. K. Das, 2 September 1980, No Pcc4345 (Herb. LAM, Yen #10580).

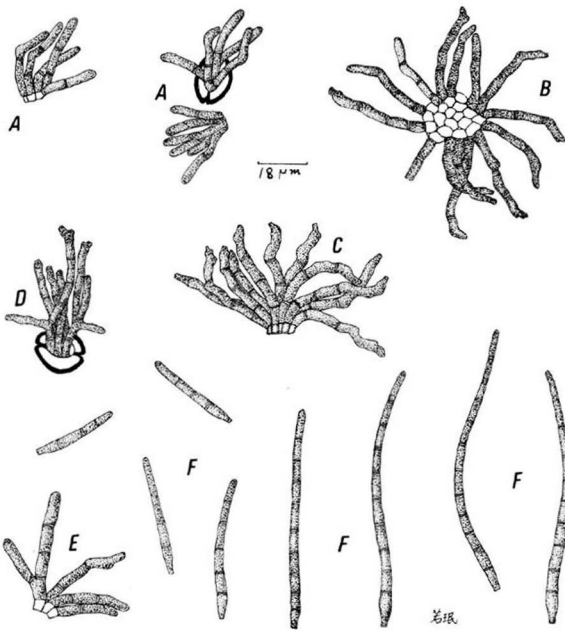
Distribution: Africa, China, Ecuador, India, Japan, Panama, Philippines, and Singapore.

9. Pseudocercospora trematis-orientalis (Sun) Deighton CMI Mycol. Pap. 140:155, 1976.
=Cercospora trematis-orientalis Sun J. Agric. (Formosa) Taiwan Prov. Coll. 9:48 (reprint), 1955.

Leaf spot distinct, at first small, brown, irregularly circular, isolate, 0.5-1mm in diameter, soon extending into large lesions, irregularly angular, vein-limited, gray-white in the center, having a brown-purple border with indefinite margin, more distinct on lower surface, scattered, up to 3mm in diameter. Caespituli amphiphyllous, but chiefly epiphyllous, dark punctiform on the upper surface. Mycelium internal: hyphae very pale olivaceous, septate, branched, 2-4μm wide. Stromata dark brown, globular, 20-40μm in diameter. Conidiophores 5-28 in fascicles emerging through the stomata, pale brown-olivaceous, paler towards the tip, straight or slightly flexuous, simple, not branched, smooth, 1-3 septate, 0-2 geniculate, apex rounded or attenuate, conidial scars sometimes distinct, 40-95 x 3.5-4μm. Conidia pale brown-olivaceous, obclavate-cylindric, often slightly curved, or slightly undulated, 3-8 septate, apex rounded or subconical, base obconic-truncate, 40-108 x 3.5-4μm.

On Trema orientalis Bl. (Urticaceae), in Raiganj, West Dinajpur, West Bengal, India. leg. B. K. Das, 20 October 1980, No. Pcc4447 (Herb. Lam, Yen #10575).

Fig. 4. A-D, Pseudocercospora euphorbiae-piluliferae Yen, Kar, & Das: A & D, Fascicles of conidiophores; B, Young conidiophores; C, Conidia. E-G, P. polyalthiae Yen, Kar & Das: E, External hyphae and formation of secondary conidiophores; F, Branched conidiophores; G, Conidia.


A
A
18 μm
B
C
D
F
F
F
E

Distribution: Taiwan (China) and West Bengal (India).

Note: Sun proposed a common name, "white stars disease on leaves of Trema", which is apropos because of the symptomatic isolated white angular leaf spots which characterize the infected leaves.

10. Pseudocercospora vignigena Yen, Kar & Das, sp. nov. (Fig. 6)

Maculis distinctis, orbicularis vel irregulariter orbicularis, clare brunneis, margine atro-brunneis, dispersis, non confluentibus, 2-5mm diam. Caespitulis amphiphyllis, nigrostrigosis. Mycelium primarium immersum: hyphis fere incoloris, septatis, ramosis, 2-3.5µm latis. Stromatibus mediocoriter evolutis, atro-brunneis, globosis vel irregulariter globosis, 15-40µm diam. Conidiophoris primariis usque 60 in fasciculo per stomatibus emergentis, pallide brunneo-olivaceis, laevis, erectis vel leniter flexuosis, 1-3 septatis, 0-2 geniculatis, apex attenuatis et cubitis, cicatricibus conidialis distinctis, 22-75 x 3-5µm. Mycelium secundarium superficiale: hyphis ex cellulis basalibus conidiophorum primariorum aliquorum oriundis, repentis, pallide olivaceis, septatis, ramosis, 2.5-4µm latis, conidiophoris secundariis erectis lateraliter gerentis. Conidiis cylindraceis, interdum obclavato-cylindraceis, pallide olivaceis, rectis vel leniter curvatis, 3-6 septatis, apice rotundatis, basi attenuatis et truncatis, 33-60 x 4-5.5(-6)µm.

Habitat in foliis vivis Vigna sp. (Leguminosae), ad Raiganj, Dinajpur occidentalis, Bengal occidentalis, India. Leg. B. K. Das, 3 XI 1980, No. Pcc4451 (Herb. LAM, Yen #10582), typus.

Leaf spot distinct, orbicular or irregularly orbicular, bright brown with a dark brown margin, scattered, more visible on the upper surface, 2-5mm in diameter. Caespituli amphiphyllous, visible under hand lens as short black hairs. Primary mycelium internal: hyphae almost colorless, septate, branched 2-3.5µm wide. Stromata not well developed, dark brown, globular or irregularly globular, 15-40µm in diameter. Primary conidiophores up to 60 in dense fascicles emerging through a stromata, pale brown-olivaceous, smooth, simple, straight or slightly flexuous, 1-3 septate, 0-2 geniculate, apex attenuate or shouldered, conidial scars distinct, 22-75 x 3-5µm. Secondary mycelium superficial: hyphae arising from the base of some of the primary conidiophores, repent or lax arcuate, pale olivaceous, septate, branched, 2.5-4µm wide, bearing secondary conidiophores as erect lateral branches. Conidia generally cylindric, sometimes obclavate-cylindric, pale olivaceous, straight or slightly curved, 3-6 septate

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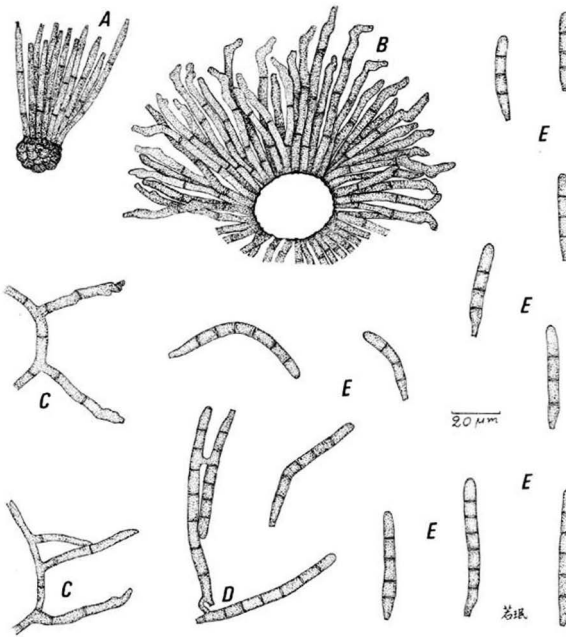
Fig. 5. Pseudocercospora pantoleuca (Saccaardo) Deighton: A, Fascicles of young conidiophores; B & C, Fascicles of old conidiophores; D, Branched conidiophores; F, Conidia.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E
E

apex rounded, base attenuate-truncate, 33-60 x 4-5.5(-6)µm.

On Vigna sp. (Leguminosae), in Raiganj, West Dinajpur, West Bengal, India. Leg. B. K. Das, 3 November 1980, No Pcc4451 (Herb. LAM, Yen #10582).

Note: This fungus differs from others (Pseudocercospora cruenta (Saccardo) Deighton, P. dolichi (Ellis and Everhart) Yen, P. mungo Deighton, and P. vignae-reticulatae Deighton) on Vigna by its distinct leaf spots with definite margin and very dense fascicles with up to 60 conidiophores.

11. Pseudocercospora vitigena Yen, Kar & Das, sp. nov. (Fig. 7, A-E)

Maculis indistinctis. Caespitulis amphiphyllis, autem principaliter hypophyllis, invisibilis. Mycelium primarium immersum: hyphis subhyalinis, septatis ramosis, 1.5-2.5µm latis. Stromatibus atro-brunneis, globosis vel irregulariter globosis, 10-30µm diam. Conidiophoris primariis numerosis vel paucis in fasciculo per stomatibus emergentis, pallide olivaceis, eretis vel leniter flexuosis, simplicibus vel ramosis, laevis, continuis vel 1-2 septatis, non geniculatis, apice rotundatis vel irregulariter rotundatis, 10-30 x 2-3µm. Mycelium secundarium superficiale: hyphis ex stromatibus oriundis, pallidissime olivaceis, repentis vel arcuatis, laevis, septatis, conidiophoris secundariis lateraliter gerentis. Conidiis pallide olivaceis, obclavato-cylindraceis, rectis vel leniter curvatis, laevis, non constrictis, 3-11 septatis, ad apicem rotundatis vel subrotundatis, basi obconico-truncatis, 36-82 x 2.5-3.5µm.

Habitat in foliis vivis Vitis sp. (Vitidaceae), ad Sylva Hemtabad, Dinajpur occidentalis, Bengal occidentalis, India. Leg. B. K. Das, 10 X 1980, No. Pcc4418 (Herb. LAM, Yen #10577), typus.

Leaf spot indistinct or none. Caespituli amphigenous, but chiefly hypophyllous, not visible even under hand lens. Primary mycelium internal: hyphae very pale olivaceous, septate, branched, 1.5-2.5µm wide. Stromata slightly developed, dark brown, globular or irregularly globular, 10-30µm in diameter. Primary conidiophores emerging through the stomata, very numerous in each of the larger fascicles, but few in smaller fascicles, pale olivaceous, straight or slightly flexuous, simple or branched, smooth, continuous or 1-2 septate, not geniculate, apex rounded or irregularly rounded, 10-30 x 2-3µm. Secondary mycelium external: hyphae arising from the stomata, sometimes from stromata,

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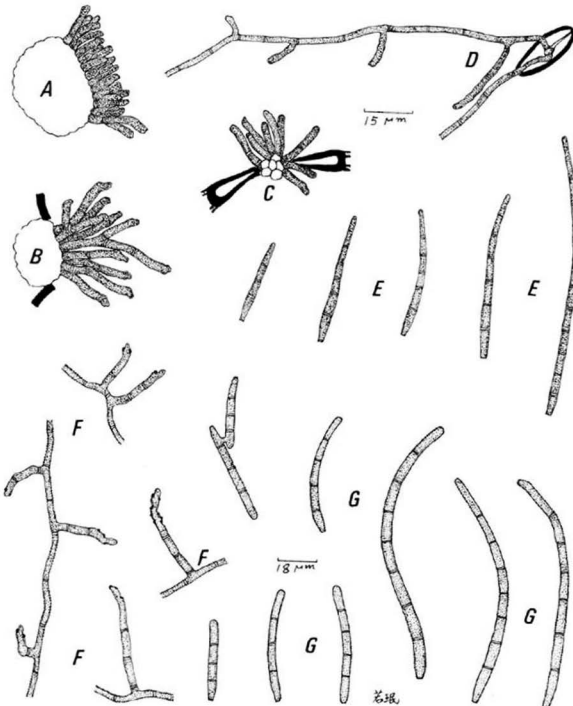
Fig. 6. Pseudocercospora vignigena Yen, Kar & Das: A, Young conidiophores; B, Fascicles of old conidiophores; C, External hyphae and formation of secondary conidiophores; E, Conidia.


A
B
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15 μm
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18 μm

repent or arcuate, very pale olivaceous, smooth, septate, bearing secondary conidiophores as lateral branches. Conidia very pale olivaceous, obclavate-cylindric, straight or slightly curved, smooth, not constricted, 3-11 septate, apex rounded or subrounded, base obconic-truncate, 36-82 x 2.5-3.5µm.

On Vitis sp. (Vitidaceae), in Hemtabad forest, West Dinajpur, West Bengal, India. Leg. B. K. Das, 10 October 1980, No Pcc4418 (Herb. LAM, Yen #10677).

Note: The indistinct leaf spots, amphigenous fruiting, and narrow pale olivaceous conidia separate this species from others on Vitis.

12. Stenella canthii Yen, Kar & Das, sp. nov. (Fig. 7, F&G)

Maculis distinctis, orbicularis vel irregulariter orbicularis, brunneo-albis et zona lata obscure brunnea restrictis, 2-10 mm diam., interdum confluentibus, usque 17mm longis. Caespitulis districte hypophyllis, invisibilis. Mycelium primarium immersum: hyphis pallidissime olivaceis, septatis, ramosis, 1.5-3µm latis. Stromatibus nullis. Conidiophoris solitariis, ex hyphis secundariis oriundis, brunneo-olivaceis vel pallide olivaceis, erectis vel leniter flexuosis, simplicibus, laevis, 1-3 septatis, 0-1 geniculatis, antice attenuatis, denticulatis et cicatricibus atro-brunneis ornatis, 21-45 x 3-3.5µm. Mycelium secundarium superficiale: hyphis ex stromatibus oriundis, pallide olivaceis, repentis vel arcuatis, subtiliter verruculosis, septatis, conidiophoris solitariis lateraliter gerentis. Conidiis plerumque cylindraceis, interdum obclavato-cylindraceis, pallide olivaceis, subtiliter verruculosis, plerumque curvatis, raro rectis, 1-7 septatis, ad apicem rotundatis, inferne attenuatis et in hilum truncatum, 18-112 x 3-4.5µm.

Habitat in foliis vivis Canthii dedymi Roxb. (Rubiaceae), ad Baraipur, 24-Parganas, Bengal occidentalis, India. Leg. B. K. Das, 15 IX 1980, No. Pcc4374 (Herb. LAM, Yen #10590), typus.

Leaf spot distinct, brown whitish, with a wide indistinct dark brown margin, 2-10mm in diameter, sometimes confluent up to 17mm long. Caespituli strictly hypophyllous, invisible. Primary mycelium internal: hyphae very pale olivaceous, septate, branched, 1.5-3µm wide. Stromata absent. Conidiophores arising from secondary hyphae as lateral branches, brown olivaceous or pale brown olivaceous, straight or slightly flexuous, simple, smooth, 1-3 septate,

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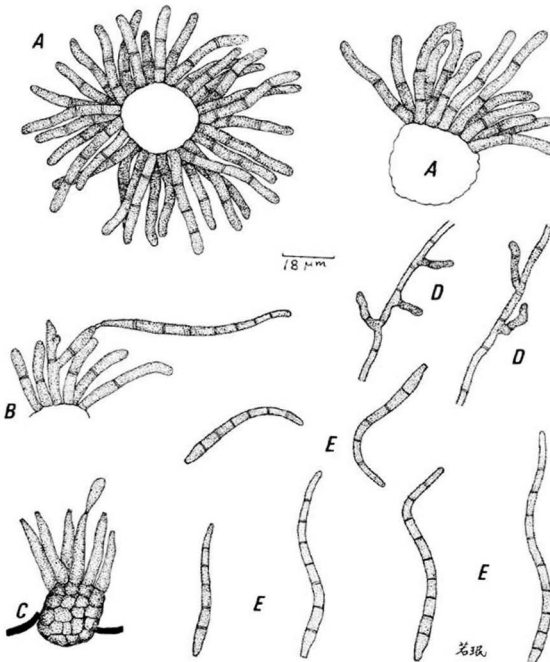
Fig. 7. A-E, Pseudocercospora vitigena Yen, Kar & Das: A, Young conidiophores; B, Branched conidiophores; C, Poor fascicles of conidiophores; D, External hyphae and formation of secondary conidiophores; E, Conidia. F-G, Stenella canthii Yen, Kar & Das: F, External hyphae and formation of normal conidiophores; G, Conidia.


A
A
18 μm
D
D
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not geniculate, apex attenuate, denticulate and decorated with dark brown conidial ciccatrices, 21-45 x 3-3.5μm. Secondary mycelium external: hyphae arising from stomata, pale olivaceous, repent or arcuate, finely verruculose, septate, bearing laterally the normal conidiophores. Conidia generally cylindric, sometimes obclavate-cylindric, pale olivaceous, finely verruculose, slightly curved, sometimes straight, 1-7 septate, apex rounded, base attenuate-truncate, 18-112 x 3-4.5μm.

On Canthium dedymum Roxb. (Rubiaceae), in Baraipur, 24-Parganas, West Bengal, India. Leg. B. K. Das, 15 September 1980, No Pcc4374 (Herb. LAM, Yen #10590).

13. Stenella dioscoreicola Yen, Kar & Das, sp. nov. (Fig. 8)

Maculis irregulariter orbicularis, brunneis, margine indistinctis, dispersis, 3-12mm diam. Caespitulis districte hypophyllis, in hypophyllo obscure punctiformibus. Mycelium primarium immersum: hyphis pallidissime olivaceis, septatis, romosis, 1.5-3.5μm latis. Stromatibus atro-brunneis, irregulariter globosis, 24-40μm diam. Conidiophoris hypophyllis, 12-40 in fasciculo per stomatibus emergentis, pallide brunneo-olivaceis, sursum pallidioribus, simplicibus vel raro ramosis, cylindraceis, erectis vel leniter flexuosis, 0-3 septatis, non geniculatis, ad apicem rotundatis, cicatricibus conidialis indistinctis, 17-80 x 4-5μm. Mycelium secundarium superficiale: hyphis parvum explicatis, cum conidiophoris primariis commixa in fasciculo per stomatibus emergentis, pallide olivaceis, repentis, septatis, ramosis, subtiliter verruculosis, 2-3μm latis, conidiophoris secundariis lateraliter raro gerentis. Conidiis pallide brunneo-olivaceis, obclaviformis vel obclavato-cylindraceis, plerumque curvatis vel undulatis, subtiliter verruculosis, 3-9 septatis, apice obtusis vel rotundatis, basi obconico-truncatis, 50-130 x 3.5-4.5(-5)μm.

Habitat in foliis vivis Dioscoreae sp. (Dioscoreaceae), ad Sylva Chelapata Cooch Behar, Bengal occidentalis, India. Leg. B. K. Das, 17 X 1980, Pcc4452 (Herb. LAM, Yen #10578), typus.

Leaf spot irregular orbicular, brown with an indistinct margin, scattered, 3-12mm in diameter. Caespituli strictly hypophyllous, visible under hand lens as dark punctiform. Primary mycelium internal: hyphae very pale olivaceous, septate, branched, 1.5-3.5μm wide. Stromata dark brown, irregularly globular, 24-40μm in diameter. Conidiophores hypophyllous, 12-40 in fascicles, arising from a stomata, generally simple, rarely branched, cylindric, straight or slightly flexuous, pale brown olivaceous, paler towards the tip, 0-3 septate, not geniculate, apex rounded, conidial

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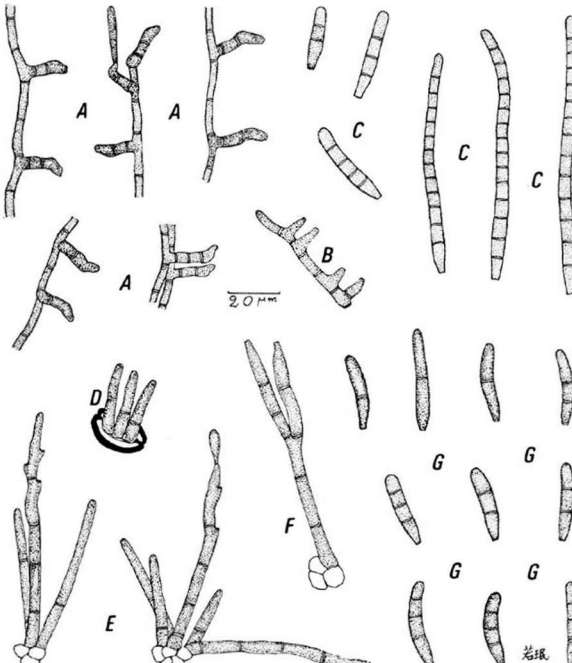
Fig. 8. Stenella dioscoreicola Yen, Kar & Das: A, Fascicles of primary conidiophores; B, Branched conidiophores; C, Young conidiophores; D, External hyphae and formation of secondary conidiophores; E, Conidia.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C
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C
B
20 μm
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若狭

scars indistinct, 17-80 x 4-5μm. Secondary mycelium superficial: hyphae very poorly developed, mixing with the primary conidiophores and arising from a stomata, pale olivaceous, repent, septate, branched, finely verruculose, 2-3μm wide, bearing occasionally the secondary conidiophores as lateral branches. Conidia pale brown olivaceous, obclaviform or obclavate-cylindric, generally curved or undulated, finely verruculose, 3-9 septate, apex obtuse or rounded, base obconici-truncate, 50-130 x 3.5-4.5(-5)μm.

On Dioscorea sp. (Dioscoreaceae), in Forest of Chelapata, Cooch Behar, West Bengal, India. Leg. B. K. Das, 17 October 1980, No Pcc4452 (Herb. LAM, Yen #10578).

14. Stenella myxa (Sydow in Sydow & Mitter) Yen, Kar & Das comb. nov. (Fig. 9, A-C)
=Cercospora myxa Sydow in Sydow and Mitter, Ann. Mycol. 33:70, 1935.

Leaf spot indistinct or none. Caespituli strictly hypophyllous, in effuse dark olivaceous irregular patches. Primary mycelium internal: hyphae almost colorless, septate, branched, 1.5-3μm wide. Stromata not developed. Conidiophores hypophyllous, solitary, arising as lateral branches on the external mycelial hphae, pale brown olivaceous, simple continuous or 1-2 septate (rarely 3), smooth, substraight below, sinuous or subgeniculate towards the tip, apex attenuate and rounded, 13-26 x 5-6μm. Conidia cylindric, brown olivaceous or pale brown olivaceous, straight or slightly curved, finely verruculose, 2-14 septate (Chupp:2-12 septate), apex rounded, base attenuate and truncate, 24-110 x 5-6μm.

On Cordia myxa L. (Boraginaceae), in Kamarkundu, Nnoia, West Bengal, India. Leg. B. K. Das, 23 February 1980, No Pcc4234 (Herb. LAM, Yen #10587).

Note: We have sent the material of this species to the Commonwealth Mycological Institute in Kew, England, and it has been identified as a Stenella sp. According to the description of Cercospora myxa Sydow in Sydow and Mitter, which parasitizes also Cordia myxa in India, we find it is similar to our fungus.

15. Stenella stephaniae Yen, Kar & Das, sp. nov. (Fig. 9, D-G)

Maculis brunneis, angularis, per nervuli limitatis, in epiphyllo plus visibilis, dispersis, 1-2mm diam. Caespitulis hypophyllis invisibilis. Mycelium primarium immersum: hyphis fere incoloris, septatis, ramosis, 2.5-4.5μm latis. Stromatibus atro-brunneis, globosis

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Fig. 9. A-C, Stenella myxa (Sydow in Sydow & Mitter) Yen, Kar & Das: A, External hyphae and formation of conidiophores; C, Conidia. D-G, Stenella stephaniae Yen, Kar & Das: D, Young conidiophores; E, Conidiophores and formation of conidia; F, Branched conidiophores; G, Conidia.

10-45µm diam. Conidiophoris hypophyllis, ex stomatibus oriundis, 2-8 in fasciculotis, pallide brunneo-olivaceis, simplicibus, interdum ramosis, laevis, erectis, 1-4 septatis, apex rotundatis vel attenuatis et denticulatis, cicatribus sporarum atro-brunneis manifestibus, 25-120 x 4-5µm. Conidiis breviter cylindraceis, pallide brunneo-olivaceis, leniter curvatis, 1-3 septatis, ad apicem rotundatis, basi attenuatis et truncatis, 31-45 x 5-7µm.

Habitat in foliis vivis Stephania hernandifolia Walp. (Menispermaceae), ad Raganj, Dinajpur occidentalis, Bengal occidentalis, India. Leg. B. K. Das, 24 X 1979, No. Pc 4231 (Herb. LAM, Yen #10591), typus.

Leaf spot small, brown, angular and vein-limited, more distinct on upper surface, scattered, 1-2mm in diameter. Caespituli strictly hypophyllous, invisible even under hand lens. Primary mycelium internal: hyphae almost colourless, septate, branched, 2.5-4.5µm wide. Stromata dark brown, globular, 10-45µm in diameter. Conidiophores hypophyllous, emerging through the stomata, 2-8 in poor fascicles, rather pale olivaceous and paler towards the tip, smooth, usually simple, occasionally branched, straight below, slightly flexuous above, 1-4 setate, not geniculate, apex rounded or attenuate and denticulate, dark-brown cicatrices conidial decorated on the shoulders, 25-120 x 4-5µm. Conidia shortly cylindric, pale brown-olivaceous, slightly curved, 1-3 septate, apex rounded, base attenuate- truncate, 31-45 x 5-7µm.

On Stephania hernandifoloa Walp. (Meninspermaceae), in Raganj, Wet Dinajpur, West Bengal, India. Leg. B. K. Das, 24 October 1979, No Pcc 4231 (Herb. LAM, Yen #10591).

Note: We have sent the material of this fungus to the Commonwealth Mycological Institute in Kew, England, and it has been identified as a Stenella sp. Although CMI has not mentioned the species name, we consider it as a new one.

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STUDIES ON HYPHOMYCETES FROM WEST BENGAL, INDIA, II. CERCOSPORA AND ALLIED GENERA OF WEST BENGAL, 2

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ABSTRACT

This study includes descriptions and illustrations of nine new species and two new combinations of Indian Cercosporae: *Pseudocercospora bridelíicola* sp. nov., on *Bridelia* sp.; *P. michelíicola* sp. nov., on *Michelia champaca*; *P. oroxyligena* sp. nov., on *Oroxylum indicum* *P. pavettae-indicae* (Gov. & Thirum.) comb. nov., on *Pavetta indica; P. stillingiae* (Ell. & Ev.) comb. nov., on *Sapium sebiferum; P. tectonicola* sp. nov., on *Tectona grandis; P. viticigena* sp. nov., on *Vitex negundo; Stenella coffeae* sp. nov., on *Coffea bengalensis; S. garugae* sp. nov., on *Garuga pinnata; S. oroxylicola* sp. nov., on *Oroxylum indicum;* and *S. xeromphigena* sp. nov., on *Xeromphis uliginosa.*

1. Pseudocercospora bridelíicola Yen, Kar & Das, sp. nov. (Fig. 1)

Maculis indistinctis, Caespitulis hypophyllis, effusis, velutinis, griseis, mox interdum confluentis et in inferiore superficie saepe fere totam folii paginam omnino obtegentis. Mycelium primarium immersum: hyphis pallidissime olivaceis, septatis, ramosis, 3-4 µm latis. Stromatibus nullis vel parvis, substomatalis, ex hyphis paucis et subhyalinis compositis. Conidiophoris 2-15 in fasciculo per stomatibus emergentis, divergentis, laevis, olivaceis et sursum pallidioris, simplicibus, interdum ramosis, erectis vel leniter flexuosis, 2-10 septatis, 0-2 geniculatis, superne interdum denticulatis, ad apicem rotundatis vel attenuatis, cicatricibus conidialis interdum visibilis (1.5-2.5 µm diam.), 40-180 (-250) x 5-6 µm. Mycelium secundarium superficiale: hyphis pallide olivaceis, ex stomatibus et conidiophoris primariis oriundis, septatis, ramosis, laevis, 2.5-3 µm latis, conidiophoris secundariis lateraliter manifestibus. Conidiis obclavato-cylindraceis, pallide olivaceis, rectis vel leniter curvatis, plerumque 3 septatis (raro 1 vel 4 septatis),

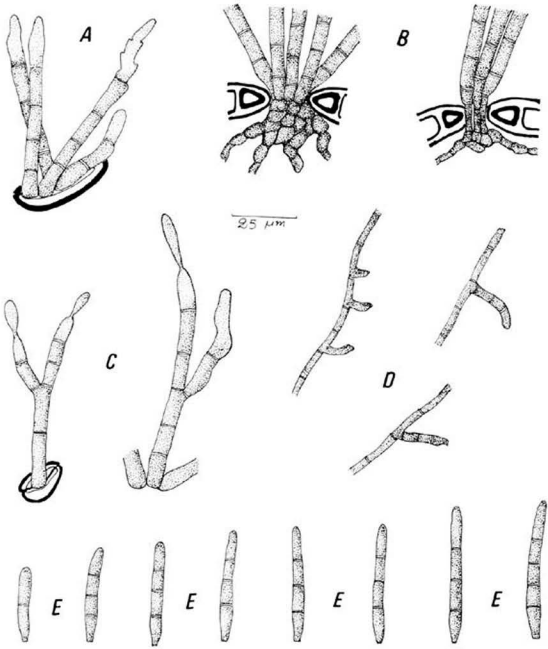

Fig. 1. Pseudocercospora brideliicola: A, Young conidiophores; B, Rudimentary stromata; C, Formation of conidia; D, Formation of secondary conidiophores; E, Conidia.

apice rotundatis, basi obconico-truncatis, 21-67 x 4.5-5 µm.
Habitat in foliis vivis *Brideliae* sp. (Euphorbiaceae), ad Bibirhat, 24-Parganas, Bengal occidentalis, India, leg. B.K. Das, 10 I 1980, No. PCC 4125 (IMI 250379) (Herb. LAM Yen #10601, holotypus).

Leaf spot indistinct or none, Caespituli hypogenous, effuse, velutinous, grayish, sometimes extending and covering all the under surface of the leaf. Primary mycelium internal: hyphae very pale olivaceous, septate, branched, 3-4 µm wide. Stromata absent or very rudimentary, only a loose mass of subhyaline internal hyphae under the stomata. Conidiophores 2-12 in fascicles emerging through the stomata, olivaceous below and paler or subhyaline towards the tip, simple, sometimes branched, 2-10 septate, 0-2 geniculate, sometimes denticulate above, apex rounded or attenuate, conidial scars visible on the shoulder or at the end of denticles, 40-180 (-250) x 5-6 µm. Secondary mycelium superficial: hyphae pale olivaceous arising from the stomata or from the prolongation of primary conidiophores, septate, branched, 2.5-3 µm wide, often bearing the short secondary conidiophores as lateral branches. Conidia obclavate-cylindric, pale olivaceous, straight or very slightly curved, generally 3 septate, rarely 1 or 4 septate, apex rounded, base obconic and attenuate-truncate, 21-67 x 4.5-5 µm.
On *Bridelia* sp. (Euphorbiaceae), in Bibirhat, 24-Parganas, West Bengal, India, leg. B.K. Das, 10 I 1980, No. PCC 4125 (IMI 250379) (Herb. LAM Yen #10601).

Note: Sawada (1943) has described in Taiwan, *Cercospora atridis* Syd., which parasitizes the leaves of *Bridelia monoica* (Lour.) Merr.; it differs from this fungus by its dark-brown, wider conidia (7.5-8 µm compared with 4.5-5 µm). On the other hand, *Pseudocercospora brideliae* Deighton differs from this species by its much longer dark olivaceous conidiophores (up to 450 µm long) and by its condial septatum (5-15 septate compared with 3 septate).

2. *PSEUDOCERCOSPORA HIBISCI-CANNABINI* (Sawada) Deighton (Fig. 2) Mycol. Pap. 140:145, 1976 = *Cercospora hibisci-cannabini* Sawada, Descr. Cat. Formosan Fungi, 2:153, 1921.

Leaf spot indistinct, but some angular areas darkish, vein-limited, more visible on lower surface, scattered, 0.5-3 mm in diameter, sometimes confluent. Caespituli amphigenous, but chiefly hypophyllous, effuse, dark-gray, sometimes extensively velutinous on lower surface of the leaf. Primary mycelium internal:hyphae subhyaline, septate, branched, 2.3-5 µm wide. Stromata absent or very rudimentary. Conidiophores emerging through the stomata, pale olivaceous, forming dense to very dense fascicles above the stomata, pale olivaceous, forming dense to very dense fascicles above the stomata, simple or branched, flexuous, rarely straight, 1-7 septate, apex rounded, or attenuate-truncate and sometimes shouldered, 14-40 x 3-3.5 µm. Secondary mycelium superficial: hyphae pale olivaceous, septate, branched, 2-4 µm wide, bearing secondary conidiophores as lateral branches.

Conidia obclavate-cylindric, very pale olivaceous, straight or slightly curved, 1-9 septate (Sawada: 3-9 septate), apex rounded, base obconic-truncate or attenuate-truncate, 21-75 x 3-3.5 (-4) µm (Sawada: 40-88 x 3-3.5 µm).

On *Hibiscus rosa-sinensis* L. (Malvaceae), in Raiganj, West Dinajpur, West Bengal, India, leg. B.K. Das, 15 IX 1980, No. PCC 3802 (IMI 250373) (Herb. LAM Yen #10599).

Note: *Pseudocercospora abelmoschi* (Ell. & Ev.) Deighton differs from this species by its wider conidia (3-7 µm compared with 3-3.5 µm). But all the systematic characters of this fungus are similar to those of *Pseudocercospora hibisci-cannabini* (Sawada) Deighton, which have been well described and illustrated by Sawada (1921).

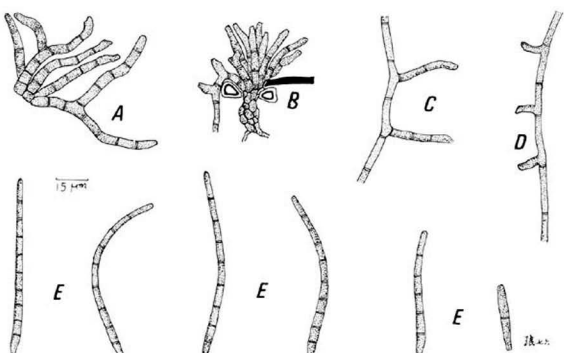

Fig. 2. Pseudocercospora hibisci-cannabini: A, Old and branched conidiophores; B, Formation of secondary mycelial hyphae; C & D, Secondary conidiophores; E, Conidia.

3. Pseudocercospora micheliicola Yen, Kar & Das, sp. nov. (Fig. 3)

Maculis distinctis, angularis, nervuli limitatis, interdum irregularis, mediocriter brunneis, autem albo-griseis in medio, dispersis, 2-5 mm diam., in inferiore superficie minus distinctis. Caespitulis amphiphyllis, autem principaliter epiphyllis, punctiformis, atro-brunneis, in superiore superficie distributis. Mycelium immersum: hyphis pallide olivaceis, laevis, septatis, ramosis, 2.5-4.5 µm latis. Stromatibus atrobrunneis, globosis vel subglobosis, 20-50 µm diam. Conidiophoris numerosis in dense vel valde dense fasciculo per stomatibus emergentis, mediocriter olivaceis vel pallide olivaceis, sursum pallidioris, laevis, simplicibus, semper tortuosis vel sinuosis, 0-3 septatis, 0-2 geniculatis, ad apicem rotundatis vel attenuatis, cicatricibus conidialis indistinctis, 10-55 x 4-5 µm. Conidiis obclaviformibus, olivaceis vel mediocriter olivaceis, rectis vel curvatis, 4-10 septatis, laevis, non constrictis, apice subacutis vel obtusis, basi obconico-truncatis, 55-120 x 5.5-7 µm.

Habitat in foliis vivis *Michelíae champacae* L. (Magnoliaceae), ad Rajahatkhawa Sylva, Alipurduar, Jalpaiguri, Bengal occidentalis, India, leg. B.K. Das, 17 x 1980, No. PCC 4420 (Herb. LAM Yen #10603, holotypus).

Leaf spot distinct, angular, vein-limited, sometimes irregular, mid brown with a grayish white center, 2-5 mm in diameter, scattered, more visible on upper surface. Caespituli amphigenous, but chiefly epiphyllous, punctiform, black brown, loosely distributed over the spot on upper surface. Mycelium internal: hyphae pale olivaceous, smooth, septate, branched, 2.5-4.5 µm wide. Stromata well developed, dark brown, globular, or subglobular, 20-50 µm in diameter. Conidiophores emerging through the stomata, numerous in dense or very dense fascicles, mid olivaceous to pale olivaceous, but very pale olivaceous or subhyaline towards the tip, smooth, simple, always tortuous with a sinuous membrane, 0-3 septate, 0-2 geniculate, apex rounded or shouldered and attenuate, conidial scars not distinct, 10-55 x 4-5 µm. Conidia obclaviform, olivaceous or mid olivaceous, straight or curved, smooth, not constricted, 4-10 septate, apex subacute or obtsue, base obconic-truncate, 55-120 x 5.5-7 µm.

On *Michelia champaca* L. (Magnoliaceae), in Rajabhatkhawa Forest, Alipurduar, Jalpaiguri, West Bengal, India, leg. B.K. Das, 17 X 1980, No. PCC 4420 (Herb. LAM Yen #10603).

Note: *Cercospora micheliae* Boedijn differs from this fungus by its conidiophores only arising from the external mycelial hyphae, without stromata, and especially by its much narrower conidia (3.5-4.5 µm wide compared with 5.5-7 µm wide).

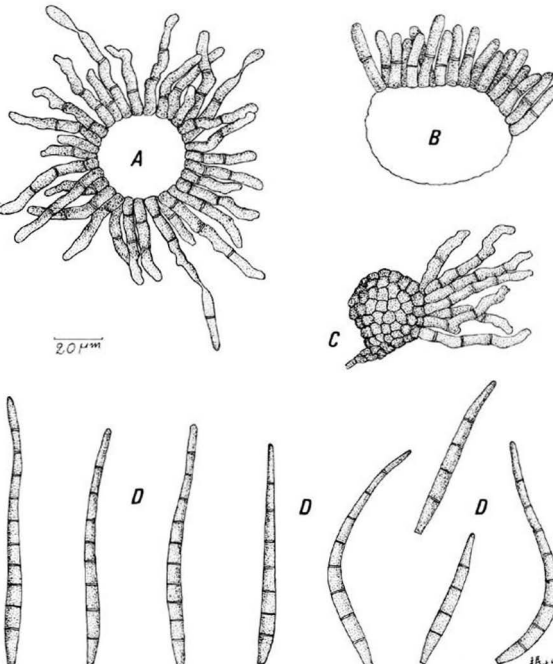

Fig.3. Pseudocercospora micheliicola: A, Conidiophores and formation of conidia; B, Young conidiophores; C, Old conidiophores and stromata; D, Conidia.

4. Pseudocercospora oroxyligena Yen, Kar & Das, sp. nov. (Fig. 4)

Maculis indistinctis, tandem areae parvae angularis, nervuli limitatis, rufo-brunneis, 2-5 mm diam., in inferiore superficie invisibilis. Caespitulis districte hypophyllis, invisibilis. Mycelium immersum: hyphis pallide olivaceis, laevis, septatis, ramosis, 2.5-4.5 µm latis. Stromatibus nullis. Conidiophoris solitariis vel 2-3 in fasciculo per stomatibus emergentis, pallide olivaceis, sursum pallidioris (fere hyalinis), simplicibus, erectis vel leniter curvatis, 0-3 septatis, non geniculatis, apex rotundatis vel attenuatis, interdum truncatis, cicatricibus conidialis interdum visibilis (2 µm diam.), 50-100 x 7-9 µm. Conidiis cylindraceis, fusiformis vel obclavato-cylindraceis, pallide olivaceis, rectis vel leniter curvatis, laevis, frequentissime constrictis, 1-5 septatis, apice rotundatis, basi attenuatis et truncatis, 24-87 x 7-9 µm.

Habitat in foliis vivis *Oroxyli indici* Vent. (Bignoniaceae), ad Garia, 24-Parganas, Bengal occidentalis, leg. B.K. Das, 26 XII 1979, No. PCC 4091a (IMI 256518a) (Herb. LAM Yen #10595, holotypus).

Leaf spot indistinct, only some pale reddish-brown angular discolored areas with indistinct margin, more or less vein-limited, scattered or confluent, 2-5 mm in diameter, more visible on upper surface, but invisible on lower surface. Caespituli strictly hypophyllous, invisible even under hand lens. Mycelium internal: hyphae pale olivaceous, smooth, septate, branched, 2.5-4.5 µm wide. Stromata lacking. Conidiophores solitary or 2-3 in fascicles emerging through the stomata, pale olivaceous and paler towards the tip (almost hyaline), simple, straight or slightly curved, 0-3 septate, not geniculate, apex rounded or attenuate and truncate, conidial scars sometimes visible (2 µm in diameter), 50-100 x 7-9 µm. Conidia cylindric, fusiform or obclavate-cylindric, pale olivaceous, straight or slightly curved, 1-5 septate, smooth, often constricted at septum, apex rounded, base attenuate and subtruncate, 24-87 x 7-9 µm.

On *Oroxylum indicum* Vent. (Bignoniaceae), in Garia, 24-Parganas, West Bengal, India, leg. B.K. Das, 26 XII 1979, No. PCC 4091a (IMI 256518a) (Herb. LAM Yen #10595).

Note: *Cercospora oroxyli* Kar & Mandal differs from this fungus by its hyaline and filiform conidia.

5. Pseudocercospora pavettae-indicae (Gov. & Thirum.) Yen, Kar & Das, comb. nov. (Fig. 5, A-E) = *Cercospora pavettae-indicae* Gov. & Thirum., Sydowia 10:271, 1957.

Leaf spot distinct, irregularly angular, more or less vein-limited, pale brown, sometimes without distinct margin, but sometimes with a linear raised dark-brown margin which is a discoloration of the limiting veins, scattered or confluent, 1-4 mm in diameter, clearer on upper surface. Caespituli amphigenous, visible as small dark punctiform bodies on both surfaces. Primary mycelium internal: hyphae pale olivaceous, smooth, branched, septate, 3-4 µm wide. Stromata well developed, black-brown, globular or subglobular, 25-50 µm in diameter. Conidiophores pale olivaceous, 5-25

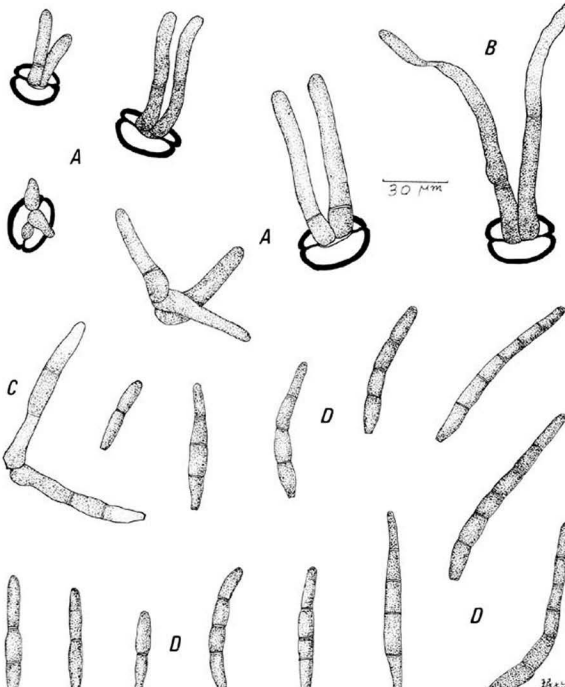

Fig. 4. Pseudocercospora oroxyligena: A, Young conidiophores; B, Formation of conidia; C, Old conidiophores; D, Conidia.

in fascicles emerging through the stomata, simple, straight when young, flexuous when old, 0-3 septate, 0-2 geniculate, sometimes with membrane finely rugose, apex rounded or attenuate and subtruncate, conidial scars not distinct, 12-50 x 4-5 (-6) µm. Secondary mycelium superficial: hyphae pale olivaceous, arising from the stomata, septate, branched, 3-3.5 µm wide, bearing the secondary conidiophores as lateral branches. Conidia cylindric or obclavate-cylindric, pale olivaceous, straight or slightly curved, smooth, not constricted, 3-6 septate, apex rounded, base attenuate and truncate, 35-80 x 3-5 (-6) µm.

On *Pavetta indica* L. (Rubiaceae), in Amtalla, 24-Parganas, West Bengal, India, leg. B.K. Das, 23 IX 1979, No. PCC 3716 (IMI 242957) (Herb. LAM Yen #10596).

Note: The systematic characters of this fungus are those of *Cercospora pavettae-indicae* Gov. & Thirum, which Govindu and Thirumalachar (1957) have described. But for lack of thickened conidial scars, this fungus ought to be transferred to genus *Pseudocercospora (Ps. pavettae-indicae)*.

6. **Pseudocercospora stillingiae** (Ell. & Ev.) Yen, Kar & Das, comb. nov. (Fig. 5, F-I) = *Cercospora stillingiae* Ell. & Ev., Jour. Mycol. 3:20, 1887.

Leaf spot orbicular or suborbicular, deep brown, bordered by a yellowish zone without distinct margin, scattered, about 2-6 mm in diameter. Caespituli amphigenous, but chiefly hypophyllous, punctiform on lower surface of old spot, but not visible on young ones. Primary mycelium internal: hyphae olivaceous or pale olivaceous, branched, septate, 2-4 µm wide. Stromata well developed, dark brown, subglobular, 20-50 µm in diameter. Conidiophores numerous in dense fascicles emerging through the stomata, pale olivaceous and very pale olivaceous towards the tip, simple, flexuous, 0-3 septate, 0-2 geniculate, apex rounded or shouldered, conidial scars sometimes visible, 10-30 x 3-4 µm. Secondary mycelium superficial: hyphae pale olivaceous, arising from the stomata, branched, septate, 2-4 µm wide, bearing the secondary conidiophores as lateral branches. Conidia cylindric or obclavate-cylindric, pale olivaceous, straight or slightly curved, smooth, not constricted, 0-4 septate (generally 3-4 septate), apex rounded, base obconic-truncate, 14-43 x 2.5-4 µm.

On *Sapium sebiferum* Roxb. (Euphorbiaceae), in Duttapurkur, 24-Parganas, West Bengal, India, leg. B.K. Das, 15 XII 1979, No. PCC 4061 (IMI 246496) (Herb. LAM #10598).

Note: This fungus shows the systematic characters of *Cercospora stillingiae* Ell. & Ev. On the other hand, Sawada (1943) has described a *Cercospora sapii-sebiferi* Sawada in Taiwan, but the description and the figures show that is a synonym of *Cercospora stillingiae* Ell. & Ev. But for lack of thickened conidial scars, this species ought to be transferred to genus *Pseudocercospora (Ps. stillingiae)*.

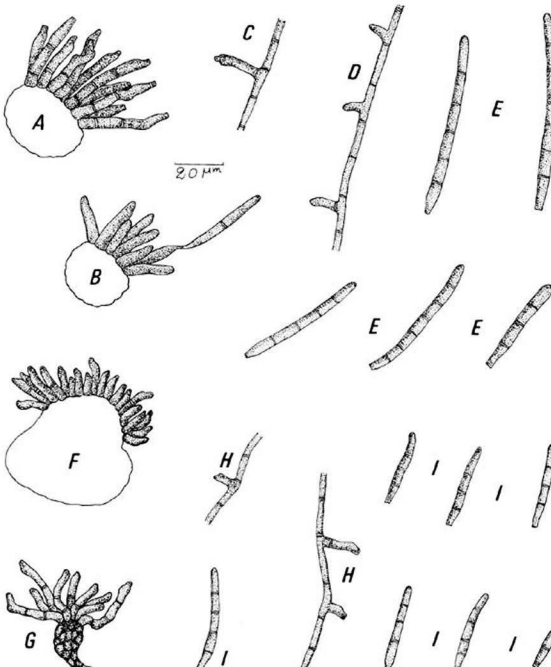

Fig. 5. Pseudocercospora pavettae-indicae(A-E): A, Primary conidiophores; B, Young conidiophores and fromation of conidia; C & D, Secondary conidiophores; E, Conidia.----Pseudocercospora stillingiae(F-I): F,Young conidiophores; C,Old conidiophores; H,Secondary conidiophores; I, Conidia.

7. Pseudocercospora tectonicola Yen, Kar & Das, sp. nov. (Fig. 6)

Maculis indistinctis, Caespitulis hypophyllis, effusis atro-brunneis, dense velutinis. Mycelium immersum: hyphis pallide olivaceis, laevis, septatis, ramosis, 2-4 µm latis. Stromatibus plerumque nullis, interdum mediocriter evolutis, atrobrunneis, subglobosis usque ad 20 µm diam. Conidiophoris hypophyllis, 2-12 in fasciculo per stomatibus emergentis, interdum solitariis, valde brunneis, sursum pallidioris, simplicibus, 0-12 septatis, non geniculatis, inferne erectis et laevis, superne leniter flexuosis et rugosis, ad apicem rotundatis vel subconicis, cicatricibus conidialis indistinctis, 36-120 x 5.5-8 µm. Conidiis obclavatis vel obclavato-cylindraceis, profunde brunneis, plerumque curvatis, raro rectis, 3-9 septatis, laevis, leniter constrictis, apice rotundatis, basi attenuatis et truncatis, 30-100 x 6.5-8 µm.

Habitat in foliis vivis *Tectonae grandis* L. (Verbenaceae), ad Santipur, Nadia, Bengal occidentalis, India, leg. B.K. Das, 28 XII 1979, No. PCC 4102 (IMI 246495) (Herb. LAM Yen #10597, holotypus).

Leaf spot indistinct or none. Caespituli hypophyllous, deep dark brown, effuse, densely velutinous. Mycelium internal: hyphae pale olivaceious, smooth, septate, branched, 2-4 µm wide. Stromata generally absent, sometimes poorly developed, dark-brown, subglobular, 20 µm in diameter. Conidiophores hypogenous, 2-12 in fascicles emerging through the stomata, sometimes solitary, deep-brown, paler towards the tip, simple, straight when young, slightly flexuous when old, 0-12 septate, not geniculate, smooth below, rugose and more or less undulated above, apex rounded or subconic and sometimes swollen, conidial scars not distinct, 36-120 x 5.5-8 µm. Conidia obclavate or obclavate-cylindric, deep-brown, generally slightly curved, sometimes straight, 3-9 septate, smooth, sometimes with constrictions at the septum, apex rounded, base attenuate-truncate, 30-100 x 6.5-8 µm.

On *Tectona grandis* L. (Verbenaceae), in Santipur, Nadia, West Bengal, India, leg. B.K. Das, 28 XII 1979, No. PCC 102 (IMI 246495) (Herb. LAM Yen #10597).

Note: The *Cercospora tectonae* Stevens differs from this fungus in having hyaline conidia.

8. Pseudocercospora viticigena Yen, Kar & Das, sp. nov. (Fig. 7)

Maculis aliquantum distinctis, atro-brunneis, in epiphyllo plus visibilis, suborbicularis, angularis vel irregularis, dispersis, 1-3 mm diam., interdum usque ad 4 mm longis. Caespitulis hypophyllis, invisibilis. Mycelium primarium immersum: hyphis subhyalinis vel pallidissime olivaceis, laevis, septatis, ramosis, 1.5-3.5 µm latis. Stromatibus atro-brunneis, irregulariter globosis, 24-40 µm diam. Conidiophoris districte hypophyllis, numerosis in dense fasciculatis, pallide olivaceis et sursum pallidioris, simplicibus, 0-3 septatis, 0-2 geniculatis, saepe flexuosis, in superne interdum denticulatis, ad apicem attenuatis vel irregulariter rotundatis, cicatricibus conidialis interdum visibilis, 15-43 x 3-4 (-5) µm. Mycelium secundarium sperficiale: hyphis ex stomatibus oriundis, pallidissime olivaceis, laevis, septatis, ramosis, 2.5-3 µm latis, conidiophoris secundariis lateraliter gerentis. Con-

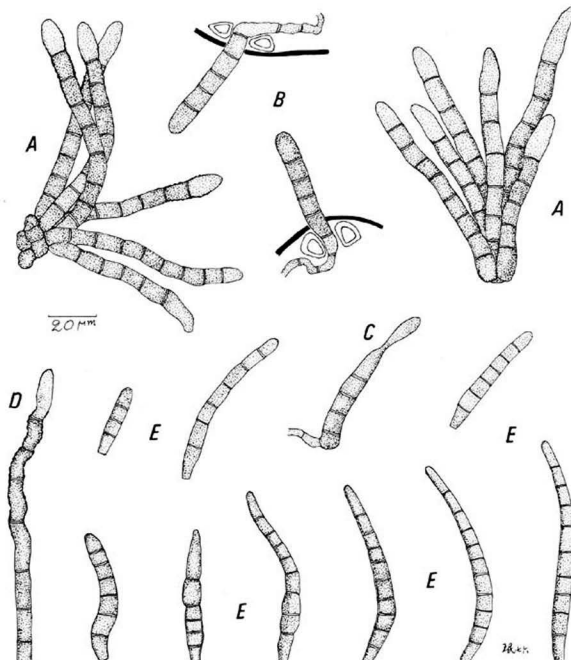

Fig. 6. Pseudocercospora tectonicola: A,Fascicles of conidiophores; B, Solitary conidiophores; C, Formation of conidia; D, Above part of old conidiophores; E, Conidia.

idiis obclavato-cylindraceis, pallide olivaceis, rectis vel leniter curvatis, 1-6 septatis (plerumque 3 septatis), apice rotundatis, basi obconico-truncatis, 15-65 x 2-4 µm.

Habitat in foliis vivis *Viticis negundo* L. (Verbenaceae), ad Duttapukur, 24-Parganas, Bengal occidentalis, India, leg. B.K. Das, 1 III 1980, No. PCC 4256 (IMI 250374) (Herb. LAM Yen #10600, holotypus).

Leaf spot rather distinct, dark-brown, more visible on upper surface, suborbicular, angular or irregular, scattered, 1-3 mm in diameter, sometimes up to 4 mm long. Caespituli hypogenous, invisible even under the hand lens. Primary mycelium internal: hyphae subhyaline or very pale olivaceous, smooth, septate, branched, 1.5-3.5 µm wide. Stromata black-brown, irregularly globular, 24-40 µm in diameter. Conidiophores strictly hypophyllous, numerous in dense fascicles, pale olivaceous and paler towards the tip, simple, 0-3 septate, 0-2 geniculate, often tortuous, sometimes denticulate above, apex attenuate or irregularly rounded, conidial scars sometimes visible, 15-43 x 3-4 (-5) µm. Secondary mycelium superficial: hyphae arising from stomata or from stromata and mixed with the primary conidiophores, pale olivaceous, septate, branched, smooth, 2.5-3 µm wide, bearing secondary conidiophores as lateral branches. Conidia obclavate-cylindric, pale olivaceous, straight or slightly curved, 1-6 septate but generally 3 septate, apex rounded, smooth, not constricted, base obconically truncate, 15-65 x 2-4 µm.

On *Vitex negundo* L. (Verbenaceae), in Duttapukur, 24-Parganas, West Bengal, India, leg. B.K. Das, 1 III 1980, No. PCC 4256 (IMI 250374) (Herb. LAM Yen #10600).

Note: *Cercospora viticis* Ell. & Ev., *C. weberi* Chupp and *C. agawalii* Chupp apud Agarwal & Hasija differ from our fungus by their strictly epigenous fruiting. On the other hand, *Pseudocercospora viticicola* (Yen & Lim) Yen and *P. vitici-quinatae* (Yen) Yen are distinct from this species by their always amphiphyllous caespituli.

9. Stenella coffeae Yen, Kar & Das, sp. nov. (Fig. 8)

Maculis irregulariter orbicularis, griseis vel obscure griseis, margine indistinctis, dispersis vel confluentis, 2-4 mm diam. Caespitulis hypophyllis, invisibilis. Mycelium primarium immersum: hyphis olivaceis vel pallide olivaceis, laevis, septatis, ramosis, subtiliter verruculosis, 2.5-4 µm latis. Stromatibus atrobrunneis, subglobosis, 25-50 µm diam. Conidiophoris primariis 2-14 in fasciculo per stomatibus emergentis, brunneis vel profunde brunneis, sursum pallidioris, simplicibus, inferne erectis vel suberectis, superne tortuosis vel denticulatis, laevis, 4-6 septatis, non geniculatis, ad apicem rotundatis et saepe undulatis vel denticulatis et cicatricibus conidialis atrobrunneis ornatis, 65-220 x 4-5 µm. Mycelium secundarium superficiale: hyphis ex stomatibus oriundis, pallide brunneo-olivaceis, laevis, septatis, ramosis, valde verruculosis, 2-3 µm latis, conidiophoris secundariis lateraliter gerentis. Conidiis cylindraceis, brunneis vel pallide brunneo-olivaceis, valde verruculosis, rectis vel leniter curvatis, interdum leniter undulatis, 3-18 septatis, non constrictis, utrimque rotundatis, cellula basali in hilum atrobrunneum, 33-200 x 3-5 (-6) µm.

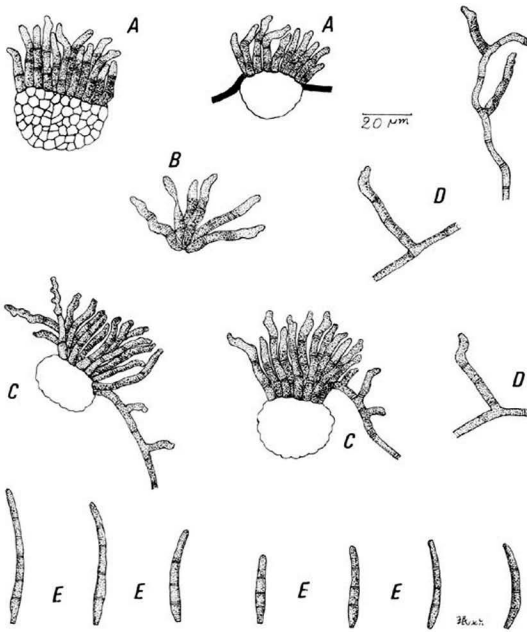

Fig. 7. Pseudocercospora viticigena: A, Conidiophores and stromata; B, Formation of conidia; C, Formation of secondary mycelial hyphae; D, Secondary conidiophores; E, Conidia.

Habitat in foliis vivis *Coffeae bengalensis* Roxb. (Rubiaceae), ad Baraipur, 24-Parganas, Bengal occidentalis, India, leg. B.K. Das, 6 XII 1979, No. PCC 4014 (IMI 246498) (Herb. LAM Yen #10592, holotypus).

Leaf spot blurred, irregularly orbicular, gray to dark gray, without distinct margin, scattered or confluent, 2-4 mm in diameter. Caespituli hypogenous, invisible even under hand lens. Primary mycelium internal: hyphae olivaceous or pale olivaceous, septate, branched, finely verruculose, 2.5-4 µm wide. Stromata dark brown, subglobular, 25-50 µm in diameter. Primary conidiophores 2-14 in fascicles emerging through the stomata, brown to deep brown, paler towards the tip, simple, straight or substraight below, very tortuous above, smooth, 4-16 septate, not geniculate, apex arounded and often undulated or denticulate, decorated with thickened conidial scars on the shoulders, 65-220 x 4-5 µm. Secondary mycelium superficial: hyphae pale brown-olivaceous, arising from the stomata, septate, branched, strongly verruculose, 2-3 µm wide, bearing secondary conidiophores which are much more shorter than the primary conidiophores. Conidia cylindric, brown or pale brown-olivaceous, strongly verruculose, straight or slightly curved, sometimes slightly undulate, 3-18 septate, not constricted, rounded on both ends, decorated with dark-brown cicatrice on the hilum, 33-200 x 3-5 (-6) µm.

On *Coffea bengalensis* Roxb. (Rubiaceae), in Baraipur, 24-Parganas, West Bengal, India, leg. B.K. Das, 6 XII 1979, No. PCC 4014 (IMI 246498) (Herb. LAM Yen #10592).

Note: According to Chupp (1953), Seymour (1967) and Ellis (1976), there are three species of *Cercospora* (*Cercospora coffeicola* Berk. & Cke., *C. herrerana* Farn. and *C. coffeae* Zimm.) which are parasites on the leaves of *Coffea*. But recently, Holliday (1980) considers that *Cercospora herrerana* Farn. and *C. coffeae* Zimm. are just the synonyms of *Cercospora coffeicola* Berk. & Cke. The last species differs from our fungus by its smooth and hyaline conidia.

10. Stenella garugae Yen, Kar & Das, sp. nov. (Fig. 9)

Maculis indistinctis. Caespitulis districte hypophyllis, effusis, angularis et nervuli limitatis, atro-olivaceis, in maculo parvis, dispersis, 0.5-2 mm diam., interdum confluentis. Mycelium primarium immersum: hyphis pallidissime olivaceis, laevis, septatis, ramosis, 1-2.5 µm latis. Stromatibus nullis. Conidiophoris primariis hypophyllis, 2-8 in fasciculo per stomatibus emergentis, divergentis, olivaceis vel pallide olivaceis, sursum pallidioris, laevis, simplicibus vel ramosis, inferne erectis, superne leniter flexuosis, 0-3 septatis, 0-2 geniculatis, ad apicem flectis et attenuatis, cicatricibus conidialis raro visibilis, 12-45 x 4-5 µm. Mycelium secundarium superficiale: hyphis ex stomatibus vel ex conidiophoris primariis oriundis, pallide olivaceis, septatis, ramosis, subtiliter verruculosis, 1.5-4 µm latis, conidiophoris secondariis lateraliter gerentis. Conidiis obclavato-cylindraceis, pallide olivaceis, rectis vel leniter curvatis, subtiliter verruculosis, non constrictis, 3-9 septatis, apice rotundatis vel subobtusis, basi obconicis et attenuato-truncatis, 32-90 x 3-4 µm.

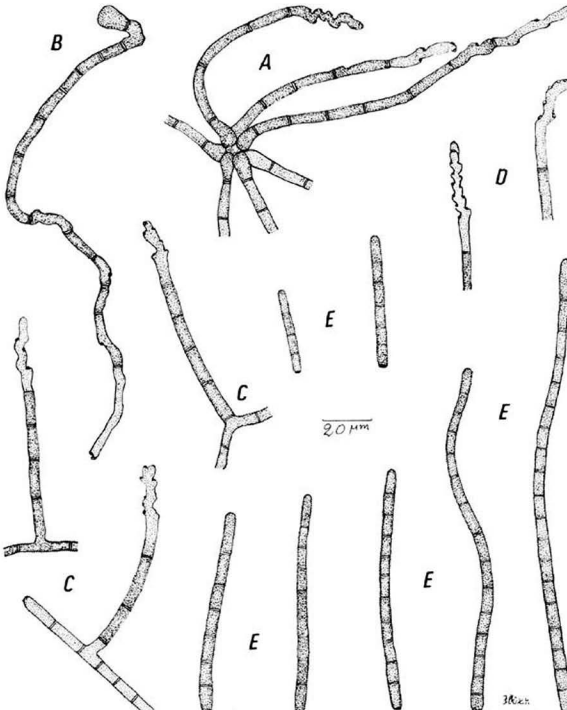

Fig. 8. Stenella coffeae: A, Fascicles of conidiophores; B, Old conidiophores; C, Secondary conidiophores; D, Above part of conidiophores; E, Conidia.

Habitat in foliis vivis *Gargugae pinnatae* Roxb. (Burseraceae), ad Simurali, Nadia, Bengal occidentalis, India, leg. B.K. Das, 4 XII 1980, No. PCC 4462 (Herb. LAM Yen #10602, holotypus).

Leaf spot indistinct or none. Caespituli always hypophyllous, forming olivaceous to dark olivaceous angular small blotches on lower surface, clearly vein-limited, effuse, scattered, 0.5-2 mm in diameter, sometimes confluent. Primary mycelium internal: hyphae very pale olivaceous, smooth, septate, branched, 1-2.5 µm wide. Stromata absent. Conidiophores 2-8 in fascicles emerging through the stomata, but at the same time secondary conidiophores arising abundantly from secondary mycelial hyphae as lateral branches, both kinds of conidiophores similar to each other, olivaceous or mid to pale olivaceous and paler towards the tip, generally simple, rarely once branched, straight below and slightly flexuous above, 0-3 septate, 0-2 geniculate, apex often shouldered and attenuate-truncate, conidial scars sometimes distinct, 12-45 x 4-5 µm. Secondary mycelium superficial: hyphae pale olivaceous, arising from the stomata or from the prolongation of primary conidiophores, septate, branched, very finely verruculose, 1.5-4 µm wide, bearing abundant secondary conidiophores as lateral branches. Conidia obclavate-cylindric, pale olivaceous, straight or very slightly curved, very finely verruculose, 3-9 septate, apex rounded or subobtuse, base obconic and attenuate-truncate, 32-90 x 3-4 µm.

On *Gargua pinnata* Roxb. (Burseraceae), in Simurali, Nadia, West Bengal, India, leg. B.K. Das, 4 XII 1980, No. PCC 4462 (Herb. LAM Yen #10602).

11. Stenella oroxylicola Yen, Kar & Das, sp. nov. (Fig. 10)

Maculis indistinctis, tantum area parva brunnea, margine indistinctis, leniter nervuli limitatis, angularis, dispersis, 2-5 mm diam., interdum confluentis, in superiore superficie plus distinctis. Caespitulis hypophyllis, effusis, in inferiore superficie griseis. Mycelium immersum: hyphis pallidissime olivaceis, laevis, septatis, ramosis, 2-5 µm latis. Stromatibus nullis. Conidiophoris 2-8 in fasciculo per stomatibus emergentis, brunneo-olivaceis, sursum pallidioris, plerumque simplicibus, raro ramosis, laevis (cum membrana incrassatula), saepe flexuosis, 2-13 septatis, leniter multigeniculatis, ad apicem rotundatis vel flectis, cicatricibus conidialis interdum visibilis, 80-260 x 6-7 µm. Conidiis obclavatis, pallide olivaceis, lenitissime curvatis, subtiliter verruculosis, non constrictis, 3-6 septatis, ad apicem subconicis, basi attenuato-truncatis, 40-105 x 5-6 µm.

Habitat in foliis vivis *Oroxyli indici* Vent. (Bignoniaceae), ad Garia, 24-Parganas, Bengal occidentalis, India, leg. B.K. Das, 26 XII 1979, No. PCC 4091 (IMI 256518) (Herb. LAM Yen #10594, holotypus).

Leaf spot indistinct, only some brownish angular discolored small areas without definite margin, slightly vein-limited, more visible on upper surface, scattered, 2-5 mm in diameter, sometimes confluent. Caespituli hypophyllous, effuse, gray, visible on lower surface of the leaf spot. Mycelium internal: hyphae pale olivaceous, smooth, branched, septate, 2-5 µm wide. Stromata absent. Conidiophores 2-8 in fascicles emerging through the stomata, brown-

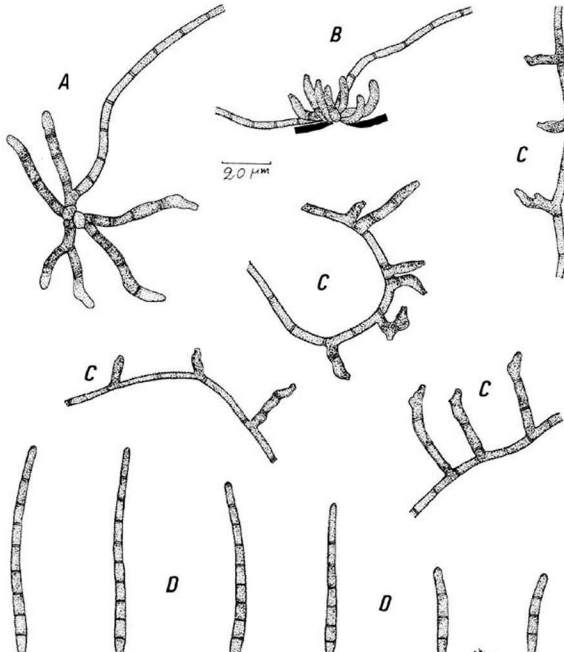

Fig. 9. Stenella garugae: A, Fascicle of conidiophores; B, Young conidiophores and formation of secondary mycelial hyphae; C, Secondary conidiophores; D, Conidia.

olivaceous and paler towards the tip, generally simple, occasionally branched, smooth with rather thick wall, almost flexuous, 2-13 septate, slightly multigeniculate, apex rounded or shouldered and attenuate, conidial scars sometimes visible, 80-260 x 6-7 µm. Conidia obclavate, pale olivaceous, slightly curved, finely verruculose, 3-6 septate, not constricted, apex subconic, base obconic-truncate, 40-105 x 5-6 µm.

On *Oroxylum indicum* Vent. (Bignoniaceae), in Garia, 24-Parganas, West Bengal, India, leg. B.K. Das, 26 XII 1979, No. PCC 4091 (IMI 256518) (Herb. LAM Yen #10594).

12. Stenella xeromphigena Yen, Kar & Das, sp. nov. (Fig. 11)

Maculis distinctis, plerumque orbicularis, in epiphyllo albogriseis, in hypophyllo pallide brunneis, autem margine linearis subelevatis, dispersis, 3-14 mm diam., interdum confluentis. Caespitulis amphiphyllis, autem principaliter epiphyllis, in superiore superficie obscure punctiformis. Mycelium primarium immersum: hyphis olivaceis, frequentissime subter cuticulis repentis, septatis, ramosis, 2.5-3 µm latis. Stromatibus subter cuticulis positis, atrobrunneis, globosis vel subglobosis, 30-55 µm diam. Conidiophoris primariis 12-42 in fasciculo per scissuris cuticulis emergentis, olivaceis, concoloris, laevis, simplicibus, erectis, cylindraceis, 1-3 septatis, non geniculatis, ad apicem irregulariter rotundatis vel attenuatis, cum cicatricibus conidialis atrobrunneis ornatis, 14-65 x 3-4 µm. Mycelium secundarium superficiale: hyphis olivaceis vel pallide olivaceis, hypophyllis, ex stomatibus oriundis, repentis vel arcuatis, subtiliter verruculosis, septatis, ramosis, 2.5-3.5 µm latis, conidiophoris secundariis lateraliter gerentis. Conidiis cylindraceis vel vermiformis, olivaceis, rectis vel leniter curvatis, interdum undulatis, solitariis vel catenatis, utrimque rotundatis, interdum utrimque cicatricibus atrobrunneis ornatis, plerumque cellulis basali in hilum cicatricibus atrobrunneis ornatis, 20-156 x 3-4 µm.

Habitat in foliis vivis *Xeromphidia uliginosae* (Rubiaceae), ad Sylva Raiganj, Dinajpur occidentalis, Bengal occidentalis, India, leg. B.K. Das, 25 III 1980, No. PCC 4286 (IMI 250390) (Herb. LAM Yen #10593, holotypus).

Leaf spot distinct, generally orbicular, gray-whitish on upper surface, pale brownish on lower surface, but with a linear raised margin on both surfaces, scattered, 3-14 mm in diameter, sometimes confluent. Caespituli amphiphyllous, but chiefly epiphyllous, visible as small dark punctiform on upper surface of the leaf spot. Primary mycelium internal: hyphae olivaceous, often under the cuticle, septate, branched, 2.5-3.5 µm wide. Stromata well developed, generally situated between the cuticle and the epidermal cells, dark-brown, globular or subglobular, 30-55 µm in diameter. Primary conidiophores 12-42 in fascicles emerging through the rupture of cuticle, olivaceous and concolorous, simple, cylindric and straight, 1-3 septate, apex irregularly rounded or attenuate-truncate and decorated with dark-brown conidial scars, 14-65 x 3-4 µm. Secondary mycelium superficial: hyphae olivaceous or pale olivaceous, hypophyllous, abundant, arising from the stomata, repent or arcuate, finely verruculose, branched, septate, 2.5-3.5 µm wide,

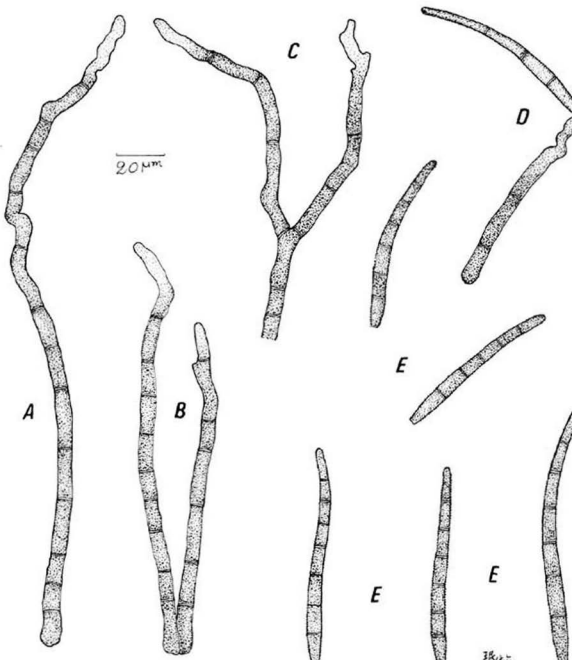

Fig. 10. Stenella oroxylicola:A, Old conidiophores; B, Young conidiophores; C, Branched conidiophores; D, Formation of conidia; E, Conidia.

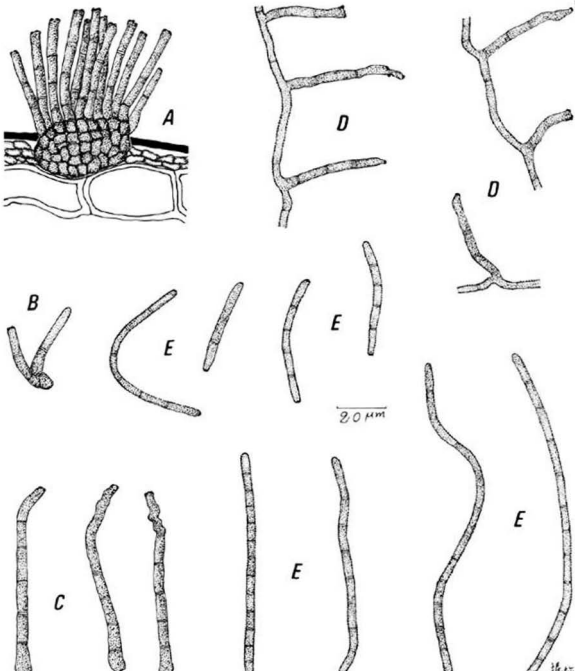

Fig. 11. Stenella xeromphigena: A, Conidiophores and stromata; B, Young conidiophores; C, Old conidiophores; D, Secondary conidiophores; E, Conidia.

bearing secondary conidiophores as lateral branches. Conidia cylindric or narrowly vermiform, olivaceous, straight or curved and undulated, finely verruculose, 1-14 septate, not constricted, solitary or catenate, rounded on both ends, generally decorated with a dark-brown cicatrice on the hilum, but sometimes both ends decorated by two dark-brown cicatrices, 20-156 x 3-4 µm.

On leaves of *Xeromphis uliginosa* (Rubiaceae), in Raigani Forest, West Dinajpur, West Bengal, India, leg. B.K. Das, 25 III 1980, No. PCC 4286 (IMI 250390) (Herb. LAM Yen #10593).

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STUDIES ON HYPHOMYCETES FROM WEST BENGAL, INDIA, III. CERCOSPORA AND ALLIED GENERA OF WEST BENGAL, 3

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ABSTRACT

The third of a series of studies on Hyphomycetes from West Bengal, India, includes descriptions and illustrations of six new species of Indian Cercosporae: *Cercoseptoria caesalpiniae* sp. nov., on *Caesalpinia digyna*; *C. cedrelae* sp. nov., on *Cedrela toona*; *Phaeoisariopeis caesalpiniae* sp. nov., on *Caesalpinia bonducella*; *Pseudocercospora meliicola* sp. nov., on *Melia azedarach*; *Stenella cedrelae* sp. nov., on *Cedrela toona*; and *Stenella cynanchi* sp. nov., on *Cynanchum callitata*.

1. Cercoseptoria caesalpiniae Yen, Kar & Das, sp. nov. (Fig. 1)

Maculis indistinctis. Caespitulis districte hypophyllis, invisibilis. Mycelium immersum: hyphis pallidissime olivaceis vel subhyalinis, laevis, septatis, ramosis, 2.5-5 µm latis, interdum usque ad 7 µm latis, substomatalis. Stromatibus nullis vel valde inchoatis. Conidiophoris hypophyllis, 2-15 in fasciculo per stomatibus emergentis, pallide olivaceis, concoloris, simplicibus vel ramosis, erectis vel leniter flexuosis, 1-6 septatis, 0-1 geniculatis, ad apicem rotundatis, cicatricibus conidialis invisibilis, 30-60 x 4-5 µm. Conidiis cylindraceis, pallide olivaceis, rectis vel leniter curvatis, plerumque 3 septatis, interdum 5 vel 7 septatis, laevis, non constrictis, apice rotundatis, basi truncatis, 35-85 x 3-3.5 µm.

Habitat in foliis vivis *Caesalpiniae digynae* Rottb. (Leguminosae), ad Aranghata, Nadia, Bengal occidentalis, India, leg. B.K. Das, 29 XII 1979, No. PCC 3708 (IMI 237401) (Herb. LAM Yen #10610, holotypus).

Leaf spot indistinct or none. Caespituli strictly hypophyllous, invisible even under the hand lens. Mycelium internal: hyphae very pale olivaceous or subhyaline, smooth, branched, septate, 2.5-5 µm wide, up to 7 µm for that situated beneath the stomata. Stromata lacking or very rudimentary. Conidiophores hypophyllous, 2-15 in fascicles

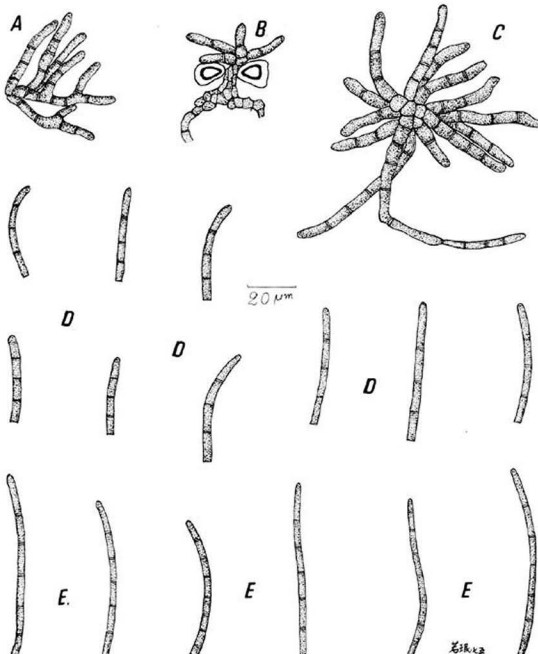

Fig. 1. Cercoseptoria caesalpiniae: A, Branched conidiophores; B, Young conidiophores and rudimentary stromata; C, Formation of conidia; D, 3 septate conidia; E, 5-7 septate conidia.

emerging through the stomata, pale olivaceous, concolorous, simple or branched, straight or slightly flexuous, 1-6 septate, 0-1 geniculate, smooth, apex rounded or attenuate and sometimes slightly swollen, conidial scars indistinct, 30-60 x 4-5 µm. Conidia cylindric, pale olivaceous, straight or slightly curved, generally 3 septate (sometimes 5 or 7 septate), smooth, not constricted, apex rounded, base truncate, 35-85 x 3-3.5 µm.

On living leaves of *Caesalpinia digyna* Rottb. (Leguminosae), in Aranghata, Nadia, West Bengal, India, leg. B.K. Das, 29 XII 1979, No. PCC 3708 (IMI 237401) (Herb. LAM Yen #10610).

2. Cercoseptoria cedrelae Yen, Kar & Das, sp. nov. (Fig. 2)

Maculis angularis vel irregularis, saepe nervuli limitalis, cum margine aliquantum distinctis, primo lucido-brunneis, dein in epiphyllo albo-griseis et in hypophyllo obscure brunneis, dispersis, interdum confluentis, 1-8 mm diam. Caespitulis amphigenis, autem principaliter hypophyllis, atro-punctiformis. Mycelium primarium immersum: hyphis pallidissime olivaceis, laevis, septatis, ramosis, 2-2.5 µm latis. Stromatibus atro-brunneis, globosis vel subglobosis, saepe intra cellulis epidermicis, 20-30 µm diam. Conidiophoris 5-32 in fasciculo per scissuris cellulis epidermicis emergentis, pallide olivaceis vel olivaceis, concoloris, simplicibus, laevis, 0-1 septatis, 0-1 geniculatis, cicatricibus conidialis indistinctis, ad apicem irregulariter rotundatis, 14-35 x 3.5-4.5 µm. Mycelium secundarium superficiale: hyphis pallide olivaceis, ex stomatibus oriundis, laevis, septatis, ramosis, 2-3 µm latis, conidiophoris secundariis lateraliter manifestibus. Conidiis filiformis, pallidissime olivaceis, leniter curvatis, plerumque 5 septatis (raro 2 vel 6 septatis), laevis, non constrictis, apice obtusis, basi truncatis, 50-80 x 2-2.5 µm.

Habitat in foliis vivis *Cedredae toonae* Roxb. (Meliaceae), ad Raiganj, Dinajpur occidentalis, Bengal occidentalis, India, leg. B.K. Das, 7 X 1980, No. PCC 4415a (Herb. Lam Yen #10608, holotypus).

Leaf spot distinct, angular or irregular, often veinlimited, with margin rather distinct, at first brownish, becoming later to white-grayish on upper surface and dull brown on lower surface, scattered or confluent, 1-8 mm in diameter. Caespituli amphigenous, but chiefly hypophyllous, black punctiform. Primary mycelium internal: hyphae pale olivaceous, smooth, branched, septate, 2-2.5 µm wide. Stromata globular or subglobular, dark brown, often situated in the epidermal cells, 20-30 µm in diameter. Conidiophores 5-32 in fascicles emerging through the rupture of the epidermal cells, pale olivaceous to mid olivaceous, concolorous, simple, smooth, 0-1 (rarely 2) septate, 0-1 geniculate, conidial scars not visible, apex irregularly rounded (sometimes shouldered), 14-35 x 3.5-4 µm. Secondary mycelium superficial: hyphae pale olivaceous, arising from the stomata, smooth, branched, septate, 2-3 µm wide, bearing secondary conidiophores as lateral branches. Conidia very pale olivaceous, filiform, slightly curved, generally 5 septate (rarely 6 septate), smooth, not constricted, apex obtuse, base truncate, 2-2.5 µm wide and 50-80 µm long.

On living leaves of *Cedrela toona* Roxb. (Meliaceae), in

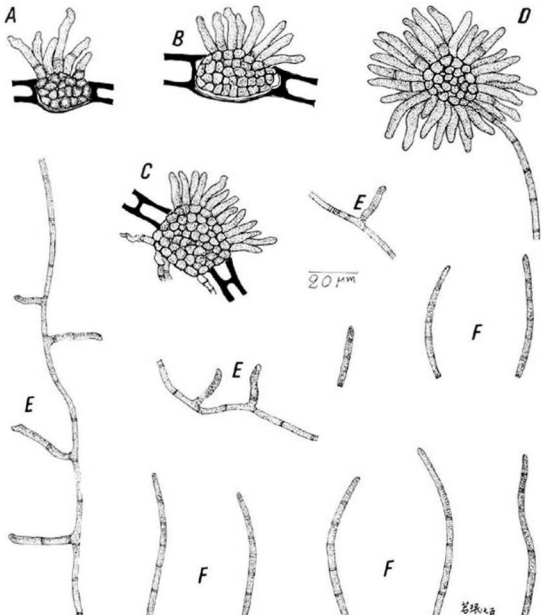

Fig. 2. Cercoseptoria cedrelae: A, Old conidiophores and stromata; B & C, Young conidiophores and stromata; D, Formation of secondary mycelial hyphae; E, Secondary conidiophores; F, Conidia.

Raiganj, West Dinajpur, West Bengal, India, leg. B.K. Das, 7 X 1980, No. PCC 4415a (Herb. LAM Yen #10608).

3. Phaeoisariopsis caesalpiniae Yen, Kar & Das, sp. nov. (Fig. 3)

Maculis orbicularis vel suborbicularis, clare brunneis, minusculis, 1-2 mm diam., dispersis, cum marginis atro-linearis et subelevatis circumtextis, raro confluentis. Caespitulis districte hypophyllis, atropunctiformis. Mycelium immersum: hyphis subhyalinis, laevis, ramosis, septatis, 2.5-3.5 µm latis. Stromatibus evolutis, irregulariter globosis, 30-45 µm diam. Conidiophoris hypophyllis, pallide brunneo-olivaceis, sursum pallidioris, laevis, 12-32 in fasciculo synnematiforme aggregatis, multi-septatis, simplicibus, plerumque erectis, ad apicem rotundatis, cicatricibus conidilis distinctis (2-2.5 µm diam.), 50-215 x 4-6 µm. Conidiis obclavatis vel obclavato-cylindraceis, pallidissime olivaceis, plerumque curvatis, raro rectis, 2-9 septatis, laevis, apice rotundatis, basi obconico-truncatis, 43-105 x 5-6.5 µm.

Habitat in foliis vivis *Caesalpiniae bonducellae* (L.) Flem. (Leguminosae), ad Palpara, Nadia, Bengal occidentalis, India, Leg. B.K. Das, 25 XI 1979, No. PCC 3706 (IMI 237382) (Herb. LAM Yen #10611, holotypus).

Leaf spot distinct, orbicular or suborbicular, bright brown, often bordered with a raised dark linear margin on both two surfaces, scattered or slightly confluent, 1-2 mm in diameter. Caespituli always hypophyllous, in dark punctiform. Mycelium internal: hyphae subhyaline, smooth, septate, branched, 2.5-3.5 µm wide. Stromata well developed, substomatal, irregularly globular, 30-45 µm in diameter. Conidiophores hypophyllous, synnematous, 12-32 in dense synnemata arising from the well developed stromata, olivaceous-brown and paler towards the tip, simple, multiseptate, generally straight, not geniculate, smooth, dark-brown conidial scars visible at the tip of young conidiophores (2-2.5 µm in diameter), apex rounded, 50-215 x 4-6 µm. Conidia obclavate or obclavate-cylindric, very pale olivaceous, generally curved, 2-9 septate, smooth, not constricted, apex rounded, base obconic-truncate, 43-105 x 5-6.5 µm.

On living leaves of *Caesalpinia bonducella* (L.) Flem. (Leguminosae), in Palpara, Nadia, West Bengal, India, leg. B.K. Das, 25 XI 1979, No. PCC 3706 (IMI 237382) (Herb. LAM Yen #10611).

4. *Pseudocercospora kashotoensis* (Yamamoto) Deighton (Fig. 4) CMI Mycological Papers, No. 140:146, 1976.
= *Cercospora kashotoensis* Yamamoto, Trans. Nat. Hist. Soc. Formosa 26:282, 1936.

Leaf spot indistinct or none. Caespituli hypophyllous, slightly effuse, forming pale olivaceous blotches on lower surface, without any boundary. Primary mycelium internal: hyphae very pale olivaceous or subhyaline, smooth, septate, branched, 2-3 µm wide. Stromata none. Conidiophores hypophyllous, 2-7 in loose fascicles emerging through the stomata, brown-olivaceous or pale brown, simple or rarely branched, straight and attenuate when young, flexuous or

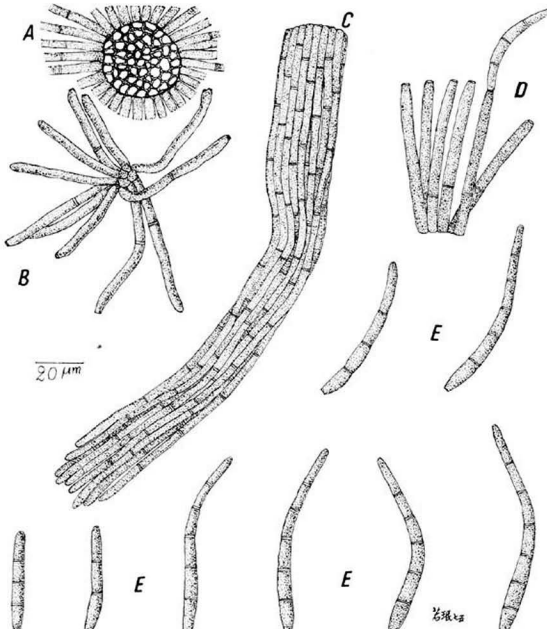

Fig. 3. Phaeoisariopsis caesalpiniae: A, Stromata; B, Young conidiophores: C, Synnemata(caespitose conidiophores); D, Formation of conidia; E, Conidia.

sinuous when old, 1-4 septate, 0-2 geniculate, sometimes forming pseudo-annellations, apex rounded or shouldered, conidial scars scarcely visible but sometimes visible on the shoulders or at the end of short denticles (1.5-2 µm in diameter), 25-75 x 4-6 µm. Secondary mycelium superficial: hyphae pale olivaceous, arising from the stomata, smooth, septate, branched, 2-3 µm wide, bearing secondary conidiophores as lateral branches. Conidia cylindric or obclavate-cylindric, very pale olivaceous, straight or slightly curved, 1-7 septate, apex subacute to subrounded, base attentuate-truncate or obconic-truncate, 25-105 x 3-4.5 µm.

On living leaves of *Clerodendron inerme* (L.) Gaertn. (Verbenaceae), in Andul, Howrah, West Bengal, India, leg. B.K. Das, 20 XII 1979, No. PCC 4082 (IMI 254413) (Herb. LAM Yen #10604).

Note: The *Pseudocercospora clerodendri* (Miyake) Deighton differs from this fungus by its distinct suborbicular to angular leaf spot and especially by its fruiting amphiphyllous or almost epiphyllous.

Distribution: Taiwan (China) and West Bengal (India).

5. Pseudocercospora meliicola Yen, Kar & Das, sp. nov. (Fig. 5)

Maculis distinctis, in epiphyllo plus visibilis, angularis vel irregularis, per nervuli limitatis, in inferiore superficie lucido-brunneis, in superiore superficie albo-brunneis, dispersis vel leniter confluentis, plerumque 1-4 mm diam., interdum usque ad 8 x 4 mm. Caespitulis amphigenis, autem principaliter epiphyllis. Mycelium primarium immersum: hyphis pallide olivaceis, laevis, ramosis, septatis, 2-3 µm latis. Stromatibus atrobrunneis, subglobosis, 25-35 µm diam. Conidiophoris amphiphyllis, numerosis in fasciculo per stomatibus emergentis, pallide brunneo-olivaceis, concoloris, plerumque simplicibus, interdum ramosis, flexuosis, 0-3 septatis, 0-2 geniculatis, laevis, ad apicem rotundatis vel attenuatis, cicatricibus conidialis indistinctis, 15-45 (-50) x 3-4.5 µm. Mycelium secundarium superficiale: hyphis pallide olivaceis, cum conidiophoris primariis commixa in fasciculo per stomatibus emergentis, septatis, ramosis, laevis, 2-3.5 µm latis, conidiophoris secundariis lateraliter gerentis. Conidiis obclavato-cylindraceis, pallide olivaceis, plerumque leniter curvatis, 3-8 (-11) septatis, apice rotundatis vel subobtusis, basi attenuatis vel obconico-truncatis, 28-92 (-120) x 3-4 µm.

Habitat in foliis vivis *Meliae azedarach* L. (Meliaceae), ad Mallickpur, 24-Parganas, Bengal occidentalis, India, leg. B.K. Das, 4 IX 1980, No. PCC 4352 (Herb. LAM Yen #10609, holotypus).

Leaf spot distinct, much more visible on upper surface, angular or irregular, vein-limited, brown-whitish on upper surface and bright brown on lower surface, scattered or slightly confluent, 1-4 mm in diameter, sometimes up to 8 x 4 mm. Caespituli amphigenous, but chiefly epiphyllous. Primary mycelium internal: hyphae pale olivaceous, smooth, branched, septate, 2-3 µm wide. Stromata dark-brown, subglobular, 25-35 µm in diameter. Conidiophores numerous in fascicles emerging through the stomata, pale brown-olivaceous, concolorous, generally simple, sometimes branched, flexuous, 0-3 septate, 0-2 geniculate, smooth, apex rounded or attenuate,

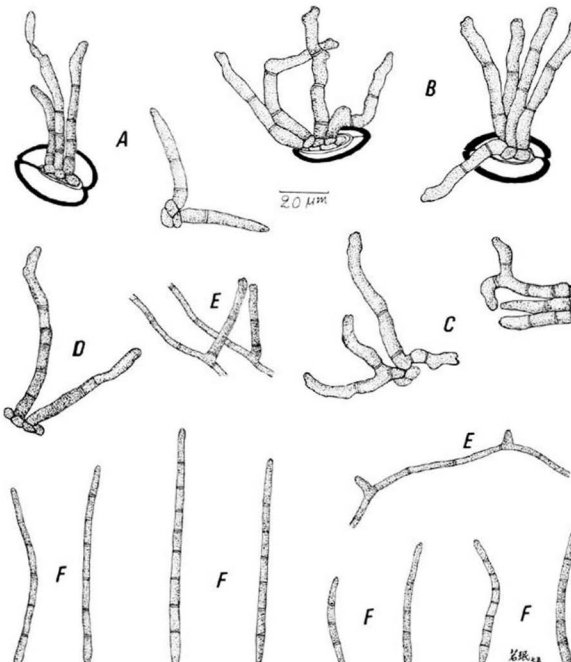

Fig. 4. Pseudocercospora kashotoensis: A, Young conidiophores and formation of conidia; B, Old conidiophores; C, Branched conidiophores; D, Pseudo-annellations; E, Secondary conidiophores; F, Conidia.

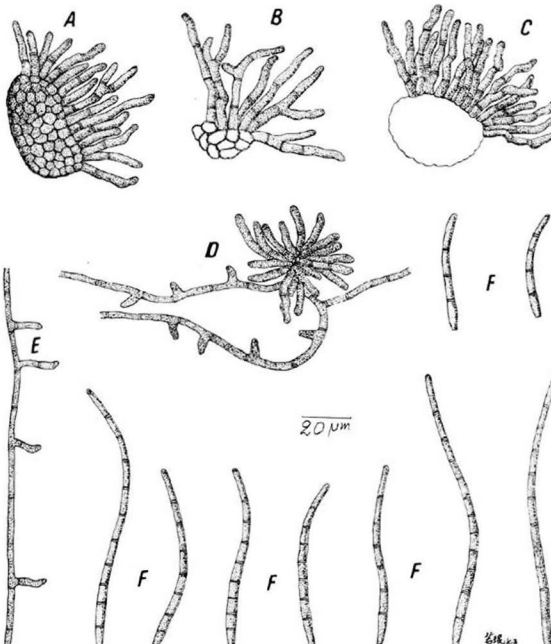

Fig. 5. Pseudocercospora meliicola: A, Stromata and young conidiophores; B, Branched conidiophores; C, Old conidiophores; D, Formation of secondary mycelial hyphae; E, Secondary conidiophores; F, Conidia.

condial scars indistinct, 15-45 (-50) x 3-4.5 µm. Secondary mycelium superficial: hyphae pale olivaceous, arising from the stomata and mixed with the primary conidiophores, septate, branched, smooth, 2-3.5 µm wide, bearing secondary conidiophores as lateral branches. Conidia obclavate-cylindric, pale olivaceous, generally slightly curved, 3-8 (-11) septate, apex rounded or subobtuse, base attenuate or obconically truncate, 28-92 (-120) x 3-4 µm.

On living leaves of *Melia azedarach* L. (Meliaceae), in Mallickpur, 24-Parganas, West Bengal, India, leg. B.K. Das, 4 IX 1980, No. PCC 4352 (Herb. LAM Yen #10609).

Note: The *Pseudocercospora subsessilis* (H. & P. Sydow) Deighton differs from this fungus by its circular and not vein-limited leaf spot, by its hypophyllous caespituli and especially by its conidiophores not septate, not branched and not geniculate.

6. *Pseudocercospora phyllanthi-niruri* (Yen) Yen (Fig. 6, D & E) Gardens' Bulletin Singapore 33:181, 1980.
= *Cercospora phyllanthi-niruri* Yen, Revue de Mycologie 32: 192, 1967.
Syn. *Cercospora phyllanthicola* Yen, REvue de Mycologie 30: 186, 1965.
non *Cercospora phyllanthicola* Shakil & Kamal, Indian Phytopathology 15:296, 1962.

Leaf spot indistinct or none. Caespituli always hypophyllous, effuse, velutinous, olivaceous-gray, often extending and covering the whole lower surface of the leaf. Mycelium internal: hyphae pale olivaceous, smooth, septate, branched, 2.5-4 µm wide. Stromata lacking. Conidiophores 2-8 in fascicles emerging through the stomata, pale to mid brown-olivaceous, simple and straight when young, flexuous and branched when old, 1-7 septate, 0-2 geniculate, conidial scars rarely visible, apex rounded, 18-110 x 4-6 µm. Conidia obclavate-cylindric but always crescent-shaped, pale olivaceous, 3 septate, apex rounded, base attenuate and obconically truncate, 32-50 x 4.5-6 µm.

On living leaves of *Phyllanthus niruri* L. (Euphorbiaceae), in Simurali, Nadia, West Bengal, India, leg. B.K. Das, 4 XII 1980, No. PCC 4465 (IMI 254415) (Herb. LAM Yen #10606).

Note: This fungus differs from other species on *Phyllanthus* by its conidia always 3 septate and 4.5-6 µm wide.

Distribution: Singapore and India.

7. *Pseudocercospora trematicola* (Yen) Deighton (Fig. 6, A-C) CMI Mycological Papers 140:154, 1976.
= *Cercospora trematicola* Yen, Bull. Soc. Mycol. Fr. 86: 752, 1970.

Leaf spot indistinct or none. Caespituli generally hypophyllous, effuse, velutinous, forming angular and vein-limited areas, small, dark-gray, scattered, 1-1.5 mm in diameter, sometimes confluent. Mycelium internal: hyphae olivaceous, smooth, septate, branched, 3-5.5 µm wide. Stromata none. Conidiophores 2-15 in fascicles emerging through the stomata, pale olivaceous to mid olivaceous, simple or branched, flexuous or undulated, 3-10 septate, smooth, not geniculate, apex rounded or attenuate, conidial scars indistinct,

30-135 x 4.5-6 µm. Secondary mycelium superficial: hyphae pale olivaceous, arising from the base of the fascicles of primary conidiophores, septate, branched, smooth, 2-3.5 µm wide, bearing numerous secondary conidiophores as lateral branches. Conidia cylindric, pale olivaceous, generally straight, sometimes slightly curved, 3-10 septate, apex rounded, base obconically truncate, 30-130 x 4.5-6 µm.

On living leaves of *Trema orientalis* Bl. (Ulmaceae), in Simurali, Nadia, West Bengal, India, leg. B.K. Das, 4 XII 1980, No. PCC 4464 (IMI 254414) (Herb. LAM Yen #10612).

Distribution: Singapore, Taiwan (China) and India.

8. *Pseudocercospora triumfettae* (H. Sydow) Deighton
CMI Mycological Papers 140:122, 1976.
=*Cercospora triumfettae* H. Sydow, Ann. Mycol. 28:218, 1930.

On living leaves of *Triumfetta rhomboidea* L. (Tiliaceae), in Hemtabad Forest, West Dinajpur, West Bengal, India, leg. B.K. Das, 7 X 1980, No. PCC 4403 (IMI 254403) (Herb. LAM Yen #10605).

Note: We have sent the materials of this fungus to Commonwealth Mycological Institute, Kew, England, and it is identified as *Pseudocercospora triumfettae* (H. Sydow) Deighton. Deighton (1976) has well described and illustrated all the characters of this species.

Distribution: Venezuela, Brazil, Bermuda, Cuba, Rep. Dominica, and India.

9. Stenella cedrelae Yen, Kar & Das, sp. nov. (Fig. 7)

Maculis distinctis, angularis vel irregularis, denique in hypophyllo obscure brunneis, in epiphyllo albo-griseis, dispersis, 1-8 mm diam., interdum confluentis. Caespitulis amphigenis, autem principaliter hypophyllis, atro-punctiformis. Mycelium primarium immersum: hyphis pallide olivaceis, laevis, septatis, ramosis, 2-3 µm latis. Stromatibus nullis. Conidiophoris 2-25 in fasciculo per stomatibus emergentis, simplicibus vel ramosis, pallide olivaceis, concoloris, laevis, flexuosis, 1-3 septatis, 0-2 geniculatis, ad apicem irregulariter rotundatis, cicatricibus conidialis invisibilis, 22-50 x 4-5 µm. Mycelium secundarium superficiale: hyphis pallide olivaceis, subtiliter verruculosis, ex stomatibus oriundis, ramosis, septatis, 2-3.5 µm latis, conidiophoris secundariis lateraliter gerentis. Conidiis obclavatis vel obclavato-cylindraceis, plerumque leniter curvatis, subtiliter verruculosis, non constrictis, 5-15 septatis, apice obtusis vel subrotundatis, basi obconico-truncatis, 42-160 x 3-4.5 µm.

Habitat in foliis vivis *Cedrelae toonae* Roxb. (Meliaceae), ad Raiganj, Dinajpur occidentalis, Bengal occidentalis, India, leg. B.K. Das, 7 X 1980, No. PCC 4415 (Herb. LAM Yen #10608, holotypus).

Leaf spot distinct, angular or irregular, often veinlimited, margin rather distinct, at first small and bright brown, then becoming dull brown on lower surface and whitish gray on upper surface, scattered, sometimes confluent, 1-8 mm in diameter. Caespituli amphigenous, but chiefly hypophyllous, in black punctiform. Primary mycelium internal: hyphae pale olivaceous, branched, septate, smooth, 2-3 µm wide. Stromata none. Primary conidiophores 2-25 in fascicl

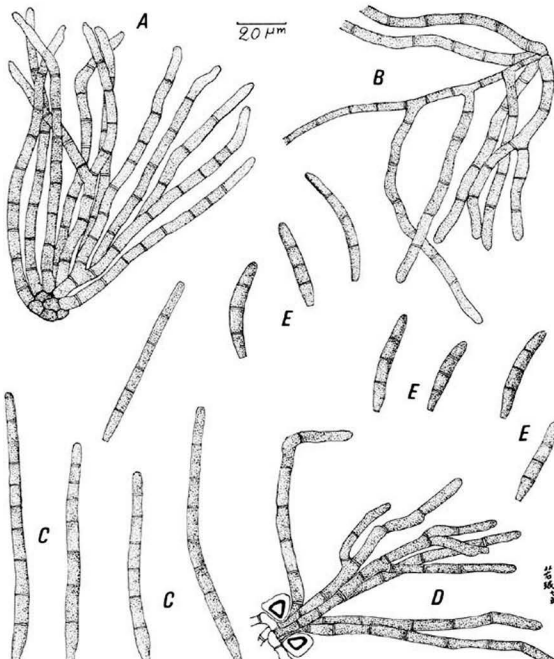

Fig. 6. Pseudocercospora phyllanthi-niruri(D & E): D, Conidiophores; E, Conidia. ---- Pseudocercospora trematicola(A-C): A, Conidiophores; B, Secondary mycelial hyphae and secondary conidiophores; C, Conidia.

emerging through the stomata, pale olivaceous, concolorous, simple or branched, smooth, flexuous, 1-3 septate, 0-2 geniculate, apex irregularly rounded or shouldered, conidial scars not visible, 22-50 x 4-5 µm. Secondary mycelium superficial: hyphae pale olivaceous, finely verruculose, arising from the stomata, branched, septate, 2-3.5 µm wide, bearing abundant secondary conidiophores as lateral branches. Conidia obclavate to obclavate-cylindric, generally slightly curved, finely verruculose, not constricted, 5-14 septate, apex obtuse or subrounded, base obconic-truncate, 42-160 x 3-4.5 µm.

On living leaves of *Cedrela toona* Roxb. (Meliaceae), in Raiganj, West Dinajpur, West Bengal, India, leg. B.K. Das, 7 X 1980, No. PCC 4415 (Herb. LAM Yen #10608).

10. Stenella cynanchi Yen, Kar & Das, sp. nov. (Fig. 8)

Maculis indistinctis. Caespitulis hypophyllis, effusis, velutinis, griseo-olivaceis, in inferiore superficie saepe fere totam folii paginam omnino obtengentis. Mycelium primarium immersum: hyphis olivaceis, subtiliter verruculosis, ramosis, septatis, 2-4 µm latis. Stromatibus nullis. Conidiophoris semper ex mycelium secundarium oriundis, simplicibus, pallide brunneo-olivaceis vel obscure brunneo-olivaceis, inferne plerumque erectis et superne leniter flexuosis vel denticulatis, 1-7 septatis, non geniculatis, laevis, apex attenuatis vel denticulatis et cicatricibus conidialis atro-brunneis decoratis, 15-135 x 3-3.5 µm. Mycelium secundarium superficiale: hyphis pallide olivaceis vel medio-olivaceis, ex stomatibus oriundis, acute verruculosis vel echinulatis, septatis, ramosis, 1.5-2 µm latis, conidiophoris secundariis numerosis lateraliter manifestibus. Conidiis cylindraceis vel fusiformis, pallide olivaceis, solitariis vel catenulatis, rectis, subtiliter verruculosis, 0-1 septatis, apice rotundatis, basi semitruncatis et cicatricibus conidialis atro-brunneis decoratis, interdum utrimque cicatricibus atro-brunneis ornatis, 7-23 x 2.5-3.5 µm.

Habitat in foliis vivis *Cynanchi calliatatae* Ham. (Asclepiadaceae), ad Sylva Joyanti, Alipurduar, Jalpaiguri, Bengal occidentalis, India, leg. B.K. Das, 21 X 1980, No. PCC 4424 (Herb. LAM Yen #10613, holotypus).

Leaf spot indistinct or none. Caespituli hypophyllous, effuse, velutinous, gray olivaceous, extending and covering the whole lower surface of the leaf. Primary mycelium internal: hyphae olivaceous, finely verruculose, branched, septate, 2-4 µm wide. Stromata lacking. Conidiophores always arising from the secondary mycelial hyphae as lateral branches, solitary, simple, pale brown-olivaceous to dark brown-olivaceous, generally straight below and slightly flexuous and denticulate above, 1-7 septate, not geniculate, smooth, apex attenuate or denticulate and decorated with numerous dark-brown conidial scars, 15-135 x 3-3.5 µm. Secondary mycelium superficial: hyphae pale olivaceous to mid olivaceous, arising from the stomata, branched, septate, sharply verruculose or echinulate, 1.5-2 µm wide, bearing numerous secondary conidiophores as lateral branches. Conidia cylindric or fusiform, pale olivaceous, solitary or catenate, straight, finely verruculose, 0-1 septate, apex rounded, base semitruncate and decorated with a dark-brown

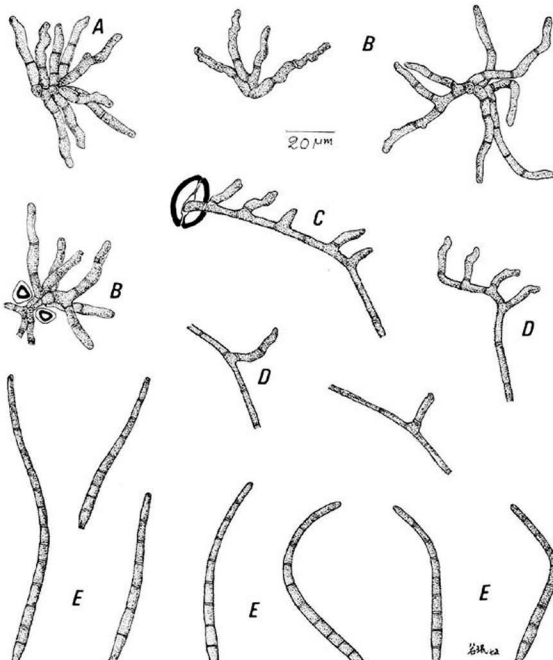

Fig. 7. Stenella cedrelae: A, Young conidiophores; B, Old and branched conidiophores; C, Secondary mycelial hyphae and secondary conidiophores; D, Secondary conidiophores; E, Conidia.

conidial scar, sometimes both two ends decorated with dark-brown conidial scars, 7-23 x 2.5-3.5 µm.

On living leaves of *Cynanchum callitata* Ham. (Asclepiadaceae), in Joyanti Forest, Alipurduar, Jalpaiguri, West Bengal, India, Leg. B.K. Das, 21 X 1980, No. PCC 4424 (Herb. LAM Yen #10613).

ACKNOWLEDGEMENTS

We are grateful to Dr. F. C. Deighton and the Director of the Commonwealth Mycological Institute, Kew, England, for the help given in the determination of critical specimens. We are much indebted to Dr. Richard P. Korf, Professor of Mycology, Cornell University and Dr. Don R. Reynolds, Curator of Botany, Los Angeles County Natural History Museum, for reviewing the manuscript.

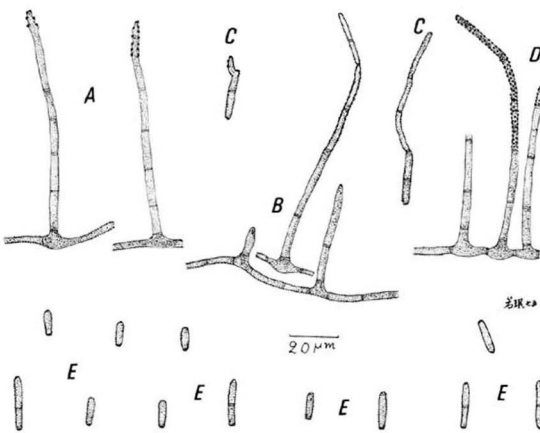

Fig. 8. Stenella cynanchi: A, Old conidiophores; B, Young conidiophores and formation of conidia; C, Germination of conidia; D, Above part of old conidiophores; E, Conidia.

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MYCOTAXON

Vol. XVI, No. 1, pp. 96-98 October-December 1982

STUDIES ON PARASITIC FUNGI FROM SOUTH EAST ASIA, 45. PARASITIC FUNGI FROM MALAYSIA, 22.

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Abstract

A new species, Stenella bougainvilleae Yen & Lim is described and illustrated from type material on its host, Bougainvillea spectabilis Willd., collected in Singapore. A new combination, Cercoseptoria cordiicola Yen) Yen, is mentioned.

Stenella bougainvilleae Yen & Lim, sp. nov.

Maculis distinctis, brunneis, orbicularis vel irregulariter orbicularis, margine atro-brunneis circumtextibus, dispersis, 1-7mm diam. saepe confluentibus. Caespitulis hypophyllis, invisibilis. Mycelium primarium immersum: hyphae pallidissime brunneo-olivaceis, septatis, ramosis, 1.5-2.5µm latis. Stromatibus non evolutis. Conidiophoris primariis hypophyllis, 2-8 in fasciculo per stomatibus emergentis, simplicibus, raro ramosis, inferne erectis, antice attenuatis et denticulatis, pallide brunneo-olivaceis, sursum pallidioribus, 3-8 septatis, 0-3 geniculatis, apicibus angustioribus et cicatricibus sporarum atro-brunneis ornatis, 30-90 x 3-4µm. Mycelium secundarium superficiale: hyphis cum conidiophoris primariis commixa in fasiculo per stomatibus emergentis, pallide olivaceis, repentis, septatis, ramosis, subtiliter verruculosis, 2-3µm latis, conidiophoris secundaris lateraliter gerentis. Conidiis cylindriaceis vel subcylindraceis, pallide brunneo-olivaceis, minutissime verruculosis, rectis vel leniter curvatis, plerumque 3-6 septatis (raro 1-2 septatis), non constrictis, ad apicem rotundatis, inferne lenitissime attenuatis, cellula basali in hilum semitruncatum et atrobrunneum, 20-65 x 2.5 - 4µm. Habitat in foliis vivis Bougainvilleae spectabilis (Nyctaginaceae). G. Lim, IV 1980, No. SU 95 (Herb. LAM, YEN #10586), typus.

Leaf spot distinct, brown, orbicular or irregularly orbicular, surrounded by a definite dark brown margin,

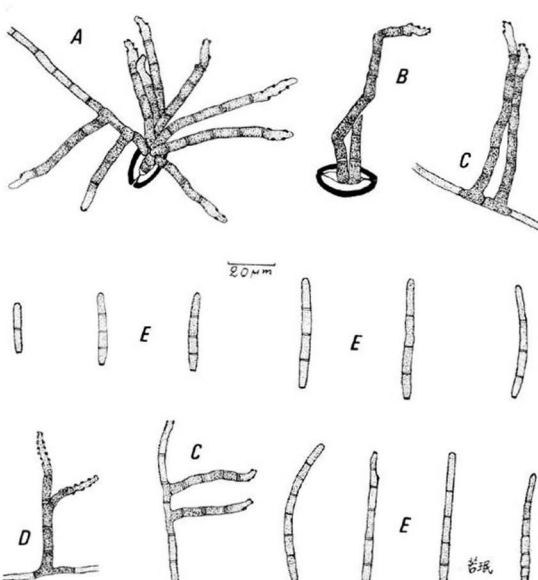

Fig. A-E, Stenella bougainvilleae Yen & Lim. A, Fascicle of conidiophores and formation of external hyphae; B, Geniculate conidiophore; C, External hyphae and formation of secondary conidiophores; D, Branched conidiophore; E, Conidia.

scattered, 1-7mm in diameter, often confluent on the terminal part of the leaf. Caespituli hypophyllous, invisible even under the hand lens. Primary mycelium internal: hyphae almost colorless, septate, branched, 1.5-2.5µm wide. Stomata not developed. Primary conidiophores hypophyllous, 2-8 in fascicles emerging through the stromata, simple or occasionally branched, erect below, attenuate and denticulate above, pale brown olivaceous and paler towards the tip, 3-8 septate, 0-3 geniculate, apex attenuate and decorate with small dark brown conidial cicatrices, 30-90 x 3-4µm. Secondary mycelium external: hyphae arising at the base of primary conidiophores and emerging through the stomata, pale olivaceous, repent, septate, branched, finely verruculose, 2-3µm wide, bearing laterally the secondary conidiophores, which are simimar in respect to the primary conidiophores. Conidia pale olivaceous, cylindric or subcylindric, finely verruculose, straight or slightly curved, generally 3-6 septate (rarely 1 or 2 septate), apex rounded, base attenuate-subtruncate and decorated with dark-brown conidial cicatrice generally not constrict, 20-65 x 2.5-4µm.

On Bougainvillea spectabilis Willd. (Nyctaginaceae), in Holland Road, Singapore, G. Lim, April 1980, No. SU 95 (Herb. LAM, Yen #10586).

Rao (1962) has described in India a Cercospora bougainvilleae P. N. Rao, parasiting also on Bougainvillea spectabilis; but it differs from ours by its hyaline conidia. On the other hand, Sobers and Seymour (1969) have described a Cercosporidium bougainvilleae (Munt.) Sob. & Seym. which differs from our fungus in having very dense fascicles and well developed stromata.

Cercoseptoria Cordiicola (Yen) Yen, comb. nov.
=Pseudocercospora cordiicola (Yen) Yen, Gard. Bull. Singapore 33:173, 1980.
=Cercospora Cordiicola (Yen) Yen, Rev. de Mycol. 32: 182, 1967.
=Cercospora cordae Yen, Rev de Mycol. 29: 216, 1964. non Cercospora cordae Chupp, Mongr. Univ. P. R. Ser. B, 2: 245, 1934.

On Cordia cylindristachya (Boraginaceae), in Singapore.

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PHYTOPHTHORA OPERCULATA SP. NOV., A NEW MARINE FUNGUS

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In 1980 a species of *Phytophthora* resembling *P. vesicula* Anastasiou & Churchland was reported to be associated with trunk cankers and decayed absorbing rootlets of declining white mangrove trees (*Avicennia marina* (Forsk.) Vierh.) in the Gladstone area of central coastal Queensland (Pegg, Gillespie and Forsberg, 1980). During a study to determine the distribution of this fungus in Queensland mangrove communities, another *Phytophthora* with a unique method of zoospore release was recovered on several occasions from decayed white mangrove leaves submerged in sea water (Pegg and Forsberg, 1981). As this fungus has sporangial characters which differ from those of other *Phytophthora* species, it is described below as new.

Phytophthora operculata sp. nov. Figures 1-3

Hyphae hyalinae, ramosae, demum septatae, 8-10 µm diam. *Sporangiophora* non ramosa, sympodialia, torsiva, 6-7 µm diam. *Sporangia* subcylindrica vel anguste ellipsoidea, ad apicem late complanata, non caduca, 30-175 x 25-75 µm, obturamento septali in sporangium usque ad 13 µm protrudenti, ad apicem circumscissa. *Zoosporae* flagellis binis lateralibus, limoniformes vel fusiformes, globosae 10-12 µm diam. ubi incystatae. Reproductio sexualis ignota. Hab. in foliis putridis *Avicenniae marinae*, Moreton Bay, Queensland, 18.vi.1980, K.G. Pegg, BRIP 13362, holotypus; IMI 249911, isotypus.

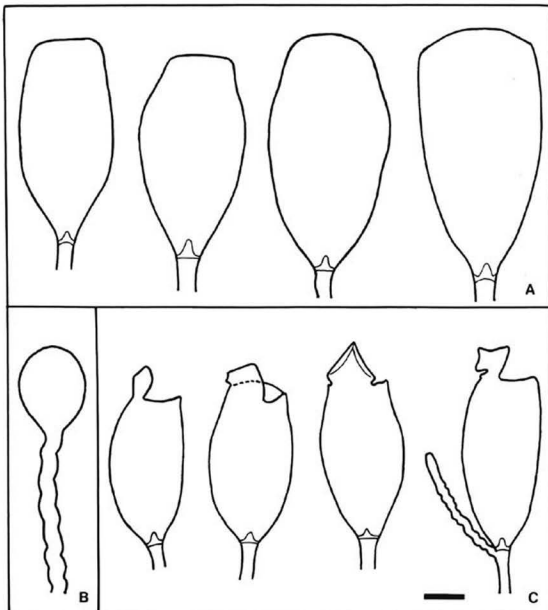

Fig. 1. Line drawings of *Phytophthora operculata* sporangia. A. Mature sporangia before zoospore release. B. Very young sporangium on spirally twisted sporangiophore. C. Sporangia after zoospore release (scale = 25 µm.

On solid media the mycelium is composed of freely branching hyphae 8-10 µm wide, non-septate when young but developing septa with age. Sporangia are produced sparingly on solid media in the absence of free water, and more abundantly when discs of V-8 juice agar or naturally-infected host tissue are immersed in autoclaved

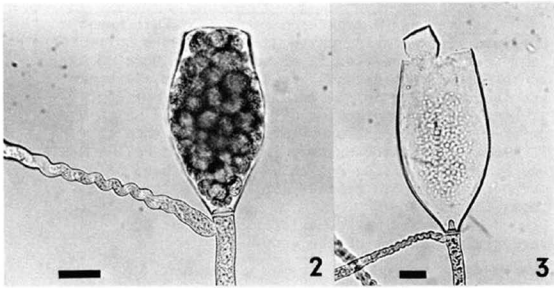

Fig. 2. Mature sporangium with differentiated zoospores, and sympodially elongating twisted sporangiophore (scale = 25 µm). Fig. 3. Sporangium after dehiscence, with prominent basal plug (scale = 25 µm).

sea water. They are borne in a lax monochasial sympodial arrangement on sporangiophores 6-7 µm diam., and which are in some parts twisted spirally (Fig. 2). Sporangia are non-deciduous, mostly narrowly ellipsoid, sometimes almost cylindrical, occasionally narrowed at the base, flat and broad at the apex, smooth-walled, 30-175 x 25-75 µm (Fig. 1). There is a conspicuous basal plug which protrudes 2.5-13 µm into the sporangium. Zoospores differentiate fully within the sporangium. A circumcissile split occurs near the sporangium apex, allowing an operculum to open and release the zoospores without formation of a vesicle. The edges of the operculum sometimes curl (Figs. 1, 3), but sporangia do not collapse after dehiscence. Radial growth on corn meal agar after 5 days at 35°C was 4-7.5 mm, with no growth at 38°C. The minimum temperature for growth was 18°C, and the optimum in the range 21-31°C.

Sexual reproduction has not been observed. Oogonia and antheridia were not produced when isolates were grown in single culture, or when six isolates of the species were paired in all combinations on 20% V-8 juice agar, carrot agar, media containing B-sitosterol (Ribeiro, 1978), or on detached white mangrove leaves incubated in autoclaved sea water.

Isolates of *Phytophthora operculata* have been obtained from decaying white mangrove leaves collected from several localities in or adjacent to Moreton Bay, south-eastern Queensland. It differs from all other species described in the genus (Ho, 1981) by the presence on the sporangium of an apical lid which opens prior to zoospore release. Other species such as *P. bahamensis* Fell & Master, *P. epistomium* Fell & Master, and *P. mycoparasitica* Fell & Master also have unique methods of zoospore release (Fell and Master, 1975). It seems that marine *Phytophthora* species are likely to produce sporangia with characteristics not seen in terrestrial members of the genus.

Cultures have been deposited as IMI 249911 and ATCC 44952.

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THECAPHORA ANDROSACINA AND ENTYLOMA GAILLARDIANUM, NEW SPECIES OF USTILAGINALES

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The types of *Thecaphora androsaces* (Karsten) Gutner and *Entyloma gaillardiae* (Speg.) Speg., proved not to be smut fungi. Consequently, it was necessary that the smuts inhabiting *Androsace* and *Gaillardia* be described as new.

THECAPHORA ANDROSACINA Vánky, sp. nov.

Typus: Androsace maxima L., Hungaria, Comit. Fejér, pr. pag. Érd, "Kutyavár", V.1874, leg. J. A. Tauscher (Herb. Ustilag. Vánky no. 10751 in UPS).

Sori multitudinem granulosam-pulveream sporarum conglobatarum formantes. Glomeruli sporarum globosi, ovoidei usque parum elongati vel forma irregulares, 16–35 x 20–45 (–52) µm e sporis 2–15(–25?) facile discedentibus compositi. Sporae rotundato-polygonales, irregulares, cuneiformes vel elongatae, 8–15 x 11–19 µm, flavidulo-hyalinae usque dilute flavidulo-brunneae, pariete 0.8–1 µm crasso, in superficie contactus levi, in parte extrorsa dense et irregulariter verrucoso.

Sori in the seeds forming pale brown, granular-powdery mass of spore balls. Spore balls (Fig. 1) globose, ovoid to slightly elongated or irregular, 16–35 x 20–45(–52) µm, composed of 2–15(–25?) easily separating spores. Spores (Fig. 1) polyangularly irregular with rounded edges, cuneiform or elongated, 8–15 x 11–19 µm in diameter, yellowish-hyaline to pale yellowish-brown, wall 0.8–1 µm thick, smooth on the contact surfaces, coarsely and irregularly verrucose on the free surface.

Type on *Androsace maxima* L., Hungary, Distr. Fejér, near the village Érd, "Kutyavár", V.1874, col. J. A. Tauscher (Herb. Ustilag. Vánky no. 10751, located in UPS).

Several smut names have been mentioned in the literature on *Androsace*, but they were either based on non fungal material or nomenclaturally incorrect. Thus, Karsten (1907: 4) described *Ustilago androsaces* in the ovaries of *Androsace ?filiformis* Retz. as "Sori fusci, pulverulenti. Sporae sphaeroideae, laeves, 35–50 µ diam.". Liro (1924: 343) examining the original specimen of Karsten found that it only contains young seeds which were mistaken by Karsten for smut spores. Lavrov (1936: 31) found a smut forming loose spore balls in the seeds of *Androsace maxima* L., considered it identical with *Ustilago androsaces* and made the combination *Sorosporium androsaces* (Karsten) Lavrov. Gutner (1941: 191) transferred this species to *Thecaphora* as *T. androsaces* (Karsten) Gutner. Săvulescu (1957: 869), though aware of Liro's finding, used the illegitimate name *Thecaphora androsaces* (Lavrov) Gutner. Another binomial for an *Androsace* smut is the herbarium name "*Thecaphora jubilei* Jacz. n. sp. ined in herb. VIZR", mentioned by Lavrov (1936: 31), which in his opinion is identical with *Sorosporium androsaces*.

ENTYLOMA GAILLARDIANUM Vánky, sp. nov.

Typus: Gaillardia aristata Pursh, (cult.) Romania, Transsylvania, Tirgu-Mureş, alt. 325 m.s.m., 9.IX.1961, leg. K. Vánky. Holotypus: Herb. Ustilag. Vánky no. 743 in UPS; isotypi in Vánky, Ust. 44 et in Herb. myc. roman. 1725 (sub Entyloma compositarum).

Sori conspicui sicut maculae dispersae vel gregariae foliorum diametro 0.1–5 mm vel confluentes majores, initio dilute flavidulo-virides deinde brunnei, saepe cum margine tenui flavidulo. Sporae globosae usque forma irregulares, magnitudine variae, 9–15 µm in diam., subhyalinae usque flavae, pariete levi, saepe bistratoso, 1–2(–4) µm crasso.

Sori in the leaves as circular, scattered or gregarious spots of 0.1–5 mm in diameter, or more by confluence, at first pale yellowish-green, later brown, often with a thin yellowish margin. Spores (Fig. 2) globose to irregular, variable in size, 9–15 µm in diameter, subhyaline to yellow, with smooth, often two-layered, 1–2(–4) µm thick wall.

Spegazzini (1925: 148) described *Entyloma gaillardiae* (Speg.) Speg., based on *Protomyces? gaillardiae* Spegazzini (1909: 284) on *Gaillardia doniana*, and characterized by spores 30–35 µm in diameter. Spegazzini (1909: 284) himself

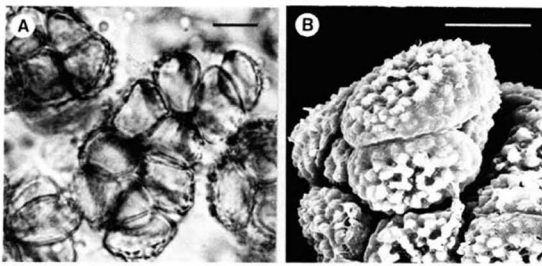

Fig. 1. Spore balls and spores of *Thecaphora androsacina* (type) seen in LM (A) and TEM (B). Bars = 10 μm.

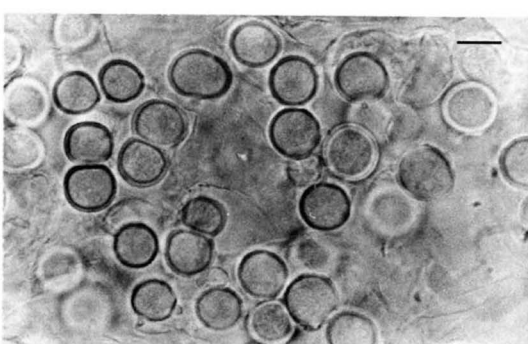

Fig. 2. Spores of *Entyloma gaillardianum* (type) in LM. Bar = 10 μm.

suspected that this fungus could represent oospores of Peronosporales. This opinion was also supported by Savile (1947: 117), Zundel (1953: 251) and Lindeberg (1959: 36). The true *Entyloma* smut on *Gaillardia* spp. was therefore referred by most of the authors to the collective species *E. compositarum* Farlow. However, by comparing *Entyloma* on *Gaillardia aristata* with *E. compositarum* (on *Aster puniceus* L., USA, Massachusetts, Wood's Holl, IX.1883, W. Trelease, in Ellis, N. Amer. fgi. 1492), I found that the first species has more irregular and somewhat larger spores, with thicker and often two-layered wall. In my opinion these are sufficiently distinct to consider the *Entyloma* on *Gaillardia* as a separate species.

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A NEW SPECIES OF ORBILIA FROM CANADA

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ABSTRACT

Orbilia piloboloides, a new species of Helotiales from the bark of *Ulmus americana*, is distinguished by its subapically swollen paraphyses which resemble the sporangiophores of *Pilobolus*. An anamorph with what appear to be sympodially produced blastoconidia is produced in culture.

Orbilia is one of the most easily recognized genera of Helotiales, yet relatively few treatments of the genus have been published (Dennis 1978, Svrček 1954, Seaver 1951) and many of its species are poorly known. Despite this, one taxon, represented by some recent Canadian collections is so markedly distinctive in having subapically swollen paraphyses and nearly fusoid spores that it is described here as a new species. All three collections are from relatively undecayed bark of *Ulmus americanus* L. and not on well-decayed, decorticated wood or herbaceous stems as is usual for *Orbilia*.

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The fungus was obtained in pure culture by placing a moistened apothecium on the lid of an inverted petri dish and allowing the ascospores to shoot upward onto the surface of 1.25% Malt agar. A characteristic anamorph was observed in culture.

ORBILIA PILOBOLOIDES Haines and Egger, *spec. nov.*

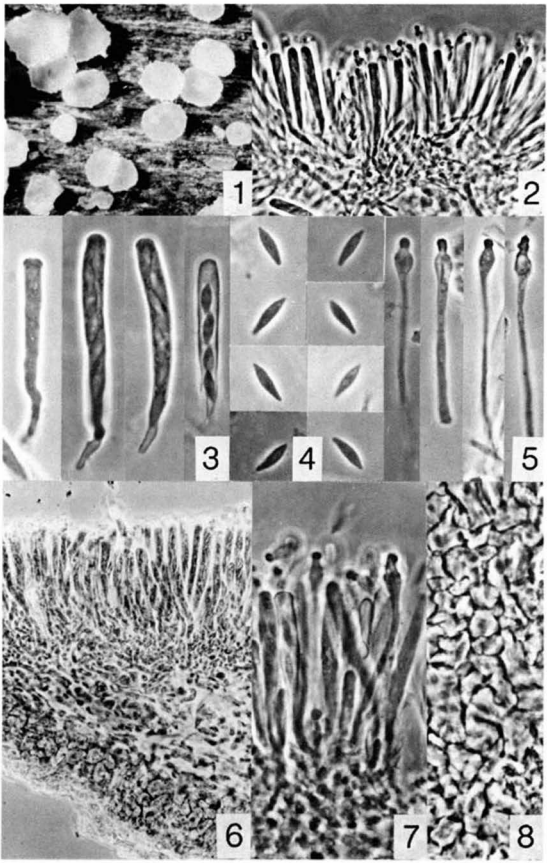
Apotheciis sessilibus ad brevi-stipitatis, aurantiluteis. Ascis (35-) 40-52 (-55) x 3-4 µm. Ascosporis 8-10 x 2.0-2.6 µm., fusiformibus ad naviculiformibus. Paraphysibus filiformibus cum bulbo apicali crassitunicato et cum gibba subapicali pyriformi tenuitunicato, 2.0-3.3 µm. diam.

Coloniis lentis crescentibus, hyalinis ad aurantis, rugulosis, semimucosis. Myceliis hyphoideis vel moniliformibus, ramosis, laevibus, hyalinis. Conidiophoris sympodialibus, 5-12 (-20) x 1.5-3 µm. Sympodulosporis laevibus, hyalinis, curvis, 1-septatis, 9-12 x 2-3 µm.

Holotype: DAOM 176753. Cinna' Farm, St. Elizabeth Road, Cantley, Gatineau Co., Quebec, Canada, April 22, 1980, J. H. Cinna. (100+ apothecia on 1 piece of substrate, 1 dried culture of anamorph, living culture in DAOM culture collection).

TELEOMORPH: Apothecia (Fig. 1) scattered to gregarious on relatively undecayed bark, luteus when hydrated, darkening to orange-luteus on drying, waxey-appearing, often with a glaucus coating most noticeable as a white fringe at the margin, cupulate at first, becoming planate at maturity, up to 1.5 mm diam., folding or curling inwards at the margin on drying, sessile to short-stipitate. Stipe, when present, 0.2-0.3 mm diam. by up to 0.3 mm high, lighter-colored than cup, sometimes with a restricted web of hyphae at the base. Exciple (Figs. 6 and 8) composed of thin-walled, hyaline cells 5-15 µm across forming textura angularis. Asci (Fig. 3) (33-) 40-52 (-56) x 3-4 µm, 8-spored, cylindrical in upper two thirds, tapered in lower third to a contorted base 1-2 µm across, apparently not subtended by croziers, distinctly truncated and sometimes slightly enlarged at the apex, without visible pore or amyloid reaction, thin-walled throughout. Spores (Fig. 4) 8-10 x 2.0-2.5 µm, short-naviculate to fusoid, bilaterally symmetrical, slightly more acute at the apex than base, non-septate, smooth, thin-walled, without conspicuous internal

Figs. 1-8 *Orbilia piloboloides*. 1. Apothecia on natural substrate, approx. 12X. 2. Hymenium 500X. 3. Asci 1,000X. 4. Ascospores 1,000X. 5. Paraphyses 1,000X. 6. Section of apothecium 400X. 7. Asci and paraphyses 1,000X. 8. Detail of ectal exciple 1,000X. (All from the holotype).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features. Paraphyses (Fig. 5) filiform, 0.9-1.2 µm diam. in the lower portion, swollen at the apex to a distinct spherical, thick-walled knob 1.1-1.8 µm diam. subtended by a thin-walled, pyriform swelling 2.0-3.3 µm diam., often with a few amorphous particles adhering to the surface, extending beyond the asci by a few microns in the hymenium. Hymenial components not adhering, easily separated by pressure on squash mounts (Fig. 2, 7).

ANAMORPH: Colonies submerged or appressed to the surface of agar, rugulose, dense, surface somewhat slimy, hyaline on 1.25% malt agar and potato carrot agar to white on potato dextrose agar, developing a light orange pigment when exposed to ultraviolet; slow-growing (6-10 mm in 10 days at room temperature). Hyphae (Fig. 9) hyaline, smooth, sparingly septate, branched, 1.2-2.5 µm wide, occasionally interspersed with moniliform mycelium with elliptical swellings up to 4 µm wide, septate at 4-8 µm intervals and constricted at the septa. Conidiophores (Figs. 10, 11, 12) sympodial, hyaline, lageniform to cylindrical, 5-12 (-20) x 1.5-3 µm, arising from undifferentiated mycelium, usually with one to three denticles at the apex or occasionally with an elongated rachiform apex. Sympoduloconidia (Fig. 13) apparently blastic, smooth, hyaline, strongly curved with an obtusely rounded apex and a narrowly truncate base, 9-12 x 2-3 µm, with a single median septum, not constricted.

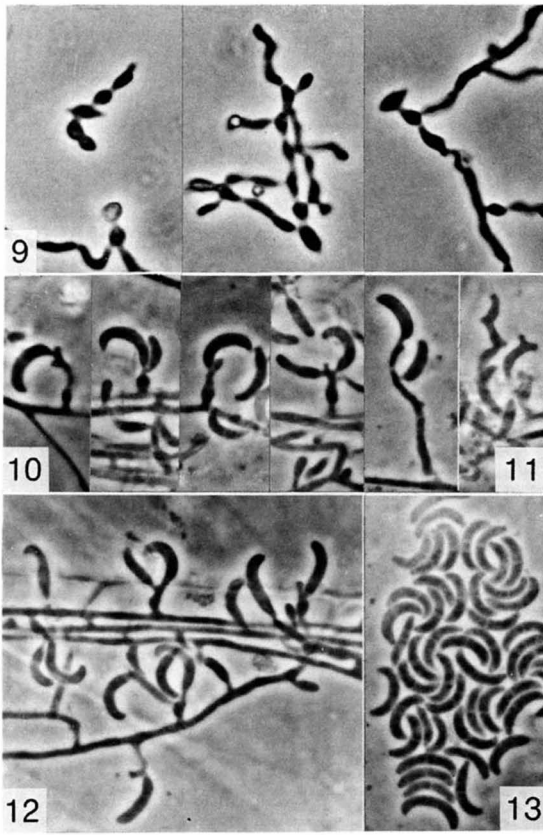
SUBSTRATE AND HABITAT: Bark of mature, standing or disintegrating *Ulmus americana* killed by dutch elm disease. Often, if not always, originating from the upper parts of the trees (J. Ginns, personal communication).

ETYMOLOGY: piloboloides = *Pilobolus* -like. Refers to the paraphyses which resemble the sporangiophores of the zygomycete *Pilobolus* Tode.

COLLECTIONS EXAMINED: CANADA: Quebec: Ginns' Farm, 45° 34'N, 75°47'W, St. Elizabeth Road, Cantley, Gatineau Co., on bark of log of *Ulmus americana* 22 April 1980, J. H. Ginns, DAOM #176753 (Type) DAOM, (Isotype) NYS 26 October 1980, J. H. Ginns DAOM #177611, (DAOM, NYS). Ontario: North Gower, on inner bark of log of *Ulmus americana*, 16 July 1979, G. P. White #169, DAOM #176754 (DAOM).

DISCUSSION: This species is immediately recognizable as a member of the Orbiliaceae by its waxey, orange apothecia, its small flat-topped asci without apparent pores, knob-tipped paraphyses and globose or angular-celled excipulum.

Figs. 9-13 *Orbilia piloboloides*. 9. Germinating ascospores. 10, 12. Sympoduloconidia and conidiophores of anamorph. 11. Conidiophore apices showing rachiform development. 13. Mature conidia. All at 1,000X. 9. from DAOM 17764. 10-13. from culture of holotype.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It is distinguished from all other species by its unusual paraphyses which resemble sporangiophores of the zygomycete *Pilobolus*. The similarity is entirely superficial, however, and there is no evidence that the paraphyses are directly involved in dispersal. The ascospores are small and non-septate as in other orbilias but they have a shape not previously described for any other member of the genus.

Recent studies (Benny, Samuelson and Kimbrough 1978) have demonstrated the presence of a blue-green algal (Cyanobacterial) associate in the excipular tissue of *Orbilia luteorubella* (Nyl.) Karst. Although one of us (JH) has confirmed these findings and has observed algal cells in several other species of *Orbilia*, none were found in *O. piloboloides*. The presence of algal cells in the lower apothecial tissues of orbilias appears to be correlated with conditions suitable for an abundance of photosynthetic organisms on the substrate surface. *Orbilia piloboloides* occurs on substrate relatively poor in these organisms.

Hymenial components which are firmly held together in a glutinous matrix are common for some species of *Orbilia* but those of *O. piloboloides* do not appear to be embedded and are easily separated by applying pressure on squash mounts. Stipitate species are rare in the genus. *Orbilia piloboloides* often has a short stipe, but it is a variable character which may be influenced by the environment near the substrate.

We do not feel that the anamorph of *O. piloboloides* can be accommodated in any known genus. However, there does not seem to be a case at this time for erecting a new genus.

Berthet (1964) described an anamorph of *Orbilia xanthostigma* (Fr.) Fr. with conidia of two types: fusoid didymoconidia and "horseshoe-shaped" bilobed conidia. This anamorph has been referred to *Dicranidion* Harkn. (fide Hennebert and Bellemere, 1979). Butterfield (1973) also noted the presence of lobed conidia and phragmoconidia in *D. fragile* Harkn. The anamorph of *O. piloboloides* does not have bilobed conidia and the conidia are curved rather than fusoid, although the method of conidium production is similar to *Dicranidion*. *Diplorhinotrichum* Höhnel (= *Dactylaria* Sacc., fide Bhatt and Kendrick, 1968) has been used for a group of fungi with hyaline didymoconidia on sympodial conidiophores, but the conidia are not curved. *Idriella* Nelson and Wilhelm, which has a *Hymenoscyphus* teleomorph (Kimbrough and Atkinson, 1972), and *Microdochium* Syd. (Sutton, Pirozynski and Deighton, 1973) are similar fungi. *Idriella spp.* produce dark chlamydospores in culture and has a faster growth rate than our species. *Orbilia piloboloides* produces moniliform hyphae in culture but these do not become pigmented. *Microdochium* is known primarily from the natural substrate. At least one species, *Microdochium phyllanthi* Sutton, Pirozynski and Deighton, does not produce chlamydospores in culture

but does produce a dark brown pseudoparenchymatous stroma. *Orbilia piloboloides* produced no stromata in culture.

ACKNOWLEDGEMENTS: The authors wish to thank Dr. J. D. Bissett for his advice and discussions during the development of this paper and Dr. J. Ginns for kindly offering fresh collections for culturing. Thanks also to Drs. Scott Redhead and James Kimbrough for their helpful comments.

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PHELLINUS ANDINA PLANK & RYV. NOVA SP.

by

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Abstract

Phellinus andina is described from Argentina. It is characterized by a resupinate fruitbody, short tramal setae in the dissepiments and large, subglobose, golden brown spores.

Under an expedition to Argentina, one of us (S. Plank) collected a Phellinus species with a unique combination of characters and for which we could not find a name.

Phellinus andina Plank & Ryv. nova sp.

Fructificatio resupinata, effusa, adnata marginibus subtiliter floccosis, 1-3 mm latis, pallide tabacinis. Facies pororum umbrina poris rotundis, 6-7 per mm, tubis concoloribus, ad 500 um altis. Subiculum cinnabarinum ad tabacinum. - Systema hypharum dimiticum: hyphae sceletales crasse tunicatae, aureae, alterae in trama, alterae in tubarum dissepimentis sitae, 2-3.5 um latae, hyphae in subiculo et in margine sitae ad 5 um latae luminibus latioribus. Hyphae generatoriae hyalinae, septis simpliciter septatae, 2-3 um latae. Setae vel hyphae setoideae in dissepimentis adsunt, breviter emergentes, nullae, crasse tunicatae, rectae vel leviter curvulae, 4-7 um latae, 35-60 um longae. Setae hymeniales desunt. Basidiae claviformes, 10-20 um longae, 4-6 um latae, sterigmatibus 4. Basidiola evoluta hyalina,

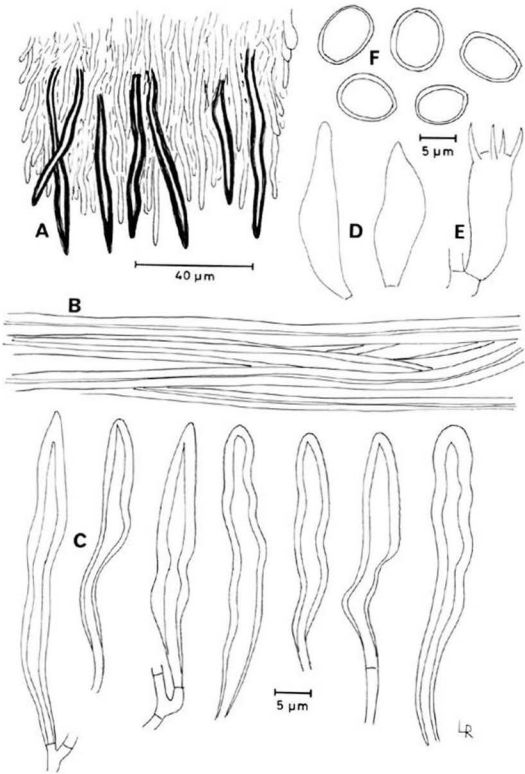

Fig. 1. Phellinus andina. A) Section through the dissepiments, B) skeletal hyphae from the trama, C) setae from the dissepiments, D) basidiols, E) basidium, F) spores. From the type.

10-20 um longa, ventricosa. Sporae subglobosae, ad late ellipsoideae, crasse tunicatae, aurei-umbrinae, 7-9/5.5-7 um.

Typus: Ad truncum mortianum Myrceugenellae apiculatae (Myrtaceae). In Argentina, regio Rio Negro (Andes), "Bosque de Arrayanes" apud lacum "Nahuel Huapi", ca. 800 m. Leg. S. PLANK & M. F. BROGGI, 26.01.1981

H o l o t y p u s : GZU.

I s o t y p i : Oslo, K, BPI, Coll. auct. Graz (S-AM/ARG 9).

Fruitbody resupinate, effused and adnate. Margin finely floccose, 1-3 mm wide, pale snuff brown, pore surface umber brown, pores round, 6-7 per mm, tubes concolorous, up to 500 um deep, context deep cinnamon to snuff brown, dense and up to 1 mm thick. Hyphal system dimitic, skeletal hyphae thick-walled and golden brown, in the trama 2-3.5 um wide, in the context and margin up to 5 um wide and with a wider lumen. Generative hyphae hyaline, simple septate and 2-3 um wide. Tramal setae or short setal hyphae present in the dissepiments, slightly projecting, dark brown, thick-walled, straight to somewhat sinuous 4-7 um wide, 35-60 um long. Hymenial setae absent, Basidia clavate 15-20 x 4-6 um with 4 sterigmata, basidiols present, ventricose, hyaline 10-20 um long, spores subglobose to broadly ellipsoid, thick-walled and golden brown by maturity, 7-9 x 5.5-7 um. Only known from a died stem of Myrceugenella apiculata (Myrtaceae).

The short tramal setae restricted to the dissepiments make this species unique in Phellinus. Such setae are known in Inonotus, such as in I. hastifer Pouz., but have hitherto been unknown in Phellinus. Furthermore, the large spores are also unusual in the genus where most species have spores shorter than 7 um. The new species reminds in several respects about an Inonotus species, but the distinct dimitic hyphal system with thick-walled, narrow skeletal hyphae rules out a place in the genus.

Acknowledgements.

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A REINVESTIGATION OF THE NORTH-WEST HIMALAYAN PULVINULAS

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SUMMARY

On a reinvestigation, it has been found that the N.W. Himalayan specimens of *Pulvinula* Boud. belong to *P. mussooriensis* (Thind, Cash & Singh) Batra, *P. globifera* (Berk. & Curt.) Le Gal, *P. orichalcea* (Cke.) Rifai, *P. convexella* (Karst.) Pfister, *P. laeterubra* (Rehm) Pfister, *P. nepalensis* R. Kaushal sp. nov., *Pulvinula* taxonomic sp. I and *Pulvinula* taxonomic sp. II. A key to all these species is given.

Species of *Pulvinula* Boud. from N.W. Himalayas have been poorly understood. For example, Thind & Batra (1957), Thind & Singh (1959) and Thind et al. (1959) probably were not clear about its generic concept when they treated species of *Pulvinula* under *Lamprospora* de Not. Later, Batra & Batra (1963) evidently were confused over these two genera. They listed some species under *Pulvinula* but at the same time described at least one of its species under *Lamprospora*. Subsequently, more *Pulvinula* species were described from the N.W. Himalayas by Thind & Waraitch (1970) and Waraitch & Thind (1977). The recent delimitation of species of this genus by Rifai (1968), Moravec (1969) and Pfister (1972, 1976), and the importance of critical microscopic observations for proper identification led the author to re-examine collections from the N.W. Himalayan ranges of India and Nepal where the earlier Indian researchers made their collections. An attempt has been made here to place the collections (both published and unpublished) in the species as understood now.

As a result of these investigations, it has been found that from among the earlier reports of the *Pulvinula* species from N.W. Himalayas, only *P. mussooriensis* (Thind, Cash & Singh) Batra was valid. Besides *P. mussooriensis*, N.W. Himalayan specimens have been found to represent seven more species viz., *P. globifera* (Berk. & Curt.) Le Gal, *P. orichalcea* (Cke.) Rifai, *P. convexella* (Karst.) Pfister, *P. laeterubra* (Rehm) Pfister, *P. nepalensis* R. Kaushal, sp. nov., *Pulvinula* taxonomic sp. I and *Pulvinula* taxonomic sp. II.

A key to all the N.W. Himalayan species of *Pulvinula* has been provided in this work. Comments have been included for the collections which are at minor variance with the

described species. Collections have been commented under the species to which they were assigned by the earlier workers.

Pulvinula carbonaria (Fuck.) Boud. var. *brevispora* Batra

Thind & Batra (1957) first described this fungus (No. 154) as *Lamprospora carbonaria*, but later Batra in Batra & Batra (1963) shifted it to *Pulvinula* and raised a new variety *brevispora*. The collection is in decayed condition in preservative and, except for the size of ascospores (up to 14 µm across) and filiform, curved paraphyses which are not enlarged apically, nothing more could be made out of it. Going by Thind & Batra's description, except for the pyrophilous habitat it does not seem to be different from *P. orichalcea* (Cke.) Rifai. Specimen examined: India: Batra 154 (PAN), on charcoal beds which were overgrown by mosses, Jabber Khet, Mussoorie, August 20, 1952.

Pulvinula constellatio Boud.

This species has been tentatively regarded as a synonym of *P. convexella* (Karst.) Pfister by Pfister (1976). CUP-In 27 referred to *P. constellatio* by Batra & Batra (1963) has ascospores 15.8-18 µm across, asci 194-248 µm long, with regular croziers and filiform, curved and branched paraphyses. In my opinion it represents *P. convexella*. Specimen examined: India: Batra 27 (CUP-In), on soil, Dhobi Ghat, Mussoorie, U.P., September 1952.

Pulvinula discoidea (P. Henn. & Nym.) Batra

I follow Pfister (1976) who does not recognize this species in the absence of its type material. CUP-In 19 described by Batra & Batra (1963) as *P. discoidea* has few, small (about 1.5 mm in diam.) whitish apothecia, which are not well preserved. The asci are 215-252 x 18-21 µm, 8-spored, tapering below, with regular croziers. The ascospores are 16-18 µm across and have many small oil droplets. The paraphyses are unbranched, up to 1.8 µm wide at the base and are up to 4 (-5) µm wide above at their bent apices. In ascospore size it is unlike any of the other white species of this genus and it seems to be a new species (*Pulvinula* taxonomic sp. I). Owing to Batra's insufficient and poorly preserved material, I am not naming this species. I have some good material of this fungus from the Eastern Himalayas which would be published shortly. Specimen examined: India: Batra 19 (CUP-In), on soil, mossy falls, Mussoorie, U.P.

Pulvinula etiolata (Cke.) Le Gal

The specimen used by Le Gal (1953) to describe *P. etiolata* has been referred to *P. tetraspora* (Hansf.) Rifai by Rifai (1968) who has described its position in detail. No. 2039 assigned to *P. etiolata* by Thind & Waraitch (1970) has small (up to 2.5 mm in diameter) whitish apothecia. These bear 8-spored asci up to 235 µm long, tapering at the base and arising from regularly two-pronged croziers, ascospores up to 12.8 (-13) µm in diameter, paraphyses filiform with curved apices up to 1.6 µm wide throughout their length.

This Himalayan collection seems not to be different from

P. globifera (Berk. & Curt.) Le Gal sensu Rifai. Though its relatively smaller apothecia and ascospores, and the form of the paraphyses bring it nearer to *P. laeteolba* J. Moravec, this species except for its 4-spored asci, may not be different from *P. globifera* as noted by Pfister (1976). Specimen examined: India: Waraitch 2039 (PAN), on humicolous soil amongst needles of some conifers under coniferous forest, Baghi, Simla, H.P., August 19, 1966.

Pulvinula globifera (Berk. & Curt.) Le Gal sensu Rifai
PAN 2322 referred to this species by Waraitch & Thind (1977) has yellow apothecia up to 3 mm in diameter and pyrophilous habitat. The asci are 180-218 x 14-18 µm, 8-spored, instead of tapering below become slightly narrower, then abruptly contracted into a short cylindrical stalk-like base and lack regular croziers. The ascospores are 12.8-15.5 µm across and the paraphyses are up to 1.6 µm wide below, expanding up to 3 µm at their bent to curved apices.

Its substrate, the type of ascal bases and size of ascospores are unlike *P. globifera*. *Pulvinula neotropica* Pfister, a pyrophilous species, is close to it but has pale yellowish-greenish apothecia and smaller asci arising from prominent croziers. The similar ascal bases, somewhat similar ascospore size and apically inflated paraphyses alienate this Nepalese collection to some extent with *P. miltina* (Berk.) Rifai, but the latter is distinct in its crimson apothecia, terricolous habitat and longer asci (up to 265 µm, fide Rifai, 1968). Waraitch's collection seems to represent a new species for which I propose Pulvinula nepalensis R. Kaushal sp. nov.* Specimen examined: Nepal: Holotype: Waraitch 2322 (PAN), on charcoal and burnt soil around a fire place in Bamboo grove, Sundarijal, Kathmandu, August 15, 1969.

Pulvinula haemastigma (Hedw. ex Fr.) Boud.
I follow Pfister (1976) and consider *P. haemastigma* a 'nomen confusum.' Batra & Batra recorded this fungus in their check-list of "Indian Discomycetes" as *P. haematostigma* [sic]. Under this species they have not cited the number of their collection deposited at PAN and it could not be located there.

There are four unpublished collections at PAN, labelled as *P. haemastigma*. No. 2251 and 2264 except for their smaller apothecia (up to 2 mm in diameter) and somewhat smaller asci (204-240 x 17-19 µm) are typical of *P. convexella* (Karst.) Pfister in their basally distinctly forked asci with regular croziers, size of ascospores (16.4-18.8 µm across) and apically regularly branched filiform paraphyses.

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*Apothecia ad 3 mm diam., disciformia, flavida. Asci 180-218 x 14-18 µm, octospori. Ascospori 12.8-15.5 µm diam., globosi, laevigati. Paraphyses filiformae, ad 3 µm ad apices. Holotypus: Waraitch 2322 (PAN).

In No. 2470 and 2562 ascospores are 14-18.6 µm across and asci 224.5-250 x 14.5-19 µm which also fall in the range of *P. convexella*, but their ascal bases instead of arising from two-pronged regular croziers are simple, tapering and lacking regular croziers and also the regular branching of the paraphyses is lacking in them. These could not be assigned to *P. miltina* because of the latter's abrupt type of ascal base and different color. *P. orichalcea* seems to be the closest but has smaller ascospores. Probably these two collections represent a new species (*Pulvinula* taxonomic sp. II). Specimens examined: India: Waraitch 2251 (PAN), on much wet soil, Harwan, Srinagar, J & K, August 27, 1967; Waraitch 2264 (PAN), on much wet soil amid mosses along a streamlet, Joru Pur, Bijbihara-Pahalgam Road, J & K, September 24, 1967; S. Chander 2470 (PAN), on wet soil, Banikhet, Dalhousie, H.P., August 11, 1972; S. Chander 2562 (PAN), on wet soil, Kilbury, Nainital, U.P., August 22, 1973.

Pulvinula haemastigma (Hedw. ex Fr.) Boud. var. *gigantea* (Thind & Singh) Waraitch & Thind

This variety, earlier published as *Lamprospora haematostigma* var. *gigantea* by Thind & Singh (1959) to accommodate No. 296, was later transferred to *Pulvinula* and validated by Waraitch & Thind (1977) who also added two more collections, No. 2338 and No. 2339 to it.

In No. 296 the type of asci and paraphyses and the size of ascospores are similar to those in *P. orichalcea* and should be taken as a representative of this species. No. 2338, 2339 along with Nos. 2131 and 2342 (unpublished and deposited at PAN as *P. haemastigma* var. *gigantea*) in my opinion also belong to *P. orichalcea*. Specimens examined: India: Singh 296 (PAN), on humus amid mosses in oak forest, Brewery Road, Mussoorie, U.P., August 10, 1956; Waraitch 2131 (PAN), on moist and sandy soil in mixed forest, Panj Pulla, Dalhousie, H.P., August 17, 1966. Nepal: Waraitch 2338 (PAN), on wet clayey soil in angiospermous forest, Godaveri, Kathmandu, September 7, 1969; Waraitch 2339 (PAN), on wet sandy soil amid mosses in oak forest, Daman, September 12, 1969; Waraitch 2342 (PAN), on wet sandy soil in Oak forest, Daman, September 12, 1969.

Pulvinula mussoorienis (Thind et al.) Batra

This species, proposed by Thind et al. (1969), has been commented upon by Pfister (1976) who considered it to be very near *P. niveoalba* J. Moravec, and I also concur with him. Specimen examined: India: Type: Singh 306 (PAN), on soil amid mosses, Brewery Road, Mussoorie, U.P., August 12, 1956.

Pulvinula taxonomic sp.

Waraitch & Thind (1977) published this fungus to accommodate Nos. 2327 and 2349. These have yellowish apothecia, 11.2-14 µm across ascospores and up to 250 µm long asci with tapering base arising from distinct crozier. These appear to represent the yellow form of *P. laeterubra*. Specimens examined: Nepal: Waraitch 2327 (PAN), on wet clayey soil

in angiospermous forest, Balaju, Kathmandu, August 22, 1969; Waraitch 2349 (PAN), on wet clayey soil in angiospermous forest, Balaju, Kathmandu, September 25, 1969.

Lamprospora multiguttulata Batra

CUP-In 104, the holotype of *L. multiguttulata*, which I received through the kindness of Prof. Richard P. Korf consists of only a slide of a vertical section of an apothecium. However, the sections are poor, and the ectal excipulum described as being compact textura intricata by Batra (1960) could not be confirmed. The ascospores are smooth, multiguttulate and the paraphyses are slightly bent. I fully agree with Rifai's annotation slip in the herbarium packet that CUP-In 104 is in no way related to *Lamprospora* and instead represents some species of *Pulvinula*. Since its microscopic features could not be fully reinvestigated, no attempt is made to place it. Specimen examined: India: Type: Batra 104 (CUP-In), on soil, Mussoorie, U.P.

KEY TO THE N.W. HIMALAYAN SPECIES

1. Apothecia white 2
1. Apothecia yellow, orange or reddish 3

2. Ascospores up to 12.8 (-13) µm in diameter; paraphyses up to 1.6 µm wide throughout their length . . . . . *P. globifera*
2. Ascospores 16-18 µm in diameter; paraphyses up to 1.8 µm wide at the base and up to 4 (-5) µm wide at the apex . . *Pulvinula* taxonomic sp. I

3. Asci without prominent, two-pronged croziers 4
3. Asci with prominent, two-pronged croziers 6

4. Apothecia yellow; asci up to 218 µm long, abruptly contracted below into short, stalk-like base . . . . . *P. nepalensis*
4. Apothecia salmon to orange; asci up to 260 µm long, tapering at the base 5

5. Ascospores up to 15 µm in diameter . . . *P. orichalcea*
5. Ascospores 14-18.6 µm in diameter . . . . . *Pulvinula* taxonomic sp. II

6. Ascospores 16.4-18.8 µm in diameter; paraphyses regularly branched at their apices . . . . . *P. convexella*
6. Ascospores smaller; paraphyses branched or unbranched 7

7. Ascospores 11-14 µm in diameter; paraphyses often branched . . . . . *P. laeterubra*
7. Ascospores 9-11.5 µm in diameter; paraphyses unbranched . . . . . *P. mussooriensis*

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ISOLATION AND IDENTIFICATION OF EUTYPA ARMENIACAE FROM DISEASED GRAPEVINES IN WASHINGTON STATE

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SUMMARY

Eutypa armeniacae is reported in Washington state from diseased grapevines that exhibit symptoms typical of Eutypa dieback. The teleomorph was not found. The fungus was identified on the basis of host symptomatology, formation of a Cytosporina state in culture, and pathogenicity on apricot. Problems in the taxonomy and identification of E. armeniacae are discussed.

Eutypa armeniacae Hansf. & Carter ex Carter (anamorph: Cytosporina sp.) (Pyrenomycetes, Sphaeriales, Diatrypaceae) causes cankers and diebacks on grapevine, Vitis vinifera L. and V. labrusca L. (Moller and Kasimatis, 1978), and apricot, Prunus armeniaca L. (Carter, 1957) and has been reported from a number of other woody plants. The fungus ranks as a major pathogen of both grapevines and apricots, and occurs throughout the world. Unfortunately, identification of this fungus is difficult. There is no monographic

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treatment of Eutypa, and taxonomic literature on the genus is scattered and often inaccessible. In addition, the type description of E. armeniacae (Carter, 1957) does not clearly differentiate it from a number of older Eutypa species, including E. acharii Tul., E. lata (Pers. : Fr.) Tul., and E. ludibunda Sacc. (Saccardo, 1882). Thus, the distinctions between E. armeniacae and some other species are unclear. Another difficulty is that the teleomorph of E. armeniacae is not known to form on natural substrata in regions receiving less than approximately 33 cm of annual rainfall, or in artificial culture (Carter, 1957). Consequently, in dry regions E. armeniacae must be identified on cultural and anamorphic characters without reference to teleomorphic characters. Although the Cytosporina state forms in culture, the lack of available information on Cytosporina states of other species of Diatrypaceae prevents confident identification of E. armeniacae solely on the morphology of its anamorph. Thus, in addition to cultural studies, previous investigations have used its pathogenicity on apricot to help differentiate E. armeniacae from other Eutypa or Cytosporina species (Carter et al., 1964; Dingley, 1960; English and Davis, 1965; Moller, 1964; Moller et al., 1968; Moller et al., 1971; Uyemoto et al., 1976).

The difficulties in identifying E. armeniacae have often impeded research on the diseases caused by it. Such has been the case in Washington state, where in 1975 (Mink, 1975) a grapevine disease resembling Eutypa dieback was reported from the semi-arid Yakima Valley, which receives approximately 18 cm of annual rainfall (Anonymous, 1978). Attempts to find the teleomorph of E. armeniacae failed, and although some fungi isolated from the vines resembled E. armeniacae in cultural characteristics, they did not sporulate and were not identified (Mink, 1975).

This paper reports the results of subsequent efforts to identify E. armeniacae isolates from diseased grapevines in Washington. Identification of E. armeniacae in this study was based on: 1) symptomatology on grapevine; 2) production of a Cytosporina state in culture; 3) pathogenicity on apricot. Problems in the taxonomy and identification of E. armeniacae are discussed, and etiology of Eutypa dieback of grapevine in Washington is discussed in relation to identification of the fungus.

MATERIALS AND METHODS

Vineyard observations. Twenty-four 10-yr old or older 'Concord' (Vitis labrusca) vineyards in the Yakima Valley

of Washington state were surveyed in late May and early June, 1976-1978 for presence of the disease. Disease incidence was estimated in five vineyards by randomly choosing a vineyard block in each that contained 600-1800 vines, and examining each vine for foliar and trunk symptoms. The same vineyard blocks were examined each year.

Isolation and cultural techniques. Diseased wood was excised from canker margins on 60 grapevines and stored at 4C until isolations were made. Pieces of wood approximately 0.5 cm square were surface-sterilized 30-90 sec in 1.62% sodium hypochlorite, and placed on several media, including potato-dextrose agar (PDA), PDA acidified by adding one drop of lactic acid per 9-cm-diam Petri plate, and PDA containing 200 ppm streptomycin sulfate and 50 ppm tetracycline. Isolates obtained in this manner were transferred to 9-cm-diam plastic Petri plates containing 30 ml PDA and incubated either in darkness or on a laboratory bench where they were subject to fluorescent room lighting. Ambient temperatures during incubation ranged from 20-28C. Two known isolates of E. armeniacae from California, no. 590 (isolated from apricot, Prunus armeniaca) and no. 1090 (isolated from grapevine, Vitis vinifera), were cultured under the same conditions for comparison.

Pathogenicity tests. Tests were conducted on apricot to assess the pathogenicity of two suspected E. armeniacae isolates from Washington grapevines; these tests also included known E. armeniacae isolates no. 590 and no. 1090 from California for comparison. The Washington isolates were no. 261, isolated from a diseased grapevine near Sunnyside, Yakima Co., June, 1976, and no. 783, isolated from a diseased grapevine near Grandview, Yakima Co., June, 1977. The pathogenicity tests were conducted at Davis, CA, and at Prosser, WA. 'Tilton' apricot trees were utilized at Davis. Because varietal trees were unavailable at Prosser, apricot trees that had been started from seed by Dr. T. Toyama were used there; parentage of the Prosser trees is unknown. Inoculum consisted of discs of mycelium cut from PDA plates; inoculum in control treatments consisted of sterile PDA discs. Inoculations were made by pruning off lateral branches 1.0-1.5 cm diam, and placing inoculum on the wounds. The inoculation points were then wrapped with aluminum foil to prevent rapid desiccation. Test results were evaluated by splitting inoculated branches longitudinally and measuring the total lengths of xylem discoloration in both directions from the inoculation points. The fungi were reisolated as before. Five trees were inoculated with each of the five treatments (four

isolates and control) in the Prosser test, and four trees with each treatment in the Davis test. The Prosser test ran from May 16-October 13, 1980, and the Davis test ran from May 28-November 21, 1980.

RESULTS

Vineyard observations. The disease was found in each of the 24 vineyards. Disease incidence in the five selected vineyards ranged from 20-84%, and did not change significantly during 1976-1978.

Foliar symptoms were most evident in late May when new shoots were three or four internodes long. Symptoms became more difficult to detect as the season progressed because diseased foliage tended to be obscured by healthy shoots. Diseased leaves were stunted, chlorotic, and cupulate. Internodes were shortened and the berries tended to fall from affected shoots. Terminals of severely diseased vines often collapsed and died during hot weather; new shoots often developed below the diebacks the following spring. Unlike healthy vines, diseased vines usually suckered profusely.

Diseased vines also had trunk cankers associated with large pruning wounds that measured 5-8 cm in diameter and had been made during the mid-1960's when trellises were changed from four-arm Kniffen trellises to two-arm trellises. Smaller wounds caused by normal pruning operations were seldom associated with cankers. Cankers occasionally were evinced by concentric peripheral ridges resulting from growth of adjacent healthy tissue, but usually were inconspicuous unless covering bark was stripped away to reveal the dark-brown-discolored wood typical of the cankers. The discolored wood usually extended below ground on vines with severe foliar symptoms. Vines died when cankers girdled their trunks.

A Cytosporina state resembling that of E. armeniacae was found on the canker of one diseased vine near Prosser, WA in June, 1977. The teleomorph was never observed.

Isolations and cultural observations. A fungus which formed a Cytosporina state in culture was isolated from 50 of 60 randomly chosen diseased vines. Colonies were initially hyaline with cottony aerial growth and diffuse margins. After 2-4 wk, regions of dark gray to black aerial hyphae developed. Isolates differed in the extent and intensity of the dark mycelial regions. Pale yellow conidial masses began exuding from black, 1-mm-diam, subconical pycnidia after 4-6 wk. Conidia were 34-74 (-78) x 1-1.5 (-2) µm, single-celled, moderately curved, filiform, and

Table 1. Pathogenicity of four isolates of Eutypa armeniacae on apricot (Prunus armeniaca) at Davis, CA and Prosser, WA.

Isolate	Ave. Length Internal Discoloration (Cm)[x]	
	Davis	Prosser
Control	4.1 a	1.0 a
261[y]	17.8 b	2.7 ab
1090[z]	30.0 c	3.3 ab
783[y]	34.0 c	4.1 b
590[z]	44.8 d	7.0 c

[x]Values within columns followed by the same letter are not significantly different from each other (P = 0.05) according to Duncan's new multiple range test.

[y]Washington isolate.

[z]California isolate.

hyaline. Reverse sides of month-old colonies were creamy white to pale yellow. Cultural characteristics of the known E. armeniacae isolates from California were identical to Washington isolates while the colonies were expanding, but sporulating cultures (4-6 wk old) differed in several respects. The California isolates did not become as dark as Washington isolates, tended to produce more pycnidia with larger spore masses and smaller conidia that measured (15-) 25-35 (-39) x 1-2 µm, and discolored the culture medium a more intense yellow. Neither the Washington nor the California isolates sporulated in darkness.

Pathogenicity tests. Results of pathogenicity tests of two suspected isolates of E. armeniacae from Washington grapevines and two known E. armeniacae isolates from California are presented in Table 1. All four isolates were pathogenic in the Davis test. At Prosser, isolates no. 590 and no. 783 were pathogenic, but isolates no. 261 and no. 1090 did not differ significantly from the control treatment. Xylem discoloration extending from wounds inoculated with isolate no. 590 was significantly greater than that produced by other isolates in both tests.

DISCUSSION

This report is one of several (Carter et al., 1964; English and Davis, 1965; Kouyeas et al., 1978; Kouyeas et al., 1976) in which the teleomorph of E. armeniacae was not found on the host from which the fungus was reported. Identification of E. armeniacae in the absence of its teleomorph under natural conditions is complicated by its inability to form the teleomorph in artificial culture. It is further complicated by a general lack of information on Cytosporina states which might be confused with the Cytosporina state of E. armeniacae. Previous studies on E. armeniacae have used its pathogenicity on apricot and behavior in culture to help distinguish it from other fungi (Carter et al., 1964; Dingley, 1960; English and Davis, 1965; Moller, 1964; Moller et al., 1968; Moller et al., 1971; Uyemoto et al., 1976). Consequently, the following three criteria were used to identify E. armeniacae in this study:

1) Consistent isolation of the fungus from diseased vines exhibiting symptoms identical to those caused by E. armeniacae in other areas (e.g., Moller and Kasimatis, 1978). Disease symptoms included stunted and deformed chlorotic foliage, dieback, and trunk cankers associated with pruning wounds. These symptoms are, insofar as is known, unique to Eutypa dieback.

2) Production of a Cytosporina state in artificial culture when exposed to light. Although some other species of Diatrypaceae sporulate in darkness (Glawe, unpublished), E. armeniacae does not. Conidia of Washington isolates are larger than the size range reported in the type description (Carter, 1957) and found in the known E. armeniacae isolates examined in this study. However, R. C. Pearson (personal communication) reports that ascospore isolates from grapevines in New York produce conidia that are similar in size to Washington isolates. Thus, it appears that the original description of E. armeniacae does not indicate the full size range of conidia formed by this species.

3) Pathogenicity on apricot. Apricots were used in this, as well as in previous studies (Carter et al., 1964; Dingley, 1960; English and Davis, 1965; Moller, 1964; Moller et al., 1966; Moller et al., 1968; Moller et al., 1971; Uyemoto et al., 1976) to verify pathogenicity of isolates from diseased grapevines. Apricots are preferred in pathogenicity tests for purposes of identification because symptoms develop in months rather than years as is required on grapevines (Moller and Kasimatis, 1978). Both the known

isolates (no. 590 and no. 1090) and the suspect isolates (no. 261 and no. 783) were pathogenic in the Davis test. In the Prosser test, isolates no. 590 and no. 783 were pathogenic, but isolates no. 261 and no. 1090 did not differ significantly from the control treatment. From these results it appears that the latter isolates were less virulent, and might have become differentiated from the control treatment in the Prosser test had that test continued longer. Differences in virulence among E. armeniacae isolates have been reported previously (Ramos et al., 1975a). Isolate no. 590 caused significantly more xylem discoloration than the other isolates in both tests. Discoloration of xylem was more extensive for each isolate, and in the control treatments, in the Davis test than in the Prosser test. The reason for this is unknown. The Davis test ran approximately six months and the Prosser test approximately five months, but it appears unlikely that the difference in test lengths is responsible for the four- to nine-fold differences between test results. Although no differences in varietal susceptibility to E. armeniacae have been reported, genetic differences among apricots might have affected the test results. Another possibility is that climatic differences between Davis and Prosser influenced the results. This possiblility is consistent with the fact that Eutypa dieback has not been reported on apricot in Washington or other cool areas of the world where they are grown, but is common on apricot in California and other areas with mild climates (Moller, unpublished). Further studies are necessary to clarify the factors affecting development of Eutypa dieback on apricot, but the pathogenicity tests in this study do demonstrate the pathogenic potential of Washington isolates on apricot.

Identification of E. armeniacae on the basis of host symptomatology, formation of a Cytosporina state in culture and pathogenicity on apricot is consistent with previous interpetations of this species (Carter et al., 1964; Dingley, 1960; English and Davis, 1965; Moller, 1964; Moller et al., 1966; Moller et al., 1968; Moller et al., 1971; Uyemoto et al., 1976). However, as stated earlier herein, the type description for E. armeniacae (Carter, 1957) is very similar to those of a number of nomenclaturally older Eutypa species. The description for E. armeniacae (Carter, 1957) does not indicate how it may be distinguished from those species, nor have any subsequent studies addressed this problem. Thus, it is possible that E. armeniacae is a synonym of an older name; the name is used here in order to conform with its widespread use among plant pathologists.

Clearly, however, studies on E. armeniacae and similar Eutypa species are needed to clarify their taxonomy and nomenclature, and to simplify their identification.

The results of this study establish the presence of E. armeniacae and Eutypa dieback of grapevine in Washington. Previous investigations of Eutypa dieback in Washington (e.g., Mink, 1975) failed to elucidate its cause, apparently because fungi isolated from diseased vines were cultured in darkness and isolates of E. armeniacae escaped attention because the cultures failed to sporulate. The source of inoculum in Washington remains to be determined. Conidia of E. armeniacae are thought not to function as inoculum because attempts to germinate them have failed (Moller and Kasimatis, 1978). The teleomorph was not found in the Yakima Valley, which receives approximately 18 cm of annual rainfall (Anonymous, 1978). Areas receiving more than 33 cm of rainfall, the amount reported as necessary for formation of the teleomorph (Carter, 1957), are located 50 to 100 km to the west and southwest of the Yakima Valley (Anonymous, 1978), and contain known host species. These areas are within the 60-km range for ascospore dispersal reported in California (Ramos et al., 1975b), and the 160-km range reported in Australia (Carter, 1957). It appears, therefore, that the teleomorph of E. armeniacae might occur in these neighboring higher-rainfall areas, and that long-range ascospore dispersal may be an important feature in the biology of this fungus in Washington. Further research is needed to determine the types and sources of inoculum in Washington.

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STILBELLACEOUS FUNGI 1. DIDYMOSTILBE

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The genus Didymostilbe was established by Hennings (1902) with D. coffeae as the type species. Twenty-six days later Didymostilbe Bresadola and Saccardo was described in Saccardo (1902) and typified by D. eichleriana. Sydow (1903) noted this nomenclatural problem and indicated that Hennings' name has priority.

We have examined the type material of six of the eight species presently place in Didymostilbe. It appears that this genus differs from Stilbella Lindau as lectotypified by S. erythrocephala (Ditmar:Fr.) Lindau solely by the presence of a septum in the mature conidia. This character is highly variable and by itself, perhaps insufficient to maintain Didymostilbe as a genus distinct from Stilbella. In the absence of a critical examination of Stilbella, we have retained Didymostilbe. A revision of the genus is presented here.

Didymostilbe P. Hennings, Hedwigia 41:148. 5 August 1902
Species Typica: D. coffeae P. Henn.

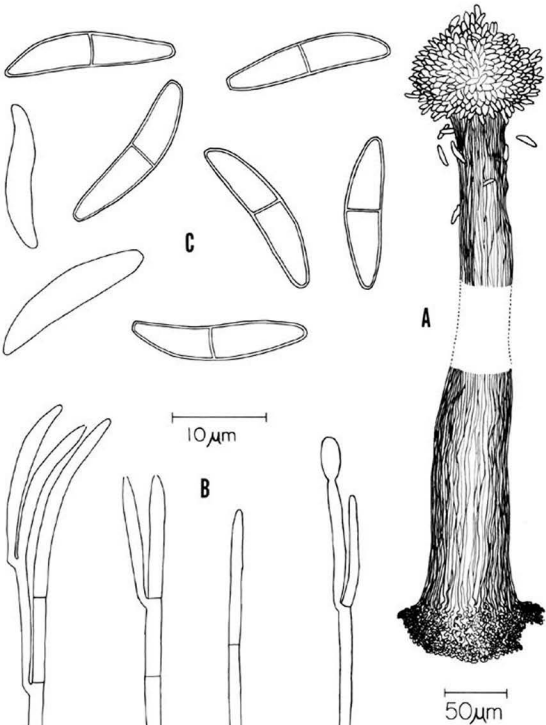

Figure 1, A-C. Didymostilbe coffeae. A. Synnema; B. Conidiogenous cells; C. Mature conidia.

= Didymostilbe Bres. & Sacc.,
Compt. Rend. Congr. Bot. Palermo 1902:59. 31 August 1902.
Species typica: D. eichleriana Bres. & Sacc.

Conidiophores macronematous, synnematous. Synnemata erect, straight, white, cream or tan, cylindrical to clavate, smooth with a mucoid head. Filaments of synnemata interwoven, hyaline, septate, monopodial, dichotomous or verticillate. Conidiogenous cells enteroblastic phialidic, integrated or discrete, terminal or lateral, hyaline, smooth-walled, cylindrical. Phialoconidia acrogenous, hyaline, 1-septate.

Key to the Species of Didymostilbe Henn.*

1. Conidiogenous cells < 20 µm long 2
   Conidiogenous cells > 20 µm long 3
2. Conidia 2.2-4.4 µm wide ..... D. ellisii
   Conidia 4.2-6.6 µm wide ..... D. coprophila (2)
3. Conidia < 10 µm long ..... D. kamatii (3)
   Conidia > 10 µm long 4
4. Conidia fusoid ..... D. coffeae
   Conidia obovoid ..... D. eichleriana

*Numbers in parentheses refer to literature cited.

Didymostilbe coffeae P. Henn. Figure 1, A-C.
Hedwigia 41:148. 5 August 1902.

Mycelium immersed in the substrate, composed of branched, septate, subhyaline or light brown hyphae. Conidiophores macronematous, synnematous. Synnemata erect, straight cream or tan-brown, cylindrical, smooth, with a mucoid head, up to 880 µm high, 60-110 m wide at the base. Filaments of synnemata interwoven, slender, hyaline, monopodial or with dichotomous branching at the apex. Conidiogenous cells enteroblastic phialidic, integrated or discrete, terminal or lateral, cylindrical, hyaline, smooth-walled, 29-35 x 3.5-4.0 µm. Collarettes poorly developed or lacking. Phialoconidia acrogenous, hyaline, smooth, fusoid, straight or slightly allantoid, 1-septate at maturity, 16.5-20.6 x 3.0 4.0 µm.

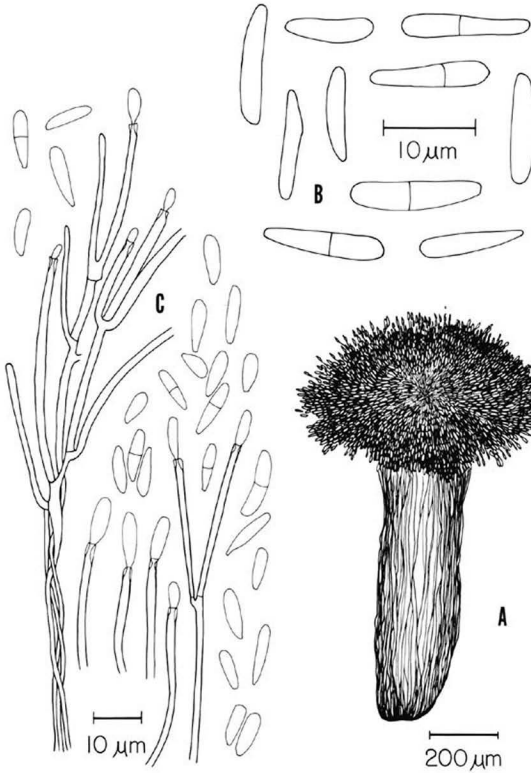

Figure 2, A-C. Didymostilbe eichleriana. A. Synnema; B. Conidia; C. Conidiogenous cells and conidia.

Etymology: After the host genus Coffea.

Type: Auf Zweigen von Coffea arabica L. Buitenzorg [Bogor], Java, A. Zimmermann, (B).

Other Material Examined: On Coffea sp., Camargo Chih, Mexico, 28 April 1967, H. R. Conway. Intercepted at El Paso, No. 68952 (BPI).

Didymostilbe eichleriana Bres. & Sacc. Figure 2, A-C. Compt. Rend. Congr. Botan. Palermo 1902:59. 31 August 1902.

= Didymostilbe obovoidea Matsushima, Icones microfungorum a Matsushima lectorum: 60. 1975.

Mycelium immersed in the substrate, composed of branched, septate, hyaline hyphae. Conidiophores macronematous, synnematous. Synnemata erect, straight, white to cream colored, cylindrical to clavate, smooth with mucoid, tan-brown heads, 500-750 x 120-130 µm. Filaments of synnemata interwoven, slender, hyaline with monopodial, dichotomous or verticillate branching at apex. Conidiogenous cells enteroblastic, phialidic, discrete, terminal or lateral, cylindrical, hyaline, smooth-walled, with a collarette, 25-50 (-55) x 1.2-2.2 µm. Phialoconidia acrogenous, collecting in tan-brown droplets, obovoid, hyaline, smooth, 1-septate at maturity, (8.9-) 11.0-15.0 x 2.2-3.5 µm.

Etymology: Honoring the collector, B. Eichler.

Type: Supra algas vivas in truncis Betulae albae in Polonia rossica, B. Eichler, (PAD).

Didymostilbe ellisii Saxena & Mukerji Figure 3, A-E. Trans. Brit. Mycol Soc. 55:503. 1970.

Mycelium superficial to immersed in substrate, composed of branched, septate, hyaline hyaphae. Conidiophores macronematous, synnematous. Synnemata erect, straight, white to yellow-white, smooth, cylindrical at base gradually expanding towards the apex into a spherical or subspherical head, 480-622 µm high, 35-45 µm wide at the base, 65-85 µm wide at the apex. Filaments of synnemata hyaline, septate, parallel at the base, divergent at the

apex, simple or once or twice branched. Conidiogenous cells enteroblastic, phialidic, integrated or discrete, terminal or lateral, hyaline, smooth-walled, cylindrical to somewhat flask-shaped, 9-14 x 2.2-3.3 µm. Phialoconidia formed in basipetal chains, oblong to fusoid, occasionally curved, hyaline, thick-walled, 1-septate at maturity, not constricted, 13-23 x 2.2-4.4 µm.

Etymology: Honoring M. B. Ellis.

Type: On rabbit dung, Delhi, India, April 1969, Leg. A. S. Saxena, DU/KS100,1M1(143075).

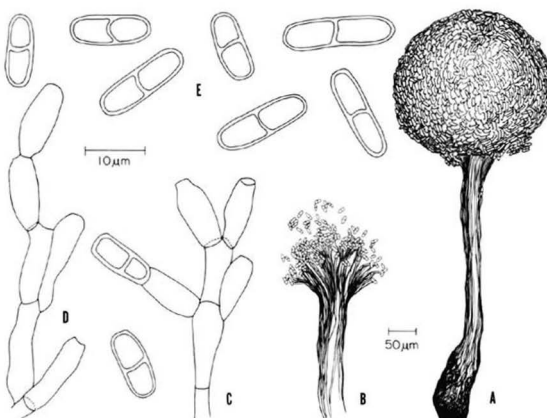

Figure 3, A-C. Didymostilbe ellisii. A & B. Synnemata; C. & D. Conidiophores, conidiogenous cells and conidia; E. Mature conidia.

Nomina Excludendae

Didymostilbe coprophila Mirza & Qureshi, Trans. Brit. Mycol Soc. 54: 148. 1970. Type material not seen.

Didymostilbe kamatii Pawar & Kulkarni, Current Science 41:73-74. 1972. (AMH!) No fertile heads remain on type specimen.

Didymostilbe capillaceae Sacc. & Bres., Annales Mycologici 1:28. 1903. (PAD!) No ferile heads remain on type specimen.

Didymostilbe coccinea (Massee) Saccardo, Syll. Fung. 22(2): 1446. 1913.

Basionym: Hartiella coccinea Massee, Kew Bulletin 1910:5. 1910. (K!)

= Calostilbella calostilbe v. Hohnel.

Didymostilbe obovoidea Matsushima, Icones microfungorum at Matsushima lectorum: 60. 1975. Type material not seen. From the description and illustrations, it appears identical with D. eichleriana except for the width of the synnemata.

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VARIABILITY OF SPORES OF DIFFERENT BASIDIOCARPS GROWING ON THE SAME MYCELIUM IN THE APHYLLOPHORALES

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The dimensions of basidiospores are one of the most important characters for distinguishing closely related species of the Aphyllophorales. However, there are many obstacles to reliable use of such characteristics. Firstly, for most fungal species, including the Aphyllophorales, we do not have available spore measurements representing the entire s p e c i e s but only for some, possibly unrepresentative, s p e c i m e n s. Thus most descriptions of new species include measurements of the spores of the type specimen only, and few descriptions include such measurements for a local population. In monographs and keys the absolute range of spore dimensions is given; in most cases neither the number of spores measured nor the origin of the specimens studied is indicated. In too many cases exactly the same dimensions are given in different text-books where fungi of remote areas are described, which does not inspire confidence in such data.

Most contemporary taxonomists accept the biological concept of the species and the rightness of the population approach to species studies. Proceeding from this point of view, a species is distinguished not by the spore characteristics of the holotype specimen but by those of different specimens of different populations of species. Like all other phenotypic characters, the spore measurements are variable within certain limits, typical for the species. This variability is complicated and includes several components: variability of populations within the species, variability of specimens, variability of one specimen during the spore discharge season (dependent and/or independent of environmental factors, especially weather conditions), diurnal variability, and variability of individual spores in a spore print obtained within a short period of time from one specimen.

In the Agaricales the variability of spores has been studied by several authors in a reasonable number of species (see Clemençon, 1979) but in the Aphyllophorales only in a small number of species. Some less well-known papers on the subject include the following.

E. Parmasto & I. Parmasto (1976) studied a local population of *Polyporus rhizophilus* Pat. in Central Asia (USSR). Differences between the mean spore lengths of some specimens was statistically highly significant, the range of means being 7.54-8.73 µm.

K. Bjørnekaer (1938) demonstrated that the mean length of the spores of the same basidiocarp of *Fomes fomentarius* (Fr.) Fr. varied from 21.0 µm on 11 May to 13.3 µm on 27 September, 1931, and from 20.7 µm on 19 April to 14.0 µm in September-November, 1932.

I. Nuss (1975) found that in seven species out of the 27 species he studied the form and/or dimensions of spores changed statistically very significantly during the sporulation period. In the same paper data were given on the mean spore measurements of different specimens of one local community.

I. Parmasto & E. Parmasto (1977) studied the variability of spore dimensions during the discharge period in three species of *Phellinus* in Estonia (USSR) and found the difference between the mean spore lengths to be statistically significant in *Ph. alni* (Bond.) Parm., *Ph. populicola* Niemelä and in three specimens of *Ph. igniarius* (Fr.) Quél. The difference was insignificant in three specimens of *Ph. igniarius*.

However, there is a further source of possible variability not accounted for in the above investigations, and which has been virtually unstudied in the Aphyllophorales, i. e. the differences which may occur between spores of different basidiocarps originating from the same mycelium. This variability is not only of taxonomic interest for it may also reflect the genetical diversity of different parts of an individual mycelium. So far as we are aware, this kind of variability has been studied only by R. Agerer (1975) in two groups of basidiocarps of *Flagelloscypha minutissima* (Burt) Donk and *F. kavinae* (Pil.) W.B. Cooke.

MATERIALS AND METHODS

Spores of 37 pairs, nine sets of three and one set of four basidiocarps of eight different species growing in nature were collected. Each set was believed to originate from the same mycelium: as a rule, members of the same set were growing not more than 15-25 cm from each other, and in some cases they had coalesced. Spore samples were collected from each basidiocarp as spore prints, shed over a 24 h period.

For four *Coriolus* species, herbarium material was used, each collection consisting of 5-6 individual basidiocarps which had been collected as presumably growing from the same mycelium.

From every sample 30 spores were measured in 2 % KOH solutiom using an eyepiece micrometer at a magnification

of x 700 under the microscope MBM-6, and the data were compared using Student's *t*-test.

RESULTS

Of the 36 pairs of basidiocarps, the difference in spore length was statistically insignificant (at $P > 0.10$) in 23 cases, significant (at $P < 0.05$) in seven cases and statistically highly significant (at $P < 0.001$) in six cases (Table 1). Amongst the species studied there were some pairs of basidiocarps with a significant difference in spore length except *Fomes fomentarius*, *Phellinus pini* (only one pair studied) and *Ph. populicola* (three pairs studied).

Of the nine sets of three and four basidiocarps (Table 2), the difference in spore length was in only two cases statistically insignificant between all the basidiocarps belonging to one set. In two cases (i. e. *Phellinus alni* and *Ph. nigricans)* all three basidiocarps significantly differed from each other in their mean spore length; and in the remaining sets (altogether six) two basidiocarps had similar spores and the third had statistically different ones. In the one set of four there were two different pairs of basidiocarps with similar spores.

In all four sets of basidiocarps of *Coriolus* spp. *(C. hirsutus, C. pubescens, C. versicolor* and *C. zonatus)* there were some pilei with similar spores and some with significantly different ones (Table 3).

Table 1

DIFFERENCE BETWEEN SPORES IN PAIRS OF BASIDIOCARPS[a]

Species, locality, substrate, date	Mean length (µm) ± s.e.	*t*	*Q* ± s.e.	*t*
Fomes fomentarius (Fr.) Fr				
Eston. SSR, on Betula sp., V.69	17.30 ± 0.21 17.34 ± 0.20	0.1	3.16 ± 0.06 2.96 ± 0.04	2.8*
Phellinus alni (Bond.) Parm.				
Eston. SSR, on Alnus incana, 15.X.69	6.47 ± 0.06 7.19 ± 0.13	5.1***	1.12 ± 0.02 1.08 ± 0.02	1.5
Eston. SSR, on Malus domestica, 24.VIII.70 [b]	6.31 ± 0.09 6.71 ± 0.06	3.9***	1.08 ± 0.01 1.10 ± 0.02	0.9
Eston. SSR, on Sorbus aucuparia, 16.X.70	5.64 ± 0.07 5.81 ± 0.09	1.5	1.07 ± 0.02 1.06 ± 0.01	0.5

[a] Significance of difference: * - significant at $P < 0.05$; ** - at $P < 0.01$; *** - at $P < 0.001$. *Q* - mean ratio of spore length and width.

[b] Basidiocarps grown together to each other.

Table 1 (continued)

Species, locality, substrate, time	Mean length (μm) ± s.e.	t	Q ± s.e.	t
Phellinus alni				
Eston. SSR, on Alnus incana, 15.X.69	6.29 ± 0.05 6.40 ± 0.06	1.3	1.08 ± 0.02 1.13 ± 0.02	2.0*
Eston. SSR, on Padus racemosa, 3.VI.69	6.06 ± 0.06 6.18 ± 0.08	1.2	1.12 ± 0.02 1.10 ± 0.02	0.7
- the same, 15.X.69	6.15 ± 0.07 5.91 ± 0.07	2.3*	1.10 ± 0.02 1.09 ± 0.02	0.4
Eston. SSR, on Sorbus aucuparia, 16.X.70	6.84 ± 0.09 6.96 ± 0.06	1.1	1.09 ± 0.01 1.11 ± 0.01	1.3
Eston. SSR, on Malus domestica, 13.V.71	5.61 ± 0.06 5.70 ± 0.07	1.0	1.12 ± 0.02 1.14 ± 0.02	0.9
Eston. SSR, on Sorbus aucuparia, 7.X.69	6.00 ± 0.09 6.01 ± 0.08	0.1	1.11 ± 0.02 1.14 ± 0.02	1.1
Ph. hartigii (All. & Schn.) Pat.				
Sakhalin, on Abies sachalinensis, 23.VIII.71	7.70 ± 0.09 8.27 ± 0.05	5.4***	1.06 ± 0.01 1.05 ± 0.01	0.7
Lvov Reg., on Abies alba, 21.IX.69	7.96 ± 0.08 8.10 ± 0.08	1.2	1.05 ± 0.01 1.04 ± 0.01	0.9
Lvov Reg., on Abies alba, 21.IX.69	8.03 ± 0.07 8.09 ± 0.06	0.6	1.04 ± 0.01 1.04 ± 0.01	0
Sakhalin, on Abies sachalinensis, 23.VIII.74	7.36 ± 0.09 7.41 ± 0.10	0.4	1.06 ± 0.01 1.06 ± 0.01	0
Caucas. Nature Reserve, on Abies nordmanniana, 23.V.75	8.07 ± 0.07 8.11 ± 0.10	0.3	1.06 ± 0.01 1.08 ± 0.01	1.2
Ph. igniarius (Fr.) Quél.				
Eston. SSR, on Salix caprea, 14.V.69	5.93 ± 0.07 6.38 ± 0.06	4.6***	1.11 ± 0.02 1.10 ± 0.01	0.6
- the same, 27.V.69	5.84 ± 0.06 6.20 ± 0.06	4.2***	1.13 ± 0.01 1.11 ± 0.01	1.5
Krasnojarsk Reg., on Salix sp., 28.VIII.71	5.62 ± 0.07 5.92 ± 0.06	3.1*	1.12 ± 0.01 1.13 ± 0.01	1.0
Eston. SSR, on Salix pentandra, 12.VI.69	6.08 ± 0.07 6.34 ± 0.06	2.9*	1.09 ± 0.01 1.15 ± 0.02	3.0*
Eston. SSR, on Salix triandra, 15.X.69	5.95 ± 0.08 6.27 ± 0.09	2.6*	1.13 ± 0.02 1.15 ± 0.02	0.7
Kamchatka, on Salix sachalinensis, 13.VIII.71	5.54 ± 0.07 5.64 ± 0.06	1.1	1.09 ± 0.02 1.13 ± 0.02	1.9
Eston. SSR, on Salix caprea, 7.VIII.69	5.48 ± 0.07 5.58 ± 0.09	0.9	1.12 ± 0.03 1.13 ± 0.02	0.6

Table 1 (continued)

Species, locality, substrate, time	Mean length (um) ± s.e.	t	Q ± s.e.	t
Phellinus nigricans (Fr.) P. Karst.				
Eston. SSR, on Betula pendula, 7.X.69	6.78 ± 0.07 7.27 ± 0.09	4.3***	1.09 ± 0.02 1.09 ± 0.02	0
Krasnojarsk Reg., on Betula pendula, 28.VIII.71	6.56 ± 0.03 6.73 ± 0.05	2.8*	1.06 ± 0.01 1.08 ± 0.01	1.2
Kamchatka, on Betula ermanii, 13.VIII.71	6.76 ± 0.06 6.95 ± 0.05	2.4*	1.07 ± 0.01 1.08 ± 0.01	0.8
Sweden, Tärna, 6.IX.74	6.36 ± 0.06 6.55 ± 0.06	2.2*	1.08 ± 0.01 1.12 ± 0.02	2.1*
Belovezhskaja Pushcha Nature Reserve, on Betula pendula, 24.IX.69	6.64 ± 0.08 6.79 ± 0.07	1.5	1.11 ± 0.01 1.12 ± 0.01	0.4
Kamchatka, on Betula ermanii, 13.VIII.71	6.62 ± 0.06 6.71 ± 0.07	1.1	1.07 ± 0.01 1.09 ± 0.02	1.1
Eston. SSR, on Betula pendula, 7.X.69	6.66 ± 0.08 6.77 ± 0.08	0.9	1.12 ± 0.02 1.10 ± 0.02	0.9
Eston. SSR, on Betula pendula, 7.X.69	7.06 ± 0.10 7.10 ± 0.08	0.3	1.12 ± 0.03 1.12 ± 0.02	0
Kamchatka, on Betula ermanii, 17.VIII.71	6.67 ± 0.06 6.67 ± 0.06	0	1.06 ± 0.01 1.06 ± 0.01	0
Ph. pini (Fr.) A. Ames				
Krasnojarsk Reg., on Pinus sylvestris, 28.VIII.71	5.30 ± 0.06 5.35 ± 0.05	0.6	1.11 ± 0.01 1.11 ± 0.01	0
Ph. populicola Niemelä				
Belovezhskaja Pushcha, on Populus tremula, 24.IX.69	5.32 ± 0.09 5.40 ± 0.07	0.7	1.18 ± 0.05 1.21 ± 0.02	0.5
Eston. SSR, on Populus tremula, 14.VI.69	5.11 ± 0.04 5.15 ± 0.05	0.6	1.09 ± 0.02 1.15 ± 0.08	0.7
Belovezhskaja Pushcha Nature Reserve, on Populus tremula, 24.IX.69	5.00 ± 0.08 5.05 ± 0.07	0.4	1.18 ± 0.02 1.19 ± 0.02	0
Ph. tremulae (Bond.) Bond. & Boriss.				
Krasnojarsk Reg., on Populus tremula, 28.VIII.71	5.07 ± 0.07 5.75 ± 0.06	7.5***	1.18 ± 0.02 1.21 ± 0.01	1.5
Eston. SSR, on Populus tremula, 7.X.69	5.42 ± 0.08 5.69 ± 0.08	2.5*	1.13 ± 0.02 1.17 ± 0.02	1.3
Caucasian Nat. Reserve, on Populus tremula, 23.V.75	5.38 ± 0.05 5.44 ± 0.05	1.0	1.17 ± 0.02 1.14 ± 0.01	1.8

Table 2

DIFFERENCE BETWEEN SPORES IN SETS OF THREE OR FOUR BASIDIOCARPS

Species, locality, substrate, date	Mean length (µm) ± s.e.	t^1 / t^2	Q ± s.e.	t
Phellinus alni				
Eston. SSR, on Malus domestica, 1.IX.70	5.16 ± 0.07	1.7	1.08 ± 0.02	0
	5.36 ± 0.10	6.0***	1.08 ± 0.02	4.1**
	6.02 ± 0.05	13.2***	1.16 ± 0.01	3.8**
Eston. SSR, on Sorbus aucuparia, 16.X.70	5.88 ± 0.08	1.1	1.08 ± 0.01	0
	5.99 ± 0.07	3.1**	1.08 ± 0.01	0.6
	5.70 ± 0.07		1.07 ± 0.01	
Eston. SSR, on Padus racemosa, 17.IX.70	5.66 ± 0.06	1.4	1.12 ± 0.01	1.4
	5.54 ± 0.07	3.0**	1.09 ± 0.02	2.3*
	5.87 ± 0.08		1.08 ± 0.01	2.3*
Eston. SSR, on Sorbus aucuparia, 16.X.71	5.79 ± 0.06	1.8	1.07 ± 0.01	0.6
	5.63 ± 0.07	2.5*	1.08 ± 0.01	0
	5.87 ± 0.07	1.8	1.08 ± 0.01	0
	5.68 ± 0.08		1.08 ± 0.02	
Phellinus igniarius				
Eston. SSR, on Salix triandra, 15.X.69	6.26 ± 0.07	0.1	1.16 ± 0.02	2.0*
	6.25 ± 0.08	4.5***	1.10 ± 0.02	1.4
	6.78 ± 0.09		1.14 ± 0.02	
Eston. SSR, on Salix pentandra, 12.VI.69	5.85 ± 0.08	1.4	1.11 ± 0.01	
	6.01 ± 0.09	2.3*	1.22 ± 0.02	
	6.25 ± 0.06	4.1***	1.12 ± 0.01	
Eston. SSR, on Salix caprea, 14.VI.69	6.08 ± 0.08	0	1.19 ± 0.08	0.9
	6.08 ± 0.06	4.1***	1.12 ± 0.02	2.2*
	6.39 ± 0.04		1.16 ± 0.01	
Eston. SSR, on Salix caprea, 16.VI.69	6.01 ± 0.09	0.2	1.12 ± 0.01	0.2
	6.03 ± 0.06	1.6	1.12 ± 0.01	3.6***
	6.19 ± 0.08		1.19 ± 0.02	
Phellinus nigricans				
Eston. SSR, on Betula pendula, 14.VI.69	6.15 ± 0.07	2.8**	1.07 ± 0.01	0.6
	6.43 ± 0.06	4.2***	1.08 ± 0.01	1.1
	6.72 ± 0.05	6.8***	1.09 ± 0.01	1.7
Phellinus populicola				
Eston. SSR, on Populus tremula, 2.X.69	5.25 ± 0.06	1.3	1.16 ± 0.01	1.9
	5.35 ± 0.05	0.3	1.10 ± 0.01	0
	5.37 ± 0.05	1.6	1.10 ± 0.01	2.0*

t^1 - value of Student's t for the samples of two neighbouring basidiocarps; t^2 - value of t for extreme means. Significance of difference marked as in Table 1.

Table 3

DIFFERENCES BETWEEN MEAN LENGTHS OF SPORES OF DIFFERENT PILEI OF ONE HERBARIUM COLLECTION
(value of Student's *t*; significance of difference marked as in Table 1)

Coriolus hirsutus (Fr.) Quél.

Collection: TAA 111799. Estonian SSR, near Tartu, on a log of Alnus glutinosa, coll. M. Saar 20.X.1979.

Mean length ± s.e. of spores: pileus no. 1 - 5.71 ± 0.08; 2 - 5.91 ± 0.13; 3 - 6.16 ± 0.09; 4 - 6.16 ± 0.11; 5 - 6.95 ± 0.12 µm.

Pileus no.	1	2	3	4
5	8.7***	6.0***	5.3***	6.4***
4	3.4**	1.5	0	
3	3.7***	1.6		
2	1.3			

Coriolus pubescens (Fr.) Quél.

Collection: TAA 52534. Primorskij Reg., Sikhote-Alin Nature Reserve, on Salix sp., coll. E. Parmasto 11.IX.1976.

Mean length ± s.e. of spores: 1 - 5.09 ± 0.09; 2 - 5.21 ± 0.07; 3 - 5.31 ± 0.07; 4 - 5.34 ± 0.10; 5 - 5.59 ± 0.12; 6 - 5.76 ± 0.10 um.

Pileus no.	1	2	3	4	5
6	4.9***	4.4***	3.6***	3.0**	1.1
5	3.4**	2.8**	2.0*	1.6	
4	1.8	1.0	0		
3	1.9	0.9			
2	1.0				

Coriolus versicolor (Fr.) Quél.

Collection: TAA 112716. Estonian SSR, near Tartu, on a log of Betula sp., coll. A. Kollom 27.VII.1979.

Mean length ± s.e. of spores: 1 - 5.13 ± 0.08; 2 - 5.23 ± 0.07; 3 - 5.36 ± 0.08; 4 - 5.39 ± 0.08; 5 - 5.46 ± 0.09 µm.

Table 3 (continued)

Pileus no.	1.	2	3	4
5	2.8**	2.0*	0.8	0.6
4	2.3*	1.5	0.3	
3	2.0*	1.2		
2	0.9			

Coriolus zonatus (Fr.) Quél.

Collection: TAA 97422. Estonian SSR, Järvselja, on a log of Populus tremula, coll. I. Parmasto 3.XI.1978.

Mean length ± s.e. of spores: 1 - 5.43 ± 0.08; 2 - 5.48 ± 0.09; 3 - 5.64 ± 0.08; 4 - 5.73 ± 0.09; 5 - 5.86 ± 0.09 µm.

Pileus no.	1	2	3	4
5	3.5***	2.9**	1.8	1.0
4	2.4*	1.9	0.7	
3	1.8	1.3		
2	0.4			

DISCUSSION

All the pairs or sets of basidiocarps studied were collected without establishing the presence or absence of dark lines, isolating different mycelia in the wood; in most cases the substratum was a growing full-size tree, and the data were collected a long time before the papers written by A.D.M. Rayner and N.K. Todd about the significance of isolating dark lines in wood were published. The only criterion for considering the basidiocarps to belong to one specimen was their close proximity.

As demonstrated recently, in several species of the Aphyllophorales studied from this aspect this criterion is not always reliable (see below). Nevertheless, in most cases the neighbouring basidiocarps of the *Phellinus* species and *Fomes fomentarius* studied by us have spores with an insignificant difference between the mean lengths and usually also between the mean values of *Q*. This may imply that the *Phellinus* species and *Fomes fomentarius* have long-living mycelia, and the mycelium of an individual may be largely extended in the infected tree trunk or log. Indeed it has been pointed out (e. g. Williams, Todd & Rayner, 1981; Boddy & Rayner, 1982) that several fungi appear to infect standing trees as extensive single individuals, whilst ubiquitous saprophytes such as *Coriolus versicolor* and *Stereum hirsutum* (Fr.) S.F. Gray often form

numerous individuals in felled timber (see below).

There are several possible explanations for the differences between the spores of other neighbouring basidiocarps:

1. The difference in the mean spore size of what is statistically significant in a technical sense does not necessarily mean that the difference is significant biologically (cf. Simpson, Roe & Lewontin, 1960: 173-175). This especially concerns the cases when the statistical significance is at the level of $P > 0.001$. As a demonstration of such a case we may indicate one pair of basidiocarps of *Phellinus alni* growing on *Padus racemosa:* the difference between the mean spore lengths was insignificant on 3 June, 1969 ($P > 0.20$), but statistically significant on 15 October of the same year ($P \approx 0.03$).

2. Different parts of the same mycelium are genetically different as a result of the fusion of genetically distinct mycelia (cf. Burnett & Partington, 1957; Bresinsky et al., 1977). However, the assumption that this phenomenon really exists under natural conditions has been disclaimed in several papers published in the last few years. (Cf. Todd & Rayner, 1980: "To date we are unaware of any convincing evidence which demonstrates effective heterocaryosis between wild dikaryotic isolates". See also Esser & Blaich, 1973 and Goldstein & Gilbertson, 1981: 177).

3. The decaying tree trunk or log is inhabited by two or several neighbouring individual mycelia of the same species, which are genetically different and which do not fuse due to their heterocaryon (somatic) incompatibility. This has been demonstrated recently in several Aphyllophorales (Rayner & Todd, 1977, 1979; Todd & Rayner, 1978, 1980; Coates, Rayner & Todd, 1981).

The last-mentioned reason seems to be acceptable for our present results. The only discrepancy which does not fit is a pair of the basidiocarps of *Phellinus alni*, which had densely coalesced but had a highly significant difference between the mean length of spores.

The difference between the mean length of spores of different pilei of one collection in the *Coriolus* species (Table 3) are easily understandable. A.D.M. Rayner and N.K. Todd (1977) have shown that many of the closely crowded basidiocarps of *Coriolus versicolor* on one tree stump belong to genetically different isolated mycelia. Obviously the same is also charactristic of *Coriolus hirsutus, C. pubescens* amd *C. zonatus*. The mean spore length data only are not sufficient to say exactly how many individual specimens we had in our cases mixed in one collection, but obviously there were no less than two or three.

R. Agerer (1975) compared the mean length of spores in two groups of the basidiocarps of *Flagelloscypha minutissima* and *F. kavinae*. He found that in both groups (species) there were some basidiocarps which probably belonged to different individuals, and that the groups of basidiocarps were consequently mixed populations (Mischpopulationen).

In conclusion from our study and the results of others we may assert that if not always, then in most cases the different basidiocarps of the Aphyllophorales growing on one mycelium have spores with an insignificant or small (at $P > 0.001$) differences in their mean size and form. Different specimens of one local population may have a statistically highly significant difference in spore size, and in some species having small basidiocarps they may happen to be kept in a herbarium as one collection.

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MYCOTAXON

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A NEW SPECIES OF ENDOPHRAGMIELLA FROM SCLEROTIA OF SCLEROTINIA MINOR

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ABSTRACT

A new dematiaceous hyphomycete, Endophragmiella constricta, isolated from sclerotia of Sclerotinia minor buried in an agricultural field in Beltsville, MD, is described and illustrated.

INTRODUCTION

An interesting fungus was observed on sclerotia of Sclerotinia minor Jagger that was used as bait in a field experiment (Adams and Ayers, 1982). This dematiaceous hyphomycete developed on sclerotia placed in moist chambers, and when isolated grew very slowly on culture media. Although this species did not show mycoparasitic ability against S. minor in vitro, it was quite unusual and is herein described as a new species of the genus Endophragmiella.

Abbreviations of herbaria follow those in the Index Herbariorum (Holmgren et al., 1981).

TAXONOMIC PART

Endophragmiella constricta Dunn sp. nov.

Coloniae in agaro ad 21 C lente crescentes, restrictae, effusae, fuscae. Mycelium ex hyphis ramosis, septatis, brunneis, 2.0-2.3 µm crassis compositum. Conidiophora macronemata, simplicia, erecta, fusca, crassitunicata, laevia, usque ad 4 cellularia, 10.0-15.0 X 3.5 µm. Cellulae conidiogenae monoblasticae, 6.9-8.0 X 3.5 µm, cellula penultima percurrenter prolifera post conidia successiva parta, proliferae usque ad 280 µm longas. Secessio conidiarum rhexolytica, cum fimbria basali excentrica, 1.0 X 2.0 µm. Conidia fusca, crassitunicata, laevia, oblonga vel oblongo-ellipsoidea, 2-septata, 15.0-23.0 X 6.9-10.4 µm, cellula basali pallida, cellula centrali constricta.

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Isolatus e sclerotio Sclerotiniae minoris, e terra, Beltsville, Maryland, M.T. Dunn (MTD 3129). Holotypus BPI, isotypus DAOM 180189, cultura exsiccata.

Colonies on artificial media restricted, effuse, dark brown to black with little aerial mycelium, hyphae loosely branched, septate, brown, 2.0-2.3 µm wide. Conidiophores macronematous, simple, erect, rarely branched, brown, thick-walled, smooth, composed of up to 4 cells, 10.0-15.0 X 3.5 µm. Conidiogenous cells monoblastic, 6.9-8.0 X 3.5 µm, terminal on conidiophores, conidiogenous cell forming on each succesive, percurrent proliferation of the penultimate cell through the conidiogenous cell and beyond the open end that formed as a result of rhexolytic conidium secession (Figs. 2, 3, 5). As many as 29 such proliferations forming on a single conidiophore, reaching a length of up to 280 µm. Conidia retaining a portion of the conidiogenous cell as an eccentric basal frill, 1.0 X 2.0 µm. Conidia often remaining partly attached laterally to the conidiogenous cells giving the appearance of sympodial proliferation (Figs. 1, 4). Conidia brown, thick walled, smooth, oblong to oblong-ellipsoid, 2-septate, the lower cell paler, the middle cell constricted, 15.0-23.0 X 6.9-10.4 µm.

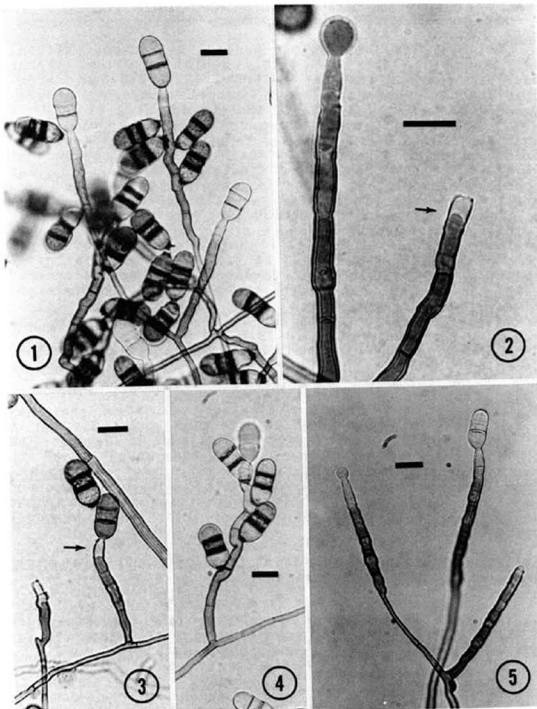
Colony growth on artificial media is very slow, attaining a diameter of only 8 mm after 24 days at 21 C on MYP, which contained 0.6% malt extract, 0.1% soytone, 0.05% yeast extract and 2% agar. Growth was faster on GYSI medium, with a colony diameter of 23 mm after 24 days. This medium contained 1% glucose, 0.05% yeast extract, 0.1% soytone, 0.001% $FeCl_3$ and 2% agar. The addition of iron to culture media has been shown to increase growth and sporulation of Sporidesmium sclerotivorum Uecker et al. [=Teratosperma sclerotivorum (Uecker, Ayers and Adams) Hughes] another dematiaceous hyphomycete associated with sclerotia of S. minor (W.A. Ayers, personal communication).

Habitat: Isolated from living sclerotia of Sclerotinia minor which had been buried in an agricultural field, Beltsville, MD.

Specimens examined: MTD 3129, June 1, 1981, dried culture in BPI (holotype) and DAOM (180189, isotype); living culture of the type deposited at ATCC 46749.

Endophragmiella constricta was isolated from a sclerotium of Sclerotinia minor Jagger during a field experiment on the ability of Teratosperma sclerotivorum to reduce lettuce drop caused by S. minor. Sclerotia were sieved from the soil and placed in petri plates with moist filter paper; E. constricta grew and sporulated on a sclerotium, and subsequently spread onto the filter paper.

Sutton (1973) first described the genus Endophragmiella to include E. pallescens and E. canadensis, both of which were hyperparasitic on carbonaceous stromata of ascomycetes. Hughes (1979) redefined



Figs. 1-5. Endophragmiella constricta (Bar = 10 µm). Fig. 1. Conidiophores and conidia. Fig. 2. Developing conidium and proliferation into conidiogenous cell after conidium secession (arrow). Stained with phloxine. Fig. 3. Young conidiophores showing the empty conidiogenous cell prior to conidium secession (arrow). Stained with phloxine. Fig. 4. Sympodial appearance of conidium production. Fig. 5. Young conidiophores.

the genus for species with rhexolytic conidium secession followed by a regular percurrent proliferation each arising from the cell below succesive terminal conidiogenous cells. Endophragmiella constricta is in the group of species with 2-septate conidia which includes E. ontariensis Hughes, E. ellisii Hughes, E. tripartita Hughes, E. biseptata (Peck) Hughes and E. hughesii Hawksworth. None of these species has been grown in culture (S.J. Hughes, personal communication). A recently described species, E. fallacia Kirk (1981), also has 2-septate conidia but they are larger than those of E. constricta and cylindrical. Endophragmiella constricta is distinct from the other species in this group in the smaller size and constricted shape of the conidia.

Endophragmiella constricta shares with other species of the genus the characteristic method of percurrent proliferation. Often the conidium remains associated with, or partially attached to, the wall of the conidiogenous cell and after several conidia have been produced, it appears as if conidia had developed sympodially (Figs. 1, 4). Kirk (1982) reported the characteristic percurrent type of proliferation in E. corticola Kirk but when the conidium failed to secede proliferation proceeded laterally through the wall of the conidiogenous cell. Proliferation can also appear sympodial in E. hymenochaeticola Hughes because the apex of the conidiogenous cell is constricted and proliferation may take place through the lateral wall instead of percurrently (Hughes, 1978).

Endophragmiella constricta has not shown any mycoparasitic ability in vitro against sclerotia of S. minor. Another dematiaceous hyphomycete recently described from sclerotia, Arthrocristula hyphenata Sigler, Dunn and Carmichael, apparently has no mycoparasitic ability (Sigler et al., 1982). Other dematiaceous hyphomycetes that have been isolated from sclerotia of S. minor with proven mycoparasitic ability include Teratosperma sclerotivorum (Uecker et al., 1978; Hughes, 1979) and I. oligocladum Uecker, Ayers and Adams (1980). These two species grow poorly on standard culture media but develop well on living sclerotia of Sclerotinia species. Another morphologically similar hyphomycete, Laterispora brevirama Uecker, Ayers and Adams (1982), was isolated from sclerotia of S. minor but colonized sclerotia only in association with the above mentioned Teratosperma spp. Evidence indicates that these three species are biotrophic parasites with facultative saprophytic ability (Ayers and Adams, 1979, 1981; Uecker et al., 1982). Endophragmiella constricta and A. hyphenata seem to be more opportunistic, possibly functioning as secondary colonizers of the sclerotia.

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MYCOTAXON

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THREE NEW SPECIES OF HYPOGYMNIA FROM WESTERN NORTH AMERICA (LICHENES: HYPOGYMNIACEAE)

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Abstract:--Two new species in the Hypogymnia enteromorpha group, H. heterophylla Pike and H. occidentalis Pike, and a California endemic, H. mollis Pike and Hale, are described.

Hypogymnia heterophylla Pike, sp. nov. Fig. 1b

Thallus laxe adnatus, lobis linearibus, libris, margine nigromarginatis, medulla nigra, sorediis isidiisque destitutis; apothecia numerosa; sporae ca 4 X 7 µm.

Thallus loosely attached at the base, almost subfruticose, rather soft, whitish gray, 8-15 cm broad; lobes variable, 1-4 mm wide but usually long and little branched, free and trailing, the tips often perforate, the margins conspicuously black rimmed; medullary cavity dark above and below; lower surface shiny, jet black, rugose. Pycnidia very common; microconidia rod shaped to weakly bifusiform, 5-6 µm long. Apothecia common, short stipitate, 3-15 mm in diameter, the disc dark brown, plane, splitting radially with age; hymenium 40-45 µm high; spores 8/ascus, colorless, ellipsoidal, ca 4 X 7 µm.

Chemistry: Atranorin, protocetraric acid, physodalic acid, and physodic acid.

Type: On stunted conifers along Pygmy Forest Reserve nature trail, Van Damme State Park, elev. 50m, Mendocino Co., California, M. E. Hale no. 49365, 9 June 1977 (US, holotype; duplicates to be distributed in Lichenes Americani Exsiccati).

Specimens examined (all in US). California: Del Norte Co., Doty 3412; Humboldt Co., Becking 61041020, Hale 56798; Marin Co., Hermann 17540; Mendocino Co., Tucker 6089. Oregon:

Coos Co., Hale 48934; Curry Co., Hale 49074; Douglas Co., Leuthner 24432; Lane Co., Hale 48821; Tillamook Co., Pike 3144.

Hypogymnia occidentalis Pike, sp. nov. Fig. 1a

Thallus adnatus, lobis irregulariter inflatis, brevibus, margine concolori, medulla nigra; apothecia numerosa; sporae 5 X 7-9 µm.

Thallus rather closely adnate throughout, whitish mineral gray, 5-10 cm broad; lobes rather short and irregularly inflated, 2-4 mm wide, lacking a black rim, the medullary cavity blackening above and below; lower surface black, deeply rugose, sparsely perforate. Pycnidia abundant; microconidia rod shaped to weakly bifusiform, 5-6 µm long. Apothecia abundant, substipitate, 3-10 mm in diameter, the rim upturned, the disc dark brown; hymenium 40-45 µm high; spores 8/ascus, colorless, ellipsoidal, 5 X 7-9 µm.

Chemistry: Atranorin and physodic acid.

Type: Big Canon, Wallowa Co., Oregon, E.P. Sheldon 8763, 23 Aug. 1897 (US, holotype).

Selected specimens examined (all in US). Alaska: Flat Island, Thomas 145. Oregon: Crook Co., Hale 49690; Curry Co., Hale 48921; Grant Co., Hale 49688; Union Co., Sheldon 9024. Washington: Spokane Co., Bonser s.n. Idaho: Bonner Co., Hale 49010; Boundary Co., Hale 48236. Montana: Flathead Co., Hale 48367; Lake Co., Barkley 2004; Lincoln Co., Hale 49562; Missoula Co., Hale 48834; Ravalli Co., Hale 48401; Sanders Co., Hale 48275. California: Humboldt Co., Hale 49730; Los Angeles Co., Wheeler 1554; Mendocino Co., Hale 49340; Plumas Co., Hale 51971; Siskiyou Co., Hale 51627; Sonoma Co., Hale 48295; Tehama Co., Hale 52286.

The name "enteromorpha" has been applied indiscriminately to virtually every nonsorediate Hypogymnia species in North America at some time. The eastern population was not split off until 1973 as H. krogii Ohlsson. Up to now the far more varied western populations have not been critically studied.

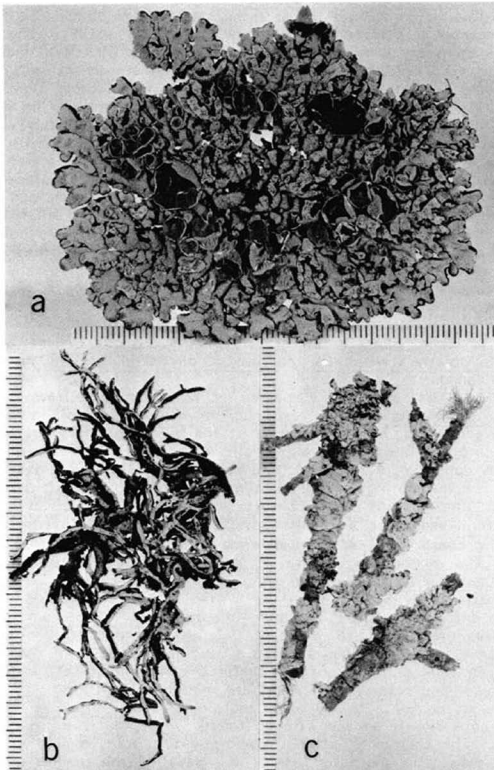
Much of the material labeled "H. enteromorpha" in the western states has in fact turned out to be H. imshaugii Krog, a widespread species, notoriously variable but easily recognized by the white medullary cavity (Krog, 1968). Almost all other species have a dark medulla. Further breakdown and understanding of this latter group has depended on accurate typification of the two oldest names, H. duplicata (Ach.) Rass. and H. enteromorpha (Ach.) Nyl., something we have now been able to do by examining appropriate lectotype materials in the British Museum (Smith herbarium) and isotypes at Helsinki (Acharian

herbarium). Hypogymnia duplicata, a conspicuous but rather rarely collected coastal lichen from Alaska south to Oregon, is the species so clearly illustrated by Krog (1968, p. 95). The usual chemistry is atranorin, protocetraric acid, physodalic acid, and accessory diffractaic acid. We have not demonstrated physodic acid in any specimens, concurring with Ohlsson (1973).

We have based the typification of H. enteromorpha on the rich material in the Smith herbarium (BM) and comparison with the scraps in H. These specimens are strongly inflated, without a conspicuous black rim, more or less loosely adnate but sometimes somewhat trailing, and produce atranorin, protocetraric acid, physodalic acid, physodic acid, and accessory difractaic acid (misidentified as barbatic acid by Krog using the microcrystal tests). In addition there is a second large population, also represented on the lectotype sheets, an acid-free chemotype containing only atranorin, which is morphologically indistinguishable from P+ plants. This species complex is very common from Alaska south to California, generally toward the coast in the Cascade ranges but also extending inland as far east as Idaho, where a few other typically Cascade lichens, such as Platismatia stenophylla and Pseudocyphellaria anomala, have been found.

The first of our new species, H. heterophylla, differs from H. enteromorpha in these respects: Lobes long and trailing, not grossly inflated, attached mostly at the center below, margins with a broad black zone, spores ellipsoidal (in H. enteromorpha nearly spherical, 5 X 6 μm), and diffractaic acid always lacking. Furthermore it has a much more restricted habitat and range, pine barrens, Pinus contorta in sand dune areas, Quercus wislizenii chaparral, etc., all within a few kilometers of the Pacific coast from central California to Oregon.

The second new species, H. occidentalis, is widespread in the Cascades (one collection from Alaska) and especially the northern Rocky Mountains in the United States, overlapping to a large extent—excepting Montana—the range of H. enteromorpha. It often grows on lower boles of Douglas fir and other conifers in dense forests and has a broad altitudinal range, from sea level to 1500 m. It has fairly distinctive morphological and chemical characters. The lobes are moderately inflated without a strong (or with no) black margin, as in H. enteromorpha, but more closely adnate with no tendency for the lobes to trail. The chemistry, atranorin and physodic acid, is another good diagnostic character, useful in separating the species not only from typical P+ H. enteromorpha but also from its P- (atranorin only) chemotype.



Figs. 1a-c. Holotype specimens of Hypogymnia: a, H. occidentalis; b, H. heterophylla; c, H. mollis (all in US). Scale in mm.

Hypogymnia mollis Pike and Hale, sp. nov. Fig. 1c

Thallus arcte adnatus, mollis et fragilis, lobis brevibus, congestis, superne diffuse sorediatis; apothecia ignota.

Thallus closely adnate on twigs, soft and fragile, white to grayish white, 3-6 cm broad; lobes short, about 1 cm long, and crowded, 1-3 mm wide, little branched, the upper surface at first continuous, shiny, but soon rugose, cracking and flaking and becoming diffusely sorediate over the whole surface; medullary cavity brown to blackening above and below; lower surface dull black, rugose, the tips perforate, part of the lower cortex often eroding away to expose the medulla. Apothecia and pycnidia not seen.

Chemistry: Atranorin and physodic acid.

Type: On shrubs in sandy area at Los Osos Oak Reserve, near Los Osos, San Luis Obispo Co., California, elev. 15 m, M.E. Hale no. 57768, 31 July 1980 (US, holotype; to be distributed in Lichenes Americani Exsiccati).

Specimens examined. California: San Diego Co., Cota 1447b (US), Du Rietz 206 (USP, US).

This rare but unusual Hypogymnia is easily recognized by the laminal diffuse soralia and the P- chemistry. It has no obvious relationship with any other species in North America. Hypogymnia laminosorediata Hawks. from Morocco has the same chemistry and extensive laminal soralia but the thallus is much larger and the medulla white on the roof of the cavity. Sorediate H. tubulosa (Schaer.) Hav., better known to lichenologists, also produces atranorin and physodic acid but has soralia delimited to the lobe tips. The three collections we have seen come from open coastal chaparral or scrub.

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MYCOTAXON

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A NEW SPECIES OF PARMELIA (LICHENES) WITH PROTOCETRARIC ACID

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Abstract.--A new species, Parmelia protosulcata Hale, is described from the Southern Hemisphere. It contains the depsidone protocetraric acid.

The genus Parmelia is typified by P. saxatilis (L.) Ach., a well-known boreal lichen characterized by effigurate pseudocyphellae (Hale, 1981). There are about 30 closely related species in this group, centered mostly in eastern Asia. While the majority contain salazinic acid, we have long known that P. discordans Nyl. is anomalous in containing protocetraric acid (along with lobaric acid), giving a negative KOH test in the medulla (Culberson, 1970). A lesser known species P. pseudosulcata Gyelnik, also produces this acid (Ohlsson, 1973). We can now add the species described below to this interesting complex, which now includes P. crambidiocarpa Zahlbr. from New Zealand, P. kerguelensis Crombie from the subantarctic islands, and P. discordans and P. pseudosulcata.

Parmelia protosulcata Hale, sp. nov. Fig. 1

Thallus adnatus, corticola, lobis sublinearibus, 2-3 mm latis, superne effigurato-pseudocyphellatis, planis, margine sorediatis, subtus nigris, rhizinis simplicibus vel sparse furcatis. Apothecia rara, sporis simplicibus, incoloribus, 7-9 X 11-13 µm.

Thallus adnate to loosely adnate on bark, pale greenish to brownish mineral gray, 2-6 cm broad; lobes sublinear, short, contiguous, 2-3 mm wide, the surface plane, rarely weakly foveolate, becoming faintly pruinose at the tips, deeply reticulately fissured in older parts; pseudocyphellae effigurate, small, rather sparsely developed, mostly toward lobe tips or on the margins, usually elongate; soralia developing on lobe tips or margins, usually orbicular but fusing and linear or densely ag-

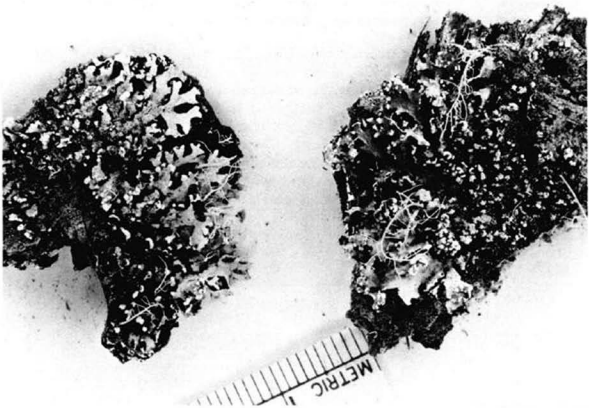

Fig. 1. Isotype of Parmelia protosulcata Hale in US.

gregated with age, the soredia coarse; cortex paraplectenchymatous, 14-16 µm thick, algal layer ca 15 µm thick, medulla white, 80-110 µm thick, lower cortex carbonized, 15-18 µm thick; lower surface black, shiny, moderately rhizinate, the rhizines simple to sparsely furcate or weakly squarrosely branched. Apothecia rare, substipitate, 4-5 mm in diameter, the amphithecium rugose, pseudocyphellate; hymenium 60-65 µm high; spores 8, simple, colorless, 7-9 X 11-13 µm (data from Imshaug 45613).

Chemistry: Atranorin and protocetraric acid.

Type: On Nothofagus antarctica in an open N. antarctica forest, Cabezera Lago at eastern end of Lago Fagnano, Tierra del Fuego, Argentina, R. Santesson 7955, 30 Mar 1940 (S, holotype; US, isotype).

This is a strictly austral species, very common with P. sulcata Tayl. in the Straits of Magellan region and southern Chile, especially in moist Nothofagus forests. It is also present on at least one of the subantarctic islands. The orbicular,

mostly marginal soralia are quite distinct from the linear, laminal ones of P. sulcata, its closest relative, which is also distinguished by densely squarrosely branched rhizines.

Two specimens from Chile (Prov. Cautin, Rundel 7457 and Prov. Malleco, Mahu 2474, both in US) contain fumarprotocetraric acid only and seem to represent a chemotype, not entirely unexpected although this acid had not previously been reported in the genus.

Specimens examined. New Zealand: Campbell Island, Harris 5455 (MSC, US). Falkland Islands, Howkins 2964 (FH). Chile: Prov. Magallanes, Imshaug and Ohlsson 43842, 43896, 44401, 44805, 44568, 45155, 45570B (all MSC), 45613 (MSC, US), Santesson 1843 (S, US); Prov. Osorno, Imshaug 42961 (MSC); Brunswick Peninsula, Imshaug and Harris 39095, 39260, 39328, 39329, 39404 (MSC).

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A new host for *Sphaeronaemella helvellae* -- *Pseudorhizina sphaerospora*

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While examining material of Helvellaceae in North America, a specimen of *Pseudorhizina sphaerospora* (Peck) Pouzar (≡ *Helvella sphaerospora* Peck ≡ *Gyromitra sphaerospora* (Peck) Sacc.) was studied and found to be infected with *Sphaeronaemella helvellae* (Karsten) Karsten (Pyrenomycetes, Melanosporaceae). Previous reports of this fungus have been made by Seeler (1943), Wells and Kempton (1968), Malloch (1974), and recently by Cannon and Hawksworth (1982). All of these reports have been based on parasitized material of *Gyromitra infula* (Schaeffer) Quélet and *G. ambigua* (Karsten) Harmaja. This is the first notice of *S. helvellae* on *P. sphaerospora*. Though *S. helvellae* does not seem to be common, it seems to be widespread in North America. Wells and Kempton (1968) stated that in the Anchorage area *Gyromitra infula* is frequently infected with *S. helvellae*, indicating that local epidemics might be quite common.

The material of *S. helvellae* on *P. sphaerospora* differs only slightly from that on species of *Gyromitra*. Seeler (1943), Malloch (1974), and Cannon and Hawksworth (1982) described the perithecia as being superficial to semi-immersed. The perithecia on *P. sphaerospora* are often deeply embedded with only the necks projecting. In general, the perithecia are somewhat smaller than those described from *Gyromitra* spp. Perithecia from *P. sphaerospora* range from 90 to 110 µm.

Virtually nothing is known of the biology of this parasite. The presence of *S. helvellae* on *P. sphaerospora* might indicate a close alliance of *P. sphaerospora* with the species of *Gyromitra* but so little information is available that no conclusion can be drawn. Certainly all the Gyromitras and allies should be examined for this parasite to determine if the host range of *S. helvellae* is

broader than presently understood.

Specimens examined: On *Pseudorhizina sphaerospora*. New York, Undercliff, trail to Lock Bonnie, June 27, 1899, R. A. and A. M. Harper (FH). On *Gyromitra infula*. Shelburne, N.H. W. G. Farlow (FH, cited by Seeler). On *Gyromitra infula*. In moss and on swampy ground at edge of boreal forest beaver pond, Tarzwell, Ontario, Canada, George P. White (965) (FH).

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MYCOTAXON

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SMITTIUM LONGISPORUM, A NEW HARPELLALES (TRICHOMYCETES) FROM CHIRONOMID GUTS

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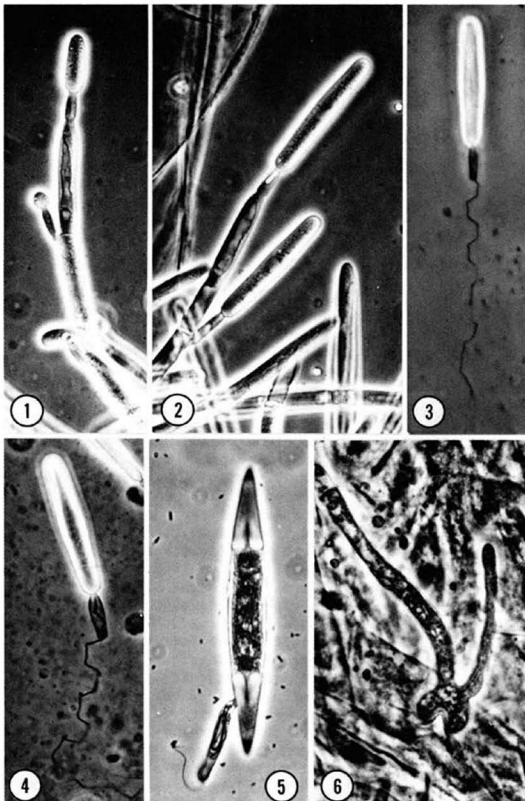
The fungal genus *Smittium* (Harpellales, Legeriomycetaceae) has 18 recognized species, including the zygospore-producing one described in this paper. *Smittium* species inhabit the hindguts of aquatic Diptera larvae such as midges (Chironomidae, Ceratopogonidae), mosquitoes (Culicidae), and blackflies (Simuliidae). Of the 18 species, 14 were described from midges (including the present species), three from mosquitoes, and one from blackflies. Some species are able to infest more than one host family. For example, we have found *S. culicis* and *S. culisetae*, normally in mosquito larvae, in the guts of blackfly larvae. Williams and Lichtwardt (1972) collected trichospores from axenic cultures of four *Smittium* spp. isolated from various geographic locations and from different dipteran hosts (chironomids, mosquito, and blackfly larvae), fed them to mosquito larvae (*Aedes aegypti*), and demonstrated that there was some degree of host preference by the fungi at the insect family level. Zygospores have been described from only six species, all of them from Chironomidae. The currently known distribution for the new species, *S. longisporum*, includes several midwestern states of the U.S.A. and one site in Sweden above the Arctic Circle.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Smittium longisporum Williams, Lichtwardt & Peterson, sp. nov.

Trichosporae elongate fusiformi-ellipsoidales, (40-)46 (-55) × (6-)8(-10) µm, collare (10-)13(-17) × ca. 4 µm. Cellulae genitales longae plerumque 1-2 trichosporae in ramo fertili omni producentes. Zygosporae oblique affixae, fusiformi-biconicae, (102-)110(-113) × (13-)15(-17) µm, collare 28-32 × ca. 5 µm lato, ad regionem (11-)14(-18) µm a termino uno zygosporae affixo, appendiculo unico praedito. Chironomidarum larvalium incola.

Trichospores long fusiform-ellipsoidal (40-)46(-55) × (6-)8(-10) µm with a long, well-defined appendage which often has a zigzag appearance upon release of the trichospore; collar (10-)13(-17) × ca. 4 µm, slightly bulged centrally. Usually 1-2 trichospores per fertile branch produced on long generative cells. Zygospores fusiform-biconical (102-)110(-113) × (13-)15(-17) µm, collar 28-32 × ca. 5 µm attached (11-)14(-18) µm from one end of the zygospore which bears a single appendage several times longer than the zygospore; attached obliquely to the zygosporophore which arises laterally from one of the conjugants. Basal cell with two downward-curved projecting branches. Growing in the hindgut of several species of larval Chironomidae.

Holotype: Slide DGK-1-1 deposited with R. W. Lichtwardt at the University of Kansas, prepared from the hindgut of a *Cricotopus* sp. larva collected 2 January 1981 in Rock Creek, Section 8, T14S, R18E, Douglas County, Kansas, USA, where County Road #462 intersects Rock Creek.

Figs. 1-6. *Smittium longisporum*. 1. Developing trichospores, ×575; note early collar development (subterminal spore) followed by spore enlargement (terminal spore). 2. Trichospores nearing maturity, ×575. 3 and 4. Mature released trichospores with the characteristic long collar and zigzag appendage, ×650. 5. Zygospore, ×535; most of the single appendage can be seen furled within the long collar. 6. Basal cell of a young thallus, ×780; note the branch growing from the clasplike holdfast portion of the cell.

Collections: In addition to the type locality, thalli and trichospores were found in larval Chironomidae from: a small stream draining into the north shore of Lake Torneträsk across from the Abisko Naturvetenskapliga Station, Sweden, 7 July 1971; Indian Creek 3.6 km S of highways MO 17 and US 63 junction, Texas County, Missouri, USA, 5 February 1982; Platte River just S of highways I 80 and NE 10 (Minden interchange), Buffalo County, Nebraska, USA, 15 April 1982; Neosho River 1.6 km E of highways US 50 and I 35 interchange near Emporia, Lyon County, Kansas, USA, 1 May 1982. All host collections were made in flowing waters.

The long, relatively wide trichospores readily differentiate this species of *Smittium* from all others presently described (Figs. 1-4). The only species which somewhat resembles this one is *S. macrosporum* Kobayasi (1969), whose trichospores are similar in shape but are shorter and narrower with a shorter collar, and whose walls are described as being coarse or finely verrucose; no zygospores have been reported in that species. The holdfast of *S. macrosporum* was described as a short-cylindrical peg arising from a branching basal cell, whereas in *S. longisporum* the basal cell has a clasping appearance due to the growth of two downwardly curved projections (Fig. 6), and the secreted holdfast structure present in many trichomycetes is not evident. The basal cell is about 7 µm in diam, with up to five lateral branches growing from the downward projections in more mature thalli. The branches of the main part of the thallus measure about 7 µm in diam near the base, about 9.5 µm at the widest part, with the generative cells on terminal branches measuring about 4 µm in diam.

Our trichospore measurements were made from phase-contrast photographs of living material mounted in water. We noticed that some shrinkage of trichospores (ca. 1 µm in width) occurred after the water mounts were fixed in lactophenol-cotton blue.

Conjugation in sexual reproduction is accomplished when two hyphae send out lateral protruberances which meet and fuse. One of the conjugants then elongates and swells to produce the zygosporophore, and a terminal zygospore begins to form at an obtuse angle to the zygosporophore. As development continues, the region of the zygosporophore below what will become the collar of the zygospore swells

such that it is often twice the diameter (ca. 10 μm) of the supporting conjugant cell and the collar. A weak circumferential zone may be observed in the wall of the zygosporophore where the collar will eventually detach. The coiled appendage may be seen through the collar of the attached, maturing zygospore (Fig. 5). After zygospore release, it appears that the single appendage may not extend completely until stimulated by some mechanical action. In contrast, the appendage of trichospores often extends from the collar in its typical zigzag manner as soon as the trichospore is released.

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MEGASPOROPORIA A NEW GENUS OF RESUPINATE POLYPORUS[1]

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SUMMARY

The genus Megasporoporia Ryv. & Wright is described with Poria setulosa Henn. as type species. The genus is characterized by large pores and spores, clamped generative hyphae and dextrinoid skeletal hyphae. The following new combinations are proposed: Megasporoporia cavernulosa (Berk.) Ryv., Megasporoporia hexagonoides (Speg.) Wright & Rajch. and Megasporoporia setulosa (Henn.) Rajch. Megasporoporia mexicana Ryv. is described as new.

Grammothele as defined by Ryvarden & Johansen (1980:34-35) included taxa with a resupinate, poroid fruitbody where the basidia lined both the walls and the bottom of the pores. Microscopically the species were characterized by dextrinoid skeletal hyphae and in many species also dendrohyphidia were present. The spores in all taxa were ellipsoid to cylindrical, non-amyloid and thinwalled with one exception. Jülich (1982) excluded G. macrospora Ryv. and transferred it to Grammothelopsis Jül. because of its thickwalled, dextrinoid spores.

Among the remaining species G. delicatula (Henn.) Ryv. and G. setulosa (Henn.) Ryv. are somewhat deviating as they both have much larger pores and spores than the type species of the genus, viz. G. lineata Berk. & Curt. Further studies in the resupinate polypores have shown that there are two more species which are closely related to G. delicatula and G. setulosa. We feel that these 4 species constitute a natural taxon and propose a new genus to accomodate them.

1) Work partially subsidized by a grant from the Consejo Nacional de Investigaciones Científicas y Técnicas.
2) Member of the "carrera del investigador científico" of the above Consejo.
3) Fellow of the above Consejo.

MEGASPOROPORIA Ryvarden & Wright nov. gen.
Frutificatio resupinata, pori magni, pori facies cremea, cinerea ad pallidum cinnamomea, systema hypharum dimiticum ad trimiticum, hyphae generatoriae fibulatae, hyphae skeletales crasse tunicatae, dextrinoideae, hyphae ligantеae dextrinoideae, praesentes vel absentes, dendrohyphidia praesentia vel absentia, sporae magnae, hyalinae, cylindricae, non-amyloideae, tenuitunicatae.
Species typica: Poria setulosa Henn. Engl. Bot. Jahrb. 28:321, 1901.

Fruitbody resupinate, pores generally large, angular to round, pore-surface cream, greyish to pale brown or cinnamon, context usually very thin white to cream or very pale brown. Hyphal system di-trimitic, generative hyphae with clamps, skeletal hyphae thickwalled and dextrinoid, branched vegetative hyphae which may be interpreted as binding hyphae present in most species, dextrinoid. Spores cylindrical, thinwalled and large, non-amyloid and non-dextrinoid. Cystidia absent, dendrohyphidia present or absent, crystals usually present, often abundantly in the subhymenium and the context. On deciduous wood with a white rot. Predominantly a tropical genus.

Remarks. The genus is characterized by its resupinate fruitbodies, the large spores and pores besides strongly dextrinoid skeletal hyphae. From Grammothele as defined by its type species, it is separated by the larger spores and pores and a more distinctly poroid fruitbody. In Grammothele the pores are in general small to minute and very shallow, which give the hymenophore a reticulate pattern or the aspect of low ridges more than a distinctly poroid appearance. The presence of dendrohyphidia in some of the species described here seems to point to a relationship to Grammothele as such organs in general are rare among the polypores. Dendrohyphidia are often very difficult to observe in dried polypores and they may have a wider distribution than hitherto assumed. Fresh or properly dried specimens are necessary to acertain their presence. Even if dendrohyphidia should be absent in some species we nevertheless feel that the characters mentioned above justify the genus in its present circumscription.

The hyphal system is somewhat difficult to interpret. The vegetative hyphae in some of the species show transitions from unbranched long and thickwalled skeletal hyphae to more sinuous hyphae with occasional branching up to arboriform or irregularly branched hyphae. The latter, when observed in freefloating segments, may easily be taken as true binding hyphae. They should better be called branched skeletal hyphae since they often have in the lower part long unbranched segments.

Key to species:

1. Pores 2-3 mm wide ..... 3. M. mexicana

1. Pores less than 3 mm wide 2

2. Hyaline, acute hyphal pegs abundant in the pores .....4. M. setulosa

2. Hyaline hyphal pegs absent or only very few present 3

3. Pore surface grey to greyish brown, pores 0,5-1 mm wide, spores 16,5-22 um long, dendrohyphidia absent ..... 2. M. hexagonoides

3. Pore surface pale cream to ochraceous, pores 2-4 per mm, spores 10-16 (18) um long, dendrohyphidia present along the pore edges .... 1. M. cavernulosa

1. MEGASPOROPORIA CAVERNULOSA, (Berk.) Ryv. Fig. 1. Comb.nov. - Basionym: Polyporus cavernulosus Berk. Hook. J. Bot. 8:235, 1856. - Poria delicatula Henn. Engl. Bot. Jahrb. 34:44, 1904. - Hexagonia heteropora Pat. J. Bot. (Morot) 3:166, 1889. - Hexagonia bartlettii Mass. Bull. Misc. Inform. Kew. 1908:216, 1908. - Poria linearis Murr. Mycologia 12:303, 1920.

Fruitbody annual, resupinate, effused, adnate and coriaceous, up to 2 mm thick. Pore surface first white to cream, then pale strawcoloured and finally when dry and old, ochraceous to pale woody brown. Pores angular and shallow, 2-4 per mm, up to 1 mm deep, pore edges finely fimbriate in actively growing specimens. Context white to pale strawcoloured.

Hyphal system trimitic, generative hyphae thinwalled, 2-3 um wide and with clamps, often difficult to find, skeletal hyphae dominating, thickwalled, rostly sinuous and unbranched, 2-3 um wide and strongly dextrinoid, binding hyphae or branched skeletal hyphae also present, especially in the context, arboriform and 2-4 um wide, strongly dextrinoid. Dendrohyphidia present, but difficult to observe in old and dry specimens, most easily seen along the pore-edges where they are abundant in young and growing specimens, hyphoidd to ventricose with irregular branching in the upper part, arising from a clamp at the base, up to 25 um long. Spores cylindrical, hyaline, thinwalled and non-amyloid, variable in size, 10-16 (18) x 5-7 um, when young and immature apparently somewhat ellipsoid; when mature longer and slender. Habitat: On deciduous wood. Distribution: Tropical Africa and America.

Remarks. The size of the spores deserves some remarks. The type of P. cavernulosus Berk. is not sterile as stated

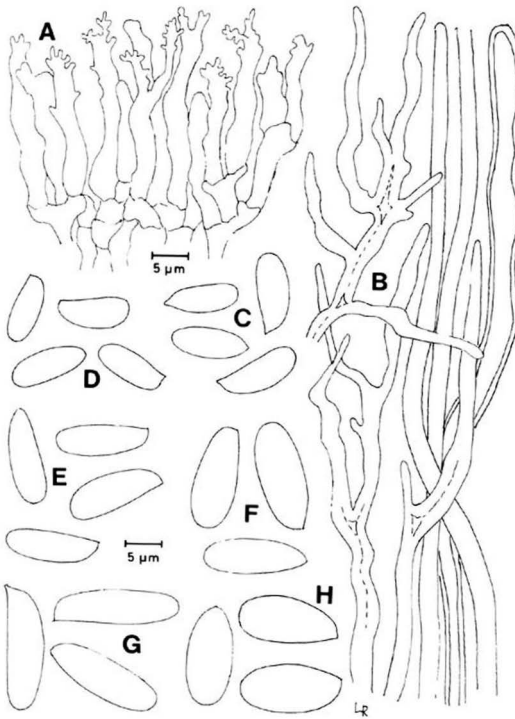

Fig.1. Megasporoporia cavernulosa A) section through the hymenium. Coll. R. 10760, B) vegetative hyphae, C) spores. From the type of P. cavernulosus, D-H) Spores, D) From the type of Poria linearis, E) Andersson, 2o,3,1980 (Ecuador), F)Deighton 1.8.1949,(Sierra Leone), G) Ryvarden 10760 (Kenya), H)From the type of Poria delicatula Henn.

by Lowe (1966:130). After repeated examinations spores were found that measured 9-12 x 4-5 um. The dextrinoid reaction of the skeletal hyphae is very strong in this specimen. In the type of Poria delicatula the spores measured 12-16 x 4-6 um while all intermediate sizes were found in others specimens examined. We believe that the medium sized pores, the cream to ochraceous fruithody and the strongly dextrinoid skeletal hyphae are diagnostic for this species. The relatively large spore-variation that can be observed from the type of P. cavernulosus and of fresh specimens collected in Ecuador (see list below) probably reflects only different stages in development. After having examined many specimens from Africa and America we came to the conclusion that a separation based on spore size was not possible.

The description given by Ryvarden & Johansen (1980:37) was based partly on an undescribed species with almost the same size of the spores but with yellow and non-dextrinoid skeletal hyphae. This species will be treated in a later paper.

Representative specimens: Brazil, Panurã, Ad ramos (type of P. cavernulosus, K!); Bahia, Serra da Agua de Rega, 28/II/1971. H.S. Irwin. (NY). Cuba. Coll. Wright 451 (det. P. cavernulosus by Berkeley). Panama: Marraganto, leg. H. Williams 3/IV/1908 (type of Poria linearis Murr.). (NY). Ecuador: Pastaza: Curaray, 20/III/1980. (GB). Guyana: Tumatumari, Leg. G. Linder, 16/IX/1923. (NY). Tanzania: Usambara, Bomole, May 1902, leg. G. Zimmermann (type of Poria delicatula Henn., S). Morogoro prov. Uluguri Mts. Morning Side Res. Sta. 24/II/1973, L. Ryvarden 10944 (O). Zaire: Shaba prov. Luisursiti, no date, leg. Thoen no 5431 (BR,O).

2. MEGASPOROPORIA HEXAGONOIDES (Speg.) Wright et Rajchenberg comb. nov. Fig. 2.
Basionym: Poria hexagonoides Speg., An. Mus. Nac. Buenos Aires 6:170-171. 1898.
Fruitbody annual, lignicolous, totally effused and attached to substratum, circular to largely ellipsoid up to 10 x 4 cm, hard, coriaceous. Pore surface when fresh light ash grey with lavender tints, when dry light greyish brown. Margin absent or present and then defined and regular, always cream, up to 2 mm wide. Pores large, honey-combed, 0,5-1 mm wide. Context thin, light brown, 0,3-1,7 mm thick. Tubes up to 2,5 mm long, concolorous with context, with triangular section. Alkali reaction negative.

Hyphal system trimitic. Generative hyphae clamped, branched, thin-walled, 2,1-3,6 um diam.; skeletal hyphae branched or not, with hyaline thickened walls or solid, 2,1-6,8 um diam., dextrinoid; binding hyphae branched with long and/or short branches, with hyaline thickened walls, 1,0-3,6 um diam., dextrinoid, all the hyphal elements are arranged intricately in the trama.

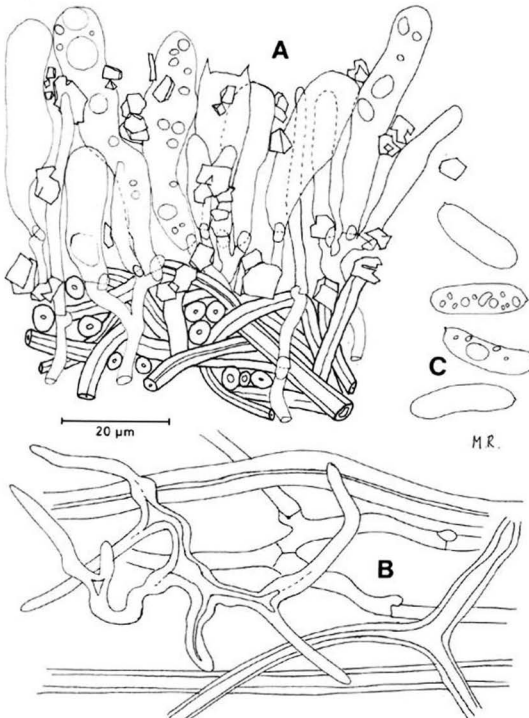

Fig. 2. Megasporoporia hexagonoides A) section through the hymenium, B) hyphae, C) spores. From the lectotype.

Hymenium 35-53 um thick. Basidia claviform 33,8-36,4 x 9,4-10,4 um, tetraspored, sterigmata triangular up to 6,2 um long. Basidiospores cylindric to slightly allantoid, aniculated, hyaline, thin-walled, with or without oily inclusions, 16,6-21,8 x 5,2-6,8 um, inamyloid, indextrinoide, acyanophilous. Basidioles cylindric to claviform 20,8-46,9 x 5,2-11,4 um, with or without distinct oily drops. Crystals polyedric, abundant, scattered between hymenial elements and in subhymenium. Cystidia absent.

Habitat: Prosopsis nigra and other unidentified angiosperms with a white rot. - Distribution: Argentina: In subxerophytic vegetation of the Chaco region (provinces of Salta, Santa Fé and Tucuman).

Remarks. The species has only slightly smaller spores and pores than M. mexicana, but is easily identified in the field because of its ashy grey to lavender fruitbodies. Lowe (1966:134) states that the isotype in BPI is sterile, but in the holotype in herb. LPS all hymenial elements are present.

Representative specimens: Argentina, Salta, La Vina, leg. Spegazzini, I/1897 (HOLOTYPE LPS 25538), between Rosario de la Frontera to G. Garmendia, leg. A. Okada VIII/1963 (BAFC 27916). Ibid., GÜemes, Mojotoro River, leg. J. Deschamps SA-2910 5/III/1976, on living branches of Prosopis nigra (BAFC 27927). Santa Fé, Santa Margarita, leg. G. Domínguez 2/X/1943 (BAFC 27918). Tucumán, Dique del Cadillal, leg. R. Singer T-1568, 10/VI/1951 (BAFC 27919).

3. MEGASPOROPORIA MEXICANA Ryv. nov. sp. Fig. 3.
Fructificatio resupinata, pori facies cremea, pori magni, 2-3 mm latus, Systema hypharum di ad trimiticum, hyphae generatoriae fibulatae, hyphae skeletales haud ramosae vel ramosae et arboriformae, crasse tunicatae, dextrinoideae, sporae hyalinae, cylindricae, non-amyloideae 20-26 x 6-9 um. Typus: Mexico, Vera Cruz, Coscontla, Municipio de Huatuzco. 16/V/1973, 1300 m alt. Coll. E. Ventura 8320. Holotype in herb. ENCB, isotypi in herbaria O, K and BPI.

Fruitbody annual, resupinate, widely effused, in the type up to 20 cm long, 10 cm wide and 1 cm thick, touch and coriaceous. Pore surface white to pale cream, pores angular to round, 2-3 mm in diameter, tubes up to 1 cm deep, cream coloured, with a few scattered low hyphal pegs or warts in the upperpart. Context 2-400 um thick, white and fibrous, trama white and dense.

Hyphal system di-(tri?)-mitic, generative hyphae thin-walled, hyaline 2-4 um in wide and with clamps at the septa, skeletal hyphae strongly dextrinoid, thickwalled and of a variable shape, partly as long unbranched segments arising from a clamp, up to 500 um long and with a rounded apex, 3-7 um wide, partly as more sinuous segments of

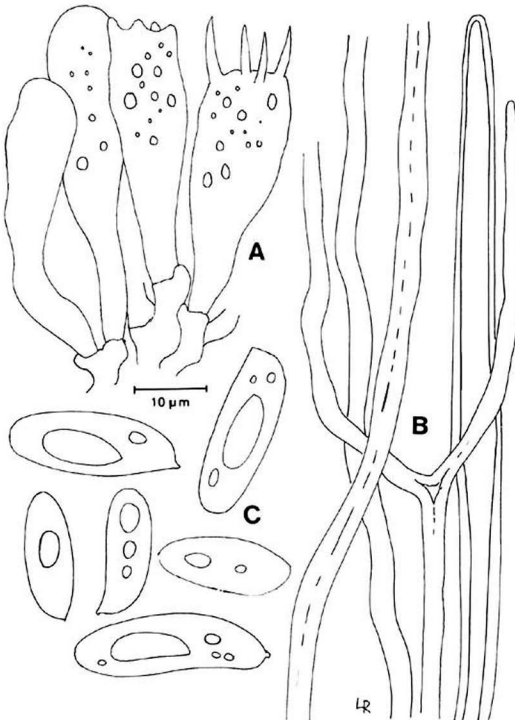

Fig. 3. Megasporoporia mexicana A) basidia, B) vegetative hyphae, C) spores. From the holotype.

variable length and with transitions to more narrow and dichotomously branched hyphae, 2-4 um wide. The latter type of hyphae is interpreted more as upper ends of skeletal hyphae more than true binding hyphae as the branching is rather scarce. Basidia clavate, 35-45 x 10-13 um with 4 sterigmata, hyaline paraphysoid hyphae present between the basidia, 3-5 um wide. Spores cylindrical to allantoid, thin-walled non-amyloid, hyaline and with smaller and larger oildrops, 20-26 x 6-9 um. On deciduous wood. Known only from the type.

Remarks. M. mexicana seems to be close both to M. setulosa and M. hexagonoides. From the former it is separated by far less hyphal pegs, larger spores and pores. From the latter it is separated by larger pores and a white to pale cream colour of the fruitbody.

4. MEGASPOROPORIA SETULOSA (Henn.) Ryvarden Fig. 4.
Nov. comb. - Basionym: Poria setulosa Henn., Engl. Bot. Jahrb. 28:321, 1901. - Trametes subspermens Murr. Mycologia 12:108, 1920. Invalid name, no description.
Fruitbody annual, lignicolous, totally effused, forming small circular patches finally coalescing up to 30 x 6 cm, corky. Pore surface white, cream, turning light brown upon drying. Margin usually present, definite, regular, up to 1,7 mm wide, concolorous with hymenial surface. Pores round, isodiametric, 1-2 per mm. Context thin, up to 0,3 mm wide. Tubes up to 1 mm long. Alkali reaction negative. Hyphal system dimitic, generative hyphae clamped, branched, with thin hyaline walls, 1,6-3,1 um diam., and skeletal hyphae slightly or not at all branched, 1,6-5,2 um diam., with hyaline thickened walls with lumina visible, or solid, dextrinoid. All elements are intricately arranged and dissection is difficult. Hymenium 18,8-33,5 um thick. Basidia: claviform, with or without oily inclusions, 18,2-28,6 x 6,8-9,4 um, tetraspored, with straight or curved triangular sterigmata 7,8 x 2,6 um. Basidiospores cylindric, apiculated, hyaline, with large oil drops, thin walled, 10-14,0 x 4,2-5,7 um, inamyloid, acyanophilous. Basidioles claviform, with small or large oily inclusions, 13,5-31,2 x 5,2-10,4 um. Paraphysoids composed by generative hyphae that emerge between basidioles. Crystals polyedric, abundant, scattered in subhymenium and in trama, 11-54 x 16-43 um. Hyphal pegs very abundant, long and rectangular 40-160 x 16-38 um easily seen under the lens.

Habitat. On angiosperms with a white rot. Distribution. Pantropical.

Remarks. The species is usually recognized already in the field because of the numerous and prominent hyphal pegs inside the pores. The type of Poria setulosa was probably lost in Berlin during the last world war, but from the description and the name there should be no doubt that Hennings name originally covered the taxon described here.

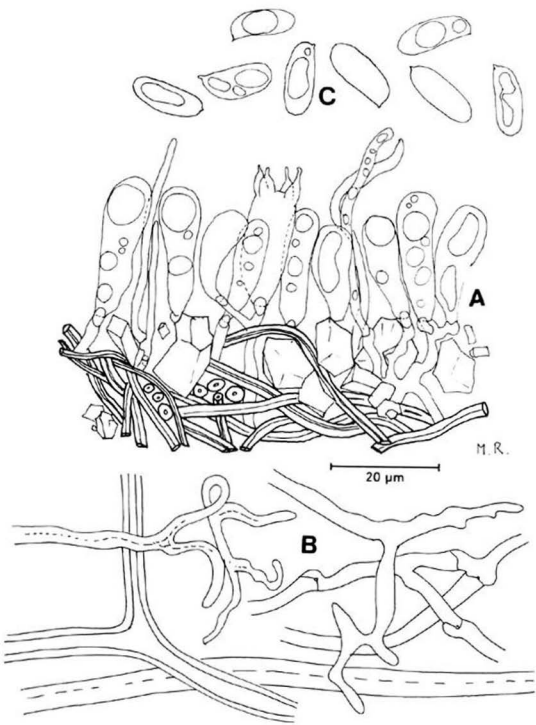

Fig. 4. Megasporoporia setulosa A) section through the hymenium, B) hyphae, C) spores. Coll. Rajchenberg 4.3. 1980 (Argentina).

Representative specimens: Argentina: Missiones, Cataratas del Iguazu, leg. M. Rajchenberg. 4/III/1980 (BAFC). Corrientes: Mburucuya. Ea. Santa Teresa, leg. J. Wright, Gomez & Del Busto. 28/I/1962 (BAFC). Venezuela: Bolivar Halo de Vergarena. L. Gumps. /X/1954 (NY). Ghana: Ashanti Region. Jimra Forest Reserve. 24/IV/1974. Ryvarden 12719 (O). Kenya: Coast prov. Shimba Hills, Makadara Forest. 14/II/1973. Ryvarden 10234 (ol). India: Tamil Nadu, Madurai distr. Tiger Shola. 17/VIII/1978. K. Kolanddavelu no I 34 (O).

Acknowledgements
We wish to express our recognition to the Servicio Nacional de Parques Nacionales, Argentina, for the facilities afforded during our field trips in the Iguazu National Park, and to the Consejo Nacional de Investigaciones Cientificas y Técnicas for financial assistance and the Fellowship granted to Mario Rajchenberg.

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MYCOTAXON

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SMITTIUM CELLASPORA, A NEW HARPELLALES (TRICHOMYCETES) FROM A CHIRONOMID HINDGUT

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This is the 19th recognized species of *Smittium* to be described, and the 15th described from midge larvae (Chironomidae, Ceratopogonidae). Previously described species of *Smittium* from all dipteran hosts have been collected from some 12 states of the U.S.A., including Alaska and Hawaii, and from Greenland, Russia, Japan, and at least five European countries.

Smittium cellaspora Williams, sp. nov.

Trichosporae ellipsoidales, (20-)29(-36) × (7-)8.5(-10) µm, appendiculo tenui pluries longitudinem sporae longo, collare (5-)9(-10) × ca. 2.5 µm. Thallus brevis, sparse ramosus, paene omnibus cellulis fertilibus. Retinaculum simplex, area adhesionis discformi. Zygosporae ignotae. Chironomidarum larvalium incola.

Trichospores ellipsoidal (20-)29(-36) × (7-)8.5(-10) µm with a fine appendage several times the spore length and which may exhibit a coiled appearance upon release of the trichospore; collar (5-)9(-10) × ca. 2.5 µm. Thallus short, up to 300 µm in length or possibly more, 6-10 µm in diam, sparsely branched, almost all cells fertile. Holdfast simple, tending to form a disklike adhesive structure. Zygospores unknown.

Holotype: Slide MIS-15-I deposited with R. W. Lichtwardt at the University of Kansas, prepared from the hindgut of a Chironomidae larva collected 7 February 1982 in the Sac River, 1.0 km north of the Greene County line on highway

MO 13, Polk County, Missouri, USA.

Hosts: Few hosts were collected from the type site and the one saved for identification is *Sympotthastia* sp. All chironomid hosts from this site were taken from leaf packs or algal growth attached to rocks in flowing water.

The spore size and unusual growth habit (Figs. 1-4) distinguish *S. cellaspora* from any currently described species. The only other species reported to have spores in this size range is *S. orthocladii* Manier (1969) {=*Rubetella orthocladii* Manier & Mathiez (1965) nom. nud.}. However, *S. orthocladii* is reported to have thalli with several basal branches growing in "bundles" which is distinctly different from the present sparsely branched species. *Smittium orthocladii* is described with trichospores measuring 25-33.5 × 6-7.5 µm with a collar (5-)8.7 (-10) µm and is reported to produce an encrustment surrounding the several basal branches. *Smittium cellaspora* has a wider spore and produces a disklike holdfast pad (Fig. 3) and no encrustment.

Smittium culicis has a similar spore shape; however, the trichospore is smaller and this species normally is found in mosquito larvae, while *S. cellaspora* is found in chironomid larvae.

The simple holdfast of the new species tends to form a disklike structure with an adhesive appearance as the thallus matures (Fig. 3). The basal cell is 30 to 50 µm long and the other cells range from 20 to 45 µm in length and from 6 to 10 µm in diam. The sparse branching pattern is a characteristic of this species and each cell generally is fertile or produces a branch which is fertile. Sporulation occurs early in the growth pattern as shown by a 2-celled thallus each with a spore (Fig. 2). Such an

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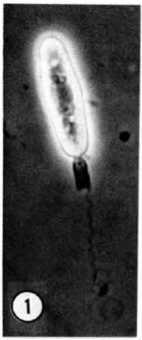
Figs. 1-4. *Smittium cellaspora*. 1. Trichospore with spiraled appendage and characteristic collar, ×1000. 2. Thalli attached to chitinous hindgut lining, ×225; note 2-celled thallus with 2 spores (arrow). 3. Branched thallus showing the disklike adhesive holdfast, ×675. 4. Thalli illustrating usual growth pattern, note lower thallus with each cell producing a spore, ×225.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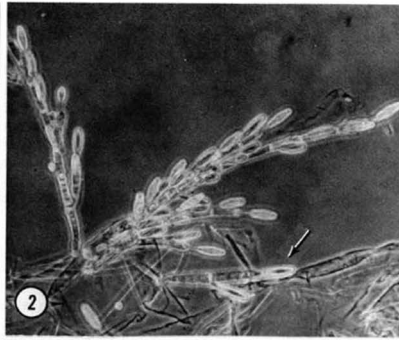
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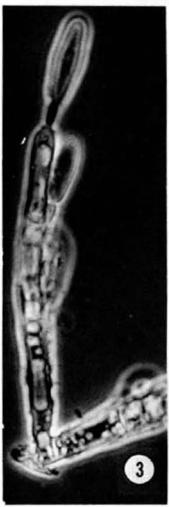
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abbreviated development is not generally reported in *Smittium* spp., and early sporulation has been observed only in laboratory infestations or axenic cultures. When spores of another species, *S. culisetae*, were fed to *Aedes aegypti* larvae in the laboratory, thalli were observed rarely to sporulate at the 2-celled stage in the hindgut. This precocious sporulation appears to occur when the fungus is becoming established shortly before the host larva is going to molt and is not the usual growth pattern. Also, in axenic cultures of *S. simulii*, single-celled germlings have been observed infrequently to produce a spore with no further vegetative growth.

It is not uncommon to find more than one species of *Smittium* growing in the same dipteran hindgut, therefore it is possible that *S. cellaspora* could be present in guts containing another *Smittium* sp. which produces more profuse growth. Under these conditions *S. cellaspora* may be overlooked due to its limited growth form.

The photographs and measurements were made from living material mounted in water. We noticed some shrinkage in trichospore width (ca. up to 1 µm) after the water mounts were fixed in lactophenol-cotton blue.

Acknowledgements: I am indebted to the Kearney State College Research Services Council, to the National Science Foundation for grant DEB-8019724 (Supplement), and to R. W. Lichtwardt for consultation and use of laboratory space at the University of Kansas. I wish to thank Dr. Leonard Ferrington for host identifications. Dr. Donald P. Rogers, Univ. of Illinois, kindly provided the Latin for the diagnosis.

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NOTES ON HYPHOMYCETES. XLII. NEW SPECIES OF *ACRODICTYS* AND *PSEUDOSPIROPES* FROM SOUTH AFRICA.

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ABSTRACT

Acrodictys eickerii Morgan-Jones and *Pseudospiropes falcatus* Morgan-Jones, two new species, are described and illustrated from collections made on decorticated twigs and wood in South Africa.

INTRODUCTION

In earlier papers in this series Morgan-Jones and Sinclair (1980a, 1980b) described new dematiaceous hyphomycete taxa, belonging to the genera *Stachybotrys* Corda and *Cuetingophora* Stolk, Hennebert and Klopotek respectively, from collections made on decorticated wood in South Africa. Continued exploration of this substrate has yielded collections of further undescribed species of which two, belonging to the genera *Acrodictys* M. B. Ellis and *Pseudospiropes* M. B. Ellis, are described herein.

TAXONOMIC PART

Acrodictys eickerii sp. nov. (Fig. 1).

Coloniae effusae, atrobrunneae vel atrae. Mycelium partim superficiale, partim immersum, ex hyphis ramosis, septatis, pallide brunneis, levibus, 2 - 3µm crassis compositum. Conidiophora macronemata, singula vel 2-3 fasciculata, non ramosa, ex lateribus hypharum oriunda, recta vel flexuosa, erecta, brunnea vel atrobrunnea, laevia, continua vel septata, usque ad 40µm longa, 5 - 6µm crassa, cum 0 - 2 proliferationibus terminalibus successivis. Cellulae conidiogenae monoblasticae, in conidiophoris incorporatae, terminales, determinatae vel percurrentes. Conidia solitaria, in apice conidiophori oriunda, sicca, subglobosa vel late pyriformia vel turbinata, muriformia, levia, brunnea vel atrobrunnae, 38 - 64µm longa, 22 - 42µm crassa,

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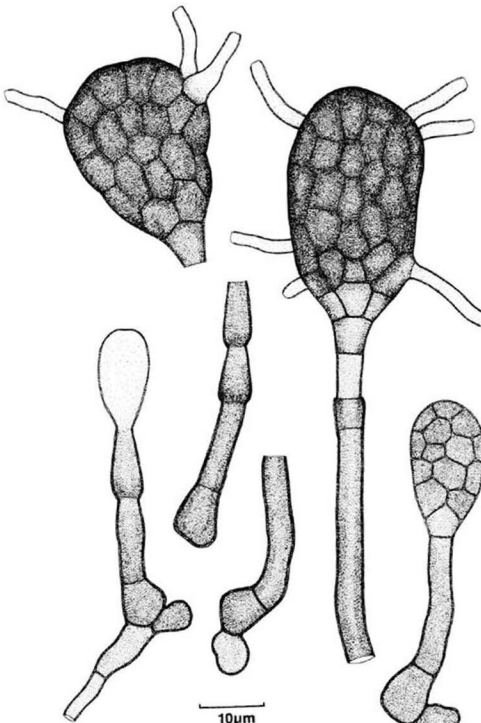

FIGURE 1. *Acrodictys eickerii*

appendicibus 2 - 7, pallide brunneis, 7 - 16µm longis, 2 - 3µm crassis; ad basim truncata.

In ramulis emortuis decorticatis, Debengeni Forest Reserve, Magaebaskloof, N. E. Transvaal, South Africa, August 17, 1979, R. C. Sinclair, AUA, holotypus.

Colonies effuse, dark brown to black. Mycelium partly superficial, partly immersed in the substratum, composed of branched, septate, pale brown, smooth, 2 - 3µm wide hyphae. Conidiophores macronematous, mononematous, single or in fascicles of two or, rarely, three, unbranched, arising laterally from the hyphae, straight or flexuous, erect, brown or dark brown, smooth, non-septate or septate, up to 40µm long, 5 - 6µm wide, with occasionally up to two terminal successive proliferations. Conidiogenous cells monoblastic, integrated, terminal, determinate, or proliferating percurrently. Conidia solitary, formed singly at the apex of each conidiophore, dry, subglobose or broadly pyriform or somewhat turbinate, muriform, smooth, brown to dark brown, 38 - 64µm long, 22 - 42µm wide, bearing 2 - 7 pale brown appendages distally and laterally, 7 - 16µm long, 2 - 3µm wide; base truncate.

On decorticated twigs; South Africa.

Collection examined: Debengeni Forest Reserve, Magaebaskloof, N. E. Transvaal, South Africa, August 17, 1979, R. C. Sinclair, AUA, holotype.

Acrodictys eickerii is named in honor of Professor Albert Eicker, Department of Botany, University of Pretoria, through whose good offices the collections of hyphomycetes on which these studies are based were made.

Among species of *Acrodictys*, *A. eickerii* resembles both *A. brevicornuta* M. B. Ellis and *A. appendiculata* M. B. Ellis in possessing a number of conidial appendages. It is morphologically quite similar to *A. appendiculata* in particular but differs from it in having much larger conidia, usually more numerous conidial appendages distributed both laterally and distally, and possessing percurrently proliferating conidiophores. In the latter characteristic it resembles several non-appendaged species of *Acrodictys*. In shape of conidia and distribution of appendages *A. eickerii* bears a broad similarity to *Piricauda cochinensis* (Subram.) M. B. Ellis.

Pseudospiropes falcatus sp. nov. (Fig. 2).

Coloniae effusae, olivaceo-brunneae vel fuscae, velutinae vel pilosae. Mycelium immersum, ex hyphis ramosis, septatis, pallide brunneis, levibus, 2 - 3.5µm crassis compositum. Conidiophora macronemata, mononemata, erecta, recta vel leniter flexuosa, crasse tunicata, septata, brunnea, apicem versus pallidiora, laevia, cicatricibus conidialibus praedita, usque ad 190µm longa, 4 - 6µm crassa, basi unterdum ad 8µm inflata. Cellulae conidiogenae

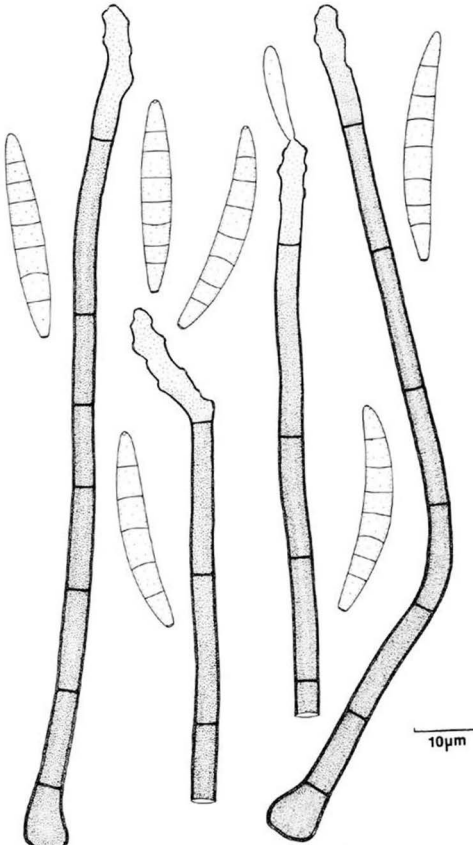

FIGURE 2. *Pseudospiropes falcatus*

polyblasticae, in conidiophoris incorporatae, terminales, sympodiales, cylindricae, usque ad 7 cicatricles. Conidia solitaria, sicca, acropleurogena, simplicia, cylindrica vel fusiformia vel falcata, basi truncata, pallide brunnea, laevia, 5 - 7 septata, 32 - 41 X 4 - 5µm.

In ligno emortuo, Pienaar's River, Pretoria, South Africa, August 13, 1979, R. C. Sinclair, AUA, holotypus.

Colonies effuse, olivaceous brown to dark blackish brown, velvety or hairy. Mycelium immersed, composed of branched, septate, pale brown, smooth, 2 - 3.5µm wide hyphae. Conidiophores macronematous, monomematous, simple, erect, straight or slightly flexuous, thick-walled, septate, brown to pale brown, paler towards the apex, up to 190µm long, 4 - 6µm wide, up to 8µm wide at the swollen base. Conidiogenous cells polyblastic, integrated, terminal, sympodial, cylindrical, bearing a number of thin, flat, small, dark, very slightly protruding scars. Conidia solitary, dry, acropleurogenous, simple, cylindrical to fusiform, most frequently falcate, base narrowly truncate, pale brown, smooth, 5 - 7 septate, often bearing a small, highly refractive spot at the extreme apex, 32 - 41 X 4 - 5µm.

On dead wood; South Africa.

Collection examined: Pienaar's River bank, junction of Bronkhorstspruit Road, Pretoria, South Africa, August 13, 1979, R. C. Sinclair, AUA, holotype.

Pseudospiropes falcatus is easily distinuishable from other species of *Pseudospiropes* possessing relatively thin-walled, septate conidia, as opposed to the thick-walled, pseudoseptate conidia of *P. nodosus* (Wallr.) M. B. Ellis and *P. simplex* (Kunze) M. B. Ellis, by the length and shape of its conidia. It most closely resembles *P. rousselianus* (Mont.) M. B. Ellis, which also, incidentally, has often a small refractive spot at the apex of its conidia.

ACKNOWLEDGMENT

I thank my former graduate student, Mr. Robert C. Sinclair, for the opportunity to examine collections made by him in South Africa. Dr. J. Leland Crane kindly reviewed the manuscript.

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MYCOTAXON

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NOTES ON HYPHOMYCETES. XLIII. CONCERNING *CHAETOPSINA ROMANTICA*.

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ABSTRACT

Chaetopsina romantica Rambelli and Lunghini is described and illustrated from a collection on leaves of *Magnolia virginiana* L. in Alabama. The collection represents the second record of the fungus and the first from North America.

INTRODUCTION

The genus *Chaetopsina* Rambelli, which remained monotypic for well over a decade after its establishment in 1965, has had a number of species added to it during the 1970's (Matsushima, 1971; Rambelli and Lunghini, 1976, 1979; Sutton and Hodges, 1976; Morgan-Jones 1979). When described, each species was known from but a single collection and this still remains the case with the majority. The exceptions are the type species, *C. fulva* Rambelli, which is now known from dead leaves in Italy (Rambelli, 1956), Papua-New Guinea (Matsushima, 1971), U.S.A. (Pirozynski and Hodges, 1973), Japan (Matsushima, 1975), Taiwan (Matsushima, 1980) and from soil in Canada (Barron, 1968), and *C. ramifera* Matsushima, which is known from dead leaves in Papua-New Guinea (Matsushima, 1971), Brazil (Sutton and Hodges, 1976), Taiwan (Matsushima, 1980) and from dead wood in the Ivory Coast (Rambelli and Lunghini, 1979). We have no knowledge of the geographical distribution of the other taxa.

Chaetopsina romantica Rambelli and Lunghini was described from unidentified bark fragments of forest floor litter collected in the Tai National Forest, Ivory Coast, Africa, in 1976. It has not, to my knowledge, been reported elsewhere to date. I have, however, encountered the fungus during an investigation of the microfungi occurring on leaf litter of sweetbay (*Magnolia virginiana* L.) in Alabama.

A comparison of the Alabama material with the description provided by Rambelli and Lunghini (1979) indicates a number of important

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characteristics of the conidiogenous cells not documented by these authors as well as a number of morphological features and variabilities. A new description and illustration of the fungus is therefore presented here.

TAXONOMIC PART

Chaetopsina romantica Rambelli and Lunghini, Trans. Br. mycol. Soc. 72: 491, 1979 (Fig. 1).

Colonies effuse, hairy, glistening, brown to dark brown. Mycelium partly superficial but most immersed, composed of septate, branched, very pale brown, smooth, 2 - 3.5µm wide hyphae. Setae formed directly from the mycelium or from a cluster of a few to many swollen, subglobose, yellowish to mid brown, thick-walled, 4 - 6µm wide cells, scattered, solitary or sometimes in pairs, erect, mostly straight, verruculose distally, thick-walled, brown, tapering gradually towards the apex, bearing up to 16 septa, septae at closer intervals near the apex, up to 370µm long, 8 - 10µm wide in the middle part, up to 14µm wide at the slightly bulbous base. Conidiogenous hyphal elements arising laterally towards the middle of the setae or at various levels in the distal portion, or terminally, simple or branched, subhyaline to very pale yellowish, cylindrical, smooth-walled, septate, of varying length. Conidiogenous cells mono or polyphialidic, discrete, determinate or nondeterminate, narrowly ampulliform or frequently assuming an hourglass-shaped configuration, borne terminally or laterally on the conidiogenous hyphae or, occasionally, directly from the setae, bearing a discernible but non-flaring collarette, 7 - 18 X 2 - 2.5µm. Sometimes integrated, intercalary cells of the conidiogenous hyphae can be fertile. Conidia enteroblastic, hyaline, aseptate, straight, smooth, cylindrical, obtuse at each end, 7 - 9 X 1.5 - 2µm.

On bark and leaves; Africa and North America.

Collection examined: on dead leaves of *Magnolia virginiana* L., off Rt. 50, 5ml south of Lafayette, Chambers County, Alabama, July 26, 1979, G. Morgan-Jones, AUA.

The binomial *Chaetopsina romantica* is being used for the Alabama collection advisedly. Although the conidia are identical the conidiogenous apparatus differs substantially from that in the type description. Of particular note is the sometimes indeterminate nature of the conidiogenous cells which, as a result of sympodial extension, increase in length, produce several conidiogenous loci and thereby become polyphialidic. The peculiar hourglass shape of some conidiogenous cells is evident in the illustration provided by Rambelli and Lunghini (1979) but no mention of this is made in their description. This type of configuration is usually evidence for percurrent proliferation of phialides but no discontinuity in the periclinal wall at the point of constriction is discernible under the resoulution limits of the light microscope in this instance. The presence of conidiogenous cells that are polyphialidic in nature, as well as fertile intercalary cells in the conidiogenous hyphal

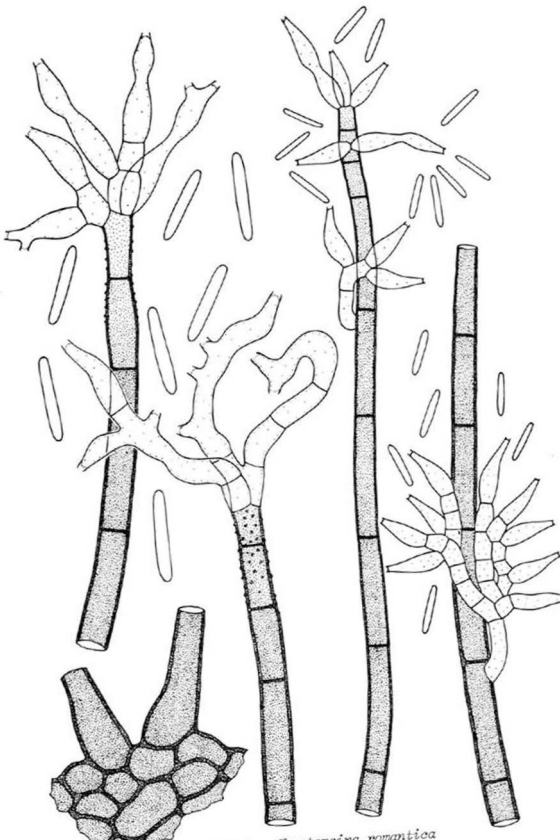

FIGURE 1. *Chaetopaina romantica*

elements, in the Alabama material may reflect especially favorable environmental conditions rather than any fundamental genotypic variance. This does, however, raise a question concerning the distinctiveness of *Chaetopsina*. As Rambelli and Lunghini (1976) have pointed out the possession of polyphialides by *Chaetopsis* Greville was regarded as the main differentiating characteristic between the two genera. *Chaetopsina ivoriensis* Rambelli and Lunghini also possesses polyphialides [Rambelli and Lunghini (1976) illustrate such structures although in their type description the conidiogenous cells are described as being monophialidic]. I should also note in passing that it appears that the phialides of *C. ivoriensis* can proliferate percurrently (there is, in fact, much similarity between the conidigenous apparatus of *C. ivoriensis* and that of the Alabama collection described herein but the conidia of that species are much smaller). In both *Chaetopsis grisea* (Ehren.) Sacc. the type species of *Chaetopsis*, and *Chaetopsina auburnensis* Morgan-Jones conidiogenous cells are sometimes replaced by setose lateral branches. The primary distinction between these two genera lies in the morphology of the lateral, phialide-bearing branches; in *Chaetopsis* they are acutely divergent, robust, and thick-walled towards their point of origin whereas in *Chaetopsina* they are, generally, flexuous and thin-walled, usually orientated more or less parallel to the seta, particularly when borne towards the middle.

ACKNOWLEDGMENT

I thank Dr. Carol A. Shearer, University of Illinois, for reviewing the manuscript.

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PHYCOSYMBIODEMES IN PSEUDOCYPHELLARIA IN NEW ZEALAND

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SUMMARY

Three instances of joined thalli in *Pseudocyphellaria* from New Zealnd are presented. Details of developmental morphology and results of phytochemical investigations are given and discussed in connection with recent findings in other genera. The importance of chemical characters especially, in evaluating influences of different symbiotic algae is underlined. *Phycosymbiodeme* is proposed as a functionally descriptive term for joined thalli occuring most commonly in the suborder Peltigerineae and especially in the families *Peltigeraceae* and *Lobariaceae*.
The new species *P.allanii* D.Galloway, *P.margaretae* D.Galloway, and *P.murrayii* D.Galloway, are described and the new combination *P.rufovirescens* (Church. Bab.) D.Galloway, proposed.

INTRODUCTION

Recent discussions of morphotypes in *Sticta* (James and Henssen 1976), and in *Peltigera* (Brodo and Richardson 1979) expanding earlier accounts of joined thalli in *Sticta* (Wilson 1891, Dughi 1944) and in *Lobaria* (Dughi 1937, Jordan 1972)have made necessary a re-evaluation of the problem of interaction between mycobionts and phycobionts in the lichen symbiosis. Detailed comparative studies on

composite thalli in the order Peltigerineae, and in the family *Pannariaceae* (James and Henssen 1975, 1976) showed that both anatomy and morphology of certain taxa in these groups may be influenced by the phycobiont present in the symbiotic system. Different genera of phycobiont exert distinctive morphogenetic pressures (e.g. the development of stalked fronds) on the same mycobiont, thereby stimulating the production of joined thalli under certain, usually favourable, ecological conditions. Studies of Brodo and Richardson (1979) on the development of subfoliose cephalodia in *Peltigera aphthosa* and *Coccomyxa*-containing lobes growing from them, support the notion of differing lichen morphologies resulting from a particular mycobiont associating with different phycobiont genera in a single autonomous plant. Further they discuss a deviating secondary metabolism as a possible cause of two different symbiotic unions, a speculation having important taxonomic implications.
In *Pseudocyphellaria* Vainio, in New Zealand (Galloway in prep.) several species pairs exist, comprising a fertile (parent) species, and a corresponding asexual (derived) species possessing either isidia or soredia but usually rarely or never fertile. Examples of usually such species pairs are *P.homoeophylla* (fertile)-*P.delisea* (isidiate) and *P.faveolata* (fertile)-*P.granulata* (sorediate). It is thought that the asexual species (often more widely distributed) is derived from the sexual species, and from an evolutionary point of view is regarded as having arisen at some time subsequent to the emergence of the fertile parent species. Interestingly enough, in the case of *P.delisea* which is widespread in New Zealand, the subantarctic islands, south-eastern Australia and in southern South America, the fertile parent species *P.homoeophylla*, is known only from New Zealand. Besides conventional species pairs in *Pseudocyphellaria*, field studies disclosed also the existence of joined thalli composed of closely similar species apparently differing mainly in the presence of a green or blue-green phycobiont. Subsequently, free-living individuals of the blue-green phycobiont-containing species were dis-

covered and are described in this paper since the green phycobiont-containing species in all cases was already named.
In at least five instances joined thalli are known and doubtless more will be found in New Zealand and elsewhere. In this paper observations on three of these are presented together with details of their chemistry , morphology and taxonomy.
James and Henssen (1976 pp 53-56) record evidence of light and humidity giving rise to morphotypic variation in species of *Pseudocyphellaria* (*P. punctulata* and *P. junghuhniana*) in south-east Asia, with *P. punctulata* (green phycobiont) occuring in high light situations in canopy branches and *P. junghuhniana* (blue-green phycobiont) growing in low-light, high humuidity sites at the base of the tree or on adjacent rocks. Between the two extremes of habitat and microclimate there exist a series of intermediates which "....freely develop pycnidia and ascocarps and, significantly, there is relatively little alteration in their respective thalline anatomy and morphology according to which of the algal partners predominates ...." (James and Henssen p.55). The situation with joined thalli found in New Zealand is somewhat different since both free-living green-phycobiont, and blue-green-phycobiont species can exist in similar habitats alongside examples of joined thalli, and there doesn't seem to be any particular microclimate factor potentiating the formation of joined thalli. However it must be noted that the joined thalli so far known are all from moist, evenly humid, habitats in moderate shade either close to sheltered streams, or in ± deep gorges or in areas of wet forest on slopes often shrouded in cloud. Since both green, and blue-green phycobiont-containing components of joined thalli are capable of an independent existence and have certain characters which allow their taxonomic separation they are given, for the time being, separate species names. The taxonomic status of the joined thalli is still a matter for major discussion and no single name can be ascribed to it under the existing rules of Botanical Nomenclature. In our treatment we recognise the names of the

two components (which appear to differ mainly in terms of the phycobiont present) within quotation marks, since it cannot be proved unequivocally (although it is strongly suspected) at present that the same fungus is common to the two components of the joined thalli. It is quite possible that already well known green phycobiont-,or blue-green phycobiont-containing species will be found joined to similar species differing in the nature of the phycobiont. Such a phenomenon seems to occur with some frequency in the families *Peltigeraceae* and *Lobariaceae*, especially in areas of rich speciation where it appears that species are in the process of emerging to exploit a particular microhabitat and/or microclimate.

TERMINOLOGY

The use of *chimera* (James 1975) and *chimeroid association* (Brodo and Richardson 1979) is misleading and best avoided. Winkler (1907) first introduced the term to describe plants composed of two or more idiotypes derived from somatic mutation, segregation or grafting. Such a definition cannot be applied to any known lichen thallus. On the other hand the term *morphotype* proposed by James and Henssen (1976) to emphasize the dimorphic character of joined thalli takes into consideration only one aspect of these composite organisms, although admittedly according to our present knowledge, the most striking aspect. We here propose an alternative term *phycosymbiodeme* to encompass all the peculiarities of joined thalli presently known. Swinscow (1977) used the term *phycotype* which is close to the term proposed here, but does not fully agree with our definition. The use here of *deme* rather than *type* as an ending in the terminology proposed above frees the term from any taxonomic or systematic connotation which may inadvertently be placed on it. Deme is a suitably neutral suffix which indicates a specific type of relationship between a group of individuals of a specific taxon, e.g. *chemodeme*, *morphodeme* etc.. It deserves a wider use in descriptive lichenology.

Phycosymbiodeme. In a number of lichens especially in the *Peltigeraceae* and *Lobariaceae* the particular morphological expression of the symbiosis is causally related to the species of symbiotic algae. Natural phycosymbiodemes always occur in pairs and are distinct products of lichenisation of one mycobiont with two different algae, one belonging to the *Cyanophyceae* the other to the *Chlorophyceae*. Any dissimilarity may be caused by physiological and/or morphological and/or anatomical and/or cytological differences between the two lichenised states. If one of the two phycosymbiodemes of a pair contains green algae, and the other blue-green algae then the first one is called a chlorosymbiodeme, the second one a cyanosymbiodeme. *A priori* the quantity of distinguishable algal species in either phycosymbiodeme is not limited.

MATERIAL AND METHODS

MATERIAL

Living material of joined thalli were obtained from several localities in New Zealand and were sectioned within 4-6 weeks of collection. Material of the pair "*P.margaretae/P.pubescens*" came from *Leptospermum* bark, Black Hill, Nelson Lakes National Park (South Island) in 1978, material of "*P.murrayii/P.rufovirescens*" from twigs of *Lophomyrtus bullata*, Mangaotaki River, King Country (North Island) in 1978, and material of "*P.allanii/P.coriacea*" from bark of *Myrsine australis*, Peel Forest, Little Mt Peel (South Island) in 1977.

METHODS

Morphology:Freezing-microtome sections were mounted in lactophenol/cotton-blue. Habitat photographs were taken with a Wild M7 microscope, photographs of micromorphology with a Wild M20 microscope. Scanning electron microscopy of air-dried thallus fragments was performed with an AMR 1200 SEM (Fa. Leitz). Lichen material was attached to stubs without prior chemical fixation and coated with a thin gold layer ($c.6 \times 10^{-4}$ mm thick)using a sputter coater with gold target as cathode (sputter coater Fa. Balzer, glow dis-

charge in air at 0.05 mbar and 180 volts).

Chemistry: Secondary metabolites were analysed by TLC in solvent systems A,B and C (Culberson 1972). Identification of some lichen compounds by quantitative isolation from thin-layer chromatograms followed the method of Renner and Gerstner (1978). UV/VIS-absorptionspectra were recorded on a DMR 10 spectrophotometer (Fa. Zeiss) and mass spectra on a Varian CH7 masspectrometer (using direct inlet system and PFK as internal standard; energy of the ion beam was 70 eV, ion acceleration voltage was 3 kV). Trimethylamine was detected by gas chromatography on a Varian Aerograph 1400, equipped with a flame ionistaion detector (column: Poropak T; carrier gas: N_2; column temperature: 50°C; injection temperature: 240°C; range: 2 x 10^{-11} [amps/mv]).

TAXONOMIC PART

Pseudocyphellaria allanii D.Galloway *sp.nov.*

Species corticola Novae Zelandiae *Pseudocyphellariam coriaceam* (J.D.Hook. & Taylor) D.Galloway & P.James, simulans sed pagina superiori plumbea, scabrida, phycobiontis coerulescentibus Nostocaceis differt.

Holotype: New Zealand. Canterbury, Mt Peel, on track to Emily Falls, Peel Forest. On fallen *Pseudowintera* on bank of stream, 20 March, 1979. D.J. Galloway, CHR 343256.

Thallus orbicular to spreading, ± entangled, to 18 cm diam., loosely to closely attached, corticolous. Lobes linear-elongate (3-)5-8 (14) mm wide, 1.5 - 6 cm long, ± subcanaliculate, subdichotomously branching, discrete, margins entire, sinuous, slightly thickened below, faintly white-pubescent towards apices. Upper surface dark greyish-blue to blue-green, tinged brownish at margins when wet, pale fawnish-grey when dry, minutely scabrid, coriaceous, uneven or very slightly wrinkled-undulate, without isidia, soredia or pseudocyphellae. Medulla white. Phycobiont blue-green, *Nostoc*. Lower surface densely tomentose to margins, occasionally glabrous centrally, pale

buff at margins, dark brown to black centrally, tomentum thick, silky, pale whitish to dark brown, occasionally in scattered, squarrose tufts. Pseudocyphellae white, scattered, conspicuous, round to irregular, 0.5 - 2.5 mm wide, plane to concave with a rised margin at maturity, often sunk in tomentum.
Apothecia not seen. Pycnidia sparse to frequent, immersed, 1.5 mm diam., visible as hemispherical swellings on the lower surface.
Chemistry: 7β-acetoxyhopane-22-ol and hopane-15α-22-diol.

Specimens examined: New Zealand. South Island. Canterbury: Peel Forest, *D.J.Galloway* (CHR)

P.allanii is very closely related to *P.coriacea* and often grows attached to this species. It has so far been found only at Peel Forest on the eastern slopes of Mt Peel. Here it most commonly occurs as an epiphyte of *Myrsine australis* and when wet is readily distinguished from *P.coriacea*. It associates with *P.epistícta* and *P.homoeophylla* but its ecology is still poorly known. It is named for Dr H.H.Allan, first Director of Botany Division, D.S.I.R., who in the 1920's described the vegetation of Mt Peel, and who later promoted interest in New Zealand lichens.

Pseudocyphellaria margaretae D.Galloway *sp.nov.*

Species corticola Novae Zelandiae *Pseudocyphellariam pubescens* (Müll. Arg.) D.Galloway & P. James, simulans, sed lobis imbricatis, rotundatis, pagina superiori plumbea, non faveolata, tomento sericea dense obtecta, phycobiontis coerulescentibus Nostocaceis differt.

Holotype: New Zealand. Nelson. Lake Rotoiti, Nelson Lake National Park, Peninsula Walk, on bark of *Leptospermum ericoides*, 29 February, 1980. *D. J. Galloway* , CHR 343279, Isotype in BM.
Thallus orbicular, rosette-forming to spreading, 6-10 (-16) cm wide, loosely attached, corticolous. Lobes short, rounded, 0.3 - 0.8 mm wide, imbricate or contiguous, margins entire, sinuous, shallowly incised, often subascendent, densely white tomentose. Upper surface dark livid leaden-grey or greyish-brown when wet, pale brownish-grey

or pinkish-fawn when dry, ± uniformly tomentose, tomentum long, white, silky, cortex below tomentum smooth, undulate, uneven, shining, never scabrid. Medulla white. Phycobiont blue-green, *Nostoc*. Lower surface pale brownish or whitish at margins, dark brown centrally, irregularly ridged or wrinkled-faveolate towards margins, ± uniformly tomentose, tomentum thick, whitish, silky, uneven, often developing in long, tufted fascicles towards margins. Pseudocyphellae yellow, tiny, 0.1 -0.3 mm diam., scattered or frequent, sunk in tomentum.
Apothecia not seen.
Chemistry: tenuiorin, methyl gyrophorate(±), methyl lecanorate, methyl evernate, pulvinic dilactone, pulvinic acid, calycin, norstictic, constictic, cryptostictic and stictic acids, hopane-15α-22-diol, hopane-6α,7β,22-triol.

Specimens examined: New Zealand. North Island. Hawkes Bay: Kuripapango, *J.K.Bartlett* (BM). South Island. Nelson: Cobb Valley, *J.K.Bartlett* (CHR 266031), Cobb Dam, *J.K.Bartlett* (CHR 266029), Lake Rotoiti, West Bay, *D.J.Galloway* (CHR 343216), St Arnaud, Black Hill, *D.J.Galloway* (CHR 343217, 343274), Tophouse, *W.Martin* (CHR 375474).

P.margaretae is a very characteristic species apparently most common in ± subalpine habitats in north-west Nelson, New Zealand. It is an epiphyte of *Leptospermum ericoides*, *L.scoparium* and *Olearia avicennifolia* in habitats modified by fire. It is tolerant of moderate shade and is found in areas of high rainfall and humidity. Although often reaching a considerable size it is not a common lichen in the habitats in which it grows. It associates with the following lichens: *Anzia jamesii*, *Nephroma australe*, *N.cellulosum*, *N.lepidophyllum*, *Pannoparmelia angustata*, *P.wilsonii*, *Pseudocyphellaria carpoloma*, *P.colensoi*, *P.coronata*, *P.crocata*, *P.granulata*, *P.neglecta*, *P.pubescens*, *P.rubella*, *Psoroma euphyllum*, *P.durietzii* and *P.pallidum*.
It is related to *P.pubescens* and the two species have been found attached to each other. However it differs from *P.pubescens* in the following respects: the lobes are shorter, and more rounded-imbricate, the upper surface is not visibly faveolate or even markedly ridged, the surface of the lobes is uniformly tomentose and the colour

of the upper surface when wet is a livid, leaden-grey-brown, because of the presence of the blue-green phycobiont. In contrast, *P.pubescens* is conspicuously green when wet, has longer and narrower lobes which are faveolate-ridged, the upper surface is often glabrous and the cortex ± distinctly scabrid. It is often fertile, and the marginal apothecia have black discs usually covered with a grey-white pruina. *P.margaretae* has not yet been found fertile.
It is named for Mrs Margaret Bulfin (née M.J.A. Simpson) who has worked for many years on the vegetation and flora of the Nelson Lakes National Park.

Pseudocyphellaria murrayii D.Galloway *sp. nov.*

Species corticola Novae Zelandiae *Pseudocyphellariam rufovirescens* (Church.Bab.) D.Galloway*, simulans sed pagina superiori plumbeus vel cinerascens, undulata vel subfaveolata, maculata, phycobiontis coerulescentibus, Nostocaceis, subtus tomento sericea dense obtect, differt.

Holotype: New Zealand. South Auckland. Mangaotaki Reserve, King Country near Pio Pio. On twigs of *Griselinia littoralis* in deep shade. D.J.Galloway, 9 June, 1978, CHR 343163. Isotype in BM. *Thallus* lobate-foliose, spreading, in entangled clones, 5-15 (-30) cm diam., loosely attached, corticolous. Lobes linear-elongate, rather narrow, 3-12 mm wide, expanding towards apices, ± subdichotomously branching, complex, imbricate centrally, discrete, ± subascendent at apices, margins entire, slightly thickened below, occasionally with

*The interpretation of *P.billardierii* (Delise) Räsänen given in Wilkins and James [*Lichenologist 11: 274 (1979)*] and in Galloway and James [*Lichenologist 12: 293 (1980)*]is in error and material discussed therein refers to an endemic taxon which must now be called *P.rufovirescens* (Church.Bab.) D.Galloway, *comb. nov.* Basionym: *Sticta richardi* var. *rufovirescens* Church.Bab., in J.D. Hook., *Fl.Nov. Zel.2: 278 (1855)*.Lectotype: New Zealand. South Island, Akaroa. *Hombron*, BM ex PC!

rounded to elongate white pseudocyphellae, apices truncate or furcate. Upper surface smooth, glabrous, even or subundulate, rarely very shallowly faveolate, ridges smooth, indistinct, without isidia, pseudocyphellae or soredia, conspicuously and irregularly white-maculate (x 10 lens),dark slate-grey to bluish-grey when wet, pale greenish-grey suffused brownish when dry. Medulla white. Phycobiont blue-green, *Nostoc*. Lower surface pale brownish-pink, wrinkled-striate centrally, ± evenly tomentose to margins, tomentum pale, whitish, short, even, lobe apices sometimes glabrous, whitish, wrinkled-bullate, shining. Pseudocyphellae round to irregular, common, plane, intense white, 0.1 - 1 - 2 mm diam., conspicuous.
Apothecia very rare, marginal, subpedicellate, 0.5-2.0 mm diam., disc glossy, coriaceous, dark chestnut-brown to black, epruinose, margins pale pinkish-brown, corrugate-striate to verrucose, ± inflexed and obscuring disc at first becoming ± coronate or denticulate to excluded at maturity, thalline exciple coarsely verrucose-scabrid, minutely tomentose, whitish to dark brownish-pink or red-brown. Epithecium 13-22 µm thick, yellow-brown, of thickened, conglutinate tips of paraphyses. Hymenium colourless 40-65 µm tall. Paraphyses dense, straight, simple, 1.5 µm thick, apices clavate, red brown or yellowish-brown, to 5 µm thick. Asci and ascospores not seen.
Chemistry: 7β-acetoxyhopane-22-ol and hopane-15α-22-diol.

Specimens examined: New Zealand. North Island. South Auckland: Kauaeranga River, *J.K.Bartlett* (Herb Bartlett), Kaimai Range, *J.K.Bartlett* (CHR 343298), Mangaotaki River, *D. J.Galloway* (CHR 343277), Hawke's Bay: Road to Lake Tutira, *W.Martin* 5484 (CHR 375498), Napier-Taupo Road near Tarawera, *J.K.Bartlett* (Herb.Bartlett), Wellington: Erua Swamp, *J.K. Bartlett* (CHR 343207), South Island. Nelson: Cobb Ridge, *J. K.Bartlett* (CHR 343162), Canterbury: Mt Sinclair Reserve, Banks Peninsula, *D.J.Galloway* (CHR 343209), Southland: Forest Hill, *J.Murray* (BM).

P.murrayii has a wide distribution in New Zealand though it is local and rather sparse in presently known habitats. It is an epiphyte of *Dracophyllum subulatum*, *Griselinia littoralis*, *Lophomyrtus bullata*, *Nothofagus menziesii* and *Weinmannia racemosa* in areas of high humidity and moderate to dense shade. It associates with the following lichens:

Coccocarpia erythroxyli, *Degelia gayana*, *Erioderma neozelandica*, *Hypotrachyna sinuosa*, *Lobaria retigera*, *L.scrobiculata*, *Pannaria fulvescens*, *Parmelia amphibola*, *Leioderma pycnophorum*, *Physma chilense*, *Polychidium contortum*, *Pseudocyphellaria aurata*, *P.crocata*, *P.episticta*, *P.faveolata*, *P.hookeri*, *P.intricata*, *P.psilophylla*. *P.rufovirescens*, *P.subvariabilis*, *Sticta latifrons* and *Sticta weigelii*.

It is closely related chemically and morphologically to *P.rufovirescens* and the two species have been found attached (joined material comes from Mangaotaki River (North Island) and Mt Sinclair Reserve (South Island) only). When growing independently it is separable from *P.rufovirescens* in the smoother, undulate, very seldom faveolate lobes which are expanded at the apices, the leaden-grey colour when wet because of the presence of blue-green phycobiont, the consistent development of a ± uniform tomentum on the lower surface, and the dark brown to black apothecial discs with corrugate-striate to verrucose margins and tomentose exciple. In *P.rufovirescens* tomentum on the lower surface is very rudimentary and ± restricted to central parts of mature lobes, margins and apices being regularly galbrous, white and shining. Also the pseudocyphellae of *P. rufovirescens* are smaller, more pocklike and scattered and not conspicuous and large as they are in *P. murrayii*. *P.murrayii* is named for the late Dr James Murray of Otago University, New Zealand who first became interested in New Zealand's lichens through his chemical studies in *Pseudocyphellaria*. He was engaged in monographing *Sticta* and *Pseudocyphellaria* at the time of his death (1961), and made the first collections of *P.murrayii* from New Zealand in January 1957.

RESULTS

Morphology of phycosymbiodeme development

In the three phycosymbiodemes investigated the chlorosymbiodeme originates from the cyanosymbiodeme. In the pair "*P.margaretae/P.pubescens*", the

chlorosymbiodeme (*P.pubescens*) often arises from the upper cortex and is formed laminally. However, marginally developing chlorosymbiodemes and those originating from the lower surface of *P.margaretae* may also be observed. By contrast in the pair "*P.murrayii/P.rufovirescens*" and "*P.allanii/P.coriacea*", laminally developing chlorosymbiodemes were not seen. Most frequently the chlorosymbiodemes of these pairs form on the lower cortex and along the margins. Critical observations of both cyanosymbiodemes disclose some notable correlations between morphology and the sites of chlorosymbiodeme emergence:
1. Cyanosymbiodemes with a glabrous upper surface (*P.allanii* and *P.rufovirescens*) show chlorosymbiodeme primordia only on the tomentose lower surface and along the margins. 2. Cyanosymbiodemes with a tomentose upper surface (*P.margaretae*) have chlorosymbiodeme primordia not only on the lower surface and margins but also on the upper surface (figs. 5,6a). The development of chlorosymbiodemes therefore seems to occur in those parts of the cyanosymbiodeme thallus where tissues undergo externally orientated differentiation. The inoculation of appropriate green algal cells is evidently restricted to very young hyphae (fig. 4f). The process of encapsulation may be explained by the accidental close coincidence of green algal cells and young hyphal cells.Active outgrowing of hyphal cells triggered by some stimulus from the algal cells does not appear to be involved since epiphytic green algal cells may sometimes cover large areas of both surfaces of

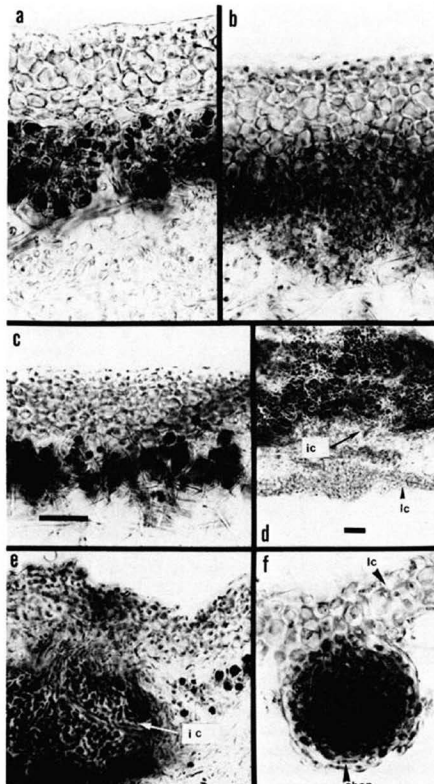
figure 1: Habitat photographs of the pair "*P.murrayii/P.rufovirescens*"; a,b:"*P.rufovirescens*" (chlorosymbiodeme) bearing young (b) and mature (a) apothecia (ap) as well as pycnidia (py); c: lower surface of "*P.murrayii*" (cyanosymbiodeme)-lobe, with 10 chlorosymbiodeme primordia formed one beside the other; d: lobe of "*P.murrayii*" bearing a young, stalked lobule of "*P.rufovirescens*" which develops marginally; e: lobes of "*P.murrayii*" with young chlorosymbiodemes on the lower surface; chs: chlorosymbiodeme; cys: cyanosymbiodeme; scale: 1mm (e:as in d).

a
Ply
ap
b
ap
c
d
Chs
Cys
e
Chs
Cys

either symbiodeme without producing any effect at all. In all cases studied, chlorosymbiodeme development begins with the contact of very slight hyphae surrounding usually only one or a few algal cells (figs. 4f,6c). These tender hyphae or outermost hyphal cells of the cortex are normal cortical constituents. The first step in chlorosymbiodeme development, once epiphytic green algal cells are recognized by the mycobiont, is the immediate surrounding of the algae by hyphae growing from the cortex of the cyanosymbiodeme (figs. 2f,4c), a process analogous to the early stages of the development of cephalodia in genera of the *Lobariaceae*.

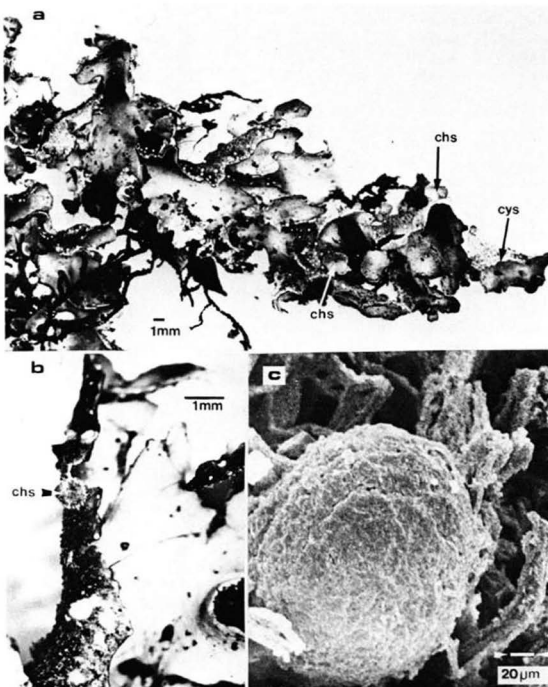
The resulting primordia, regardless of their site of formation are at first nearly spherical (figs. 3c, 4c) and in them the hayphal envelope forms from the very beginning a kind of pseudoparenchymatous cortex. They later elongate and become slightly falttened (figs. 1d,e, 3b,4e) as the visible chlorosymbiodeme. At the apices of these young lobules an heteromerous arrangement of tissues is evident. Sometimes also the presumptive lower cortex may already have developed pseudocyphellae (fig. 4e). During a period of further growth, with continuously changing micromorphology, a typically organized green-algal-containing lobe with a distinct upper and lower cortex, medulla and algal layer is formed. Whereas the structure of the cortical hyphal cells, the thickness of the cortices, and that of the whole thallus are similar in both phycosymbiodemes, at the site

figure 2: Thallus anatomy of the pair "*P.murrayii/P.rufovirescens*"; a: cross section of "*P.murrayii*" with upper cortex, algal layer and part of the medulla; b,c: cross section of "*P.rufovirescens*" with upper cortex, algal layer and part of the medulla, b: young lobe in close vicinity to "*P.murrayii*", c: mature lobe; d,e: cross section of "*P.rufovirescens*", showing internal cephalodia (ic) developing from the lower thallus surface (d) and exeptionally from the upper thallus surface (e); f: cross section of "*P.murrayii*" with one chlorosymbiodeme primordium (chsp) on the lower cortex (lc); scale in c (representative also of a,b,e,f) and in d: 20 µm.


a
b
c
ic
lc
d
e
ic
f
lc
chsp

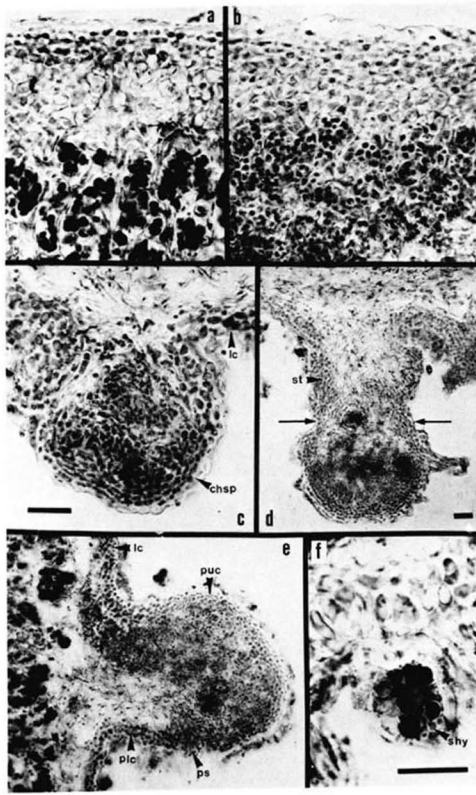
of attachment these anatomical structures may successively change with continuing growth of the chlorosymbiodeme and its increasing distance from the cyanosymbiodeme. This drifting apart of developmental morphology is best seen in the pair "*P.murrayii/P.rufovirescens*".
At the base of the thallus of *P.rufovirescens* which is very close to the thallus of *P.murrayii* the cells of the cortices are ± isodiametric with large lumina and rather thin cell walls, resembling those of *P.murrayii* (fig.2b). The green algal cells are arranged in a wide-ranging layer with numerous aplanosproangia and free aplanospores accounting for the small size of the algal cells in this region. The green algal layer reaches deep into the medulla and sometimes nearly touches the lower cortex. If the chlorosymbiodeme is attached to the cyanosymbiodeme by a stalk-like transition zone (fig 1d), then this area is devoid of algae and the formation of the upper cortex of the chlorosymbiodeme is seen as a sudden constriction in the cortex of the stalk. With increasing distance from the chlorosymbiodeme's growing tip, the algal layer becomes confined to a thin zone beneath the upper cortex (fig. 2c), the algal cells being closely packed and only rarely developing aplanosporangia. The upper cortical cells are no longer exclusively isodiametric (fig. 2c).The outer layer especially consits of periclinally orientated hyphal elements with small cell lumina and thickened cell walls. The lower cortex develops a sparse tomentum. In this zone internal cephalodia may develop (fig. 2d). Exceptionally, cephalodia originating from the glabrous upper surface are formed (fig. 2c). In contrast to the cyanosymbiodeme,the chlorosymbiodeme bears both apothecia and pycni-

figure 3: Habitat and SEM-photographs of the pair "*P. allanii/P.coriacea*"; a: greater part of "*P.allanii*" (cyanosymbiodeme)-thallus with lobules of "*P.coriacea*" (chlorosymbiodeme); b: young lobule of "*P.coriacea*" developing marginally from "*P.allanii*"; c: SEM-photograph of a chlorosymbiodeme primordium on the lower cortex of "*P.allanii*" surrounded by hyphae of the tomentum.


a
chs
cys
chs
1mm
b
1mm
chs
c
20µm

dia (fig.1a,b).
An inhibitory effect of the developing chlorosymbiodeme in suppressing the formation of further primordia in its immediate vicinity was not demonstrated. Sometimes one may find up to ten chlorosymbiodeme primordia growing close together (fig. 1c), a fact, rendering unlikely the action of any soluble morphogen. The lower cortex of the chlorosymbiodeme does not undergo any remarkable differentiation and is therefore not different from that of the cyanosymbiodeme. The same is true for pseudocyphellae which appear, in the cyanosymbiodeme, to be places of heightened secondary metabolic activity; they are nearly always filled with large amounts of lichen substances.
In order to show the influence of either algae on the formation of particular structures in the phycosymbiodemes of one pair, the development of pseudocyphellae was studied. These are characteristic of species of *Pseudocyphellaria*. The results accord with those of Renner (1980) for *P. freycinetii* and *P. thouarsii*. The first discernable sign in the process of formation of pseudocyphellae is the appearance of typically differentiated medullary hyphae in a circumscribed region of the medulla directly above the lower cortex. These

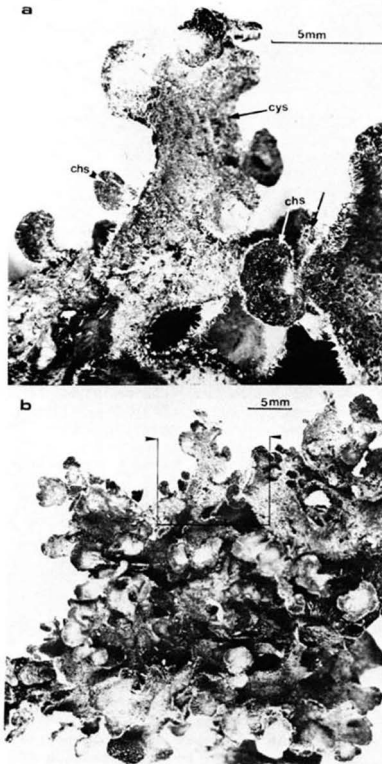
figure 4: Thallus anatomy of the pair "*P.allanii/P.coriacea*"; a,c,d,e,f: cross sections of "*P.allanii*"; a: anatomy of upper cortex and algal layer; c: chlorosymbiodeme primordia (chsp) growing from the lower cortex (lc) of "*P.allanii*"; d: chlorosymbiodeme growing with a stalk (st) on the lower surface of the cyanosymbiodeme: note that the stalk is devoid of algal cells; the algal-containing tip is slightly separated from the stalk by a constriction (arrows); e: very young lobe of "*P.coriacea*" in which a prospective upper cortex (puc) and prospective lower cortex (plc) may be discerned, the latter having already developed pseudocyphellae (ps); f: very early stage of chlorosymbiodeme formation, showing very tender hyphae of the tomentum (shy) surrounding a few algal cells; b: cross section of "*P.coriacea*" with upper cortex and algal layer; scale in c (representative also of a,b), e (as in d), f: 20 µm.


a
b
lc
chsp
c
st
d
lc
puc
e
plc
ps
f
shy

hyphal initials consist of branches with short, swollen cells with enlarged lumina(fig.7a). Some of these cells make contact with the lower cortex and forcibly rupture it. While growing through the cortex the hyphal initials further subdivide into many short-articulate cells (fig.7b). The lower cortex first invaginates and later disintegrates probably through gradual lysis (fig.7c). Once the cortex is breached, the medullary hyphae are in free contact with the substrate. Further enlargement of this opening in the cortex is initiated along the border of the pseudocyphellae (fig.7c). In some cases the lower cortex bordering the pseudocyphellae become ± crateriform. In this general scheme of development no differences between species of *Pseudocyphellaria* with green algae and those with blue-green algae can be shown, nor are there differences between the two phycosymbiodemes. Nevertheless the final morphological appearance of these structures, e.g. the frequency, diameter and shape of pseudocyphellae may vary to some extent as is true for cyphellae in *Sticta* (Renner 1980).

The course of chlorosymbiodeme development outlined for the pair "*P.murrayii/P.rufovirescens*" is similar to that of the other two pairs of phycosymbiodemes studied (figs. 3,4,5,6). Although similarities in the development of phycosymbiodemes discussed by James and Henssen (1976) in *Sticta*, and in *Peltigera* by Brodo and Richardson (1979) are obvious, one striking feature distinguishes the pairs of phycosymbiodemes in *Pseudocyphellaria* from these last, viz., the remarkable resemblance of both phycosymbiodemes forming a pair. When dry they are scarcely distinguishable from each other and when wet their morphologies are closely similar but thallus colour ist strikingly different. Clear evidence of different

figure 5: Habitat photographs of the pair "*P.margaretae/P.pubescens*"; b: greater part of "*P.maragaretae*" (cyanosymbiodeme) bearing numerous leaflets of "*P.pubescens*" (chlorosymbiodeme); a: enlarged part of b, giving evidence of the hairy upper cortex of both, the cyanosymbiodeme (cys) and the chlorosymbiodeme (chs).

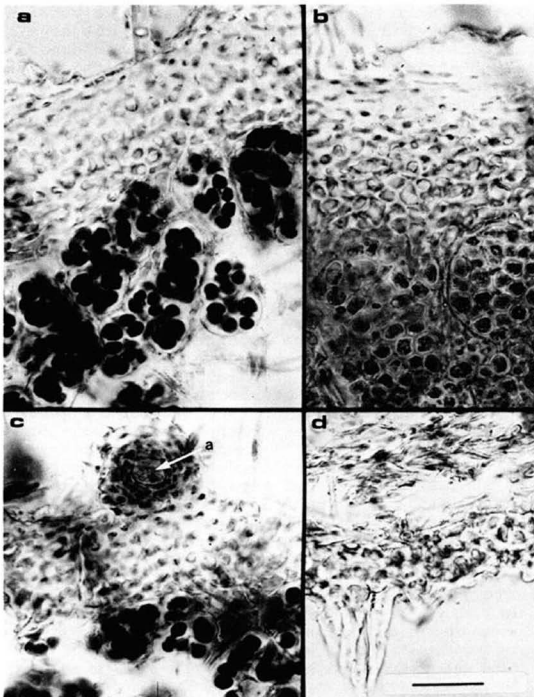

a
5mm
cys
chs
chs
b
5mm

thalli distinguished only by the presence of two kinds of algae is only obtained after cutting the lichen sample.

Chemistry

Fragments of phycosymbiodeme pairs were mechanically isolated under microscopic control and then extracted in cold acetone and chromatographed. Results of ascending TLC in solvent system C are given (fig.9). For "*P.margaretae/P.pubescens*" two-dimensional TLC was necessary to demonstrate the occurence of methyl lecanorate and methyl evernate and of norstictic acid (fig.10). Neutral compounds belonging to the main substances were further characterised by their mass spectra. Detailed data are presented elsewhere (Renner 1980). In two pairs of phycosymbiodemes viz., "*P.murrayii/P.rufovirescens*" and "*P.allanii/P.coriacea*" results give strong evidence of two triterpenoids, 7β-acetoxyhopane-22-ol and hopane-15α-22-diol (Wilkins and James 1979, Renner 1980) being present in both joined thalli as well as in either phycosymbiodeme (fig.9). Mass spectral data of 7β-acetoxyhopane-22-ol:
M^+: *m/e 486 (not registrated), m/e 468, m/e 453, m/e 428 (not registrated), m/e 393, m/e 249, m/e 206, m/e 205, m/e 207, m/e 189 and m/e 149.*
Mass spectral data of hopane-15α-22-diol:
M^+: *m/e 444, m/e 426, m/e 411, m/e 386, m/e 223, m/e 205, m/e 191 and m/e 165.*
The chemistry of the pair "*P.margaretae/P.pubescens*" is more complex, containing substances from

figure 6: Thallus anatomy of the pair "*P.margaretae/P. pubescens*"; a,c,d: cross sections of "*P.margaretae*"; a: upper cortex and algal layer; c: chlorosymbiodeme primordium on the upper cortex, containing two green algal cells(a) being intimately surrounded by hyphae of the tomentum; d: lower thallus cortex with part of the medulla; the structure of the lower cortex is the same as in "*P.pubescens*"; b: cross section of "*P.pubescens*"-lobe in proximity of "*P.margaretae*" with upper cortex and adjoining algal layer; scale in d (representative also of a,b,c): 20 µm.


a
b
c
a
d

all three main biosynthetic pathways involved in secondary metabolism in lichens. Among the neutral constituents, hopane-15α-22-diol and hopane-6α-7β-22-triol were clearly identified (fig.9,10). Mass spectral data of hopane-6α-7β-22-triol: *M^+: m/e 460, m/e 442, m/e 427, m/e 402, m/e 223, m/e 207, m/e 189 and m/e 149.*
These two triterpenoids of the hopane-series are present in both phycosymbiodemes(fig. 9,10). There is possibly also a trace of 7β-acetoxyhopane-22-ol present in both and one further neutral compound (triterpenoid or sterol ?) of a higher R_f. Products of the shikimic acid pathway, calycin, pulvinic dilactone and pulvinic acid are present in both phycosymbiodemes. Depsidones are norstictic acid, stictic acid, constictic acid and cryptostictic acid, with all compounds present in both thalli. Two tridepsides, tenuiorin and methyl gyrophorate (only in trace amounts) are present in both phycosymbiodemes. The identification of all other depsides remains speculative - they are present only in trace amounts and most likely represent the additional spots, often occuring together with tenuiorin and methyl gyrophorate,viz., methyl evernate, methyl lecanorate and possibly two others. Of the four last-mentioned constituents at least one is not present in *P.pubescens*.
Among volatile compounds of the methylamine series, only trimethylamine was detected by gas chromatography. Aliquots of aqueous extracts of both phycosymbiodemes yielded similar amounts of

figure 7: Schematic outline of pseudocyphellae-development in *P.thouarsii* (taken from Renner 1980);a: very early stage in the development showing strong coloured hyphae in contact with the lower thallus cortex (lc) and inducing cells of the cortex into active growth; b: stage to be characterized as an invasion of the lower cortex by articulated hyphal elements; the cortex is ruptured by the pressure of growing hyphae and lysis (ly); c: young pseudocyphella, with hyphae directly exposed to the substratum.

25µm
lc
a
b
c

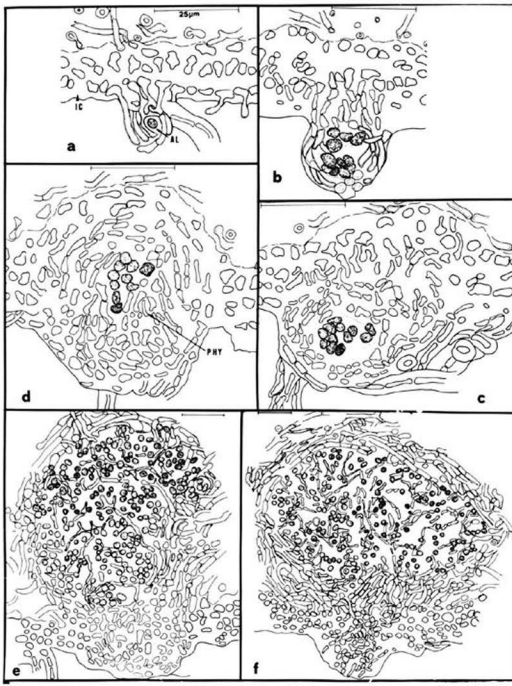
this compound.

DISCUSSION

The similarity shown by pairs of phycosymbiodemes of *Pseudocyphellaria* studied in the developmental processes leading to the formation of chlorosymbiodemes is very striking. In all cases studied chlorosymbiodemes are secondarily produced by the mycobiont of the cyanosymbiodeme. Leaving aside differences in the organisation of other cyanosymbiodemes as well as different sites of origin, the sequence of morphogenetic steps in chlorosymbiodeme development is much the same in *Pseudocyphellaria*, *Sticta* (e.g. "*S.dufourii/S.canariensis*") and *Peltigera* (unnamed (*P.avenosa* Gyelnik) [P.W. James, pers.comm.] blue-green morphodeme with *Coccomyxa*-containing lobes). Whenever a chlorosymbiodeme is formed it is of secondary origin and is characterised by an heteromerous arrangement of tissues. A schematic representation of this process is given in fig. 11, with the chlorosymbiodeme showing heteromerous arrangement of tissues.

Changes in morphology and anatomy in both thalli of joined species resulting from the morphogenetic influences of two different algae vary in their expression. Differences in both secondary metabolites, and developmental morphology of structures such as pseudocyphellae and cyphellae (Renner 1980) in most cases are negligible. That both phycosymbiodemes may produce fruiting bodies (as in an unnamed pair of phycosymbiodemes from *Sticta* - Renner 1980) contrasts with assertions

figure 8: Semi-schematic outline of internal cephalodium-development in *Sticta latifrons* (taken from Renner 1980); The course of development starts with the capture of *Nostoc*-algae (Al) by fungal hyphae of the lower cortex (lc), stage a, followed by successive surrounding of algal cells by hyphae, stage b and c, and the invagination of algal cells into the thallus medulla by hyphal pressure (PHY), stage d, to form an internal cephalodium which then enlarges within the medulla, stage e,f, is typical for foliose green-algal lichens in the Peltigerineae.


25µm
IC
a
AL
b
PHT
d
c
e
f

that sexual reproduction might be influenced by the algae present (James and Henssen 1976).

In the Peltigerineae many chlorosymbiodemes known to occur as independent green-algal lichens (all chlorosymbiodemes studied here) contain internal cephalodia as sometimes do the chlorosymbiodemes themselves. A comparison between cephalodium development and chlorosymbiodeme formation demonstrates certain parallels. Formation of cephalodia may be regarded as the reverse process to that of chlorosymbiodeme formation, e.g. the secondary lichenisation of blue-green algae (*Nostoc*).

The process - illustrated here for *Sticta latifrons*, according to Renner (1980) - starts with capture and encapsulation of epiphytic blue-green algae (fig. 8a) by hyphae of the mycobiont. Very early stages in this process show a small, nodule-like protuberance on the lower surface of the green phycobiont-containing lichen (or chlorosymbiodeme) resembling in structure primordia seen in the formation of chlorosymbiodemes (fig. 8b,c). Unlike the development of chlorosymbiodemes, further differentiation of cephalodia is characterised by an invagination of *Nostoc*-algae into the thallus medulla (figs. 8d,e,f) or, in the case of external cephalodia, by a moderate enlargement of the protuberance to form a ± sacculate, corticate hump with cells of *Nostoc* irregularly distributed throughout the mycobiont tissue (see Henssen and Jahns 1973). In no case is a new heteromerous thallus formed.

In cephalodia the lichenisation of a secondary alga results in a marked change in metabolite pattern. The same situation obtains in *Pseudocyphellaria* and in *Lobaria* (*Lobaria amplissima*, Renner 1980, 1982a,b) and will probably also be true for other members of the Peltigerineae. The change noted is an absence of secondary metabolites from the core of the cephalodia. The absence of these substances may be explained by the diversion of products of primary metabolism (nitrogen fixation) of the alga to the mycobiont where they are absorbed, and probably subsequently fixed and interconverted (Feige 1976, Renner 1980). These latter

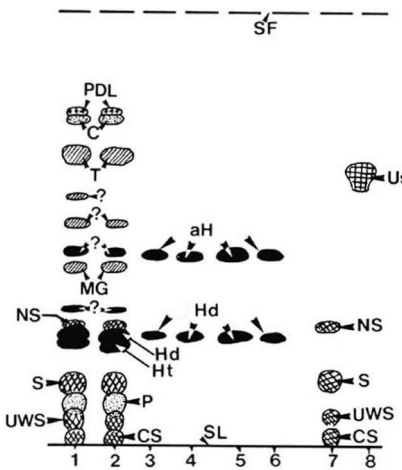


figure 9: Thin layer chromatogram (solvent system C acc. to Culberson 1972) of crude lichen extracts of all pairs of phycosymbiodemes investigated here; position 1: "*P. margaretae*"; position 2: "*P.pubescens*"; Position 3:"*P. murrayii*"; position 4:"*P.rufovirescens*"; position 5: "*P.allanii*"; position 6:"*P.coriacea*"; position 7: stictic-acid-complex standard; position 8: usnic-acid standard; SF: solvent front; SL: start line; PDL: pulvinic dilactone; C: calycin; P: pulvinic acid; T: tenuiorin; MG: methyl gyrophorate; aH:7β-acetoxyhopane-22-ol; NS: norstictic acid; Hd: hopane-15α-22-diol; Ht: hopane-6α-7β-22-triol; UWS: (Unknown S-2 with Stictic acid sens. Culberson 1972) identical with cryptostictic acid; CS: constictic acid; S: stictic acid; Us: usnic acid.

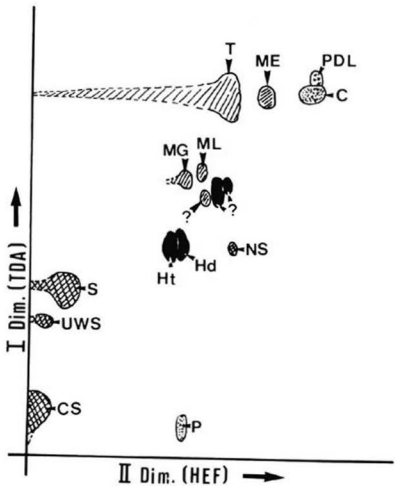


figure 10: Two-dimensional thin layer chromatogram (solvent system A: 1.dimension, B: 2. dimension, A,B acc.to Culberson (1972)) of the acetone extracts of "*P.margaretae*"; ML: methyl lecanorate; ME: methyl evernate; all other abreviations as in fig.9

processes remain to be conclusively proved. Leaving aside the vexed problems involved in demonstrating the presence of lichen substances in different parts of the thallus, the question remains to what extent secondary metabolites may correlate with the alga present. Any discussion of this question must necessarily at present be speculative. As long as we have no reliable evidence for any correlative links between the phycobiont's

metabolic activities and the production of lichen substances within the mycobiont we are far from understanding the possible directing role of phycobionts in the expression of phytochemistry in lichen symbioses. The absence or the additional presence of some secondary products in either phycosymbiodeme may well be known but cannot be determined by considering the algae alone. The converse case, viz., taking the identity of secondary products in both phycosymbiodemes as proof of the continuity of the mycobiont in joined thalli (Jordan 1972) is also inadmissable. The only metabolites known at present to be clearly confined to the mycobiont are the methylamines (Bernard et al. 1974, 1980), however these products are of restricted occurence. James and Henssen (1976) record that *Sticta dufourii* has a distinct fishy smell (methylamines) whereas *S. canariensis* does not have any smell at all. Contrasting with this assertion one of us was able to prove by gas chromatography (Renner 1980) that free-living specimens of either species mentioned above do contain trimethylamine. The proportion in the two species could not be determined.
Evidence for divergent metabolic activities in the tissues of lichenised mycobionts comes from an *in-situ* localisation of lichen acids using a cytophotometric technique (Renner 1982a,b). It is shown in this study that in contrast to high concentrations of depsides and depsidones in the medulla, no substances of this class were detectable within the fungus tissue of cephalodia in green-algal species of *Pseudocyphellaria*, *Lobaria* and *Nephroma*. Further, the detection in some species of *Pseudocyphellaria* of sustantial concentrations of secondary products in particular thalline structures (e.g. pseudocyphellae and soralia: in "*P.margaretae/P:pubescens*" the yellow pseudocyphellae contain pulvinic acid and its derivatives) or in the medulla, supports the assumption of a heterogenous metabolic activity of the lichenized mycobiont. These facts cannot at present be satisfactorily explained.
The reflections outlined here have some important implications for interpretations based on secon-

dary metabolites detected in both phycosymbiodemes or in structures of the green-algal thallus containing blue-green algae, e.g. cephalodia. Whereas in the inner mycobiont tissues of some external cephalodia such as in *Nephroma kuehnemanii*, no metabolites are detectable, the cortex of the cephalodia may give a positive result for at least some secondary metabolites characteristic of *N. kuehnemanii* (Renner 1980, 1982b). Extraction of excised cephalodia of this lichen and analysis of the extract while showing the presence of secondary metabolites, does not prove that the detected compounds are synthesised in the cephalodia under the influence of the secondary algae (*Nostoc*).
The difficulties inherent in correlating secondary metabolites with any particular algae in the symbiotic association will only be resolved by carefull labelling experiments with ^{14}C-labelled precursor substances and such investigations are curently in progress.

figure 11: Schematic outline of phycosymbiodeme formation in *Pseudocyphellaria*; a: blue-green algal lichen; if a tomentum (t) is present on the upper cortex (uc) and on the lower cortex (lc) the capture of green algal cells may occur on both cortices; chsp: chlorosymbiodeme primordium; ap: apothecia; all: algal layer; m: medulla; psc: pseudocyphellae; b: resulting pair of phycosymbiodemes, with lobes of the chlorosymbiodeme (chs) on either surface of the cyanosymbiodeme (cys) at sites of formation of chlorosymbiodeme primordia; above: fertile chlorosymbiodeme with tomentum on both cortices and the development of internal cephalodia (dic); the fully developed chlorosymbiodeme may represent a combination of the two demonstrated alternatives.

ap
chsp
psc
chsp
t
uc
all
m
lc
t
chs
cy
ch
uc all m lc
psc
ap
dic
dic
a
b

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A Note on *Sporotrichum gougerotii* Matruchot 1910

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SUMMARY

The taxon *Sporotrichum gougerotii* Matruchot 1910 is rejected as a *nomen dubium* because the name is of uncertain application. Owing to the absence of type material, an inadequate description, and the lack of illustrations, there has been no consistent taxonomic concept for this fungus. We reject as invalid the recently proposed new combinations of *Exophiala gougerotii* Ravisse et Rodriguez Vindas 1981, *E. gougerotii* South, Brass et Stevens 1981, and *E. gougerotii* Nishimura et Miyaji 1982.

INTRODUCTION AND DISCUSSION

In 1907, Beurmann and Gougerot (1) described an atypical case of sporotrichosis (case XI) in a patient suffering from tuberculosis. The infection manifested itself as a painless, deep, hard nodule on the right thigh. Prolonged direct examination of pus aspirated from the nodule revealed a single, oblong fungal form that Beurmann and Gougerot considered to be compatible with that produced by a species of *Sporotrichum* Link. The fungus that was isolated from the aspirated pus was described as being black, slow growing, and producing bouquets of 6 to 12 spores with a few spores being borne singly only in the

center of the colony. On the basis of these findings, the authors equated their isolate with *Sp. beurmannii* (as *beurmanni*) Matruchot et Ramond 1905, which is now considered to be a later synonym of *Sporothrix schenckii* Hektoen et Perkins 1900. Unfortunately, Beurmann and Gougerot paid little attention to the alleged tissue form of the fungus, which cast doubt on the very existence of a mycotic infection. On the basis of the data furnished in their case report, one could conclude that the recovered fungus was merely a contaminant.

Beurmann and Gougerot gave their isolate to Matruchot, who in 1910 (13) described it as *Sp. gougerotii* (as *gougeroti*). It is uncertain whether or not Matruchot intended the name *gougerotii* to be used as a variety or species name. On page 545 of his paper (13), he wrote "Je le considere comme une variété stable du *S. Beurmanni* et le dénomme *S. Gougeroti*". Later on that same page, Matruchot stated that among the small group of fungi that caused sporotrichosis, he recognized *Sp. gougerotii* as one of the "...trois types assez différents pour constituer trois espèces distinctes ..." In one instance he proposed *Sp. gougerotii* as a variety of *Sp. beurmannii*, and in a second instance a distinct species. Since Matruchot did not refer to Beurmann and Gougerot's description of the isolate presented to him (1), the name *Sp. gougerotii* must rest solely upon the description that Matruchot provided in his study. Matruchot considered the aerial fructifications produced by *Sp. gougerotii* to be intermediate to those of *S. schenckii* and *Sp. beurmannii*. In addition, Matruchot described a "budding" form as being characteristic of *Sp. gougerotii*. Judging from his description, the "budding" form may have consisted of, in part, toruloid hyphae. The description provided by Matruchot is so vague that it is impossible to determine the diagnostic characteristics of his fungus, which has resulted in substantial taxonomic confusion. Unfortunately, a specimen was not prepared, illustrations were not provided, and the culture that Matruchot had used for the description of *Sp. gougerotii* was not saved. As a result, Matruchot's taxon has been classified in the genera *Rhinocladium* Saccardo et Marchal (22), *Torula* Persoon (12), *Dematium* Persoon (7), *Oospora* Wallroth (10), *Cladosporium* Link (5), *Phialophora* Medlar (2), and *Rhinocladiella* Nannfeldt (19) by various investigators.

Castellani and Chalmers (6) considered *Sp. gougerotii* to differ "....from the typical *Sp. beurmannii* only in small details, the principal ones of which are the black pigmentation of the colonies from the very beginning, and the extremely abundant sporulation." This disposition can be supported by examining the exquisite drawings prepared by Nannizzi (16) for figure 194 in his text book. These show the characteristic sympodial conidiogenous cells and arrangement of conidia that are typical of the genus *Sporothrix* Hektoen et Perkins. In contrast, Grütz (8) and Grigoraki (7) characterized *Sp. gougerotii* as producing what appears to be toruloid hyphae with and without clusters of round cells associated with the hyphae. Some of their illustrations are suggestive of *Moniliella* Stolk et Dakin. Janke's (10) concept parallels that of Grütz, with the additional morphological form of budding yeast cells being included (see his figures 6 and 11). A third interpretation of *Sp. gougerotii* was presented by Kesten et al. (11), Young and Ulrich (23), and Borelli (3), who depicted the conidiogenous cells as being cylindrical and bearing clusters of conidia at their apices as seen in the genus *Exophiala* Carmichael.

In 1953, Young and Ulrich (23) isolated a dematiaceous hyphomycete from a human case of phaeohyphomycosis. They identified it as *Sp. gougerotii* and sent it to Gougerot, who confirmed their identification. Borelli obtained a subculture of Young and Ulrich's (NCMH 575) isolate and in 1955 designated it as the neotype for *Sp. gougerotii* (3). He then transferred the taxon to the genus *Phialophora* (2). Borelli considered *E. jeanselmei* (Langeron) McGinnis et Padhye 1977 and *Wangiella dermatitidis* (Kano) McGinnis 1977 to be later synonyms of *P. gougerotii*. Because a living culture can not serve as a neotype (Article 9.5, ICBN) (21) and a specimen was not provided (4), Borelli's proposed neotype is invalid. In addition, even if his proposed neotype had been prepared properly as stipulated under the rules of nomenclature, his neotype could not be accepted because it can not be shown that the neotype is compatible with the protologue of *Sp. gougerotii* (Article 8.1, ICBN).

The problem of Gougerot's confirmation (23) of Young and Ulrich's isolate as *Sp. gougerotii* needs to be taken under consideration. It is important to remember that the

protologue fixes the characteristics of the taxon. NCMH 575 could have been typical of the culture that Gougerot gave to Matruchot, but it may not have been what Matruchot actually described. In addition, Matruchot (13) made no reference in his paper to the description of the fungus that Beurmann and Gougerot provided in their paper (1). If Gougerot and Matruchot had saved their original cultures or specimens, this doubt would not have arisen. Even though Gougerot considered NCMH 575 to be *Sp. gougerotii*, a fungus that he had isolated 46 years earlier, the description provided by Matruchot must be followed. Based upon the descriptions provided by Beurmann and Gougerot and by Matruchot, it is now impossible to determine if these authors were working with the same fungus.

In 1968, Schol-Schwarz (19) proposed the new combination *Rhinocladiella mansonii* (Castellani) Schol-Schwarz. She treated *Sp. gougerotii* as a later synonym of this taxon. Recently, de Hoog (9) considered *Sp. gougerotii* to be a later synonym of *E. mansonii* (Castellani) de Hoog 1977. McGinnis (14) concluded that *Sp. gougerotii* sensu Borelli represents misidentified isolates of *E. jeanselmei* and that *Sp. gougerotii* sensu Matruchot was a later synonym of *S. schenckii*.

In three recent independent studies, the new combination *E. gougerotii* has been invalidly proposed. Ravisse and Rodriguez Vindas (18) in 1981 cited "*Exophiala gougerotii* (*Phialophora gougerotii*), McGinnis et Padhye, 1977" as an etiologic agent of phaeohyphomycosis. Because McGinnis and Padhye (15) did not propose this combination, the name *E. gougerotii* must be attributed to Ravisse and Rodriguez Vindas. This name is invalid and must be rejected because they did not publish it in accordance with Article 33.2 of the ICBN. South, Brass, and Stevens (20) also invalidly proposed the name *E. gougerotii* and incorrectly implied that Zaias (24) had used this name. Nishimura and Miyaji (17) in their studies on *W. dermatitidis* used the binomial *E. gougerotii*. As in the case of Ravisse and Rodriguez Vindas, the latter two proposals must be rejected for the same reason. The invalid name *E. gougerotii* could have been avoided, if these three groups of investigators had followed the provisions of the International Code of Botanical Nomenclature.

In summary, we believe that the name *Sp. gougerotii* should be rejected because the identity of Matruchot's fungus can not be determined with certainty. The name *Sp. gougerotii* is considered to be a *nomen dubium* because its application is uncertain. This taxonomic problem exists because the original cultures and specimens were discarded, illustrations were not provided, and the description of the taxon was inadequate.

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PARAFFIN EMBEDDING AND SEMITHIN SECTIONING OF BASIDIOCARP TISSUES

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ABSTRACT

Microscopic details of basidiocarps are important in species determination among agarics. A method of embedding in paraffin was devised to demonstrate sporocarp microscopic morphology. Semithin (3 µm) microtome sections were obtained that clearly revealed the cuticle, context, and tramal region; the hymenium remained indistinct.

INTRODUCTION

Microscopic characters are important to taxonomic studies, especially at, or below, the species level (Singer, 1962; Hesler & Smith, 1979). Agaricologists typically have used hand sectioning to study the microscopic morphology of basidiocarps. Paraffin sectioning should provide more consistent results, but no satisfactory technique has been reported. The technique described here produces material which can be cut to 3 µm thickness. The uniform quality and thinness of the sections make them well suited for photography. As an additional advantage, the permanently prepared slides can be kept for future reference.

MATERIALS AND METHODS

Pieces of the pileus and stipe of fresh basidiocarps were placed in a 70:25:5 (v/v) water, ethanol, formalin fixative (Corner, 1967) for a minimum of 24 h. Portions approximately 4x4 mm were cut from these pieces and dehydrated in an upgraded series of tertiary butal alcohol (TBA) solutions (Johansen, 1940): TBA 1 (2 h), TBA 2 (2 h), TBA 3 (2 h), TBA 4 (2 h), TBA 5 (overnight), and finally absolute TBA (3 changes; 4 h, 4 h, and overnight). Following dehydration, the tissues were infiltrated by three 20-minute changes of molten paraffin (56°-57°C), and embedded in fresh paraffin. Tissue blocks

were sectioned at 5 and 3 µm using a rotary microtome and sections mounted on slides lightly coated with Mayer Albumin Fixative (Humason, 1979). Sections were floated on a thin film of distilled water applied to the edge of the ribbon. The slides were transferred to a 39°C warming tray for 6-12 h, deparaffinized in two changes of xylene (5 and 3 min respectively), and rehydrated by means of a downgraded series of ethanol: 100% and 95% (5 min each); 85%, 70% and 60% (3 min each). The slides were further rehydrated in 3% (w/v) potassium hydroxide (KOH) (5 min), stained in a 1:1 (v/v) aqueous solution of 1% phloxine and 1% Congo Red (30 min), rinsed in distilled water, and again placed in 3% KOH (15 min). Coverslips were mounted using Kaiser Glycerine Jelly (Humason, 1979).

RESULTS

Sections were cut at 5 µm thickness to demonstrate the cuticular layers and at 3 µm to show the trama and context. Satisfactory sections of less than 3 µm in thickness could not be obtained as tissues tended to compress and wrinkle during sectioning.

The 3 µm thick sections clearly demonstrated the pileal and stipe cuticles, context, and lamellar trama (Figs. 1, 2, 3, 4), but morphology of the hymenial elements was indistinct. Despite the lack of structural detail in the hymenium, it was possible to determine the relative density and positioning of the cystidia (Fig. 4).

DISCUSSION

While hand sectioning is a useful method, paraffin embedded tissues yield more consistent results as they can be cut at a uniform thinness.

Berta (1976) described an embedding method using butylmethacrylate and styrene with benzoyl peroxide from which 2 µm thick sections of agaric tissues were obtained. With respect to morphology, the 3 µm thick sections cut from paraffin embedded tissues are comparable to Berta's (op. cit.) results. Plastic embedding techniques involve potentially carcinogenic, costly, and non-reusable materials in contrast to the less toxic, less expensive, and reusable chemicals involved in the paraffin method.

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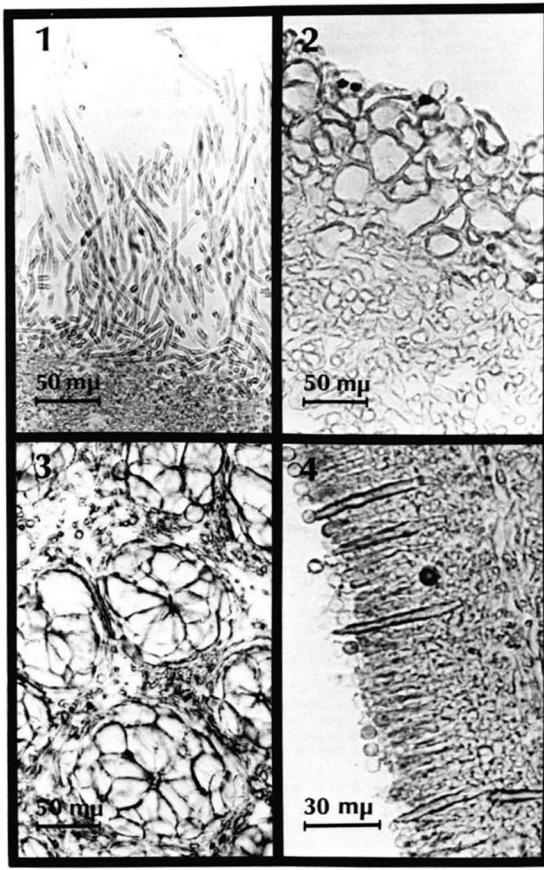
Figures 1-4. 1. Stipe cuticle of *Lactarius vellereus* (section 5 µm thick). 2. Pileal cuticle of *L. volemus* (section 5 µm thick). 3. Context tissues of *L. deceptivus* (section 3 µm thick). 4. Trama and hymenium of *L. volemus* (section 3 µm thick).


1
50 mμ
2
50 mμ
3
50 mμ
4
30 mμ

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BASIDIOSPORE VARIATION IN LOCAL POPULATIONS OF SOME APHYLLOPHORALES

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The variability of mean spore length, width and spore form index *Q* (mean length divided by mean width) of eleven local populations of five *Phellinus* spp. and one local population of *Polyporus rhizophilus* was studied. The coefficient of variation, *V*, for spore length and width usually lay between 2-10, and for *Q* between 1-8. These values are within the range found for similar parameters in other organisms.

The variability of mean spore length and width is usually smaller, and that of mean *Q* considerably smaller at the population level than at the individual level.

The variability of *Q* is much smaller with subglobose spores than with cylindrical ones.

Spore size and spore form are characters widely used in the taxonomy of fungi for distinguishing closely related species. However, these characters have a statistical meaning but are frequently used uncritically without taking into consideration the extent of their variability. In our earlier paper (E. Parmasto & I. Parmasto, 1982) we asserted that the variability of these characters in the Aphyllophorales is complicated and includes several components.

The coefficient of variation (or variability) $V = \frac{\sigma \cdot 100}{\bar{x}}$ has been evaluated by Simpson, Roe & Lewontin (1960) as the most convenient measure of variability. It has been widely used in zoology and botany (including algology) but rarely in mycology and probably not until now for the Aphyllophorales.

This paper deals with the variability of mean spore length, width and spore form index *Q* (ratio of mean length to mean width) of five *Phellinus* species in 11 local populations. For comparison, the variability of *Polyporus rhizophilus* in one local population was also studied.

MATERIALS AND METHODS

The following species were studied: *Phellinus alni* (Bond.) Parm. (*Ph. igniarius* (Fr.) Quél. f. *alni* Bond.), *Ph. hartigii* (All. & Schn.) Pat., *Ph. hippophaëcola* H. Jahn,

Phellinus igniarius (Fr.) Quél. s. str., *Ph. robustus* (P. Karst.) Bourd. & Galz., and *Polyporus rhizophilus* Pat.

Spore samples were collected as spore prints shed during 24 hours from basidiocarps under natural conditions, simultaneously from all the basidiocarps in each population studied, except in two cases (*P. rhizophilus* and *Ph. hippophaëcola* from Sweden), where spores of herbarized basidiocarps collected within about one hour were measured.

From every sample 30 spores were measured in 2 % KOH solution using an eyepiece micrometer at a magnification of x 700 under the microscope МБИ-6. For every sample the mean values of spore length, spore width and Q, and the coefficient of variability V_{ind} of these data were calculated. Similar data were thereafter calculated for each population, the coefficient of variation of sample means within a population being denoted V_{pop}. Details of the samplings are given in Table 1.

RESULTS are summarized in Table 2.

DISCUSSION

The number of specimens (samples) in the populations studied was rather small (from 6 to 17) but the results are similar enough to draw some conclusions, and Simpson, Roe & Lewontin (1960) also used some rather small samples (N = 8; 10) among their examples.

Variability of spores in one sample (specimen).

The value of the variation coefficient V was usually 4-10 for spore length and width, and 3-8 for Q in the *Phellinus* species. The mean value of V for Q (4.77) was somewhat smaller than the ones for spore length (6.43) and spore width (6.30); this is obviously connected with the subglobose spore form. The mean value of V for Q was higher in *Polyporus rhizophilus* (10.3), which has cylindrical spores.

Variability of the means of specimens within one population.

The value of V was usually 2-7 for spore length and width, and 1-2.7 for Q in the *Phellinus* species. The mean value of V for Q is much higher in *Polyporus rhizophilus* (5.7), which has cylindrical spores. Compared with the variability of the spores of one basidiocarp, that of individual basidiocarps of the same population is usually somewhat smaller for the mean spore length and width, but always and remarkably smaller for Q.

Extent of variability in the fungi studied.

According to Rokickij (1973), the value of V ranges mostly between 5 and 10 in homogeneous biological material. Simpson, Roe & Lewontin (1960) as well as Mayr (1969)

asserted that the great majority of *V*'s for the linear dimensions of the anatomical elements of mammals lie between 4 and 10. Blue algae show similar or a little greater variability (Kondratyeva, 1980). Our data fall within the same range; obviously, the extent of variability of essential meristic characters is similar in most organisms.

Variability between different populations of the same species.

The comparision of data which may seem to be possible for the *Phellinus alni* and *Ph. hippophaëcola* populations has been avoided due to the fact that they were sampled at different times. It has been demonstrated previously (I. Parmasto & E. Parmasto, 1977), that spore size of *Phellinus* species may vary considerably within the same specimens during the sporulation period. Obviously, comparison of different populations in this group of fungi yields reliable results only when the samples (from all populations!) have been collected simultaneously, or in sufficient numbers at quite different times and/or in the case of basidiocarps at different stages of their development. Even simultaneous collection of samples may only yield suitable material when the collecting areas are not too far from each other thus avoiding differences in weather conditions.

Possibility of comparing the spores of two specimens.

Sometimes it is necessary to compare two specimens (usually types) to establish their possible conspecificity. Having measured a sufficient number of spores, it is possible to use Student's *t*-test for establishing the significance of difference between their mean measurements.

To evaluate such comparisions we studied two sets of spore samples from *Ph. igniarius* and *Ph. hippophaëcola* (from Sweden). Both sets were characterized by relatively small variability of spores both of specimen and local population levels.

Using the *t*-test in *Ph. igniarius* all (136) possible combinations (pairs) of specimens were compared and it was established that the difference in the mean spore length was highly significant (at $P < 0.001$) in 26 cases and significant (at $0.001 < P < 0.01$) in 21 cases. Similar results were obtained for *Ph. hippophaëcola:* of 66 possible combinations (pairs) of specimens the difference was highly significant in 20 cases and significant in 10 cases.

These results were obtained using specimens of one local population characterized by a rather small coefficient of variability and collected at the same time. Even in such "ideal" cases the comparision of two randomly selected specimens using the *t*-test does not give any useful information for the establishment of their species identity or difference. A biometrical comparison is only reasonable between two populations, or between a population and a single specimen.

TABLE 1. SAMPLING DETAILS

Species	Sampling Code	Location	Diam. of Sampling Area (km)	Substrata	Date of Sampling	No. Basidiocarps Sampled
Phellinus alni	A	Estonian SSR, Põlva Distr., Valgemetsa	3	Alnus incana Padus racemosa Sorbus aucuparia	11-12.VI.69	8
	B	as above	3	Alnus incana Padus racemosa	14-15.X.69	8
	C	Estonian SSR, Jõgeva Distr., Levala	2.5	various deciduous trees	16-17.IX.70	13
	D	Estonian SSR, Viljandi Distr., Polli	2	Malus domestica	31.VIII.-1.IX.70	6
	E	Polar Urals, Krasnyj Kamen'	1.5	Alnaster fruticosus	7-8.VIII.69	12
Ph. hartigii		Ukrainian SSR, L'vov Reg., Truskavets	2	Abies alba	19-20.IX.69	8
Ph. hippophaëcola	A	Altai Reg., Katun' Basin		Hippophaë rhamnoides	IX.69	9
	B	Dagestan ASSR, Samur Nature Reserve	0.5	Hippophaë rhamnoides	7-8.VI.74	6
	C	Sweden, Uppland, near Billuden	0.4	Hippophaë rhamnoides	30.VIII.74	12
Ph. igniarius		Byelorussian SSR, Byelovezhskaya Pushcha Nature Reserve	3	Quercus petraea	24-25.IX.69	17
Ph. robustus		as above	3	Quercus robur	24-25.IX.69	10
Polyporus rhizophilus		Tajik SSR, Ramit Nature Reserve	0.015		11.IV.77	11

TABLE 2. DIMENSIONS (µm) OF SPORES OF LOCAL POPULATIONS OF APHYLLOPHORALES

Species	Sampling Code	Spores of Individual Basidiocarps Range of Means			Population Means			V_{ind}						V_{pop}		
								Length		Width		Q				
		Length	Width	Q	Length	Width	Q	Range	Mean	Range	Mean	Range	Mean	Length	Width	Q
Phellinus alni	A	5.57-6.75	5.10-6.30	1.07-1.13	6.12	5.59	1.11	4.9-6.8	5.6	4.4-7.5	5.6	3.2-6.5	4.6	6.3	6.9	1.8
	B	5.79-7.07	5.23-6.41	1.08-1.14	6.32	5.66	1.12	4.8-9.6	6.9	6.0-11.5	7.4	4.6-10.1	6.5	7.3	7.1	2.7
	C	5.12-5.99	4.60-5.51	1.06-1.11	5.68	5.18	1.10	4.4-7.9	6.2	3.6-7.1	5.4	3.4-6.9	4.7	4.1	4.7	1.9
	D	5.69-5.96	5.04-5.35	1.10-1.13	5.78	5.20	1.12	5.3-9.0	6.8	4.9-7.4	6.0	3.9-6.6	5.2	1.7	2.0	0.9
	E	5.66-6.61	5.12-6.04	1.08-1.13	6.01	5.43	1.11	4.1-6.8	5.4	4.5-7.2	5.9	3.6-5.5	4.4	3.9	4.2	1.5
Ph. hartigii		8.18-9.71	7.55-9.10	1.04-1.10	8.76	8.16	1.08	4.3-9.3	6.8	3.8-8.2	6.1	2.7-5.9	4.2	6.0	5.6	1.8
Ph. hippophaëcola	A	7.12-7.28	6.36-6.61	1.09-1.12	7.19	6.53	1.10							0.9	1.4	1.0
	B	5.71-6.88	5.21-6.03	1.07-1.13	6.40	5.79	1.11	4.4-7.2	5.7	4.2-8.0	6.0	3.8-7.3	4.7	6.2	5.2	2.1
	C	5.89-6.72	5.48-6.22	1.06-1.08	6.29	5.87	1.07	4.2-8.8	7.0	4.4-9.3	7.2	2.1-4.7	2.8	4.0	3.9	0.6
Ph. igniarius		5.58-6.20	4.98-5.46	1.08-1.16	5.80	5.28	1.11	5.5-9.4	6.8	4.9-10.0	6.7	4.7-8.3	5.9	3.2	2.8	2.2
Ph. robustus		7.12-8.38	6.74-7.59	1.06-1.13	7.66	7.06	1.08	5.6-9.7	6.9	2.5-12.9	6.4	3.6-7.7	4.7	5.0	3.7	2.3
Polyporus rhizophilus		7.54-8.73	3.40-3.77	2.09-2.49	8.20	3.57	2.32	8.1-11.8	9.6	8.7-20.6	11.9	7.9-12.5	10.3	5.7	2.7	5.7

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NEW SPECIES OF FUNGI FROM THE YUCATAN PENINSULA * **

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SUMMARY

Eight new species of fungi from the Yucatan Peninsula (Mexico) are described. These are HYPHOMYCETES: Rhinotrichum mexicanum; AGARICALES: Lepista singeri, Melanoleuca tropicalis, Amanita silvatica, A. yucatanensis. A. dunicola and Inocybe tropicalis, and HYMENOGASTRALES: Octavianina ciqroensis. All of them are from the tropical rain forests, except Amanita dunicola which grows in the dunes in the north of the peninsula where it is associated with Coccoloba uvifera.

INTRODUCTION

During an extensive mycological exploration in the tropical rain forests of Quintana Roo, and parts of Yucatan and Campeche States, in November 1981, the author, in collaboration with the Biologist Armando Lopez from Xalapa, Ver., found numerous interesting fungi, lichens, and Myxomycetes, many of them newly recorded in Mexico, of which eight species are described here. Other (Lepiotaceae fungi) in Guzmán Dávalos and Guzmán (1982).

All herbarium material is deposited in the following three herbaria Mexican Institutes: Escuela Nacional de Ciencias Biológicas (ENCB) Mexico City, Instituto Nacional de Investigación sobre Recursos Bióticos (INIREB), Xalapa, Veracruz and Centro de Investigaciones de Quintana Roo (CIQRO), Puerto Morelos, Quintana Roo. The latter has been provisionally deposited in Merida, Yucatan.

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** Presented in the I National Congress of Mycology, at Xalapa (Mexico).

The microscopic study was made from section mounted in KOH (5%) or Melzer's solution. The colors of the spore, hyphae and cystidia are described from mounts in KOH solution.

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HYPHOMYCETES

Rhinotrichum mexicanum Guzmán, sp. nov. Figs. 1-3

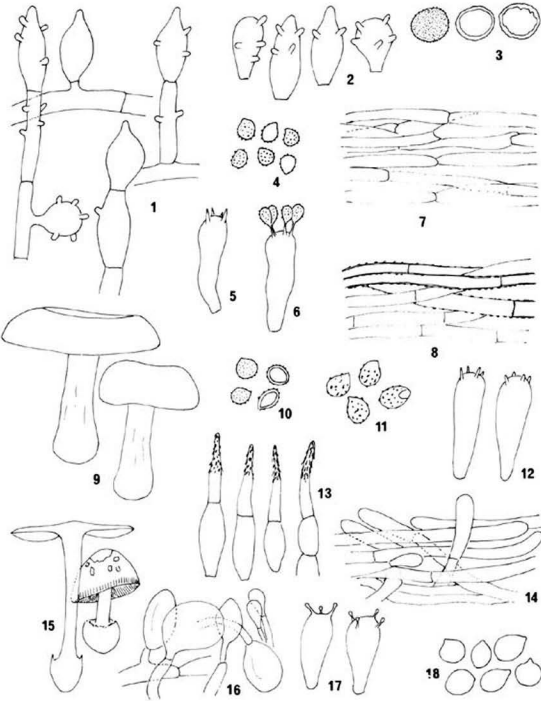
Mycelium flocci caespitosi, septati, brunneus ferrugineus, hyphae pallide brunneae 6-12 um latae. Conidiophoris 11-25 × 7-9 um, globosis vel ventricosis dein clavatus. Sterigmatis numerosus breviculus. Conidiis 10-13 um latae, globosis, hyalinae, tenuis verrucosis. Ad ligna vel corticem, subsilva tropicalis. Quintana Roo prope, Coba-Nueva Xcan, López 1922 (Typus ENCB).

Mycelium ferrugineus brown, cottony, forming a loose cushion-like mass on the substratum. Hyphae pale brown, septate, intricately interwoven, 6-12 µm diam. Fertile branches erec or suberect. Conidiophores globose to ventricose or clavate, sometimes mucronate; with numerous short sterigmata over the surface, 11-25 × 7-9 µm; sterigmata not more than 3 µm long. Frequently the spores are borne on numerous sterigmata on cells below of the conidiophore. Spores hyaline, globose, thick walled, finely rough, 10-13 µm diam.

Habitat. On bark in an open (disturbed) tropical rain forest.

Specimens examined. MEXICO, QUINTANA ROO, Coba to Nueva Xcan road, near the crossing to Sajaca-chen, López 1922 (Type, ENCB).

Discussion. This fungus is close to R. subalutaceum Peck, from NE of United States, but that species has spores 8-10 µm diam., conidiophores which are not globose and mycelium that is



Figs. 1-18.- 1-3: Rhinotrichum mexicanum, 1: Hyphae and conidiophores, 2: Conidiophores, 3: Spores.- 4-9: Lepista singeri, 4: Spores, 5: Basidium, 7: Trama, 8: Structure of the pileus, 9: Carpophores.- 10-14: Melanoleuca tropicalis, 10: Spores in KOH, 11: Spores in Melzer solution, 12: Basidia, 13: Cheilocystidia, 14: Structure of the pileus.- 15-18: Amanita silvatica, 15: Carpophores, 16: Elements of the volva on the pileus, 17: Basidia, 18: Spores.

yellowish brown. It is also close to R. subferruginosum Sumstine in the color of the mycelium and tropical habitat (Jamaica forests), but that species has smooth spores (Sumstine, 1911). It is probable that R. mexicanum has a wide distribution throughout the tropical forests of Mexico (the author has observed this kind mycelium on bark in forests in Veracruz State). Balfour-Browne (1952) described R. domesticum Balfour-Browne and R. lanosum (Cooke) Cooke as growing on walls in England, both with smooth spores.

AGARICALES
Tricholomataceae

Lepista singeri Guzmán, sp. nov. Figs. 4-9

Pileo 50-80 mm lato, convexo vel applanato dein subdepresso, levi, haud hygrophano, brunneolo griseus vel brunneolo alutaceus. Lamellae subdecurrentibus vel subadnatis, subroseus. Stipite 45-55 × 10-15 mm, centralis vel subcentralis, albidus. Carne alba, inmutabili, odore et sapore gratus vel fortis aromaticus. Sporis 5.4-7 × 3.5-4.5 µm, hyalinae, globosis or ellipsoides, subtiliter echinatis, haud amyloideis. Haud cystideis. Hyphis fibuligeris. Quintana Roo, Puerto Morelos Prope, silva tropicalis, Guzmán 21010 (Typus, ENCB).

Pileus 50-80 mm diam., convex to plane or subconcave or subinfundibuliform, smooth, sometimes with radical fibrills or subrimose, dry, brownish gray or brownish leather color, with some metalic shine, non hygrophanous. Lamellae subdecurrent or subadnate, pale rose, more or less distant. Stipe 45-55 × 10-15 mm, central or excentric, equal or slightly tapering, bulbous, whitish, fibrillose, smooth but somewhat floccose above, solid to somewhat hollow, subcartilagineus, with white short rhizomorphs. Context white; taste and odor pleasant; dried specimens with strong aromatic odor. KOH stains the pileus reddish brown.

Spores 5.4-7 × 3.5-4.5 µm, hyaline, globose or ellipsoid, thin walled, finely echinulate, inamyloid. Basidia 28-37 × 8-9µm, tetrasporic, hyaline, ventricose-fusoid. Pleurocystidia and cheilocystidia absent. Trama regular, with hyaline hyphae 4.5-11 (-15)µm diam., thin walled, with numerous clamp connections. Pileus surface with appressed hyaline hyphae, 3-6µm diam., some with irregular incrusted brown pigment.

Habitat. Solitary or gregarious on humus, in the tropical rain forests, below several species of trees, e.g., Achras zapota (as ectomycorrhizic ?).

Specimens examined. MEXICO, QUINTANA ROO, near the road from Puerto Morelos to Tulum, close to the crossing to Vallarta, footpath to the sea, Guzmán 21010 (Type ENCB); Guzmán

21018; Guzmán 21032; López 1875. 10 km. from Tomas Garrido, km 77 on road from Chetumal to Escarcega, Guzmán 20883.

Discussion. This species is close to L. glabella (Speg.) Sing. known from Argentina, Paraguay, Brazil and Florida in subtropical forests, but differs in the absence of an aqueous zone in the gills close to the stipe, as well as in the presence of a brown aqueous zone in the context above the gills, in the absence of an odor and in the size of the spores (4.8-6.2 × 3.3-4.2 µm), according Singer & Digilio (1951). None of the species of Lepista described by Pegler (1977) from Africa agree with L. singeri. This is first record of a Lepista in the tropical rain forests of Mexico. The specimen 21018 was identified tentatively as L. singeri because it is a young carpophore without spores, and with the pileus surface formed from hyaline to somewhat incrusted more or less repent hyphae 3-6um diam. The context has the same odor and the KOH also stains the pileus brown reddish.

Melanoleuca tropicalis Guzmán, sp. nov. Figs.10-14

Pileo 15-35 mm lato, convexo vel subapplanato, glabro, brunneolus griseus vel griseus plumbeus. Lamellis subadnatis, albidis vel pallide cremeis. Stipite 20-40 × 1-2 mm, haud bubose, albido, glabro. Carne albidae, odore nullo. Sporis (5.2-) 6-7.5 × 4.5-6 (-6.7) µm, globosis vel ellipsoideis, verrucosis, fortiter amyloideis. Pleurocystidiis analogus cheilocystidiis, rarus. Cheilocystidiis 31.5-55.5 × 4.5-9 µm, numerosus, obclavatis vel lanceolatis, hyalinis, parte centralis septatis, ad apicem acutissimis, crystallis hyalinis ad apicem incrustatis. Haud fibulis. Ad terram in silva tropicalis. Quintana Roo, Puerto Morelos Prope, Santa Matilde, Guzmán 21430 (Typus ENCB).

Pileus 15-35 mm diam., convex to somwthat plane or subconcave, glabrous, dry grayish brown to grayish lead color. Lamellae subadnate, white or whitish to pale yellowish. Stipe 20-40 × 1-2 mm equal, white to whitish, glabrous. Context whitish, odorless.

Spores (5.2-) 6-7.5 × 4.5-6 (-6.7) µm, globose or subellipsoid, hyaline, verrucose, thin walled, strongly amyloid, with a more or less distinct plage on one side close to the apiculus. Basidia 16.5-28.5 × 9-10.5 µm, hyaline, tetrasporic ventricose. Pleurocystidia scarce, like the cheilocystidia but without apical crystals. Cheilocystidia 31.5-55.5 × 4.5-9 µm, numerous, obclavate or lanceolate, with a transver septum in the middle part and with characteristic hyaline apical crystals. Trama of more or less interwoven hyaline hyphae. Pileus surface with appressed or subappressed hyphae, with brownish gray content, 3-9 µm diam. Clamp connections absent.

Habitat. Solitary on humus in the tropical rain forests.

Specimens examined. MEXICO, QUINTANA ROO, Puerto Morelos to Vallarta road, 1 km. from the crossing to Tulum, Santa Matilde, Guzmán 21430 (Type ENCB). Puerto Morelos to Tulum, close to the crossing to Vallarta, footpath to the sea, Guzmán 21079.

Discussion. This species is close to M. brevipes (Bull. ex Fr.) Pat. because of the cheilocystidia, but differs in the size of the spores (8-10.5 × 4.5-6µm sensu Pegler, 1977; 7-8.5 × 4.5-6 µm sensu Bon et al., 1973) and in the long stipe (short in M. brevipes). It is also close to M. pseudoluscina Bon but that species has spores (6-) 7-8.5 (-9.5) × (5-) 6-7.5 (-8) µm (Bon, 1980). M. tropicalis is also close to M. tucumanensis Sing. from Argentina (Singer & Digilio, 1951), but differs in the size of the spores (7.5-10.3 × 6.2-7.5 µm) and in the basidia (31-35 × 8-9.7 µm). Previous to this report, Melanoleuca was only known in Mexico in temperate forests (Mendiola, 1974).

AMANITACEAE

Amanita silvatica Guzmán, sp. nov. Figs. 15-19

Pileo 20-35 mm lato, convexo dein applanate, subviscidus, centro umbonatus, margin sulcatus striatus, aurantio luteus, margin albidus, fragmentum volvae tenuis, luteus, forma irregulariter. Lamellae liberae, albae. Stipite 35-45 × 3-7 mm, albus, exannulatus. Volva subsacciformis, alba, friabilis, marginis aurantio luteus et fimbriate. Carne alba. Sporis (4.9-) 6.7-9 (-9.7) × (4.9-) 6-7.5 (-8.2) µm, globosis vel subglobose, haud amyloideis. Celluis volva 18.7-49.5 × 7.5-30 µm, globosis, fusiformis vel subellipsoideis. Fragmenta volva celluis pileo (9-) 25.5-43.5 (-45) × (6-)16.5-26.2(-30) µm, globosis vel subellipsoideis et subfusiformis. Fibule absentes. Ad terram in silva tropicalis. Quintana Roo, Puerto Morelos prope, López 1847 (Typus, ENCB).

Pileus 20-35 mm diam., convex to plane, smooth to sulcate-striate at the margin, subviscid, yellowish orange to pale yellow toward the margin, glabrous or with scattered, irregularly shaped, yellowish, rather thick, floccose-membranous flat patches from the volva. Lamellae free, white to cream. Stipe 35-45 × 3-7 mm, equal or attenuated upward, base globose or subglobose, white to whitish cream, somewhat floccose be low. Annulus absent. Volva as an adhering sac, with the upper part free, with the margin fimbriated or lacerated, white to orange yellowish on the margin. Context white, odor not distinctive.

Spores (4.9-)6.7-9(-9.7) × (4.9-)6-7.5(-8.2) µm, globose to subglobose, with a short apiculus, hyaline, inamyloid. Basidia 19.5-22.5 × 9-9.7 µm, tetrasporic, hyaline, ventricose. Cells of the margin of the volva 18.7-49.5 × 7.5-30 µm, globose, fusiform or subellipsoid, hyaline, thin walled, borne on hyphae 1.5-13.5 µm broad. Cells of the volva on the pileus globose, subfusiform or subellipsoid, (9-)25.5-43.5(-45) × (6-)16.5-26.2(-30) µm, hyaline, thin walled, borne on hyphae 3-12 um broad. Clamp connections absent.

Habitat. Subgregarious on soil in a tropical rain forest (as ectomycorrhizic ?).

Specimens examined. MEXICO, QUINTANA ROO, near the road from Puerto Morelos to Tulum, close to the crossing to Vallarta, footpath to the sea, López 1847 (Type, ENCB).

Discussion. A. silvatica is close to A. elata (Mass.) Corner & Bas, which is known only from Singapore and differs in the size of the cells of the volva at the stipe (40-60 × 25-40 µm), presence of annulus, in the difference in the color of the pileus (pale dingy ochraceous buff or dingy buff with sulphur yellow tones) and in the more narrow volva at the bulb without fimbriate edges (Corner & Bas, 1962).

Amanita yucatanensis Guzmán, sp. nov. Figs. 20-23

Pileo circa 25 mm lato, convexo dein subapplanato, margin sulcatus, siccus, albus vel subflavidus, fragmentum volvae albidus, tenuis, forma irregulariter. Lamellae subliberae, albae. Stipite circa 12 × 5 mm, albus, squamosus, exannulatus. Volva saccifformis, alba, tenera. Sporis (7.5-)9-12(-12.7) × (7.1-)8.2-9 (-10.5) µm, globosis, haud amyloideis. Celluis volva subglobosis, 30-52.5 × 12-21 µm, hyalinae. Fibule absentes. Ad terram in silva tropicalis. Quintana Roo, Puerto Morelos prope, Guzmán 21044 (Typus, ENCB).

Pileus about 25 mm diam., convex to somewhat plane, smooth to striate at the margin, dry, white to pale yellowish, glabrous or with some scattered irregularly shaped, whitish, thin, flat patches of the volva. Lamellae subfree, white to whitish rose, with fimbriate edges. Stipe about 12 × 5 mm, very attenuated upward, floccose-scaly to pruinose above, without annulus. Volva more or less high and wide, as a membranous sac, white and delicate. Flesh white, odorless.

Spores (7.5-)9-12(-12.7) × (7.1-)8.2-9(-10.5) µm, globose with a short apiculus, hyaline, inamyloid. Basidia 42-54 × 10.5-13.5 µm, tetrasporic, but some mono or bisporic, hyaline,

ventricose, with a middle constriction. Cystidia none. Trama with elongated to broad cells, hyaline. Volva with subglobose hyaline cells, 30-52.5 × 12-21µm, borne on narrow hyphae 2.2-9 µm broad, many of them with grayish irregularly incrusted pigment on the walls. Epicutis formed by more or less repent hyaline hyphae, 3-7.5 µm broad. Hypodermium with subglobose hyaline elements, 9-19.5 µm broad. Clamp connections absent.

Habitat. Solitary on soil in a tropical rain forest.

Specimens examined. MEXICO, QUINTANA ROO, Road to Vallarta, near the crossing from Puerto Morelos to Tulum road, Guzmán 21044 (Type, ENCB).

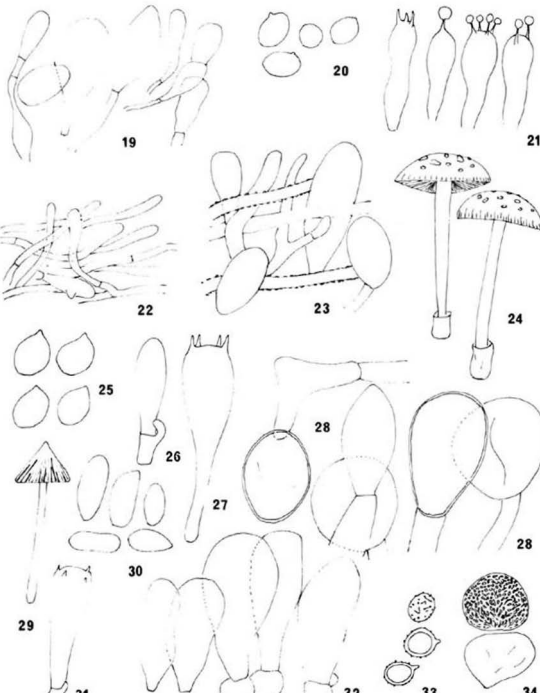
Discussion. This species is very close to Amanita species No. 4 of Corner & Bas (1962), known only from Singapore, but differs in the spores (9-11.5 × 7-8.7 µm). The white basidiocarp seems similar to A. praegraveolens (Murr.) Sing., also a tropical species, but that fungus has scaly floccose, poorly formed volva and amyloid spores (Guzmán 1975).

Amanita dunicola Guzmán, sp. nov. Figs. 24-28

Pileo 15-40 mm lato, convexo dein subcampanulatus vel subapplanato, subviscidus, sulcatus-striatus, subbrunneolus vel alutaceous, fragmentum volva albus tenuis, forma irregulariter. Lamellis liberae, albidus roseus. Stipite 30-80 × 3-7 mm, albus vel inaequaliter brunneolus, exannulatus. Volva sacciformis, alba, tenera. Sporis (9.9-)11-12.5(-13.5) × 8-9 µm, subglobosis, non amyloideis. Celluis volva globosis 17-38 µm. Fibule in the basidia. Ad arena contiguus ad oceanus. Yucatan prope, circa Ixil, Progreso-Telchac, Guzmán 21235 (Typus, ENCB).

Pileus 15-40 mm diam., convex to subcampanulate or somewhat plane, smooth to sulcate-striate at the margin, subviscid, pale brownish to leather brown, with white, irregularly flat patches from the volva. Lamellae free, whitish rose to rose brown, with white fimbriate edges. Stipe 30-80 × 3-7 mm, equal or somewhat attenuate at the base, smooth but floccose under the lens, white to irregularly brownish. Annulus absent. Volva as a membranous sac, white and delicate, more or less permanent in the adult. Context white, odor not distinctive (but in dry specimens very pleasant, like bread); taste pleasant.

Spores (9.9-)11-12.5(-13.5) × 8-9µm, subglobose with a short apiculus, hyaline, inamyloid. Basidia 50-70 × 13-16 um, tetrasporic, hyaline, clavate; sterigmata up to 6um long. Cystidia absent. Trama with hyaline elongated hyphae, 3-6 µm broad, some anastomoses. Cuticle of the pileus subgelatinous, formed by hyaline to brownish appressed hyphae up to 5 µm



Figs. 19-34.- 19: Amanita silvatica, elements of the volva on the stipe.- 20-23: Amanita yucatanensis, 20: Spores, 21: Basidia, 22: Structure of the pileus, 23: Elements of the volva.- 24-28: Amanita dunicola, 24: Carpophores, 25: Spores, 26: Young basidium with a clamp connection, 27: Basidium, 28: Elements of the volva at the stipe.- 29-32: Inocybe tropicalis, 29: Carpohore, 30: Spores, 31: Basidium, 32: Cheilocystidia.- 33-34: Octavianina cigroensis, 33: Spores, 34: Carpophores.

broad. Elements of the volva globose, hyaline, 17-38 µm broad, thin to thick walled, borne on hyphae 3.3-6 µm broad. Clamp connections observed only at the base of the basidia.

Habitat. Gregarious, rarely solitary, in sand below Coccoloba uvifera, in dunes close to the sea. It seems to be an ectomycorrhizic fungus.

Specimens examined. MEXICO, YUCATAN, Municipio de Ixil, Progreso to Telchac road, Guzmán 21235 (Type, ENCB).

Discussion. This species is close to A. antillana Dennis from Trinidad, but differs in the friable volva, in the scaly-floccose stipe, broader spores (7.5-11.5 µm), glabrous and olive brown or grayish pileus, and in the habitat (ad terram in silvis) (Dennis, 1952, 1970). It is also close to Amanitopsis floridana Murr. from Florida, because of color of its pileus and non friable volva, but it has narrower (6-7 µ m) spores and grows on soil close to pines (Murrill, 1949). Amanita species No. 5 of Corner & Bas (1962) from Singapore is also close, but differs in its glabrous pileus and broader spores (9.5-11 µ m).

CORTINARIACEAE

Inocybe tropicalis Guzmán, sp. nov. Figs. 29-32

Pileo 20-25 mm lato, conic, bruneus aurantius, vel brunneolus, fortiter rimosus. Lamellis brunneus aurantiacus cum albidus fimbriate marginis. Stipite 16-18 × 3-5 mm, albidus vel rufobrunneus. Carne albidus, odor nullus. Sporis (8.8-) 12-13(-17.6) × 5.5-6.6(-7.7)µm, subellipsoideis vel oblongatus-ellipsoideis. Plecrocystidiis absens. Cheilocystidiis 44-55 × 12-27.5µm, hyalinea, subclavate vel subturbinate, sine crustare. Epicutis cum parallelis vel suberigo hyphae, 7-15 (-20) µm latus. Hyphae fibululigeris. Ad terram, solitario, in silva tropicalis. Quintana Roo, Tomas Garrido prope, Guzmán 20927 (Typus, ENCB).

Pileus 20-25 mm diam., conic, brownish orange to pale brown, strongly radially fibrillose and rimose, revealing the pale context. Lamellae subadnate, brownish orange with white fimbriate edges. Stipe 16-18 × 3-5 mm, uniform, whitish to yellowish, finally brownish red, smooth, somewhat cortinate in the middle portion. Context whitish, odorless.

Spores (8.8-)12-13(-17.6) × 5.5-6.6(-7.7) µm, subellipsoid or oblong-elliptical, brownish mustard, with a narrow germ pore. Basidia 35-40 × 11-15µm, tetrasporic, hyaline, ventricose-clavate, with sterigmata up to 2um thick. Pleurocystidia absent. Cheilo-

cystidia 44–55 × 12–27.5 µm, numerous, hyaline, subclavate or subturbinate, without incrustations. Subhymenium pale brownish mustard. Trama regular, hyaline. Pileus surface with prostrated to somewhat erect incrusted brownish orange pigmented hyphae, 7–15(–20)µm broad. Clamp connections observed in several hyphae, even at the base of basidia and cheilocystidia.

Habitat. Solitary on soil in tropical rain forest (ectomycorrhizic ?).

Specimens examined. Mexico, Quintana Roo, 10 km N of Tomas Garrido (South of Quintana Roo), Guzmán 20927 (Type ENCB).

Discussion. I. tropicalis is somewhat close to I. jalapensis (Murr.) Sing. but differs in the presence of pleurocystidia (55–80 × 16–20 µm) in that species as well as in the size of the spores (7.7–9.8 × 4.2–5.7µ m), and in the subtropical distribution. Murrill described that species from Xalapa, Ver. and Dennis reported it from Colombia (Singer, 1957; Dennis, 1970), in both cases it is ectomycorrhizic and associated with Quercus. It is also close to I. jamaicensis Murr. but that species has rugose spores 8–9 × 5µm (Murrill, 1912). The only species of Inocybe reported by Pegler (1977) from Africa is I. lanuginella (Schroet.) Konr. & Maubl. from a Pinus forest in Tanzania, which has pleurocystidia.

HYMENOGASTRALES

Octavianina cigroensis Guzmán, sp. nov. Figs. 33–34

Carpophoris 5–10 mm lato, globosis vel subglobosis. Peridio luteus vel spadiceus. Gleba albidus vel spadiceus. Sporis (8.2–)9–12(–13.5) × (7.5–)9–9.7(–10.5)µm, globosis, pseudoamyloideis, verrucosis subreticulatis. Cystidiis nullis. Hypogaeum in silva tropicalis. Quintana Roo prope, Carrillo Puerto–Vijia Chico, López 1759 (Typus, ENCB).

Gastrocarp globose or subglobose, 5–10 mm diam. Peridium glabrous, with some innate veins especially below, thin, yellow, fading to leather brown. Gleba chambered, whitish to pale brownish,columella and sterile base absent.

Spores (8.2–)9–12(–13.5) ×(7.5–)9–9.7(–10.5) µm, globose, hyaline, verrucose, subreticulate, pseudoamyloid, with a short but conspicuous appendage. Cystidia none. Peridium with irregularly elongated hyaline to pale brownish hyphae, without clamp connections.

Habitat. Hypogeous in humus of a tropical rain forest.

Specimens examined. MEXICO, QUINTANA ROO, 20 kms from Felipe Carrillo Puerto, road to Vijia Chico, López 1759 (Type, ENCB).

Discussion. O. tuberculata (Hesse) O. Kuntze and O. laevis (Hesse) O. Kuntze are the only species somewhat close to O. ciqroensis following Singer & Smith (1960) key's, but they differ in diameter and ornamentation (broad cones) of the spores (12-16 µm diam. in the first, and 13-18(-20) µm diam. in the second). Both species are only known from Germany. Apparently O. ciqroensis is the first record of the genus in the tropics, at least in Mexico.

The name of the species refers to CIQRO Institution (Centro de Investigaciones de Quintana Roo) in recognition to the support given to this research project through its Director, Dr. Alfredo Carreaga.

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TWO NEW FAMILIES IN THE ASCOMYCOTINA

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SUMMARY

Two new families are described in the Ascomycotina for the first time. Ascodichaenaceae fam. nov. (Rhytismatales) is introduced for Ascodichaena, Delpinoina, and (?) Pseudophacidium. Odontotremataceae fam. nov. (Ostropales) is described for Bryodiscus, Lethariicola, Odontotrema, Odontura, Skyttea, Spilomela, Stromatothecia and Xerotrema.

In the course of our investigations on the systematics of the Ascomycotina, it became clear that two groups of these fungi were worthy of recognition in the rank of family. These two family names are formally described here and their circumscription and affinities discussed.

ASCODICHAENACEAE D.Hawksw. & Sherw. fam. nov.

Familia ad ordo Rhytismatales pertinens. Ascomata stromatica, erumpescentia, aggregata, carbonacea, disciformia ad breve hysteriformia, longitudinaliter apperientia, excipulum vero desunt, stromata ex cellulis pseudoparenchymatis polyedricis et verticalis. Paraphyses numerosae, simplices, septatae. Asci cylindrici sed clavati ubi maturitati, tenue, cum apicibus late annulatis, probaliter operculati, 4-8-spori. Ascosporae hyalinae, simplices.

Anamorphosis holoblasticae vel ignota.

Holotypus: Ascodichaena Butin.

Family belonging to the order Rhytismatales (syn. Phacidiales auct.). Stromata erumpent in dense clusters, carbonaceous, true excipulum absent, stromatal tissue orbicular to short-hysteriiform, opening by a longitudinal slit, composed of vertically orientated polyhedral pseudoparenchyma. Paraphyses numerous, simple, septate. Asci at first cylindrical and sessile, becoming clavate or saccate as the ascospores mature, thin-walled, I-, with a broad apical annulus, possibly operculate, 4-8 spored. Ascospores large, colourless, unicellular, lacking a gelatinous sheath.

Anamorph coelomycetous, holoblastic (Polymorphum Chev.), or unknown; spermatial phase sometimes present.

Habitat: On the bark of Fagaceae in temperate regions of the Northern Hemisphere.

Genera: Ascodichaena Butin, Delpinoina Kuntze (syn. Henriquesia Pass. & Thüm.) and possibly Pseudophacidium P. Karsten.

Relationships: Butin (1977) summarized earlier treatments of Ascodichaena, concluding that it was most closely allied to Pseudophacidium and referring it to the family Phacidiaceae Fr. However, neither Ascodichaena nor Pseudophacidium have an ascus with an amyloid apical ring such as that seen in Phacidium Fr. This distinction, and the presence of a holoblastic anamorph in Ascodichaena and a phialidic one in Phacidium, indicates that the former is most appropriately placed in the Rhytismatales. Further, the distinctive anamorph, the stroma, and absence of sheaths on the ascospores, justifies the placement of Ascodichaena in a separate family within that order.

The family name Dichaenaceae Fr. cannot be taken up for this family as the type species of Dichaena Fr. is anamorphic (Hawksworth & Punithalingam, 1973). Speer (1980) considered that Dichaena was a teleomorphic generic name but his conclusions were based on a number of misinterpretations of the Code which will be discussed by DLH in a separate paper.

On the basis of ascus structure, the Phacidiaceae is most appropriately referred to the Helotiales and has strong affinities with the Dermateaceae Fr. In addition to Phacidium, the Phacidiaceae comprises Lophophacidium Lagerberg, Phacidiostroma Höhnel, and perhaps also the genera Cryptomycina Höhnel, Nannfeldtia Petrak, Micraspis Darker and Phacidina Höhnel.

ODONTOTREMATACEAE D.Hawksw. & Sherw. fam. nov.

Familia ad ordo Ostropales pertinens. Ascomata hemiangiocarpia, apothecia, immersa vel erumpescentia, marginata, singularia vel in stromatis aggregata; excipulum ex hyphis compositum, usque atrobrunnea ad nigra, interdum carbonacea. Asci unitunicati, cylindrici, cum apicibus crassis, plusminusve pori, cum iodo non reagens, 8- vel multispori. Ascosporae ovoideae, sigmoideae, vel filiformiae, hyalinae, septatae ad muriformiae.

Anamorphosis ignota.

Holotypus: Odontotrema Nyl.

Family belonging to the order Ostropales. Ascomata hemiangiocarpic, apothecioid, immersed or erumpent, determinate, marginate, single or immersed in a stroma; excipulum hyphal, usually dark coloured and in some genera carbonaceous. Paraphyses simple or branched at the base, septate. Asci cylindrical, sessile or nearly so, the lateral walls thin and the apex thickened, I-, with or without an apical pore, inoperculate, 8- or multispored. Ascospores ovoid, sigmoid, or filiform, hyaline, simple, transversely septate or muriform.

Anamorph not definitely known (a pycnidial fungus was illustrated by Grummann, 1969, associated with Lethariicola apothecia but its connection with them is uncertain).

Habitat: Saprobic, chiefly on wood in xeric situations, or lichenicolous (and then usually parasymbiotic).

Genera: Bryodiscus Hein et al., Lethariicola Grumm., Odontotrema Nyl., Odontura Clem., Skyttea Sherw. et al., Spilomela (Sacc.)Keissl.,

Stromatothecia D.Hawksw. & D.Shaw, and Xerotrema Sherw. & Coppins. It is also probable that the lichen-forming genera Bryophagus Nitschke ex Arnold and Ramonia Stizenb. should be referred to this family.

Relationships: This distinctive assemblage of genera was noted by Sherwood et al. (1981) to almost certainly form a natural unit. No new family name was introduced at that time as the application of some other names, especially Triblidiaceae Rehm, was then uncertain. The latter family includes Pseudographis Nyl. and Triblidium Rebent., Tryblidiopsis P. Karsten being more appropriately placed in the order Rhytismatales. The Triblidiaceae differs from the Odontotremataceae in that the covering stroma splits stellately or by a slit to expose the hymenium, the presence of a distinct epithecium, and ascospores which are either transversely septate with lenticular cells or muriform, turning reddish-purple in iodine. This last reaction may indicate some relationship to the Graphidales. The asci in the Triblidiaceae have a strongly thickened apex which can be clearly seen to be pierced by a pore; they are I- as is the case in the Odontotremataceae and Graphidaceae.

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CYLINDROCLADIUM SPATHIPHYLLI SP. NOV.[1]

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ABSTRACT

Cylindrocladium spathiphylli is described as a new species from Spathiphyllum sp. 'Clevelandii' in Florida.

INTRODUCTION

Beginning in late 1978 and continuing to the present, several nurseries in Florida have incurred serious economic losses from a Cylindrocladium root and foliar disease of various species of Spathiphyllum. We have heretofore designated the pathogen as Cylindrocladium floridanum Sobers and Seymour (1967) in previous publications (Schoulties and El-Gholl, 1980a, 1980b, 1981). However, the isolate described from Spathiphyllum is now known to be different from other described species of Cylindrocladium. The following presents the distinctive morphological features of the fungal isolate from Spathiphyllum and provides the basis for establishing it as a new taxon.

METHODS AND MATERIALS

The isolate of Cylindrocladium under study was obtained from basal portions of petioles and from roots

[1]Contribution No. 256, Bureau of Plant Pathology.

of Spathiphyllum sp. 'Clevelandii' which was being grown at a commercial nursery in Apopka, Florida. The isolate of C. floridanum was obtained for comparative study from leaf spots on leatherleaf fern, Rumohra adiantiformis (G. Forst.) Ching which was being grown in Pierson, Florida.

Potato dextrose agar (PDA) was prepared from the broth of 200 g freshly peeled, diced, and boiled Irish potatoes supplemented with 20 g dextrose, 1 g KH_2PO_4 and 18 g Difco bacto-agar, and made up to 1 liter with deionized water.

Peanut stem water agar (PSWA) was prepared in the following manner: cooled (48 C), autoclaved (121 C for 15 min) water agar was poured over dried, propylene oxide-fumigated (Hansen and Synder, 1947) stem pieces of peanut. Under careful handling, the stem piece floated and became partially submerged upon solidification of the agar.

To obtain monoconidial cultures, the method described by Hansen and Smith (1932) was used.

Cultures of Cylindrocladium were grown at 25 C under 12-hour periods of alternating light (fluorescent light, Westinghouse F20T12/CW at an intensity of approximately 2800 lux) and dark on either PDA or PSWA for 10 days.

Morphological features were detailed and measured under oil immersion and were photographed (Fig. 1) with Nomarski differential interference-contrast microscopy using a Zeiss photomicroscope III. Spore measurements represent 400 conidia.

TAXONOMY

The Cylindrocladium from Spathiphyllum sp. 'Clevelandii' differs from other species of Cylindrocladium in the following characteristics. It has 1-septate conidia and a stipe terminating in a globose vesicle, differing from Cylindrocladium ilicicola (Hawley) Boedijn and Reitsma (1950), C. crotalariae (Loos) Bell & Sobers (1966), and C. citri (Fawcett & Klotz) Boedijn and Reitsma (1950) which have globose vesicles and 3-septate conidia. It differs from other species of Cylindrocladium with globose vesicles and 1-septate conidia in having cylindrical conidia 45.0-101.0 x 5.0-7.0 µm as compared to 40-46 x 3-4 µm for the curved conidia of C. curvatum Boedijn and Reitsma (1950) and 30-56 x 3.5-5.4

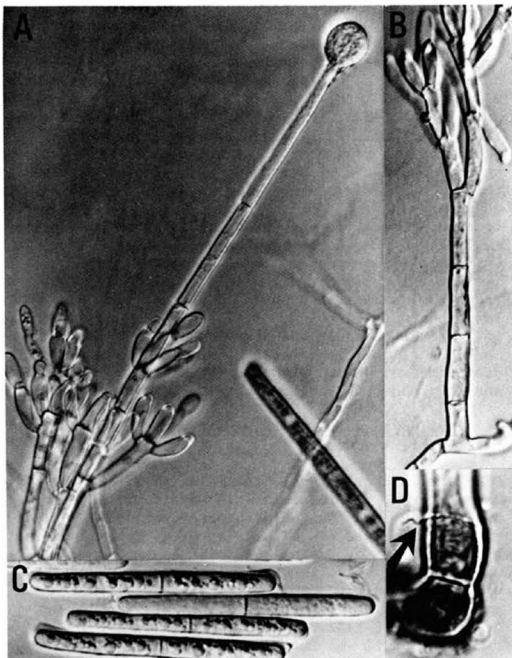

Fig. 1. Cylindrocladium spathiphylli: A) Single central stipe terminating in a globose vesicle, 560 X. B) Conidiophore arising from young procumbent mycelial cell, 560 X. C) One-septate conidia, 560 X. D) Conidiophore arising from a sclerotial cell with a ruptured cellular membrane (collarette - noted by arrow), 1400 X.

µm for the cylindrical conidia of C. floridanum Sobers & Seymour (1967). We obtained the following conidial measurements on an isolate of C. floridanum from leather-leaf fern: (39.5-) 47.2 (-56.0) µm long by (3.0-) 3.9 (-4.0) µm wide. Further, C. floridanum is known to have in addition to the central stipe (an extension of the main axis of the conidiophore stalk) lateral stipes from secondary and tertiary conidiophore branches (Morrison and French, 1969), terminating in sphaeropedunculate (Snell and Dick, 1971) vesicles with a somewhat flattened top, whereas the Cylindrocladium from Spathiphyllum has but a single, central stipe per conidiophore, terminating in a larger globose, nonsphaeropedunculate vesicle, as well as having larger and wider conidia. Descriptions were based on a monoconidial isolate and were compared with original descriptions of Cylindrocladium species. Matings among various isolates from Spathiphyllum never produced the teleomorphic state under the conditions studied, hence the species appears to be heterothallic.

On the basis of the differences noted as outlined in Table 1, this isolate is considered morphologically distinct from previously described species in this genus and we propose the following new species:

Cylindrocladium spathiphylli Schoulties, El-Gholl et Alfieri, sp. nov.

Aerium mycelium coloniae in agaro Solani tuberosi, bene maturum, initio album et gossypinum, aetate varie brunneum vel rufum. Conidiophora lateraliter portata stipite suragente ex cellulis mycelii procumbentis vel ex cellulis sclerotiorum quae cellulae membranum cellulare ruptum, ut collare parvulum, ad basim stipitis praebent. Conidiophorum ramificatio dichotoma. Rami primarii hyalini, leves, non septati, aliquando uniseptati, (19.0-) 32.8 (-57.0) µm x (4.0) 5.1 (-6.5) µm; rami secundarii vel metulae hyalini, leves, non septati, (13.0-) 21.6 (-35.0) µm x (4.0-) 4.6 (-6.0) µm; rami tertii, cum adsunt, hyalini, leves, non septati (18.0-) 20.3 (-22.0) µm x 4.0 µm. Phialides 2-4, cylindratae, fine apicis obtusae, vel aliquando doliiformes vel reniformes, hyalinae, non septatae, (10.0-) 14.6 (-20.0) µm x (3.0-) 4.2 (-5.0) µm. Stipites vel ex hospite vel ex myceliis in cutura procumbentibus vel ex corporibus sclerotiorum in hospite et in cultura recte surgentes,

Table 1. Comparison of distinctive morphological features of Cylindrocladium spathiphylli with Cylindrocladiun floridanum that also has one septate conidia.

SPECIES	CONIDIAL MEASUREMENTS LENGTH (µm)	WIDTH (µm)	VESICLE SHAPE	LATERAL STIPES	SEXUAL STATE
C. spathiphylli	(45.0-)80.3(-101.0)	(5.0-)6.0(-7.0)	globose	absent	not known
C. floridanum					
conifer isolate[a]	(33.0-)NG[b](-59.0)	(4.0-)NG(-5.3)	sphaero-pedunculate	present	known
leatherleaf fern isolate	(39.5-)47.2(-56.0)	(3.0-)3.9(-4.0)	sphaero-pedunculate	present	known
peach isolate[c]	(34.0-)NG(-55.0)	(3.5-)NG(-4.8)	sphaero-pedunculate	present	known
Robinia pseudo-acacia L. isolate[d]	(29.0-)41.0(-51.0)	(3.0-)4.0(-5.0)	sphaero-pedunculate	present	known

[a]Morrison and French (1969).

[b]NG = Not given (i.e., average).

[c]Sobers and Seymour (1967).

[d]Terashita (1968) and Sobers (1972).

septati, ad basim dilute brunnei, (7.0-) 7.8 (-9.0) µm lati, (111.0-) 140.8 (-253.0) µm longi, ad apicem sensum hyalini et angustiores (3.0-3.7 µm lati), vesicula hyalina, granulari, globosa, (9.0-) 12.5 (-15.0) µm diam. terminati. Conidia ex apice phialidum singulatim ficta et in circulis vallo similibus et substantia mucilaginosa contentis cumulata, hyalina, granularia, cylindrata, levia, recta, utrisque finibus rotundata, uniseptata, (45.0-) 80.3 (-101.0) µm longa, (5.0-) 6.0 (-7.0) µm lata.

Segregatum ex partibus basalibus petiolarum et ex radicibus Spathiphylli sp. 'Clevelandii' in Apopka, Florida. Depositum ut ATCC 44730 in American Type Culture Collection, 12301 Parklawn Drive, Rockville, Maryland 20852, U.S.A.

Cylindrocladium spathiphylli Schoulties, El-Gholl & Alfieri, sp. nov.

Aerial mycelium of colony on potato dextrose agar, well developed, initially white and cottony, becoming variously brown to reddish brown with age. Conidiophores are borne laterally on a stipe arising from cells of procumbent mycelium or from cells of sclerotia that produce a ruptured cellular membrane seen as a collarette at the base of the stipe. Conidiophore branching is dichotomous. Primary branches hyaline, smooth, nonseptate, occasionally 1-septate, (19.0-) 32.8 (-57.0) µm x (4.0-) 5.1 (-6.5) µm; secondary branches or metulae, hyaline, smooth, nonseptate, (13.0-) 21.6 (-35.0) µm x (4.0-) 4.6 (-6.0) µm; tertiary branches when present, hyaline, smooth, nonseptate (18.0-) 20.3 (-22.0) µm x 4.0 µm. Phialides 2-4, cylindrical with obtuse apical end to occasionally doliiform or reniform, hyaline, nonseptate, (10.0-) 14.6 (-20.0) µm x (3.0-) 4.2 (-5.0) µm. Stipes arise at right angles from the host or from procumbent mycelia in culture or from sclerotial bodies on the host and in culture, septate, light brown at the base (7.0-) 7.8 (-9.0) µm wide, (111.0-) 140.8 (-253.0) µm long, becoming hyaline and narrower at the apex (3.0-3.7 µm wide), terminating in a hyaline, granular, globose vesicle (9.0-) 12.5 (-15.0) µm diam. Conidia are formed singly from the apex of the phialides and accumulate in palisade-like clusters held together by a mucilaginous substance. They are hyaline, granular, cylindric, smooth, straight, rounded at both ends, 1-

septate (45.0-) 80.3 (-101.0) µm long by (5.0-) 6.0 (-7.0) µm wide.

Isolated from basal portions of petioles and from roots of Spathiphyllum sp. 'Clevelandii' in Apopka, Florida. Deposited in the American Type Culture Collection, 12301 Parklawn Drive, Rockville, Maryland 20852, U.S.A. as ATCC 44730.

DISCUSSION

Cylindrocladium spathiphylli is closely related to C. floridanum but can be separated from the latter because the conidia of C. spathiphylli are longer and wider, the vesicle shape is globose (sphaeropedunculate in C. floridanum), and lateral stipes are absent (present in C. floridanum). Further, the teleomorphic state of C. spathiphylli is wanting, whereas that of C. floridanum is Calonectria kyotensis Terashita (1968). It should also be noted that other isolates of C. spathiphylli obtained from various locations in Florida were identical to the described type culture, which clearly represents a distinct species.

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ERYNIA NEOPYRALIDARUM SP. NOV. AND *CONIDIOBOLUS APICULATUS*, PATHOGENS OF PYRALID MOTHS COMPONENTS OF THE MISDESCRIBED SPECIES, *ENTOMOPHTHORA PYRALIDARUM* [ZYGOMYCETES: ENTOMOPHTHORALES]

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ABSTRACT

A reexamination of the species *Entomophthora pyralidarum* Petch showed that the original description was based on different species, namely *Conidiobolus apiculatus* (Thaxter) Remaudière & Keller and another species described here as *Erynia neopyralidarum* sp. nov. The name *E. pyralidarum* should, therefore, be considered as a junior synonym of *C. apiculatus*.

Entomophthora apiculata (Thaxter) Gustafsson, the previous synonym of *C. apiculatus*, included *Entomophthora pseudococci* (Speare) [now *Conidiobolus pseudococci* (Speare) Tyrrell & MacLeod] as a synonym. *C. pseudococci* was subsequently restored as an independent species because of production of microconidia. The restoration of this species is further supported in the present study by evidence of other differences between *C. apiculatus* and *C. pseudococci* in conidial and rhizoidal morphology.

Entomophthora destruens Weiser & Batko, a pathogen of mosquitoes, has rhizoids of the same type as *C. pseudococci*, as well as other familial and generic conidioboloid characters. A new combination, *Conidiobolus destruens*, is proposed for this species.

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INTRODUCTION

Several species of Entomophthorales discovered by T. Petch, including *Entomophthora pyralidarum* Petch, apparently were not encountered again, judging by their very infrequent subsequent citation in the literature. This fungus was described (Petch, 1937) from dead "grass moths" (Lepidoptera: Pyralidae) found in December 1923 and January 1924 in three localities in Ceylon (Sri-Lanka). Specimens had been sent for identification to Prof. R. Thaxter who stated (fide Petch, 1937) that he was not acquainted with the fungus.

The description of *E. pyralidarum* by Petch (1937) was rather sketchy and was not accompanied by photographs or drawings. Characters of taxonomic importance at the generic level, such as the number of conidial nuclei and structure of the conidial wall, were not mentioned. For these reasons *E. pyralidarum* was not included in the classification proposed by Batko (1964-1974, cited from Ben-Ze'ev and Kenneth 1982a) or in the neobatkoan classification of Humber and Ben-Ze'ev (1981). Probably for the same reasons it was not mentioned in the neobatkoan classifications of Remaudière and Hennebert (1980), and Remaudière and Keller (1980). Ben-Ze'ev and Kenneth (1982a) placed *E. pyralidarum* in a newly proposed group, *Entomophthora nomina provisoria*, a group designed for species of Entomophthorales that are incompletely described.

An examination and eventual complementary description of *E. pyralidarum* appeared to be possible because most fungi described and/or collected by Petch and Thaxter were carefully preserved.

E. pyralidarum as depicted by Petch (1937) was an "anomalous" species. It possessed branched conidiophores and rhizoids, features which are very frequently associated in the genus *Erynia* Nowakowski *emend.* Humber and Ben-Ze'ev (1981), and pyriform, oval or globose conidia which are usually characteristic of other genera of Entomophthorales. Globose primary conidia, however, have not been encountered yet in any of the 47 species classified as *Erynia* by Nowakowski (1881), Remaudière and Hennebert (1980), Remaudière and Keller (1980), Humber and Ben-Ze'ev (1981) and Ben-Ze'ev and Kenneth (1982b). This fungus, therefore, was considered to be a good test of the view outlined by Humber (1981), that "one of the most severe tests for a classification system is to see how well it can handle the least typical species from the group being classified."

MATERIALS AND METHODS

Specimens Examined

The following dried specimens were obtained from T. Petch's collection, through the courtesy of The Herbarium, Royal Botanical Gardens, Kew, England: package no. 9, labelled "*Entomophthora pyralidarum* Petch on moth, Kandy, January 1924, per G. M. Henry, ex Herb. Petch", containing a moth on a piece of leaf; package no. 10, labelled "*Entomophthora pyralidarum* Petch on moths, Vavuniya, Dec. 1923, ex Herb. Petch", containing a moth and remains of a second one; package no. 11, labelled "*Entomophthora pyralidarum* Petch on moths (Pyralidae), Peradeniya, Dec. 25, 1923, ex Herb. T. Petch", containing three moths and pieces of tree bark to which they were attached by rhizoids.

Four slides labelled "Acc. no. 6423 *Entomophthora apiculata* Thax. on Pyralid moth, Peradeniya, Ceylon, T. Petch 1924" were obtained from R. Thaxter's collection, through the courtesy of The Farlow Herbarium, Harvard University, Cambridge, Mass., U.S.A. The fungus in these slides was identified by A. G. Kevorkian, about or previous to 1935 (Dr. D. M. Pfister, Curator, The Farlow Herbarium, pers. commun.), which was prior to the description of *E. pyralidarum* by Petch (1937). The specimen from which these slides were prepared was examined by Dr. R. A. Humber (pers. commun.) and found to contain *Conidiobolus apiculatus*.

Microscopic Preparations and Measurements

Small portions were dissected from exsiccata and mounted for microscopic examination on glass slides, in lactophenol-cotton-blue (LPCB), in acetocarmine (Lee, 1950; Hall and Bell, 1963) or in safranin-O (Bandoni, 1979). Slides were gently heated over an alcohol flame to enhance staining and to exclude air bubbles.

The ocular micrometer used for measurements had a calculated error range of ± 0.6 µm. Diameters of flattened cylindrical structures were calculated using the formula $D = 2 \cdot \text{width}/\pi$.

RESULTS AND DISCUSSION

The specimens collected by Petch in Kandy and Vavuniya (packages nos. 9 and 10 from The Herbarium, Royal Botanical Gardens) and the specimen collected by Petch in Peradeniya and sent to Thaxter (slides obtained from The Farlow Herbarium) contained the same fungus, *Conidiobolus apiculatus*

(Thaxter) Remaudière & Keller. The specimens in Petch's collection were still labelled as "*Entomophthora pyralidarum*", indicating that they had not been reexamined, whereas the slides in Thaxter's collection were correctly labelled as *Entomophthora apiculata* (the synonym of *C. apiculatus* used until 1980). Package no. 11 in the Petch collection contained, side by side, one moth infected by *C. apiculatus* and two others infected by a species of *Erynia*. The moth infected by *C. apiculatus* was removed by the present author from specimen box no. 11 and was placed in a new box labelled "11a - *Conidiobolus apiculatus* on moth, Peradenyia, Ceylon, Dec. 25, 1923".

The description of *E. pyralidarum* (Petch, 1937) contains elements of *C. apiculatus*, together with elements of the *Erynia* sp., and apparently some elements of one or more Deuteromycetes which are also present in the specimens of the Petch collection. Accordingly, *Entomophthora pyralidarum* Petch 1937 is considered as a junior synonym of *Conidiobolus apiculatus* (Thaxter) Remaudière & Keller (= *Empusa apiculata* Thaxter 1888). The *Erynia* elements are described here as a new species.

Erynia neopyralidarum sp. nov., NON *Entomophthora pyralidarum* Petch 1937, Trans. Br. Mycol. Soc. 21: 36.

Conidiophora primaria ramosa, digitata, determinata. Conidia primaria uninucleata (? bitunicata), pyriformia, papillata vel papillata-apiculata (secundum Lakoni [1919] systema), 16.0-28.0 x 12.0-17.2 µm, papillae 1.2-4.6 µm altae; conidia secundaria conidiis primariis similia sed minoria, minime 13.7 x 9.2 µm, in conidiophoris brevibus ex conidiis primariis lateraliter orientibus portata. Sporae perdurantes sphaericae, subhyalinae, diametro 25.2-42.4 µm (med. 33.1 ± 3.9 µm), sporarum pariete 2.3-3.4 µm crasso, episporio leni; sporarum nuclei 2-7, ellipsoideis 5.7 x 6.9-8.0 x 9.2 µm. Rhizoidea filiformia, unihyphalia, aliquando ramosa, interdum apicem versus incrassata; pseudocystidia non visa. In Pyralidae (Lepidoptera) imagine, Peradeniya, Ceylon, Dec. 1923. Typus: exsiccati no. 11 "Erynia neopyralidarum, Peradeniya, Ceylon, Dec. 1923", et lamina per microscopium Erynia neopyralidarum designata, Ben-Ze'ev, no. 11 (I - VIII), Reg. Bot. Herb., Kew, Anglia.

Primary conidiophores are digitately branched, deter-

minate and uninucleate in the conidiogenous cells (Fig. 1). Primary and secondary conidia are pyriform, uninucleate. Their nuclei (stained with acetocarmine -- Fig. 2) are entomophthoroid, relatively large (see dimensions and distribution in Table 1) spherical or more frequently ellipsoidal. The results of this study are ambiguous with regard to the conidial wall structure in *E. neopyralidarum*: a separable outer wall was observed in only three of 102 conidia screened (Fig. 3). Since *E. neopyralidarum* fits all other generic features-criteria of the genus *Erynia* as defined by Humber and Ben-Ze'ev (1981) and by Ben-Ze'ev and Kenneth (1982b), its conidia would be expected to be bitunicate rather than unitunicate. A similar scarcity of bitunicate conidia has been observed by the present author (Ben-Ze'ev, in preparation) in other *Erynia* species collected by Petch, although more bitunicate conidia were observed in the other species. It seems very likely that the unitunicate condition observed in the conidia of *Erynia* spp. in the Petch collection is an artifact caused by the preservation technique used by Petch, and that the bitunicate condition observed in some of these conidia reflects their true nature.

Dimensions of *E. neopyralidarum* conidia, and other conidial and resting spore parameters calculated in the present study and those given by Petch (1937) for *E. pyralidarum* are compared in Table 1. Conidia usually have acuminate papillae (Fig. 1) of *apiculata-type* [according to Lakon's (1919) classification], with a conspicuous or, more frequently, inconspicuous collar. On average, the papilla occupies 15.5% of the total conidial length and approximately 1/3 to 1/2 of the total conidial width. The ranges in length and width given by Petch for the pyriform or oval conidia coincide with the upper part of the range found in the present study (Table 1). Petch (1937) probably measured conidia on a moth collected soon after death and his range probably represented primary conidia or primary conidia with fewer secondary ones than were included in the range found in the present study. The fungus in the moths kept in Petch's collection, from which conidia were measured in this study, probably developed for a longer time, producing more secondary conidia. The present findings indicate that the length/width ratios of primary and secondary conidia of *E. neopyralidarum* are very similar making distinction between the two classes of conidia very difficult. The maximum dimensions of secondary conidia overlap the measurements of the primary ones and therefore, are not

distinguishable, whereas the minimum dimensions in the range found, 13.7 x 9.2 µm, are the minimal dimensions of secondary conidia. These conidia are borne on short conidiophores arising laterally from primary ones (Fig. 3).

Resting spores of *Entomophthora pyralidarum* were described by Petch (1937) as "...zygospores (?), spherical, smooth, hyaline, 14-24 µ diameter...". Spherical structures matching this description were found in specimen no. 11 in the present study (Table 1) but they were probably not entomophthoralean resting spores. They were very thin-walled and stained uniformly in acetocarmine and safranin-O without showing nuclei, vacuoles or lipid drops (Fig. 4a). These spherical structures could belong to one of several Deuteromycetes present in Petch's specimens as mycelium, conidia, and possibly chlamydospores.

True entomophthoralean resting spores were found in the present study in one of the two moths in package no. 11 from Peradenyia which contained the other structures of *E. neopyralidarum*. They were found in mats of mycelium and hyphal bodies but their mode of production (as zygospores or azygospores) remains unclarified. These resting spores were much larger than those described by Petch (Table 1) and had a thicker wall consisting of a somewhat darker (subhyaline) episporium which was sometimes partly detached from the lighter, apparently bi-layered endosporium (Fig. 5). Resting spores stained in acetocarmine contained 2-7 nuclei/spore. These nuclei were more frequently ellipsoidal than were nuclei of conidia but were within the same range in

FIGS. 1-4: *Erynia neopyralidarum sp. n. on Pyralid moths, photographs from the type material in T. Petch's collection*

1. *Digitately branched conidiophores, x 500.*
2. *Primary (and possibly secondary) conidia stained with acetocarmine, showing nuclei and variously shaped papillae, x 1000.*
3. *Primary conidia with secondary conidiophores, two of them showing secondary conidia; the conidial outer wall layer is detached at the apex of the conidium in the lower left corner (probably by the pushing conidiophore), x 1000.*
4. *Unidentified spherical structures (a) possibly those interpreted by Petch (1937) as resting spores (arrows) together with conidia (b) stained with acetocarmine, x 500. Conidial nuclei are visible.*

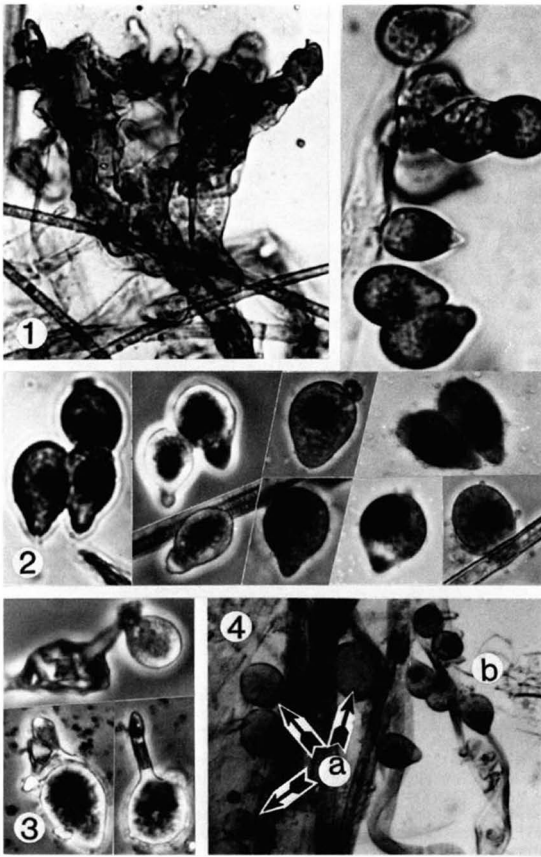
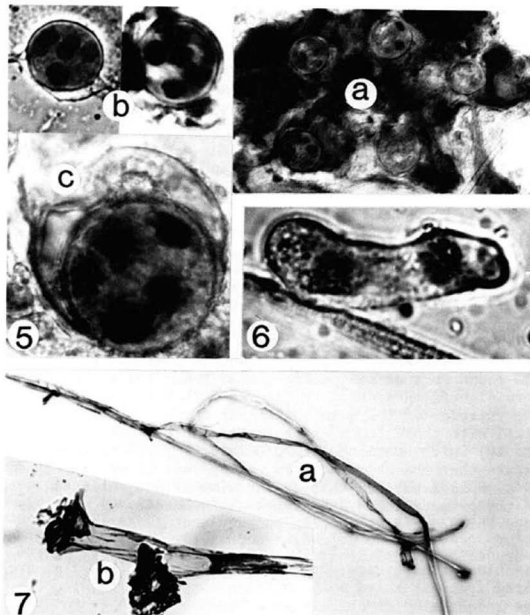

1
2
3
4
a
b

TABLE 1. *Quantitative features (parameters) of Erynia neopyralidarum. Those measured or calculated in this study are from Petch's specimen no. 11.*

Parameter	n	Present study	n	Petch (1937)
Conidial length x width (µm)				
min.-max.		*13.7-27.6 x 9.2-17.2*		*16-28 x 12-16*
$\bar{x}$ *length (s; $s_{\bar{x}}$) x* $\bar{x}$ *width (s; $s_{\bar{x}}$)*	*102*	*18.4 (2.2; 0.22) x 12.1 (1.6; 0.16)*	*?*	*?*
Conidial length/width ratio				
min.-max. ($\bar{x}$) (s; $s_{\bar{x}}$)	*102*	*1.20-1.88 (1.53) (0.14-0.014)*		
Conidial papillar height (µm)				
min.-max. (most frequent, 65% of measurements)	*102*	*1.15-4.60 (2.30-3.40)*		
Resting spore diameter (µm)				
min.-max. ($\bar{x}$; s; $s_{\bar{x}}$)	*16*	*25.2-42.4 (33.1; 3.94; 0.96)*		
wall thickness (min.-max.)		*2.3-3.4*		
Spherical structures considered resting spores by Petch (1937) - diameter (µm)				
min.-max. ($\bar{x}$; s; $s_{\bar{x}}$)	*37*	*8.0-22.9 (16.6; 3.17; 0.52)*	*?*	*14.0-24.0*
wall thickness		*1.0*		*?*
Conidial nuclei (µm)		*approx.*		
spherical min.-max.($\bar{x}$); %		*5.7-8.0 (6.9) 45%*		
ellipsoidal min.-max; %	*82*	*5.7 x 6.9, 5.7 x 8.0-9.2 } 45%; 6.9 x 6.9-8.0*		
		6.9-8.0 x 9.2 10%		
Resting spore nuclei (µm)		*approx.*		
spherical (diameter) min.-max.; %	*	*6.9 20%*		
ellipsoidal (length x width) min.-max.; %		*5.7-8.0 x 6.9-9.2 80%*		

* *(2-7 nuclei/resting spore, measured in 16 spores)*

size (Table 1). Hyphal bodies were usually short, unbranched, with few nuclei (Fig. 6). Chlamydospores, as described by Petch (1937) have not been observed in the material containing *E. neopyralidarum*. His description, however, seems to fit some of the hyphal bodies of *C. apiculatus* during formation of resting spores, as observed in the slides from



S. 5-7: *Erynia neopyralidarum sp. n. on Pyralid moths, photographs from the type material in T. Petch's collection*

Resting spores stained with acetocarmine to show nuclei: (a) in a mycelial mat, x 250; (b) x 500; (c) resting spore with 5 nuclei and a partially detached episporium, x 1000.
Short, binucleate hyphal body (acetocarmine), x 1000.
(a) Monohyphal rhizoids showing ramifications (cotton blue), x 125; (b) bifurcate extremity of a rhizoid with two funnel-like holdfasts, x 500.

the Thaxter collection.

Rhizoids of *E. neopyralidarum* from specimen no. 11 were numerous, monohyphal, sometimes branched but not profusely so, with infundibuliform enlargements as holdfasts. Their filaments were devoid of cytoplasm at maturity appearing flattened in microscope preparations with a calculated diameter range of 10.2-20.4 µm (Fig. 7). Pseudocystidia were not observed by Petch or by the present author.

Type material of *E. neopyralidarum* is preserved as dried specimens and microscope slides at The Herbarium, Royal Botanical Gardens, Kew, England. In addition, original negatives and photographs of temporary microscope preparations are preserved at the same institution.

Conidia of *E. pyralidarum* described by Petch (1937) as "...globose, 18-28 µ diameter, with a conical papilla 4-8 µ high..." (source 5 in Table 2) were not encountered in the two moths of specimen packet no. 11 which contained *E. neopyralidarum* but were in a majority in the third one from this packet. The nuclei of these globose conidia were not stained by any of the stains used in the present study. These conidia were similar in shape to those of *C. apiculatus* found in specimen packages nos. 9 and 10, although they were significantly smaller (source 7 in Table 2). Moreover, the rhizoids on the moth containing these conidia were identical with those found in the other two packages (nos. 9 and 10) which contained *C. apiculatus*. These findings indicate that the third moth in package no. 11 was infected by *C. apiculatus* and that by the time it was collected most of the primary conidia had produced secondary or tertiary ones which are smaller than primary conidia.

A few conidia of *E. neopyralidarum*, each with a clearly visible nucleus, were observed in preparation no. 11a, prepared from the third moth in Petch's specimen no. 11, the one infected by *C. apiculatus*. Because the three moths containing the two different fungi were in the same package, actually in contact with each other for many years, mixing would be expected. This observation suggests how the two different species became mixed in the description of *E. pyralidarum* by Petch (1937).

E. neopyralidarum matches all the generic characters of *Erynia* Nowakowski emend. Humber and Ben-Ze'ev (1981), noting some ambiguity regarding the bitunicate condition of its conidia. Because its subgeneric characters are incompletely known, it cannot be included in any of the subgenera of *Erynia* in the classification of Ben-Ze'ev and Kenneth (1982b) and it is, therefore, placed in the temporary subgroup *Erynia sensu lato*. By having pyriform conidia with

TABLE 2. *Comparative conidial dimensions of Conidiobolus apiculatus, C. major and C. pseudococci: (1)--C. apiculatus combined from various hosts, C. major on imago of Ptilodactyla serricolis (Coleoptera) - from Thaxter (1888); (2), (3) and (4)--C. apiculatus from Diptera and Psocoptera spp., (2) and (3)--C. major on a Tipula sp. (Diptera) and from a culture isolated from an aphid (Homoptera), respectively - from Gustafsson (1965); (5)--C. apiculatus (as Entomophthora pyralidarum - from Petch (1937); (6)--C. apiculatus on adult moth (Lepidoptera: Pyralidae) from Petch's specimen no. 9 of E. pyralidarum (prep. no. 9a, this study); (7)--C. apiculatus, secondary or tertiary conidia on adult Pyralid moth from Petch's specimen no. 11a, formerly E. pyralidarum (prep. no. 11a this study); (8)--C. pseudococci on Pseudococcus calceolariae (Homoptera), *() length and mean calculated here from Speare (1912, Pl. I, figs. d, e, f, k, j, k, q).*

Source	*C. apiculatus* length x width	($\bar{x}$) µm	*C. major* length x width	($\bar{x}$) µm
(1)	30-37 x 28-30	(35 x 30)	55-60 x 38-45	(?)
(2)	25-39 x 21-30	(32 x 26)	40-64 x 37-55	(55 x 45)
(3)	24-37 x 19-25	(28 x 23)	37-69 x 35-55	(50 x 47)
(4)	18-32 x 16-27	(26 x 23)		
(5)	? x 18-28	(?)		
(6)	29.8-51.5x 20.6-45.8 (length s=3.14; width s=3.21; n=72)	(39.7 x 31.9)		
(7)	17.2-30.3x 12.6-27.5 (length s=3.78; width s=3.5; n=25)	(22.5 x 18.8)		
			C. pseudococci	
(8)			*(25.5-34.4)x 20-25(32.3x23.9)* (length s=2.5; width s=1.9; n=7)	

an average l/w ratio of 1.5, which superficially resemble the conidia of the *Entomophaga grylly*-type, *E.neopyralidarum* is one of the least typical species in *Erynia* with regard to conidial shape. However, the exclusion of the conidiobolo-id elements changed the "anomalous" character of this species, as it appeared to be from Petch's description.

Remarks on *Conidiobolus apiculatus* and Related Species

Empusa apiculata Thaxter was first described by Thaxter (1888) in adults of various genera of Lepidoptera, in one lepidopterous larva, in numerous genera of small flies and gnats (Diptera) and in adult leafhoppers (Homoptera). One of the isolates studied by Thaxter was from a beetle (Coleoptera) and was similar to the other *E.apiculata* isolates, except for substantially larger conidia. This isolate was classified by Thaxter (1888) as *E.apiculata* var. *major*. These two variants were transferred by Gustafsson (1965) to *Entomophthora* as two independent species, *E. apiculata* (Thaxter) Gustafsson and *E. major* (Thaxter) Gustafsson.

Recently the two species were transferred to *Conidiobolus* by Remaudière and Keller (1980) as *C. apiculatus* Rem. & Kell. and *C. major* (Thax.) Rem. & Kell. Gustafsson (1965) reported isolation and growth of these species in artificial culture. He added Psocoptera (unidentified genera and spp.) to the host-range of *C. apiculatus*, and gall-midges (Diptera: Cecidomidae) to that of *C. major*. *C. apiculatus* was reported later to have killed aphids (Homoptera) in France (Thoizon, 1970), and in Israel and South Africa (Ben-Ze'ev *et al.*, 1981, and unpublished data).

To summarize, Petch's (1937) description of *Entomophthora pyralidarum* comprised: 1) branched conidiophores, found in the present reexamination to belong to *Erynia neopyralidarum*; 2) oval or pyriform conidia with conical papillae, demonstrated here to be uninucleate, probably bitunicate and belonging to *E. neopyralidarum*; 3) globose conidia with conical papillae, larger than the former ones, demonstrated in this study to be *Conidiobolus apiculatus*; 4) resting spores considered here to be of unknown origin, and demonstrated as different in size and cytology from the genuine resting spores of *E. neopyralidarum*; and 5) rhizoids which were insufficiently described by Petch (1937), and which according to his sketchy description could be those of either *C. apiculatus* or *E. neopyralidarum*.

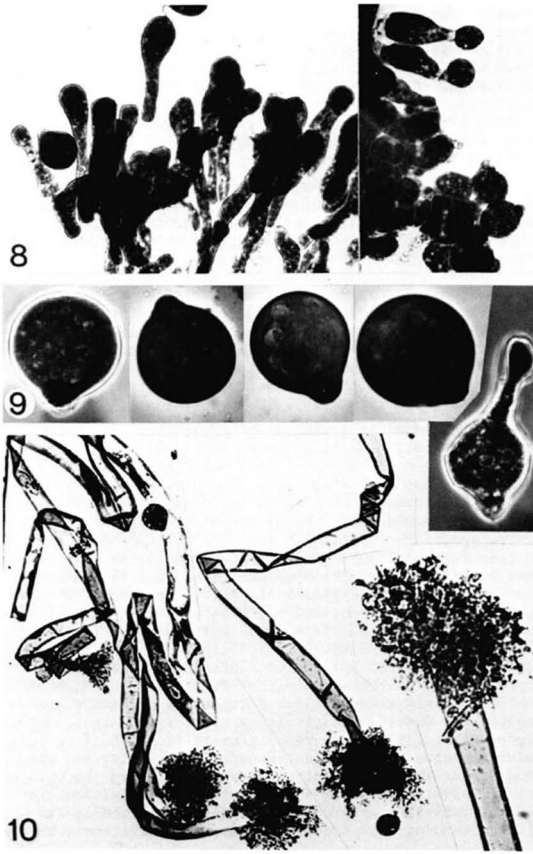
According to the most recent interpretation of the International Code of Botanical Nomenclature (15th International Botanical Congress, 1981) there were two possible resolutions to the classification of *E. pyralidarum*: 1) to exclude the conidioboloid elements and to propose a new combination, with an emended description for the *Erynia* elements, under the specific name "*pyralidarum*"; 2) to synonymize *E. pyralidarum* with the senior specific name, *C. apiculatus*, based on the conidioboloid elements, and to

FIGS. 8-10: *Conidiobolus apiculatus on Pyralid moths from T. Petch's collection, specimens nos. 9, 10 and 11a*

8. Simple conidiophores extended toward their apices, the two on the upper right corner with neck-like constrictions below the developing conidia, x 250.

9. Primary conidia (cotton-blue), the one on the extreme right with an apiculate papilla germinating to produce a secondary conidium, x 1000.

10. Characteristic monohyphal rhizoids, unbranched, with irregularly discoid holdfasts, x 125, the one on the extreme right, x 250.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10

describe the *Erynia* elements as a new species. The second solution was chosen because: 1) most of Petch's specimens contained *C. apiculatus*; 2) at the time that *E. pyralidarum* was described by Petch (1937) sufficient information about *C. apiculatus* was available to easily avoid a misdescription; and 3) the specimen sent by Petch to Thaxter was already identified as *C. apiculatus* in 1935 and was available if Petch wanted to reexamine it before publishing his findings from Ceylon in 1937.

Thaxter (1888) and Gustafsson (1965) described the conidiophores of *C. apiculatus*, under previous synonyms, as unbranched or slightly branched. The conidiophores of *C. apiculatus* observed in this study were unbranched with characteristic constrictions at the apices (Fig. 8) similar to those shown by Gustafsson (1965, Fig. 33) for *C. major*. The taxonomic importance of these constrictions was discussed by Humber (1981) and by Ben-Ze'ev and Kenneth (1982a). Primary, secondary and possibly tertiary conidia were measured from specimens nos. 9 and 11a and are compared in Table 2. In both of these specimens the conidia had apiculate papillae and the rhizoids were characteristic of *C. apiculatus* (Figs. 9 and 10).

Gustafsson (1965) included *Conidiobolus pseudococci* (Speare) Tyrrell & MacLeod (under its former name, *Entomophthora pseudococci* Speare [1912]) as a synonym of *E. apiculata*, because of similarity in conidial morphology, presence of rhizoids in both fungi and production of microconidia by *C. pseudococci* and by one of Gustafsson's isolates of "*E. apiculata*". A comparison of conidial dimensions of *C. apiculatus*, *C. major* and *C. pseudococci*. (Table 2) showed that conidia of *C. apiculatus* and *C. major* from Thaxter's study (1888) differed greatly in size. Conidia of *C. apiculatus* in Petch's specimen no. 9 were slightly larger in length and width than those of *C. apiculatus* described by Thaxter (1888) and substantially larger than those of Gustafsson's (1965) *C. apiculatus* isolates, but smaller by approximately 25% than conidia of *C. major*. The size of conidia did not allow a clear distinction between *C. pseudococci* and Gustafsson's isolates of *C. apiculatus*. Remaudière *et al.* (1979) compared different isolates of *Conidiobolus obscurus* (Hall & Dunn) Remaudière & Keller and concluded that there is substantial variability in the size of conidia within and among species with spheroidal conidia and that distinction according to this criterion is very difficult among such species. Thus, the differences in co-

nidial size of the *C. apiculatus* isolates shown in Table 2 could be explained in consideration of the remarks of Remaudière *et al.* (1979), or could be attributed to the possibility that Gustafsson's sources (3) and (4) were not really *C. apiculatus*. This last possibility was discussed by MacLeod and Müller-Kögler (1973, p. 836) who suggested that Gustafsson's (1965) isolates that had smaller conidia than had Thaxter's isolate of *E. apiculata* and that produced microconidia were probably related to either *Conidiobolus pseudococci* or to *C. coronatus*.

Thaxter (1888) and Gustafsson (1965) noted, without providing measurements, that the ratio of papillar length to conidial length of *C. major* was smaller than that of *C. apiculatus*. Such conidial parameters as the absolute papillar length (APL), proportional papillar length (PPL), conidial length/width ratio (l/w), and apapillate conidial l/w ratio (AC-l/w) were calculated in the present study and evaluated as additional quantitative criteria to increase precision of differentiation among species with spheroidal conidia. A comparison of these parameters (Tables 2 and 3) showed that *C. pseudococci* differs from both *C. apiculatus* and *C. major* by having smaller conidia, a larger conidial l/w ratio and a much larger PPL. *C. major* differs from *C. apiculatus* by larger conidia (Table 2), larger resting spores (Gustafsson, 1965) and a smaller PPL (Table 3: 14.34% as compared to 16.10-17.38%). This apparently small difference in PPL between the two species is, however, substantial enough to be readily detected in Thaxter's (1888) drawings (Pl. 15, Figs. 63-70, var. *apiculata* vs. Figs. 71-73, var. *major*)*. The APL allowed good distinction between *C. major* and *C. apiculatus* or *C. pseudococci* but not between the latter two species. The AC-l/w ratios for the three species were about 1.0, meaning that their conidia without papillae were almost perfectly spherical. Although this ratio was of little value in differentiating these species, it could be useful when species possessing spheroidal conidia are compared with species that have ovoid or pyriform conidia, e.g. *C. apiculatus* vs. *E. neopyralidarum*.

It is concluded that Gustafsson (1965) was justified in elevating *C. major* to species level, but not in considering *C. pseudococci* to be a synonym of *C. apiculatus*.

*See Thaxter (1888, p.194-195, DESCRIPTIONS OF THE PLATES). An error was made in the designation of drawings in his Plate 15.

TABLE 3. *Comparative conidial parameters of Conidiobolus apiculatus, C. major and C. pseudococci calculated here from the following sources: (1)--C. apiculatus from Thaxter (1888, Figs. 65-70), and C. major (l.c. Figs. 71-73); (2)--C. apiculatus on adult Pyralid moth from Petch's specimen no. 9 of Entomophthora pyralidarum (prep. no. 9a, this study); (3)--C. pseudococci on Pseudococcus calceolariae from Speare (1912, Pl. I. Figs. d, e, f, i, j, k, q).*

Parameter	*C. apiculatus* (1)	*C. apiculatus* (2)
Absolute papillar length (APL) min.-max. (x̄) µm	*5.5-9.2 (7.4)*	*4.6-9.2 (6.4)*
standard deviation; n	*1.6; 6*	*0.9; 72*
Proportional papillar length (PPL) as % of average conidial length	*17.38%*	*16.10%*
Conidial length/width ratio (l/w)		
min.-max. (x̄)	*1.1-1.3 (1.2)*	*1.1-1.4 (1.25)*
s; n	*0.09; 6*	*0.06; 72*
Apapillate conidial l/w ratio = length minus papilla/width (AC-l/w)		
min.-max. (x̄)	*0.90-1.04 (0.99)*	*0.9-1.2 (1.04)*
s; n	*0.05; 6*	*0.04; 72*
	C. major (1)	*C. pseudococci* (3)
APL: min.-max. (x̄) µm	*6.9-11.5 (9.2)*	*6.3-8.0 (7.3)*
s; n	*2.3; 3*	*0.7; 7*
PPL: %	*14.34%*	*22.71%*
l/w: min.-max. (x̄)	*1.12-1.15 (1.14)*	*1.3-1.4 (1.35)*
s; n	*0.02; 3*	*0.03; 7*
AC-l/w: min.-max. (x̄)	*0.95-0.99 (0.97)*	*1.01-1.09 (1.05)*
s; n	*0.02; 3*	*0.03; 7*

In addition to the conidial differences, *C.pseudococci* differs from the other two species by ability to produce microconidia and by different rhizoid endings (holdfasts). Among the 31 species classified in the genus *Conidiobolus* Brefeld (Ben-Ze'ev and Kenneth, 1982a) only *C. apiculatus, C. major, C. papillatus* (Thaxter) Rem. & Kell., and *C. pseudococci* are known to produce rhizoids. These four species are pathogenic to insects and their rhizoids are monohyphal, but the holdfasts of the first three are similar (Fig. 10), while those of *C. pseudococci* are different (Fig. 11b). Monohyphal rhizoids with holdfasts similar to those of *C. pseudococci* are produced by some species of *Erynia*, by *Entomophthora culicis* (A. Braun) Fres. (Gustafsson,1965; Ben-Ze'ev, unpublished) and by *Entomophthora destruens*

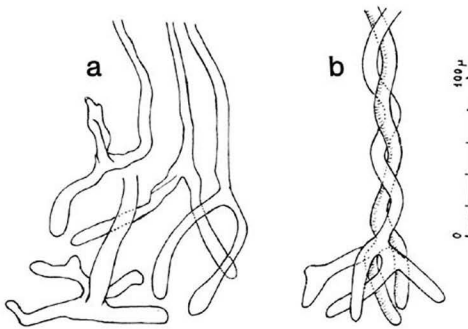

FIG. 11: *Conidioboloid rhizoids differing from those of Conidiobolus apiculatus:*

(a) distal extremities of Conidiobolus destruens rhizoids, redrawn from a drawing by Batko (in Weiser and Batko, 1966), and

(b) distal extremities of C. pseudococci rhizoids redrawn and brought to the same scale as (a) from a drawing by Speare (1912).

Weiser and Batko (1966, Fig. 2) (reproduced here in Fig. 11a). The last species, which has conidioboloid nuclei (R. A. Humber, pers. commun.) and all of the other generic characters of *Conidiobolus*, was suspected for several years to be synonymous with *C. thromboides* Drechsler (R. A. Humber, R. S. Soper, D. Tyrrell, pers. commun.). However, the production of rhizoids and loricoconidia (conidia which metamorphose into resting spores) described by Weiser and Batko (1966) establish this species as different from *C. thromboides*, whereas the conidioboloid characters justify the proposal of the following new combination.

> *Conidiobolus destruens* (Weiser & Batko), comb. nov. BASIONYM: *Entomophthora destruens* Weiser and Batko, *Folia Parasitol. (Praha) 13*: 145-146, Text-fig. 1-2, Pls. 1 (Fig. 1-3), 2 (Fig. 1-2), 1966.

Since *C. destruens* does not produce capilliconidia or microconidia, producing only Type I secondary conidia, it

is placed in the subgenus *Conidiobolus* subg. *Conidiobolus* as defined by Ben-Ze'ev and Kenneth (1982a), close to the other three rhizoid producing species classified there, *C. apiculatus, C. major* and *C. papillatus*. Phylogentically, however, *C. destruens* appears to be closer to *Conidiobolus* (subgen. *Delacroixia*) *pseudococci*, because it has similar rhizoids. Other species placed in subgen. *Conidiobolus*, because they produce only Type I secondary conidia, appear to be related biochemically to either subg. *Delacroixia* (Sacc. & Syd.) Tyrrell & MacLeod or to subg. *Capillidium* Ben-Ze'ev and Kenneth (Tyrrell and MacLeod, 1972; King, 1976; Ben-Ze'ev & Kenneth, 1982a, p. 422 and 428-431). These phylogenetic problems encountered with species of the subgenus *Conidiobolus* suggest that this subgenus is phylogenetically artificial, undoubtedly containing some species that are more closely related to the other two subgenera but that have lost the ability to produce microconidia or capilliconidia. From the systematic point of view it is convenient to retain the subgenus *Conidiobolus* until additional knowledge allows broader definitions for the other subgenera of the genus *Conidiobolus*.

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SURVEY OF THE ARGENTINE SPECIES OF THE *GANODERMA LUCIDUM* COMPLEX.

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SUMMARY

Macro and micromorphological and cultural studies showed that the *Ganoderma lucidum*-complex is represented in Argentina by *Ganoderma lucidum s. str.*, *G. ceratedii*, *G. resinaceum*, *G. zonatum* and *G. subamboinense var. laevisporum* var. nov. based mostly on the study of type materials. A general key is presented in this complex and additional synonyms for *G. resinaceum* are proposed. *G. tuberculatum* is a synonym of *G. ceratedii*.

The species of the *Ganoderma lucidum* (Leys.:Fr.)Karst. complex are important wood-rotting fungi and cover a wide array of hosts in Argentina: *Tipuana*, *Acacia*, *Robinia*, *Ocotea*, *Pinus*, *Quercus*, *Ulmus*, *Acer*, etc., inflicting serious damage both to native and introduced trees. The group is formed by those species possessing a typical "hymenodermis" (Steyaert, 1972).

Unfortunately they have been poorly studied, particularly for Central and South America. Thus, we lack modern keys for their identification (cfr. Murrill, 1915; Dennis, 1970), and those that are available are not sufficiently comprehensive and are based almost entirely on macromorphological features. A study was thus carried out on most of the species of the area having a hymenodermis, particularly on Argentine forms. This has allowed us to develop a tentative key of the representative species and varieties from Central and South America, with major emphasis placed on the basidiospores .

The genus *Ganoderma* was created by Karsten (1881) based on *Polyporus lucidus* Leys.:Fr., the type of which is not extant. It comprises those species of polypores whose pileus and stem (when present) are covered by a crust with the consistency and appearance of lacquer, sometimes brilliant,

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and with ovoid to ellipsoid basidiospores varying from yellow to brown, provided with a hyaline perisporium that is usually smooth and truncate, and a thick endosporium with projections reaching to the external layer (Heim, 1962; Furtado, 1962, 1965). The apex becomes truncate upon maturation due to the collapse of the apical papilla. Until recently the genus was included in the Polyporaceae but Donk (1933) segregated the subfamily Ganodermoideae which he later gave family rank as *Ganodermataceae* (Donk,1964).

Since Patouillard (1889) revised the species to that date, several workers dealt with the genus, describing numerous species, among them Murrill (1908b, 1915), Lloyd (1912,1915, 1917, 1920, 1921, 1924), Torrend (1920), Spegazzini (1926), Imazeki (1939), Rick (1938), and mainly Steyaert (1961a and b, 1962, 1967b, 1972). Steyaert's untimely death prevented him from writing a monograph of the genus (but cfr. Steyaert, 1980).

In spite of the work carried out by these workers, the taxonomy of the genus has been, and still is, rather chaotic, principally due to the great variety of forms encountered and the different criteria used for classification. It is now obvious that macromorphology alone is useless as a basis for distinguishing among species.

New criteria arose after the studies of Humphrey & Leus (1931) and of Haddow (1931). The former though referring only to the *G. applanatum-complex* (another difficult problem), emphasized the importance of employing anatomical characteristics in their classification. Haddow (1931) was the first to use the structure of the fruit-body's dermis for the identification of a few species, but did not propose any descriptive terminology; he did, however, refer to the spore ornamentation as the "smooth type" in *Ganoderma sessile* (=*G. resinaceum*) and the "rugose type" in *G.lucidum*. This was later confirmed by Steyaert (1962, 1972). For our species concept we have emphasized the type of spore ornamentation, shape and size, the number of pores per mm and, in some instances only, the colour of the context. Thelatter has been widely used by previous authors but is not always a reliable feature. Studies with the SEM corroborated the structure of the spore wall proposed by Furtado (1962) as well as the types of ornamentation proposed by Steyaert (1972), to which we have added the "semirugose type" intermediate between the typically "smooth" and"rugose" types. Steyaert (1962, 1972, 1980) considered that the different forms constitute constellations or "complexes" according to the types of dermis, which were defined and carefully studied by Furtado (1965). All the species here described fall in Steyaert's (1980) subgenus *Ganoderma*, Section *Ganoderma*, although some related ones included in the key do not.

MATERIALS AND METHODS

The description of the basidiomes was made according to their macroscopic features (size, colour, number of pores

per mm, length of tubes, colour and consistency of context, presence or absence of stem, etc.). The microscopic features studied were the types of hyphae, and the vegetative and reproductive structures, mostly using the indications given by Teixeira (1956). The hyphal system was studied by dissecting small portions of the context and/or the dissepiments. Dermic elements were examined and measured in thin sections perpendicular to the pileus surface. Spore ornamentation and gasterospore[1] features were studied both with the optic and SE microscopes.

Cultural studies "in vitro" were made of some species according to the methods of Nobles (1948, 1958, 1965), and code numbers obtained.

Colours are according to Maerz & Paul (1930), and herbarium abbreviations those of Holmgren & Keuken (1974).

KEY TO REPRESENTATIVE SPECIES OF THE *GANODERMA LUCIDUM-COMPLEX* TO BE FOUND IN CENTRAL AND SOUTH AMERICA.

1. Spore ornamentation distinctly rugose.....2
1'.Spore ornamentation not so.....3

2. Context dark brown; spores 9-13 x 5-6,9 µm.....*G. lucidum s. str.*
2'.Context almost white; spores broadly ellipsoid, 8-9 x 5-7 µm.....*G. punctisporum* Furtado

3. Spores of the "smooth" type (with numerous slender endosporic pillars that do not show up on the perisporium, thus appearing smooth when observed with the optical microscope at 400 x).....4
3'.Spore ornamentation "semirugose, intermediate between that of 1 and 3.....8

4. Gasterospores present in context and dissepiments.....5
4'.Gasterospores absent.....6

5. Gasterospores with walls formed by veins or ribs (particularly evident with the SEM); Brazil... .....*G. subamboinense* P.Henn. var. *subamboinense*
5'.Gasterospores with smooth walls; Brazil and NE Argentina.....*G. subamboinense* P.Henn. var. *laeviporum* var. nov.

6. Pores 3-5 per mm; spores ellipsoid, 9-13 x 5-8 µm .....*G.resinaceum* (Boud.)Pat.
6'.Pores usually larger than 5 per mm.....7

7. Pores 5-6 per mm; spores 7-10 x 5-7 µm, context almost white.....*G. parvulum* Murr.
7'.Pores 6-7,5 per mm, mostly 7 per mm, spores 9-10 x 5-7 µm, context brown.....*G.bibadiostratum* Steyaert

[1]Term used in the sense of Steyaert and employed much earlier by Spegazzini for imperfect spores on or in normal basidiomes.

8. Context dark brown.....9
8'. Context almost white or, at least, not dark brown; basidiomes generally small and sessile; spores 9-11 x 6-8; Mexico .....*G. sessiliforme* Murr.

9. Spores broadly ellipsoid, 9-14 x 6-10 µm; pores 4-7 per mm, surface of pileus usually strongly tuberculate.....*G. cerstedii* (Fr) Torr.[1]
9'. Spores narrower, pileus surface not distinctly tuberculate.....10

10. Spores 11-13 x 5-7 µm; pores 4-5 per mm; surface of pileus smooth or concentrically sulcate.....*G. zonatum* Murr.
10'. Spores 10-11 x 5-6 µm; pores 5-6 per mm; surface of pileus radially rugose and concentrically sulcate.....*G. subfornicatum* Murr.[1]

G A N O D E R M A P.Karst., Rev. Mycol. 3 (9): 17.1881, emend Patouillard, Bull. Soc. Mycol. France 5: 67. 1889

Xylophagous polypores producing a white-rot in wood. Basidiome annual or biannual, rarely perennial, pileate. Pileus with an eccentric stem, or sessile and then dimidiate, rarely centrally stipitate. Pileus and stem surfaces (when present) covered with a crust with the consistency and appearance of lacquer which may or not be shiny like varnish, well defined, generally brilliantly coloured. Context corky, fibrous-coriaceous, or somewhat woody, more or less tomentose or fibrillose, sometimes very hard and durable, with various hues of brown, frequently whitish, sometimes with a thin dark brown layer among the tubes. Hymenophore tubular, in one or several layers, generally dark, with a smooth surface. Pores small, mostly circular, almost white, exceptionally golden yellow. Hyphal system trimitic with hyaline, septate, clamped, thin-walled generatives, usually branched and more frequent at the margin. Skeletal hyphae aseptate, thick-walled, light brown, long, wavy, scantily branched,occasionally with dendritic endings, generally more frequent in the context. Binding hyphae scarce, strongly branched and tortuos , aseptate, thick-walled, more slender than the skeletals. Cystidia and setae absent. Basidia short clavate to napiform, 4-spored. Spores ovate-ellipsoid, with a truncate apex and a t wo-layered cyanophilous wall, the external smooth and hyaline, the internal brown, verrucose or reticulate.

Type species: *Ganoderma lucidum* (Leys.:Fr.)P.Karst.

[1] Both species belong to Section Characoderma, according to Steyaert (1980).

GANODERMA LUCIDUM (Leys.:Fr.)P. Karst., Rev. Mycol. 3 (9): 17.1881.

= *Boletus lucidus* Leys. Fl.Halensis p. 300. 1783. = *B. dimidiatus* Thunb., Fl. p. 348, tab. 39. 1784 (Fide Imazeki). = *B. laccatus* Timm, Fl. megalop. Prodr., p. 269. 1788 (Fide Imazeki). = *Polyporus lucidus* Leys.:Fr., Syst. Mycol. I: 353. 1821. = *P. laccatus* Timm:Pers., Mycol. europ. 2: 54. 1825 (Fide Imazeki). = *P. japonicus* Fr., Epicr. p. 442. 1838 (Fide Imazeki). = *F. lucidus* (Leys.:Fr.)Sacc.,Syll. Fung. 6: 157. 1881. = *Placodes lucidus* (Curt.:Fr.)Quél., Fl. Mycol. p. 399. 1888 (Fide Domański). = *F. japonicus* Fr. in Sacc., Syll. Fung. 6: 156. 1888 (Fide Imazeki). = *Ganoderma pseudoboletus*(Jacq.) Murr., Bull. Torrey bot. Cl. 29: 602. 1902 (Fide Imazeki). = *G. laccatum* Pat. in Bresadola, Icon. Mycol. 21, t. 1004. 1932, non *G. laccatum* Bourd. & Galz. 1928. Icon. Michael & Henning, Pilzfr. 2, t. 73. 1960 (Fide Domański et al.).

Figs. 1-4, 23-25, 61.

Annual, sessile and dimidiate or, more frequently with a lateral stem and then usually reniform (Figs. 1,3). Pilei isolated, small to medium sized, 2-8 x 2-4,5 x 0,5-2 cm. Pileus surface radially rugose and concentrically sulcate, brilliantly laccate, light reddish brown (Pl. 6 L 12 of Maerz & Paul), to dark reddish brown or mahogany (Pl. 7 L 6). Margin sterile, generally thick and blunt, sometimes acute, white in actively growing specimens, becoming yellowish and reddish brown inwards; in older specimens of the same colour as pileus surface, and then incurved. Stem lateral, vertical, cylindric, usually long, slender, tortuous, 4-10 cm long,0,5-2 cm thick, reddish black to almost black, laccate, brilliant, somewhat thicker at the base. Cutis thin, brilliant black. Context almost as thick as the tube layer but thickening towards the base of the stem, ochraceous brown when young (Pl. 13 H 10) to dark brown when mature (Pl. 14 L 12), corky. Dermis of the "hymenodermis" type, composed of thick, golden walled, claviform elements originating from the ends of skeletal hyphae, with narrow lumina and blunt ends, arranged in a palisade-like hymenium (Fig. 62), 5-10 µm thick, the total thickness of the dermis 14-42 µm. These elements are covered by a thick layer of a lacque-like substance that dissolves in a hot solution of 5% KOH. Hymenophore white to yellowish white when young, greyish white in mature specimens (Figs. 2, 4) with a tube layer up to 7 mm long, slightly lighter than context (Pl. 13 D 8). Pores small, round, somewhat irregular, 4-7 per mm, 6-200 µm diam. Dissepiments 17-116 µm diam. Hymenium not persistent, composed of scant globose to subglobose basidia, 9-19 x 7-14 µm. No other hymenial elements present. Basidiospores subovoid with the apex truncate, perisporium hyaline, smooth and thin, and endosporium golden with relatively scant endosporic pillars, wide and long, reaching the perisporium and rumpling it so that it appears strongly "rugose" (Figs. 23-25, 61); 9-13 x 5-6,9 µm. Hyphal system trimitic with hyaline,thin-walled,clamped,septate generatives, 1-4µm diam.,septa restricted to clamps, scant-

ilybranched, abundant at the growth margin of pileus and dissepiments, rare or absent in the context (Fig. 71). Skeletals "arboriform" (Teixeira, 1956), aseptate, clampless, very long, 3-6 µm diam., scantily branched, branches with limited growth at distal end, with thick golden walls, sometimes subsolid; they compose most of the context and dissepiments, originating immediately behind the growth margin from generative hyphae (Fig. 68). Binding hyphae of the "Bovista" type (Cunningham,1946a), aseptate, clampless, profusely branched, tortuous, of limited growth, generally thinner and lighter than the skeletals, 1-3 µm diam., rather scant and only present in the context; they are intertwined with the latter, giving the context its firm cohesion (Figs. 69-70).

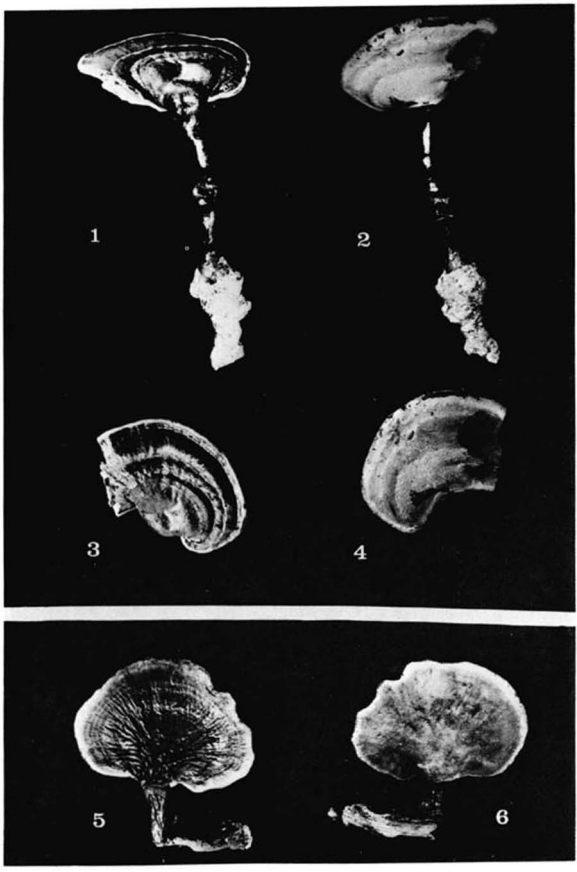
Hosts: at the base of trunks and on roots of harwoods, rarely on conifers. Recorded also on *Acer, Quercus, Castanea, Alnus, Populus, Fagus, Fraxinus*and *Pinus* (Domański, 1967). According to Domański (loc. cit.) it grows saprophytically and only exceptionally attacks living trees. Boyce (1938) agrees with this. However, Pirone (1957) through experiments with *Acer* proved that it is an important parasite of hardwoods.

Distribution: apparently worldwide in temperate and tropical zones.It has been recorded for Europe, Asia, Philippines, Australia, Africa and North and South America (in the latter for Venezuela, Brazil, Uruguay and Argentina).

Apart from the records given below for Argentina, Spegazzini cited collections from the provinces of Córdoba and Chaco. We have been unable to find materials from those areas.

Material studied: ARGENTINA: Buenos Aires: Don Torcuato, leg. Kohn, 10.IX.1970 (BAFC 24406); Pereyra Iraola, IV.1971 (BAFC 24421); Bella Vista, leg. Gallardo, 31.I.1965 (BAFC 25531). Capital Federal: Jardín Botánico, leg. Molina, 7.IV.1978 (BAFC 24408). Corrientes: 4 km E of Paso de la Patria, leg. Krapovickas, 20.V.1966 (BAFC 24428). Misiones:Parque Nacional Iguazú, leg. Bazzalo, 14.III.1980 (BAFC 25055); Garupá, leg. Cricel, 16.IV.1976 (BAFC 24433); Arroyo Yacuy, leg. Gómez, I I.1969 (BAFC 24418). Tucumán: road to Tafí del Valle, km 19, leg. Gómez, 22.V.1966 (BAFC 24419); road to El Cadillal, Hway 9, leg. Ruiz, 26.IV.1973 (BAFC 24425); ibid., leg. Guerrero & Bettuci, 27.I.1965 (BAFC 25524); no locality, leg. Spegazzini, VI.1917 (LPS 24886). BRAZIL: Sao Leopoldo, leg. Rick (sub *G.renidens*) (BAFC 25599). FRANCE: Basses Pyrénees, leg. Candousseau, 1972 (BAFC 25600). URUGUAY: no locality, leg. Berg (LPS 24851); Montevideo, leg. Arechavaleta, IX.1898 (LPS 24972); ibid., Cerro Largo, leg. Felippone (LPS 24882).

Figs. 1-4: *Ganoderma lucidum s. str.* 1-2: aspect of basidiome; 3: surface of pileus; 4: hymenophore. Figs. 5-6: *Ganoderma subamboinense* var. *laevisporum*. 5: surface of pileus; 6: hymenophore (all figures 1/2 x).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Cultural features Figs. 75-79, 81-82, 88-90, 107.

Strains: BAFC n°112 = ARGENTINA: Catamarca, Dique de Collagasta leg. Laterra, 14.I.1981. BAFC n°815 = ibid.

Code Number: 2. 3. 8. 10. 37. 39. 45. 53. 54. 55.

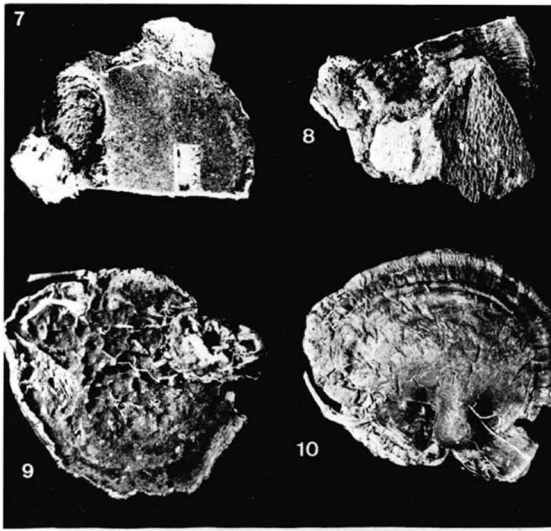
Macroscopic characters: growth slow, covering Petri dishes in 5 weeks. Mycelium mat not dense, adhering to agar, arranged in concentric bands the 1st week, alternatively white and ochraceous (Pl. 11 K 1). After the 4th week it becomes totally ochraceous yellowish with more or less darker concentric bands (Fig. 107). Texture completely farinaceous, margin subfelty. Reverse:discoloration brown. Margen regular, border smooth. Odour sweetish. Oxidase reaction: with tannic acid= ++++ with growht; with gallic acid= ++++ without growth; with gum guaic = +.

Microscopic features: marginal mycelium formed only by generative, clamped hyphae, with septa restricted to clamps, scarcely branched, 2,5 µm diam. (Figs. 88-90); during the 2nd week fibrous hyphae appear, slender, hyaline, thick-walled, clampless, heavily branched, 1-2 µm diam. (Figs. 77-78). Ochraceous yellowish mycelium formed by: i) generative hyhae as above; ii) clamped, thick-walled hyphae, golden, unbranched, 2-7 µm diam., of uniform thickness or like rosary beads (Figs. 79, 81-82); iii) stag-horn clamped hyphae, thick-walled , with numerous branches, generally dichotomic, projecting in several planes, 1-3 µm diam., or with short branches laterally disposed in a single plane at regular intervals, 2-3 µm diam.; iv) globose, thin-walled golden yellow cuticu lar cells which are very abundant, tightly packed forming a "pseudoparenchyma", 5-20 µm (Figs. 75-76); v) fiber hyphae as in the margin, scarce. Submerged mycelium similar to aerial.

These cultures are characterized by a strong yellowish colour that extends to all the mycelial layer, whereas in other species it is limited to a few spots and is not so intense. The cultures resemble those of *G. subamboinense* var. *laevisporum* but differ in the lack of chlamydospores.

For a long time the *G. lucidum*-complex has been a difficult problem for taxonomists. It has been a tradition to consider all the stipitate forms as *G. lucidum s. str.* and the sessile ones as *G. resinaceum* (= *G. sessile* Murr.). This distinction has an absolute lack of anatomical foundation. When one deals with a large number of specimens, clear distinctions appear with regard to spore ornamentation, whatever the macroscopic configuration may be. This had already been observed by Haddow (1931) and was only reconfirmed 35 years later by Steyaert (1967a). Haddow termed the spores of *G. lucidum* as of the "rugose" type. Unfortunately the holotype of this species has not been found, although Steyaert (1972) states there is a coloured illustration of such specimen in Flora Londinensis (1781), which was collected at Peckham, S of London. This would constitute the pres-

Figs. 7-8. *Ganoderma sessile* (Holotype). 7: hymenophore; 8: surface of pileus, 9-10. *G. resinaceum*, BAFC 24450. 9 hymenophore; 10: surface of pileus. 11-12. *G. subamboinense* var. *laevisporum*. 11: aspect of the basidiome; 12: hymenophore (all figures 1/2 x).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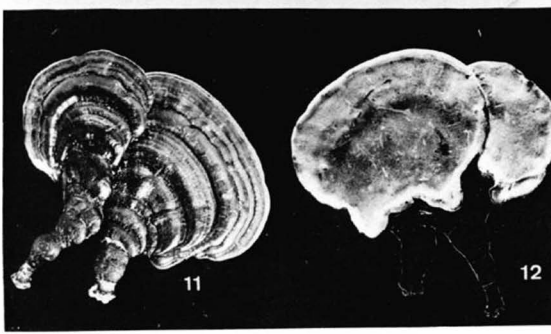
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ent type of the species. However, such an illustration does not reveal the spore features. Attempts to find a neotype at Peckham have failed. Karsten, the founder of the genus, left at H a specimen with the same type of "rugose" spores (Steyaert, 1972), which could be selected as neotype and thus arrive at a satisfactory "modus vivendi" to distinguish among both species.

GANODERMA SUBAMBOINENSE P. Henn. Fungi amazonici I. Hedwigia 43: 175. 1904 (sub *Fomes* (*Ganoderma*) *subamboinensis*) var. *LAEVISPORUM* var. nov.

Figs. 5-6, 11-12, 46-50, 62-71.

A typo differt gasteroseporis laevis. Holotypus Argentina, Buenos Aires, Tigre, leg. Connon, 15.V.1980, in Herb. BAFC 25525 conservatus est.

Annual, sessile, dimidiate or, more frequently, stipitate flabelliform to conchate, pleuropus, with isolated pilei which are sometimes concrescent, small to medium-sized, 3,5-13 x 2,5-10,5 x 0,2-1,5 cm. Pileus surface radially rugose with concentric, slightly deep sulcations, or radially rugose and then with numerous, deep, concentric sulcations, that make it appear undulate (Figs. 5, 11); dark reddish brown (Pl. 7 L 11 of Maerz & Paul), gradually becoming lighter towards the margin, with a narrow yellowish-orange band (Pl. 11 J 7) in young specimens; in mature ones this graduation is not observed, the colour tending to become homogeneous, brilliantly laccate. Margin sterile, straight, yellowish white (Pl. 11 B 1), thin and acute to thick and blunt; in the first case undulate and somewhat irregular; in the second smooth and regular. Stem horizontal, short and thick or long and slender, tortuous, reddish black to almost black, laccate, brilliant, cylindric, 1,5-5,5 cm long, 0,5-2,5 cm thick. Section very thin in general, slightly swollen at the base, 0,3-1,5 cm deep at about half the radius. Cutis thin, black, brilliant. Context thin, up to 1 cm thick, light brown, almost white (Pl. 11 D 5), slightly darker in a narrow zone above the tubes; in the Brazilian specimensbrown (Pl. 13 H 8); corky. Dermis of the "hymenodermis" type, composed of clavate elements with thick walls and blunt ends, 5-10 µm diam., covered by a thick layer of lacquer that dissolves in a hot solution of KOH (Fig. 62); 16-36 µm thick. Hymenophore poroid, concolorous with margin, tube layer 1-4 mm long, concolorous (Figs. 6, 12); pores circular, 4-7 per mm, 98-260 µm diam., dissepiments 36-170 µm. Hymenium formed only by easily collapsing subglobose basidia, 4-spored, 9-13 x 7-14 µm (Fig. 57). Basidiospores broadly ellipsoid with truncate apex (Figs. 46-50), of the "smooth" type, perisporium hyaline, thin, endosporium light

Figs. 13-16. *G. oerstedii*. 13-14: aspect of the basidiome (BAFC 24441); 15-16: aspect of the basidiome (Holotype of *G. tuberculosum*) (both 1/4 x). Figs. 17-22. *G. zonatum*. 17-19: aspect of the basidiome of the Holotype (1/2 x); 20-22: aspect of the basidiome of BAFC 24416 (1/2 x).


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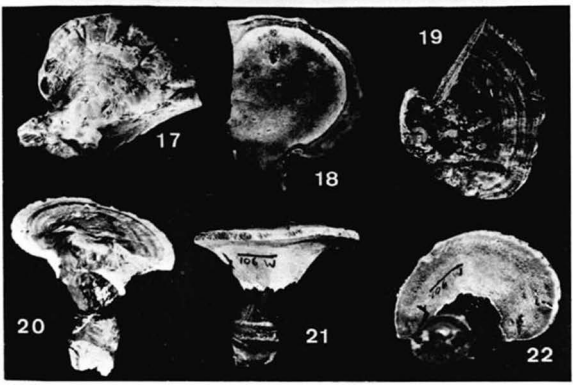
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brown, thick, endosporic pillars numerous, slender, not affectingthe perisporium; small, 6-9 x 4-6 µm. Hyphal system trimitic with clamped, thin-walled, hyaline generatives, with septa restricted to clamps, sparingly branched, 1-3 µm diam., abundant at the growth margin of the pileus, but also present in the context and dissepiments (Fig. 71). Skeletals aseptate, thick-walled, almost hyaline, solid to subsolid, arboriform at the end of branches, 3-8 µm diam., they form the bulk of the context and dissepiments (Fig. 68). Binding hyphae of the "Bovista" type, thinner than the skeletals, almost hyaline, thick-walled, aseptate, heavily branched, 1-3 µm diam., only present in the context (Figs. 69-70). Gasterospores abundant in the context, present in the dissepiments originating from vegetative hyphae, with dense contents and thick-walled, sometimes with 1-2 guttulae, almost spherical, completely smooth, 7-14 x 6-12 µm (Figs. 63-67).

Hosts: on dead fallen trunks of various species, on live *Platanus* (at considerable height on the trunk), and on stumps of *Pinus taeda*.

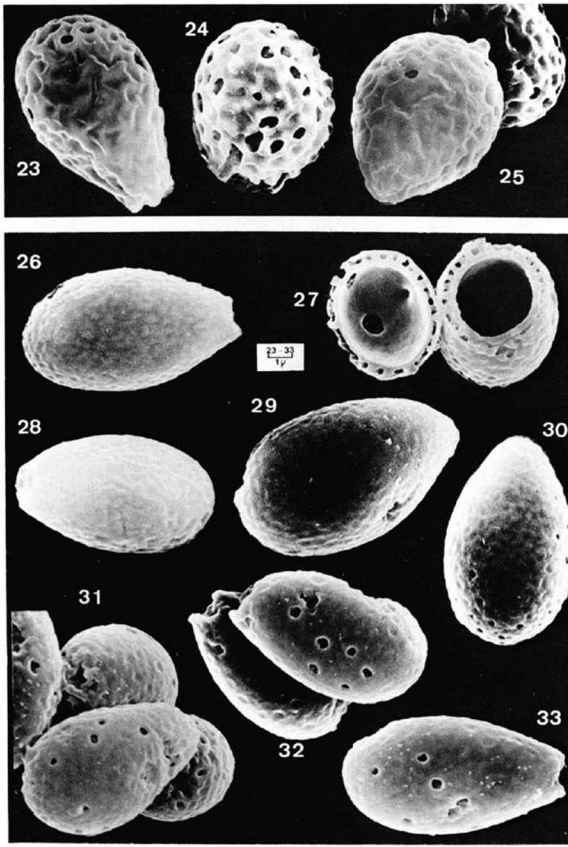
Distribution: Brazil, Argentina (Buenos Aires, Misiones).

Material studied: ARGENTINA: Buenos Aires: Tigre, leg. Connon, 15.V.1980. (HOLOTYPE, BAFC 25525). Misiones: Puerto Libertad, Alto Paraná plantation, leg. Deschamps, 21.XII.1979 (BAFC 24535); Parque Nacional Iguazú, leg. Bazzalo, 3.III.1980. (BAFC 25056). BRAZIL: Manaos, banks of Rio Tapajos,leg. Alves da Sousa, 9.X.1977 (BAFC 24429); ibid.,Parque Nacional Pedreiras, leg. ipse, 1977 (BAFC 25527).

The basidiomes have the external appearance of *G. lucidum s. str.*but the micromorphologic differences are striking: much smaller spores which are broadly ellipsoid, of the "smooth" type, light context and frequent gasterospores both in the context and dissepiments. The study of a part of the holotype (S) of *G. subamboinense* P. Henn. showed that it possessed gasterospores (not mentioned in the diagnosis), of the same size and shape but differing in being ornamented with veins anastomosing to form a sort of reticulum. Since our materials only differ from *G. subamboinense* var. *subamboinense* in the total lack of ornamentation of the gasterospores and a slight variation in the spore measurements which are 7-9 x 4-6,5 µm in the holotype mentioned, we believe this warrants the new variety proposed.

Furthermore, the specimens studied appear to be close to *G. multiplicatum* (Mont.) Pat. var. *vitalii* Steyaert (1962), which has also gasterospores but of a much larger size. We have been unable to secure the holotype of the latter.

Figs. 23-25: basidiospores of the "rugose" type of *Ganoderma lucidum s. str.*(BAFC 24425). 26-33: basidiospores of the "smooth" type of *G. resinaceum*.26 and 28 from BAFC 24436; 27, 31-33: from BAFC 24431; 30: from the holotype of *G. sessile* (all 10000 x).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Cultural features Figs. 72-82; 88-92; 94-101; 106.

Strains: BAFC n°247 = the HOLOTYPE (BAFC 25525). BAFC n°745 = Misiones: Parque Nacional Iguazú (see BAFC 25056).

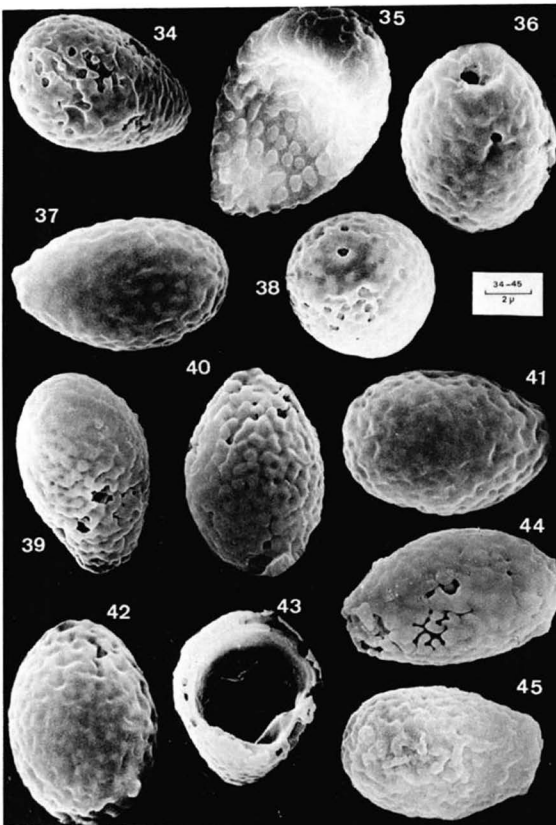
Code number: 2. 3. 8. 10. 34. 36. 37. 39. 42. 53. 55.

Microscopic characters: growth fast, reaching 3-4,5 cm diam. in the first week, covering the plates in 2 weeks; mycelial mat white (Pl. 1 A 1); during the 3rd week ochraceous yellowish zones begin appearing appressed to agar (Pl. 12 B 7), at first irregularly at inoculum or at the marginal area. Texture farinaceous during the 1st week at the inoculum, the rest felty, becoming after the 2nd week totally farinaceous (Fig. 106). Reverse only altered in the areas of coloured mycelium, becoming yellowish to brownish. Margin regular, smooth. Odour sweetish. Oxidase reaction: with tannic acid = ++++ with growth; with gallic acid =++++ without growth; with gum guaic= +.

Microscopic features: Marginal mycelium: formed solely by generative hyphae during the 1st week, which are clamped, with scant branches, septa restricted to clamps (Figs. 88-90), 2,6 µm diam., staining with phloxine or remaining hyaline; during the 2nd week: i) appear clamped stag-horn hyphae that stain well with phloxine, of the same size as the former, and with very abundant and thin ramifications which are very characteristic, in general dichotomic, very intrincately branched (Fig. 92); ii) unclamped, fibrous, aseptate, hyaline, thick-walled slender hyphae, 1-2 µm diam., heavily branched (Figs. 77-78); iii) hyaline "cuticular cells", originating from globose branches of hyaline generatives (Figs. 72-74), attaining various shapes and sizes and arranged tightly into a "pseudoparenchyma"; iv) dextrinoid chlamydospores, terminal or intercalary, with a simple or double golden wall (Figs. 94-101), almost spherical to ellipsoid, with dense contents that stain deeply with phloxine, 11-18 x 9-15 µm. Inoculum: with same features as the white mycelium. Coloured mycelium: i) generatives as in i) above, scarce; ii) "cuticular" cells with a thick golden wall arranged in a pseudoparenchyma which becomes compact and is responsible for the colour observed, shape and size variable, each element ca. 9-47 µm diam. (Figs. 75-76); iii) thick-walled clamped hyphae with golden walls, unbranched or with terminal irregular branches and unclamped sclerotized hyphae with narrow portions at regular intervals, appearing as rosary beads, 2-6 µm diam. (Figs. 79-82); iv) fibrous hyphae as in ii) above, very abundant, 2-4 µm diam.; v) dextrinoid chlamydospores which may be terminal or intercalary, same as iv) above. Submerged mycelium formed by: 1) generative hyphae with thin wall, tortuous, much branched with short branches, staining with phloxine (Fig. 91), 2-5 µm diam.; 2) chlamydospores as above; 3) "Cuticular cells" as above. The submerged mycelium in the coloured zone have "cuticular cells" with thick, golden walls and sclerotized generative hyphae, 2-8 µm diam., as well as typical chlamydospores; generative hyphae are scant.

This species has apparently not been described in culture before.

Figs. 34-45. Basidiospores of the "semirugose" type of *Ganoderma oerstedii*. 34-35, 37-38: from BAFC 24441; 36, 41-42: from the holotype of *Ganoderma tuberculosum*; 39-40, 43-45: from BAFC 24410 (all 10000 x).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GANODERMA RESINACEUM (Boud.)Pat., Bull. Soc. Mycol. Fr. 5: 72. 1889.

=*G. chaffangeoni* Pat., ibid. 5: 74. 1889 (Fide Steyaert). = *F. resinaceus* (Boud.) Sacc., Syll. Fung. 9: 179. 1891. = *G. sessile* Murr., Bull. Torrey bot. Cl. 29: 604. 1902; North Amer. Fl. 9: 120. 1908 (NY!). = *G. polychromum* (Copel.) Murr., North Amer. Fl. 9: 119. 1908. = *G. pulverulentum* Murr., ibid. 9: 121. 1908 (NY!). = *G. praelongum* Murr., ibid. 9: 121. 1908 (NY!). = *G. subinaruetatum* Murr., ibid. 9: 120. 1908 (NY!). = *G. argillaceum* Murr., ibid. 9: 122. 1908 (NY!). = *G. nitidum* Murr., ibid. 9: 123. 1908 (NY!). = *G. subperforatum* Atk., Bot. Gaz. 46: 337. 1908. = *G. platense* Speg., Bol. Acad. Nac. Cienc. Córdoba 28: 363. 1926 (LPS!).

Figs. 7-10; 26-33; 60.

Annual, lignicolous, generally dimidiate to reniform, sometimes circular, spathulate or ungulate; isolated or imbricate, sometimes several pilei laterally confluent with their pseudostipes free or fused into one; sessile, substipitate; 3,5-55 x 3-18 x 1-8 cm. Pileus surface applanate, concave or more or less infundibuliform, smooth, irregularly rugose, concentrically sulcate and radially rugose or strongly tuberculose, laccate, brilliant or dull, sometimes dull due to a thick deposit of spores. Central zone yellowish brown, very light in young specimens (Pl. 12 H 12), darkening with age from the centre towards the margin, with a broad cream coloured to yellowish marginal band (Pl. 9 E 4); in mature specimens there is no such gradation, the surface being dark reddish brown (Pl. 7 L 11) or light reddish brown, homogeneous (Figs. 8, 10). Margin sterile, thick, blunt, straight, incurved or recurved, yellowish cream in actively growing specimens, dark reddish brown in mature ones. Pseudostipes lateral or central, very short to long, slender to thick, black, laccate, brilliant, 4-7 cm long, 2-5 cm wide, sometimes rudimentary. Section thin to very thick, thickening towards the base, 1-4 cm at about half the radius. Context corky and soft or woody and hard; 2-5 cm thick, uniformly brown (Pl. 13 H 9), or with a thin darker band above the tubes. Hymenophore poroid, white to yellowish, becoming dark brown when old (Figs. 7, 9) with a layer of tubes often decurrent on the stem, 5-15 mm long, slightly lighter than the context; pores circular, large to medium sized, 2-5 per mm, 89-309 µm diam., dissepiments 27-267 µm wide. Hymenium composed only of basidia that are globose, soon collapsing, 7-14 x 8-20 µm, 4-spored (Fig. 60). Basidiospores of the "smooth" type, 9-13 x 5-8 µm, with a thick endosporium, light yellowish, ellipsoid, with numerous slender endosporic pillars that do not influence the perisporium, which is smooth and thin, thus appearing "smooth" when observed with the O. M. at 400 x (Figs. 26-33). Dermis of the "hymenodermis" type, composed of claviform elements with scant lumen

and blunt ends, originating from skeletal hyphae and arranged as in a hymenium, 7-16 µm diam., dermis 13-43 µm thick (Fig. 62). Hyphal system trimitic, with clamped, thin-walled generatives, with septa restricted to clamps, 1-6 µm diam., sparsely branched, abundant at the growth margin of the pileus and dissepiments (Fig. 71). Skeletals of the "arboriform" type, clampless, aseptate, with a thick, golden wall, with few branches limited to the distal end, 3-8 µm diam., very long, forming the bulk of the context and dissepiments (Fig. 68). Binding hyphae of the "Bovista" type, clampless, aseptate, of limited growth, thick-walled, in general thinner and paler than the skeletals, much branched, 1-4 µm diam. (Figs. 69-70), only present in the context, as a rule very scarce.

Hosts: on dead trunks of *Tipuana tipu* (dead as a result of the fungal attack); *Quercus suber* and undetermined hardwoods; at the base of *Cuenarina cuninghamiana, Platanus acerifolia, Ulmus procera, Acacia sp., Salix, Prosopis algarrobilla, Blepharocalyx tweedii* and *Robinia pseudoacacia*; also on stumps and roots of undetermined hardwoods. Domański et al. (1967) record it also on *Fagus* and *Alnus*, although rarely.

Distribution: SOUTH AMERICA: Argentina (Buenos Aires, Capital Federal, Córdoba, Corrientes, Misiones, Tucumán and Salta); Uruguay; Venezuela. NORTH AMERICA: U. S. (Connecticut to Missouri, Alabama, Louisiana). CENTRAL AMERICA: Cuba, Honduras, Jamaica. It has also been recorded from Euro-Asia and Africa (Central). It seems to have a world-wide distribution in temperate and tropical areas.

Holotype: *Fomes resinaceus Boud.* (PC!).

Material studied: ARGENTINA: Buenos Aires: Parque Pereyra Iraola, leg. Merlo, 15.IV.1969 (BAFC 24458); Llavallol, Santa Catalina, leg. Deschamps et al., 4.II.1973 (BAFC 24460); Castelar, leg. Quiroga, 1.V. 1979 (BAFC24450); San Fernando, leg. Doyle (BAFC 25532); Hway 2, km 100, leg. Wright & Deschamps, 24.IV.1971 (BAFC 25535);Martínez, leg. Wright, 21.II.1971 (BAFC 24461); San Miguel, Quinta Zemborain, leg. Campi, 22. IV.1944 (BAFC 25529);La Plata, leg. Spegazzini, 8.V.1909 (LPS 24880) Acassuso, leg. Soriano, 23.III.1949 (LPS 31293, sub *G. lucidum*); no locality, leg. Spegazzini, II-1918 (LPS 24868, sub *G. lorentzianum*);no data (LPS 24855). Capital Federal: Fac. Agronomía, leg. Maluh & Bargiela, 4-1-1979 (BAFC 24427); Golf Municipal, leg. Wright, 15.II.1968 (BAFC 24439); Villa Pueyrredon, leg. Romero, 16.II.1978 (BAFC 24440); Jardín Botánico, leg. Agullo, 27.IV.1978 (BAFC 24412); Jardín Zoológico, leg. Astort, 29.IV.1979 (BAFC 24445); leg. Deschamps & Rovetta, 16.III. 1972 (BAFC 24459). Córdoba: Alta Gracia, leg. Spegazzini, I.1925 (LPS 30989). Corrientes: 12 km NE of Curuzú Cuatiá, leg. Singer, 8.II.1964 (BAFC 24436). Entre Ríos: Concepción del Uruguay, La Salamanca, leg. Hawryszko, 16.XII.1961 (BAFC 24407); Colón, Parque Nac. El Palmar, La Calera, leg. Del Busto & Deschamps, 2.IV.1971 (BAFC 24430); Dept°Rosario del Tala, Palacio San José, leg. ipse, 9.IV.1971 (BAFC 24432); ibid., leg. Deschamps, 15.II.1972 (BAFC 25533); ibid, leg. ipse, 31.XII.1971 (BAFC 24434); Gualeguay, banks of Gualeguay River, leg. Wright, 27.I.

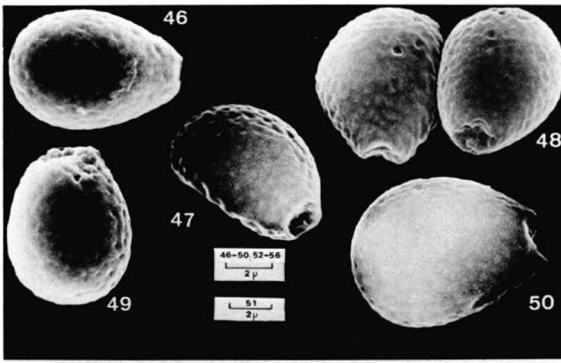
1951 (BAFC 24438); Salto Grande, leg. Deschamps, 31.XII.1971 (BAFC 24454); Gualeguaychú, Rincón de Lauda, leg. Tonni, 21.VII.1974 (BAFC 24457); ibid., Parque Unzué, leg. Deschamps, 25.XI.1978 (BAFC 25530); Arroyo Isletas, leg. Bettucci, 12.XII.1963 (BAFC 24431); no data (BAFC 24453). Misiones: Colonia Belgrano, leg. Gómez, II.1965 (BAFC 24420). Salta: Alemania, leg. Bettucci & Guerrero, 29.I.1965 (BAFC 24409), Tucumán: garden of Lillo Inst., leg. Wright, 27.II.1971 (BAFC 24411); San Javier, leg. Rosa Mato n°2186 (LPS 26190 ex MVM); no data (LPS 24866). CUBA: Prov. Santiago, Alto Cedro, leg. Earle & Murrill 536, 19/20.III.1905 (HOLOTYPE of *G. praelongum* Murr., NY); Prov. Habana: pr. Santiago de las Vegas, leg. Earle 658, 5.VII.1904 (HOLOTYPE of *G. argillaceum* Murr., NY). UNITED STATES: New York, Bedford Park, V-1902 (HOLOTYPE of *G. sessile* Murr., NY). BRITISH HONDURAS: Puerto Sierra, Rio Esperanza, leg. Wilson 607, 28.II.1903 (HOLOTYPE of *G. nitidum* Murr. NY). GRENADA: leg. Broadway, 4.XI.1905 (HOLOTYPE of *G. pulverulentum* Murr., NY). JAMAICA: Hope Gardens, leg. Earle 176, 26.X.1902 (HOLOTYPE of *G. subincrustatum* Murr., NY). URUGUAY: Dept°Canelones, Parque Nac. Carrasco, leg. García Zorrón, 16.V°1960 (MVHC 2473).

Steyaert (1972) studied the holotypes of *G. sessile, G. praelongum, G. argillaceum, G. resinaceum, G. polychromum, G. subperforatum* and *G. chaffangeonii*, and found that they all possessed identical micromorphological features, particularly the "smooth" type of spores, for which reason he considered them synonyms, the valid name of the species being *Ganoderma resinaceum* (Boud.) Pat. We have been able to study all the holotypes of Murrill's species deposited at NY and we agree with him, but found that to the above list must be added *G. nitidum* and *G. pulverulentum*, as well as *G. platense* Speg., the holotype of which was studied in detail (LPS).

The description of *G. subincrustatum* given in North American Flora by Murrill, does not agree with the holotype (Murrill, 1908: 122), since the spores are given as 8 x 4 µm, whereas our measurements are 9-11 x 6-8 µm. In the diagnosis of *G. nitidum* Murr., in the same paper, no mention is made of the spores; its holotype, according to our measurements, has spores measuring 9-13 x 5-7 µm.

Spegazzini (1926) reported from Argentina *G. lorentzianum* Kalchbr., including stemless, pleuropodal and centrally stipitate specimens, a concave, more or less infundibuliform pileus, and ovate, smooth to slightly ornamented spores measuring 10-12 x 5-7 µm; at first we believed they were mere forms of *G. resinaceum*, but a detailed study of them showed there were really significative differences between those specimebs and *G. resinaceum*. We do not know whether Spegazzini studied authentic materials of *G. lorentzianum* Kalchbr., and we were unable to locate the holotype in order to solve the

Figs. 46-50. Smooth type basidiospores of *Ganoderma subamboinense var. laevisporum* 46,49: from BAFC 24535; 47: from BAFC 25056; 48: from BAFC 25527; 50: from BAFC 25525. 51-56. Semirugose type of basidiospores of *G. zonatum*. 51-52: from the Holotype; 53,55: from BAFC 24416; 54: from BAFC 24449; 56: from BAFC 24414 (fig. 51, 9000 x; the rest are all 10000 x).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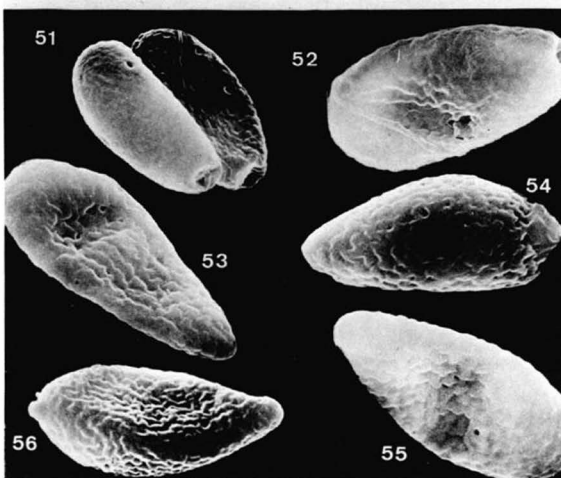
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problem.On the other hand of two other specimens identified as *G. lorentzianum* by Spegazzini at LPS, one has "smooth" type of spores and the other "semirugose" type. Thus, the former must be included in *G. resinaceum* and the latter in *G. tuberculosum*.

The study of the holotype of *G. lorentzianum* Kalchbr. would be important to ellucidate the cospecificity of this species with *G. resinaceum*, since should they prove to be the same, *G. lorentzianum* would be the valid name.

Cultural features Figs. 75-78; 88-93; 96-103.

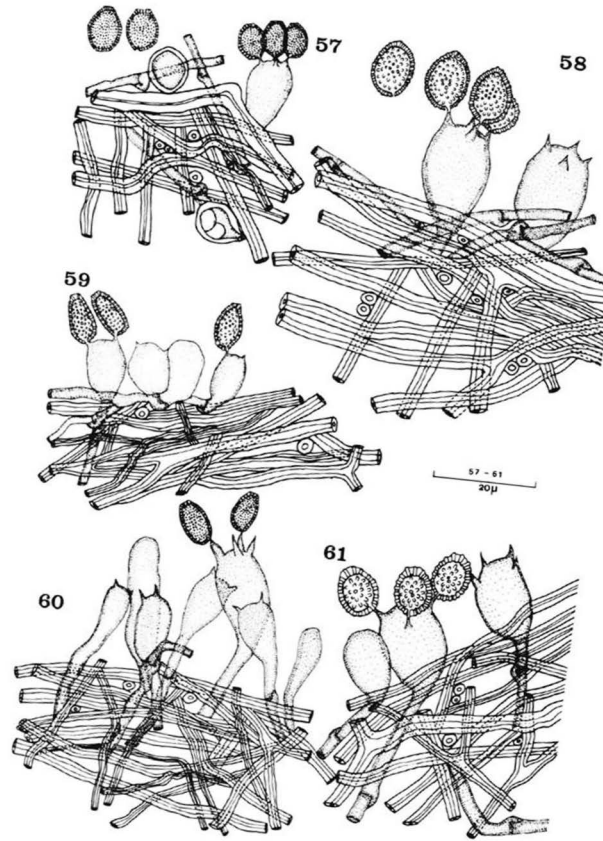
Strains: BAFC n°2221 = ARGENTINA: Buenos Aires, Llavallol (See BAFC 24460). BAFC n°2775 = Capital Federal, Villa Pueyrredon (see BAFC 24440). BAFC n°2354 = ibid. (see BAFC 24459). BAFC n°658 = ibid., Jardín Botánico (see BAFC 24412). BAFC n°2318 = ibid., calle Julian Alvarez y Aráoz. BAFC n°2813 = Entre Ríos, Arroyo Isletas (see BAFC 24431). BAFC n°228 = ibid., Dept°Rosario del Tala, Palacio San José (see BAFC 24432). BAFC n°2294 = ibid. (see 25533). BAFC n°443 = ibid., leg. Del Busto & Deschamps, 25.XI.1968. BAFC n°1009 = ibid., Gualeguay (see BAFC 24438). BAFC n°445 = ibid., Colón (see BAFC 24430). BAFC n°2576 = Tucuman: garden of the Lillo Inst. (see BAFC 24411). BAFC n°834 = CANADA, Ontario, Ottawa, 12.IX.1941 (DBFP 10222). BAFC n° 712 = ex NY 5191 sent by Dr. Robbins. BAFC n°716 = ex CBS 15222.

Code number: 2. 3. 8. (10). 34. 36. 37. 39. (42). (47). 54.

Macroscopic characters: growth moderately rapid, covering Petri dishes in 2-3 weeks. Mycelial mat transparent white at first, later remaining snow white with rather loose mycelium; in some cultures the inoculum becomes cream coloured with a few light yellowish zones appressed to the agar, irregularly distributed. Texture farinaceous during the first week at the inoculum, the rest subfelty, later the whole surface becoming farinaceous and the mycelium much denser (Fig. 102); in other cultures there is an alternation of dense, fan-shaped areas, with much less dense mycelium (Fig. 103), or zones that show alternation of dense and thin mycelium. Reverse: only altered in correspondence with zones of coloured mycelium, which becomes brown. Margin regular, smooth,with mycelium appressed to agar. Odour: slightly fungic to somewhat sweetish. Oxidase reaction: with tannic acid = ++++ with or without growth; with gallic acid = +++ or ++++ with or without growth; with gum guaiac = +.

Microscopic features: marginal mycelium: composed during the 1st week only of generatives, staining or not with phloxine, clamped, thin-walled with septa restricted to clamps, sparsely or not branched (Figs. 88-90), 2-6 µm diam. From the 1st to the 3rd weeks the following appear: i) "stag-horn" generatives, staining with phloxine, whose ends begin to branch out in numerous and very thin ramifications, mostly dichotomic, that become intertwined and form a dense reticulum (Fig. 92), 2-4 µm

Fig. 57 .Aspect of hymenium, basidiospores and gasterospores present in the dissepiments of *G. subamboinense var. laevisporum*. Fig. 58. Aspect of hymenium and basidiospores of *G. overatedii*. Fig. 59. Aspect of hymenium and basidiospores of *G. zonatum*. Fig. 60. Aspect of hymenium and basidiospores of *G. resinaceum*. Fig. 61. Aspect of hymenium and basidiospores of *G. lucidum*. (All figures 1500 x).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diam;ii) chlamydospores both intercalary and terminal, abundant, the first originating from generatives, the latter from the ends of stained generatives; thick-walled, golden, with dense contents, ellipsoid, spherical or ovoid, dextrinoid, 9-22 x 7-18 µm (Figs. 96-101); iii) fibrous hyphae that are clampless, aseptate, thick-walled, hyaline or pale, not staining, heavily branched, in some cases forming the bulk of the mycelium, 1-4 µm diam (Fig. 77-78); from the 3rd to 4th weeks, there appear "cuticular cells", hyaline, originating from globose ramifications of generatives, of very irregular shape and size, 10-30 µm each, much appressed and forming a pseudoparenchyma that may become very compact (Fig. 93). Inoculum: same features as the marginal mycelium. Yellowish zones: formed by the same elements as the rest of the mat but the "cuticular cells" have a thickened golden wall (Figs.75-76); in a few cases sclerotized clamped hyphae appear, with thick, golden walls, but are not abundant. Submerged mycelium composed of tortuous generative hyphae with thin walls, that may stain or not, and have short but numerous projections, 1-5 µm diam. (Fig. 91). Also chlamydospores similar to those of the margin and a few "cuticular cells" may be found.

Observations: Culture BAFC n°2354 was the only one that fruited in the Petri dishes after the 5th week, in the form of an elevated mound in which a great density of fibrous hyphae concentrated; on them the pores were formed with fertile hymenium composed of globose basidia and basidiospores of the "smooth" type, 8-11 x 5-6 µm.

There exists a difference that allows the separation of the strains in two obvious groups, while the remaining features are similar in all cases, namely, the presence or absence of "cuticular" cells. Strains BAFC n°2372, 277, 113 and 1009 always formed these cells. The rest did not. The basidiomes corresponding to these cultures did not exhibit any differences.

The cultural characteristics of the strains studied coincide with those given by Nobles (1948), excepting the "cuticular cells", which may or may not be present, and the reverse that darkens but does not appear to become discoloured, as mentioned by her. Concerning this aspect, Stalpers (1978) states that it discolours locally and becomes locally coloured, with which observation we agree. Cultures from the CBS and NY identified as *G. resinaceum* were studied and they also did not show "cuticular cells".

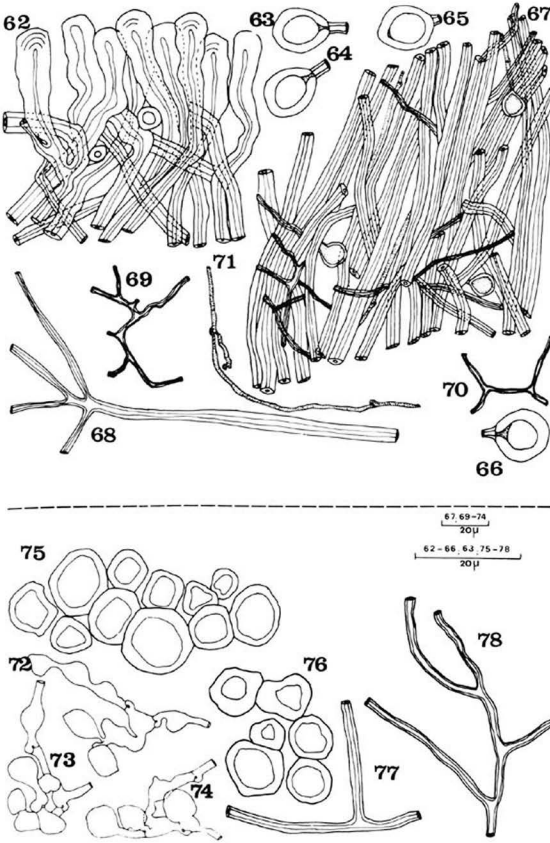
GANODERMA OERSTEDII (Fr.)Torrend, Broteria 17: 37. 1920.

=*Fomes oerstedii* Fr., Nov. Symb. Myc. p. 63. 1855 (S!). = *G. tuberculosum* Murrill, North Amer. Fl. 9 (2): 123. 1908 (NY!).

Figs. 13-16; 34-45; 58.

Annual, lignicolous, dimidiate to reniform, isolated, cometimes imbricate, sessile or stipitate, small to large, 10-40 x 5-25 x 2-10 cm.

Figs. 62-71. *G. subamboinense var. laeviporum*. 62: hymenodermis; 63-66: gasterospores from the context and dissepiments; 67: aspect of context; 68: skeletal hyphae; 69-70: binding hyphae; 71: generative hyphae. Figs 72-78: cultural features (continued next page)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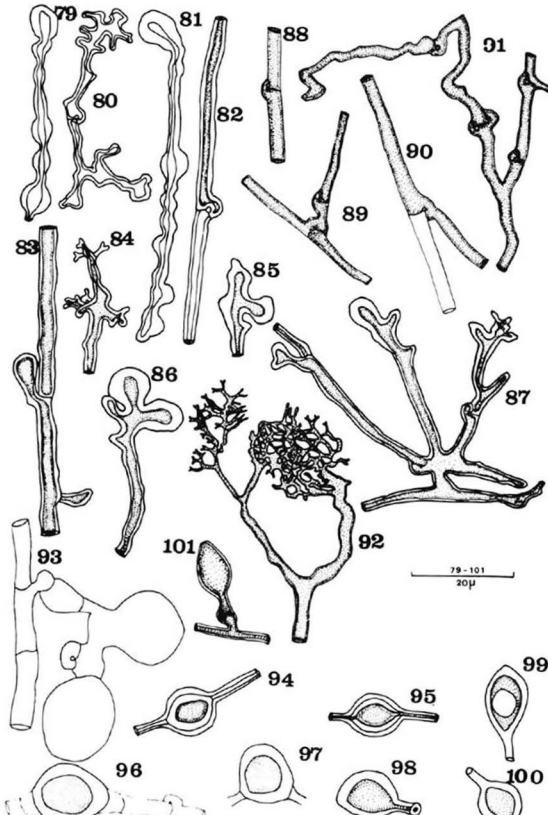
Pileus surface radially rugose and concentrically sulcate or strongly tuberculate, frequently umbonate behind, laccate, brilliant,but mostly appearing somewhat opaque due to the deposition of a thick layer of brown spores (Figs. 14, 16); central zone dark reddish brown (Pl. 56 L 12), almost black, to light reddish brown (Pl. 6 L 12), much lighter towards the margin; generally the young specimens exhibit a wide creamish yellow marginal band (Pl. 9 E 4) that becomes homogeneous dark in mature ones. Margin sterile, thin to thick, acute to blunt, smooth or wavy, white to cream-colour (Pl. 9 B 1) in actively growing specimens, then straight, reddish brown in adult specimens, then incurved. Stem dark reddish brown, laccate, brilliant, thin and cylindric to thick and depressed, 5,5-9 cm long, 1,1-5 cm wide. Section thin to thick, 1,5-5 cm deep at about half the radius, thickening towards the base. Cutis thin, black brilliant. Context corky, brown (Pl 13 E 8), with a thin darker band over the tubes, or homogeneous dark brown (Pl. 7 C 11), up to 7 cm thick. Dermis of the "hymenodermis" type, composed of claviform tips of skeletal hyphae arranged like a hymenium, lumen small and blunt ends, 6-14 µm diam., 17-40 µm wide (Fig. 62). Hymenophore poroid, greyish white to yellowish (Pl. 9 J 5) darkening sometimes with age; pores small, circular to somewhat irregular, 4-6 per mm, 70-270 µm wide (Figs. 13, 15); tube layer slightly lighter than context, up to 3 cm thick; dissepiments 27-180 µm thick. Hymenium composed only of scant globose, 4-spored basidia, 9-16 x 9-10 µm (Fig. 58). Basidiospores of the "semirugose" type, brown in mass, broadly ellipsoid to almost ovoid (Figs. 34-45), with truncate apex, hyaline perisporium smooth and thin, endosporium thick, golden brown, with numerous endosporic pillars reaching the perisporium, rumpling it slightly and making it appear slightly rugose, 9-14 x 6-9 µm. Hyphal system trimitic with clamped, thin-walled generatives with septa restricted to clamps, unbranched, 2-4 µm diam., almost always restricted to dissepiments (Fig. 71).Skeletals of the "arboriform" type, clampless, aseptate, with a thick, golden wall,subsolid, with a

72-74: formation of "cuticular cells" from globose branches of generative hyaline hyphae; 75-76: thick-walled "cuticular cells"; 77-78: fibrous hyphae.

Figs. 79-93. Cultural features of *G. subamboinense var. laeviporum* and of *G. lucidum*. 79-82: sclerotized hyphae which are identical in both species, in 79 and 81 with thickenings that make them appear like rosary beads; in 80 only in the former species, with irregular branches and also unbranched. Figs. 83-87. *G. ceratedii*. Cultural features. Sclerotized hyphae with 83: short branches, 84: with numerous branches in all planes, 85-87: with claviform ends; 88-91: thin-walled generative hyphae, 88-90 from aerial mycelium; 91: from submerged mycelium; 92: "staghorn" hyphae; 93: formation of hyaline "cuticular cells". Figs. 94-101: chlamydospores. 94-95: double-walled chlamydospores of *G. subamboinense var laeviporum*. 96-97: simple-walled intercalary chlamydospores; 98-101: terminal ones (all figures 1500 x).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few restricted branches at the apical end (Fig. 68). Binding hyphae aseptate, unclamped, with limited growth, heavily branched, thick-walled, generally thinner and paler than skeletals, 1-4 µm diam., only present in the context (Figs. 69-70).

Hosts: on stumps of undetermined hardwoods, fallen trunks, dead *Quercus suber*, *Pinus spp.*, *Cootea acutifolia*, *Casuarina cunninghamiana*, *Spiraea cantoniensis*, *Scutia buxifolia* and *Lonchocarpus sp.*

Distribution: ARGENTINA (Buenos Aires, Córdoba, Corrientes, Entre Ríos, Misiones and Tucumán). Murrill (1915) records it on dead wood in British Honduras, Panamá and Western Jamaica; Dennis (1970) records it for Guyana.

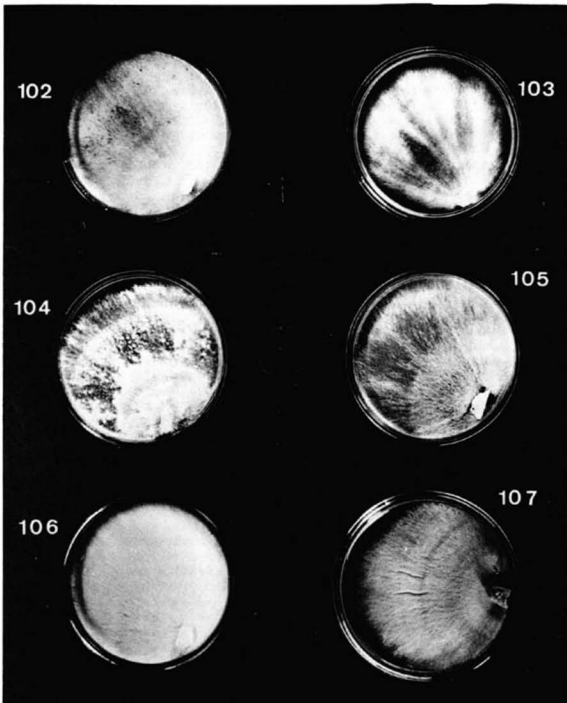
Material studied: ARGENTINA: Buenos Aires: Acassuso, leg. Sauval, 17.IV.1980 (BAFC 25528); Punta Lara, leg. Wright, 21.II.1971 (BAFC 24441 24423); Gral Alvear, leg. Di Riccio, 10.IV.1968 (BAFC 24410, 24411). Córdoba: Salsipuedes, leg. Godeas, 5-III-1973 (BAFC 24442). Corrientes: Saladas, Paso Naranjito, marginal forest of Río Santa Lucía, leg. Rovetta et al., 12.VII.1973 (BAFC 24413); Mburucuyá, Estancia Santa Teresa, leg. Wright et al., 16.VIII.1972 (BAFC 24424); Dept°Monte Caseros, Río Uruguay, Isla Itacumbú, E bank, leg. Irigoyen, 20.XII.1977 (CTES 438). Entre Ríos: Salto Grande, leg. Deschamps, 31.XII.1971 (BAFC 24426). Misiones: Parque Nacional Iguazú, Cataratas, leg. Wright et al.,25-X-1973 (BAFC 24437). Tucumán: no data (LPS 24866 as *G. lorentzianum*); no data (LPS 24869); no data (LPS 2497 as *G. orbiforme*). BRITISH HONDURAS: leg. M. Peck (HOLOTYPE of *G. tuberculosum* Murrill, NY). COSTA RICA: leg. Oersted (HOLOTYPE of *Fomes oerstedii* Fr., S; part at BPI).

Observations: Our materials coincide with the features of the holotype in everything except that their spores are somewhat more polymorphic, varying from ellipsoid to broadly ellipsoid. Some specimens resemble macromorhologically *G. resinaceum* (Boud.)Pat., but can be readily distinguished from this species by the basidisopores that are of the "smooth" type, and the number of pores per mm. This is the first record for Argentina. Steyaert (1980) places this species in his Section Characoderma on the basis of the thinner hyphae ending in a sphaeroid, which form the hymenodermis. We believe this feature is sufficiently variable to invalidate this proposal, precisely because in the present species such character, as Steyaert (loc. cit.) himself states, is intermediate in nature.

Cultural features Figs. 33-92; 104-105.

Strains: BAFC n°218 = ARGENTINA: Buenos Aires: Gral Alvear (see BAFC 24411). BAFC n°178 = ibid. (BAFC 24410). BAFC n°2249 = Córdoba:

Figs. 102-103. Cultural features of *G. resinaceum*. 102: strain BAFC n°2576; 103:strain BAFC n°113. Figs. 104-105. Cultural features of *G. oerstedii*. 104: strain BAFC n°218; 105: strain BAFC n°2249. Fig. 106: Cultural features of *G. subamboinense var. laevisporum*. Fig. 107: Cultural features of *G. lucidum s. str.* strain BAFC n°112 (all figures illustrate 3 week old cultures).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Salsipuedes (BAFC 24442). BAFC n°2382 = Corrientes: Saladas (BAFC 24413).

Code number: 2. 3. 8. 10. 32. (34). 36. 37. 39. 42. (43). 53. 54.55.

Macroscopic characters: growth rapid, covering Petri dishes in 2-3 weeks. Mycelial mat subfelty and white, at first transparent, later becoming totally farinaceous with yellowish zones (Pl. 13 K 5), irregularly arranged on the inoculum and the margin opposing it (Fig. 105),which may reach a large surface, or closely packed, felty at the inoculum, borders and discrete mounds irregularly scattered, somewhat elevated, later becoming confluent with ochraceous yellowish zones (Pl. 9 K 5), irregularly appearing on a dense mycelium (Fig. 104). Odour sweetish. Reverse altered in correspondence with the areas of coloured mycelium, becoming light to dark brown. Oxidase reaction: with tannic acid = ++++ with or without growth; with gallic acid = +++ with or without growth; with gum guaiac = +.

Microscopic features: Marginal mycelium during the 1st week composed mainly of generative, clamped hyphae with septa restricted to clamps, thin-walled, scarcely or not at all branched; in general, the branches originate at the clamps staining with phloxine, or hyaline, 1-4 µm diam. (Figs. 88-90); during the 1st or 2nd week, "stag-horn" hyphae appear, clamped, staining well, with dichotomically branched tips, developing numerous and very thin ramifications (less than 1 µm diam.), very intrincate and intertwined (Fig. 92); fibrous hyphae clampless, aseptate, hyaline, with a pallid thick-wall, heavily branched, 1-2 µm diam., these appear mostly the 2nd week, and when the margin becomes dense these constitute the bulk of the mycelium; otherwise they are not so numerous (Figs. 77-78); intercalary chlamydospores arising along clamped generativess, spherical to ellipsoid, with dense contents, 8-18 x 5-11 µm, very abundant or totally absent (Figs. 96-97). White farinaceous mycelium is composed of: i) generatives like those of margin, scarce; ii) "cuticular cells", hyaline, originating from globose ramifications of hyaline generatives (Figs. 72-74), very abundant, arranged in an appressed pseudoparenchyma, of various shapes, globose to very irregular; each element 4-30 µm diam.; iii) chlamydospores as those described above. Yellow farinaceous mycelium: with same elements as former, but the "cuticular cells" have golden, thick walls (Figs. 75-76); generatives with sclerotized golden walls are also present, which stain well with phloxine, and bear short branches, 1-4 µm diam.(Fig. 83). Zone of dense mycelium and elevated mounds: formed mainly by fibrous, abundant hyphae, with same features as those of margin; "cuticular cells" also present, mainly hyaline, as well as stag-horn hyphae. The zones of dense mycelium that become yellowish are formed by sclerotized clamped hyphae or not, sometimes very abundant, with a golden thick wall, scant lumen and claviform ends similar to the elements of the dermis of the basidiome, or numerous small branchlets branching in all planes, 2-9 µm diam. (Figs. 84-87). Submerged mycelium: formed by the same elements as the marginal, but generatives are more tortuous and possess numerous short branchlets (Fig. 91).

This species has not been described in culture before.

Numerous differences are observed between strains 178 and 218, and between strains 2383 and 2249. The first two exhibit a tight felty texture (Fig. 104) complete absence of chlamydospores, abundance of fibrous hyphae and less proportion of "cuticular cells"; the latter two present a farinac-

œoustexture (Fig. 105), presence of intercalary, dextrinoid chlamydospores, smaller proportion of fibrous hyphae, and compact pseudoparenchyma of abundant "cuticular cells". Coincident with these differences, the basidiomes from which strains 218 and 178 were obtained, have larger pores than the remaining specimens studied, the average being 4 pores per mm. Until further studies on interfertility can be carried out that could prove whether these differences are significant, it is preferable to maintain these materials as *G. oerstedii*.

GANODERMA ZONATUM Murrill, Bull. Torrey bot. cl. 29: 606. 1902; North Amer. Fl. 9 (2): 120. 1908.

= *G. sulcatum* Murr., ibid. 29: 607. 1902; North Amer. Fl. 9 (2): 120. 1908 (NY).

Figs. 17-22; 51-56; 59.

Annual, isolated, dimidiate and laterally stipitate, or several pilei imbricate on a common stem, 6-20 x 4,5-20 x 0,5-5 cm. Pileus surface smooth or concentrically sulcate, usually with 1-3 furrows, the inner one usually deeper, thus exhibiting a wavy appearance, sometimes also radially rugose; laccate, brilliant, central zone reddish brown (Pl. 7 I 11) becoming lighter towards the margin, with a narrow orange brownish marginal band (Pl. 12 D 11), often delimited by the external furrow and the margin (Figs. 17, 19-20). Margin sterile, blunt, straight, yellowish whitish (Pl. 11 B 1). Stem concolorous with pileus, laccate, brilliant, 3,5-5 cm long, 2-4 cm wide, vertical,cylindric or depressed. Section 8-10 mm deep at about half the radius, thicker at the base. Cutis thin, black, brilliant. Context brown (Pl. 14 C 12), slightly lighter at the surface of pileus, 3-44 mm thick, corky, soft. Dermis of the "hymenodermis"type, composed of the claviform ends of skeletal hyphae arranged in a palisade-like hymenium, 6-11 µm diam., with small lumina, blunt ends and thick, golden walls; dermis 17-33 µm thick (Fig. 62). Hymenophore poroid, tube layer 1-5,5 mm long, slightly lighter than context (Pl. 13 C 8), decurrent on stem, concolorous with margin, pores 3-5 per mm, 98-267 µm diam., circular to subangular, greyish to slightly brownish upon maturation (Figs. 18, 21-22); dissepiments 30-89 µm. Hymenium not persistent, composed only of scant basidia, 4-spored, 11-17 x 7-11 µm (Fig. 59). Basidiospores of the "semirugose" type, very characteristic, ellipsoid, long and slender, with truncate apex or, more frequently, rounded, 11-14 x 5-7 µm, perisporium hyaline, smooth and thin, endosporic pillars numerous, reaching the perisporium and slightly rumpling it, thus making it appear slightly rugose; endospore golden and thick (Figs. 51-56). Hyphal system trimitic, with hyaline, thin-walled, clamped generatives, with septa restricted to clamps, sparsely or not at all branched, 2-4 µm diam., present in the growth margin of pileus and dissepiments (Fig. 71). Skeletals of the "arboriform" type, long, with a thick, golden wall, clampless, aseptate, with 2-3 branches of same diam. as

mother hyphae at distal end (Fig. 68), 3-6 µm diam., the most abundant in the context and dissepiments. Binding hyphae of the "Bovista" type, clampless, aseptate, of limited growth, heavily branched, generally thinner and lighter than skeletals, 1-3 µm diam., thick-walled, restricted to the con text (Figs. 69-70).

Hosts: on dead stem of palm (*Butia yatay*) and dead wood and roots of living *Tipuana tipu*.

Distribution: U. S. (Florida, Georgia); ARGENTINA (Corrientes and Entre Ríos).

Material studied: ARGENTINA: Corrientes: Dept°Cosme, Paso de la Patria, leg. Singer, 5.IV.1957 (BAFC 24416); Mburucuyá, Estancia Santa Teresa, leg. Pedersen, 29.III.1977 (BAFC 24414). Entre Ríos: Parque Nacional El Palmar, leg. Mercuri, 25.II.1979 (BAFC 24449). UNITED STATES: Florida leg. Underwood, 1914 (HOLOTYPE , NY!); ibid., leg. Lloyd, I.1897 (HOLOTYPE of *G.sulcatum* Murr., NY!). CUBA: leg. Murrill (BAFC 25601, as *G. tuberculosum*).

It was not possible to obtain cultures of this species.

According to Murrill, the only differences between *G. zonatum* and *G. sulcatum* lie in the pileus surface. Both holotypes were studied in detail, their microscopic features being identical, especially the basidiospores, which are long, slender, ellipsoid, "semirugose" and of the same size. Pores are identical. All this coincides with the Argentine specimens(their spores being very slightly more rugose). We do not agree with Murrill's description in North American Flora, since our measurements of the spores from the holotypes are 11-14 x 5-7 µm and not 8-10 x 4-6 µm as he states, and the pores are 4-5 per mm and not 3-4.

We agree with Steyaert and Overholts that both species are synonyms. The former revised the holotypes in 1962 established their identity, and the latter published them as synonyms but as varieties of *P. lucidus* Leys.:Fr. under the epithet *P. lucidus var. zonatum* (Murr.)Overh. Only interfertility studies will be able to prove whether or not this taxon can be separated from *G. lucidum*. For the time being we prefer to consider it as separate.

DISCUSSION

According to our studies, the *G. lucidum*-complex would thus appear to be represented in Argentina by five species, namely, *G. lucidum s. str.*, *G. resinaceum* (Boud.)Pat., *G. zonatum* Murr., *G. oerstedii* (Fr.)Torrend, and *G. subamboinense* P. Henn. var.*laevisporum* var. nov. Spegazzini (1926) recorded other species for Argentina, which we have been unable to find in his herbarium, namely *G. cupreum*, *G. sceleton* and *G. fornicatum*. *G. platense* Speg., whose holotype was studied, resulted another synonym for *G. resinaceum*. Additional synonyms for this species proved to be *G. pulverulentum*, *G. nitidum* and *G. subinarustatum*. The question of the validity of *G. multiplicatum* var.*vitalii* Steyaert, *G. lorentzianum*

Kalchbr., and *G. orbiforme* Fr. remains pending a thorough study of their respective holotypes.

Since other holotypes and authentic materials of species that have as yet not been found in Argentina were studied, but were recorded from other South American countries, a preliminary general key for the complex has been included in this paper.

The type of dermis is useless for the separation of species, but permits the separation of "complexes" of species, such as in the present case. In this we agree with Steyaert (1972, 1980) and Imazeki (1939); they considered the existence of three or four (Steyaert, 1980) subgenera on this basis. Regarding the hyphal system of basidiome construction, our results confirm those obtained by Hansen (1958).

Cultural studies did not exhibit significative differences and ought to be used with caution. We attempted several methods for germinating spores with the hope of obtaining monosporous cultures in order to verify interfertility patterns, but were unsuccessful. This had been done previously by Merrill (1970) with similar results. We also tried the methods proposed by Aoshima (1953) and Brown (1970) for spores of *G. applanatum*,but also failed. We did not test Lim's method (1970). Equally unsuccessful were our attempts to obtain monokaryotic mycelia from dikaryotic ones (dedikaryotization). More studies in this line are urgently needed.

ACKNOWLEDGEMENTS

We wish to express our gratitude to the Instituto Forestal Nacional (IFONA), of Argentina, for granting Miss Bazzalo a fellowship for this study; to the Curators of the herbaria of the New York Botanical Garden, Jardin Botanique National de Belgique, Instituto "Carlos Spegazzini" and Instituto de Botánica del Nordeste (Corrientes) for the generous loan of holotypes and other specimens in their keeping; to Mr. Emilio Del Busto, in charge of the culture collection of the Mycology Laboratory, for his unflinching cooperation in our cultural work; to the SEM Service of the Consejo Nacional de Investigaciones Científicas y Técnicas, for the work on spore ornamentation, and to the many colleagues who have at different times and in different ways made this work possible. Special thanks are due to Dr. Leif Ryvarden (Oslo), Frances F. Lombard and Michael Larsen (Madison) for critically reading the typescript and making invaluable suggestions.

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NOTE.

After this paper was ready for the printer, two works related to a new species of the Ganoderma lucidum-complex from Europe came to our attention. Jahn, Kotlaba & Pouzar (Westfälische Pilzbriefe 9 (6): 97-124, 1979/1980) *described Ganoderma atkinsoni n. sp., very akin to G. lucidum, but differing by its rugose, wider spores measuring (9,8)-10,4 -12,5 (-13,5) x (6,8)-7,3-7,8 (-8,5) µm, often larger carpophores, the dark colour of the pileus and other substrates, mostly conifers. This species had been named G. pseudoboletus (= G. lucidum) forma montanum by Atkinson.* Kotlaba & Pouzar (Ceská Mycologie 35 (3): 121-133. 1981) *added further data on this species, which seems restricted to Central Europe and Great Britain.*

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TWO NEW SPECIES OF HELOTIALES FROM THE EASTERN HIMALAYAS

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During fungal forays undertaken by the senior author to the Eastern Himalayan regions of India and part of Bhutan, several interesting taxa belonging to the Helotiales have been collected. These include two new species belonging to the genera Bisporella Sacc. and Crocicreas Fr. emend. Carpenter, described and illustrated here.

Bisporella calycellinoides R. Sharma & Korf, **sp. nov.**

[FIGS. 1, 2]

Apothecia gregaria, parva, sessiles, cupuliformes, cremea ad brunneola, ad 1.5 mm diam., extus minute puberula, as basim annulo brunneo. Hymenium dilutum aurantiacum, in sicco cyathiformis, peraurantiacum. Asci octospori, poro iodo caerulescente, 58-65 x 6.5-7.5 µm, cylindracei-clavati, e uncis natis. Ascosporae hyalinae, biseriatae, guttulatae, guttulae polares, 9-11 x 2-3 µm, fusiformes, inaequilaterales. Paraphyses lanceolatae, septatae, leviter tumidae sub apice, ramosae, ad 6 µm latae, ascos superantes ad 18 µm. Excipulum ectalum ex textura intricata ad 36 µm latum, hyphae e cellulis parietibus incrassatis, cellulae plusminusve rectangulares. Excipulum medullatum ex textura intricata, ad 44 µm latum, hyphae hyalinae, cellulae leptodermaticae, ad 2 µm diam. - Holotypus: In foliis mortuis, Bhutan, Nawephu, Sept. 18, 1980; Raghunandan Sharma, PAN 17518. In herbario universitatis Panjab Cryptogamarum, Chandigarh.

Apothecia gregarious, small, sessile, cupulate, hymenium light orange, margin and external surface cream coloured, minutely downy, up to 1.5 mm diam, with a dark brown ring at the point of attachment, hymenium becoming deep orange, apothecia becoming more cupulate on drying. **Asci** 8-spored, J+, 58-65 x 6.5-7.5 µm, cylindric-clavate, base slightly swollen, apex round, arising from croziers. **Ascospores** hyaline, biguttulate, guttules polar, 9-11 x 2-3 µm, fusoid, inequilateral, biseriate. **Paraphyses** lanceolate, swollen a little below the apices, branched, septate, up to 6 µm broad, projecting up to 18 µm beyond the ascus tips. **Excipulum** differentiated into two zones: **ectal excipulum** up to 36 µm thick, of thick-walled, gelatinized, undulating hyphae, cells hyaline, 11 x 5.5 µm, somewhat rectangular; **medullary excipulum** of textura intricata, up to 44 µm thick, hyphae hyaline, thin-walled, up to 2 µm broad. **Hairs** formed when outermost cells are drawn out into small, smooth, 1-septate, hyaline hairs with obtuse tips, up to 18.5 x 3.5 µm, giving the apothecium its downy appearance. Hyaline hyphae near the base of the apothecium were up to 2 µm in diam, and observed to penetrate the host.

ETYMOLOGY: Refers to the calycellinoid ring at the base of the apothecia.

HABITAT: On dead angiosperm leaves.

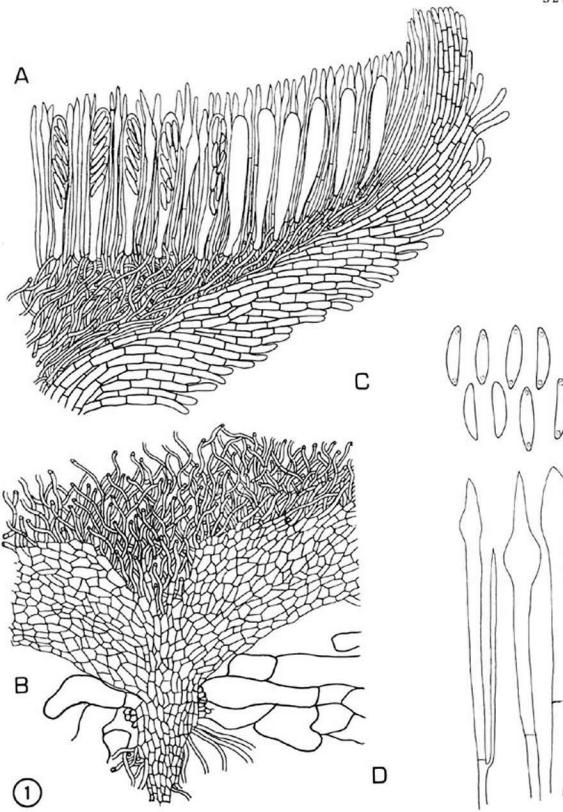


FIG. 1. **Bisporella calycellinoides.** A. Transverse section through margin. B. Transverse section through base of apothecium. C. 8 ascospores. D. 3 paraphysis apices. A, B: x 500; C, D: x 1000. (del. R. Sharma)

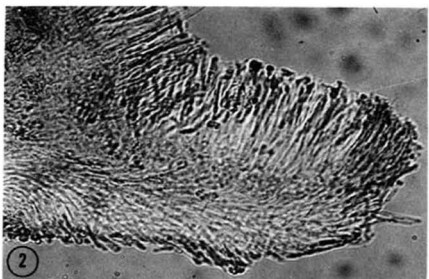
TYPE LOCALITY: Bhutan: Nawephu.

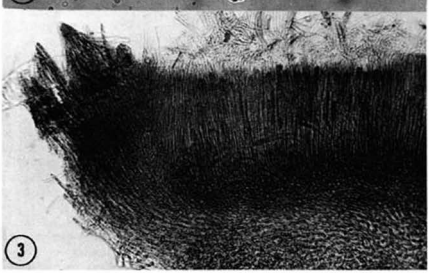
HOLOTYPE: PAN 17518, R. Sharma, September 18, 1980; ISOTYPE: CUP-IN 612.

NOTES: The undulating, thick-walled, gelatinized ectal tissues place this species in Bisporella. The habit on leaves, and the distinct brown basal ring immediately recall Calycellina, as does the yellow colour. In both genera hair-like processes are formed in some species.

Crocicreas carpenteri R. Sharma & Korf, **sp. nov.** [FIGS. 3, 4]

Apothecia sparsa, parva, sessiles, nigra, in sicco porphyrea, cupuliformes, ad 1 mm diam. Extus pilosus, pili saepe fasciculati, ad marginem formans dentes, cylindracei, contracti versus apicem, atrobrunnei, multiseptati (ad quatuordecimseptati), pachydermi, aspri granulis, ad 130 µm longi, cellulae ad 11.5-3.5 µm, parietes cellularum ad 2 µm crassi. Hymenium dilute brunneum. Asci octospori, poro jodo non caerulescente, 90-108 x 7.5-9 µm, apex rotundatis, incrassatus ad 2.0 µm. Ascosporae hyalinae, multiseptatae (at maturatim usque ad septemseptatae), 15.5-21 x 2.5-3.5





FIGS. 2, 3. Transverse sections through margins, x 500. FIG. 2. **Bisporella calycellinoides.** FIG. 3. **Crocicreas carpenteri.** (photos: R. Sharma)

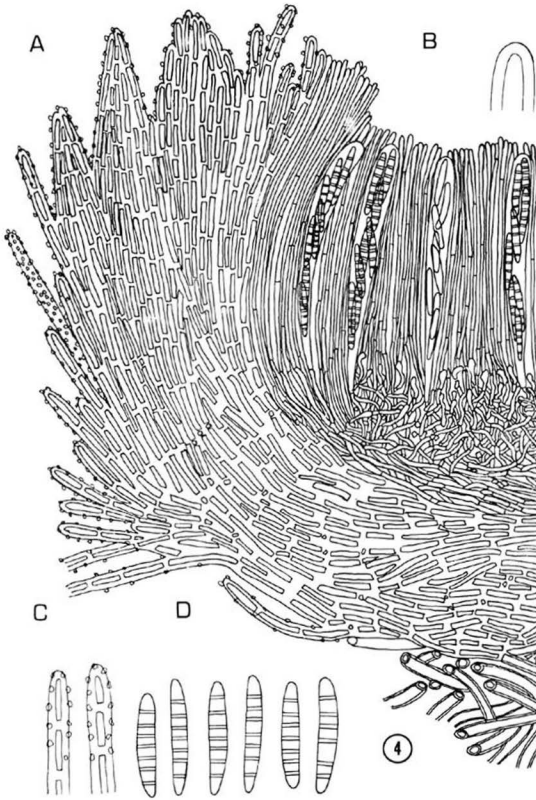


FIG. 4. **Crocicreas carpenteri.** A. Transverse section through margin. B. Ascus apex. C. Two apices of granulate hairs. D. 6 ascospores. A: x 500; B-D: x 1000. (del. R. Sharma)

µm, cylindraceae, rectae vel curvatae, biseriatae, in extremitatibus rotundae. Paraphyses filiformes, ramosae, septatae, usque ad 1 µm latae, ascos superantes ad 8 µm. Excipulum ectalum ex textura oblita, gelatinosum, cellulae hypharum pachydermae vitreaeque, usque ad 32 x 5.5 µm. Excipulum medullatum ex textura intricata, hyphae hyalinae leptodermeae usque ad 2 µm latae. - Holotypus: In ligno decorticato, Darjeeling (W. B.), Aug. 20, 1980; Raghunandan Sharma, PAN 17406. In herbario universitatis Panjab Cryptogamarum, Chandigarh.

Apothecia scattered, small, saucer shaped, hairy, margin strongly incurved, up to 1 mm diam, external surface black, the margin shining due to the granularly roughened apices of the hairs, hymenium light brown. **Hairs** cylindrical, tapering towards the apices, dark brown, granularly roughened, thick-walled, multiseptate, up to 14-septate and 130 µm long, cells up to 11.5 x 3.5 µm, wall of cell up to 2 µm thick, hairs often cemented together to form **teeth**, particularly at the margin. **Asci** J-, 8-spored, 90-108 x 7.5-9 µm, apex hemispherical, up to 2 µm thick. **Ascospores** hyaline, up to 7-septate at maturity, 15.5-21 x 2.5-3.5 µm, cylindrical, curved, with round ends, arranged more or less biseraitely. **Paraphyses** filiform, hyaline, branched, septate, up to 1 µm wide at the apices, not swollen, projecting up to 8 µm beyond the ascus tips. **Excipulum** differentiated into two zones: **ectal excipulum** of textura oblita, up to 84 µm thick, cells very thick-walled, up to 32 x 5.5 µm; **medullary excipulum** of textura intricata, up to 29 µm thick, hyphae hyaline, up to 2.0 µm wide.

ETYMOLOGY: In honour of S. E. Carpenter, monographer of the genus.

HABITAT: On decorticated angiosperm wood.

TYPE LOCALITY: India: 6th mile, Darjeeling (W. B.).

HOLOTYPE: PAN 17406, R. Sharma, August 20, 1980; ISOTYPE: CUP-IN 608.

NOTES: Though in some respects this species recalls Xylogramma Wallr., its affinities are surely in Crocicreas, though it is clearly distinct from any of the 54 taxa accepted by Carpenter (**1981**).

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REVUE DES LIVRES

par

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PREDOMINANTLY HOLOCARPIC AND EUCARPIC SIMPLE BIFLAGELLATE PHYCOMYCETES, by John S. KARLING, 252 p., 64 plates, Din, hard cover, 1981, J. Cramer, FL-9490 Vaduz, Lichtenstein.

This large size Cramer's edition is appropriate for the publication of the 64 ful-page plates of line drawings beautifully prepared by the author for the illustration of the 150 species described and which so much remind the high quality Thaxter's line drawings.

The species are classified in 7 families on the basis of thallus structure, developmental cycles and the methods of asexual and sexual reproduction. As the way of reproduction and of production of resting spores are unknown in many species, the limits of the genera are not sharply defined and their classification in coherent families is only tentative. Such classification is nowaday however provided as an aid in identification and a means of reference. The distinction between holocarpic and eucarpic organisms is not a clear cut and intermediate reproduction is found. The expression "predominantly holocarpic" is thus prefered. Two new species and one new combination are established. The 31 unnamed species however described demonstrate the state of constant progress in that field of taxonomy.

THE AGARIC GENERA LENTINUS, PANUS, AND PLEUROTUS, with particular reference to Malaysian species, by E.J.H. CORNER, in Beihefte zur Nova Hedwigia, part 69, 169 p., 2 pl., 40 fig., 8°, hard cover, 1981. J. Cramer, FL-9490 Vaduz, Lichtenstein.

Lentinus Fr. is redefined with skeleto-binding hyphae and relates with *Polyporus* sensu stricto. *Panus* Fr. is defined with long intercalary or terminal skeletal hyphae without binding hyphae. *Pleurotus* Fr. is either dimitic with tapering terminal skeletal hyphae without lateral branched binding hyphae and with thickened generative hyphae, or monomiti *Panus* and *Pleurotus* relate with other polyporoid genera. Ten *Lentinus* species and one variety are described, 7 of which are Malaysian. Twenty species and 7 varieties are described in *Panus*, amongst them 12 species and the 7 varieties are Malaysian. *Pleurotus* includes 10 non Malaysian species and 23 species and 8 varieties from Malaysia. Many of these Malaysian taxa are new.

HIGHER TAXA OF BASIDIOMYCETES, by Walter JÜLICH, in Bibliotheca Mycologica n° 85, 485 p., 20 pl., 34 fig., 8°, hard cover, 1981. J. Cramer, FL 9490 Vaduz, Lichtenstein. Price: DM 120./150.-

The author proposes a new classification of the Basidiomycetes based on microscopical characters such as basidia, basidiospores and

hyphal structure. He also emphasizes the phylogenetic relationships between members of traditional groups like Agaricales, Aphyllophorales and Gastermycetes in the Homobasidiomycetes. Interesting relationships are shown also in the Heterobasidiomycetes. In the Gasteromycetes, microscopical studies should also reveal more evidences of affinities. A general phylogenetic scheme is proposed in which the Cantharellales and the Auriculariales take the oldest position.

The class Homobasidiomycetes is subdivided in 12 unnamed groups of orders which are 49 all together. The Tricholomatales, the Entolomatales, the Amanitales and the Pluteales are segregated in the group 6 from the Agaricales (group 7). The Sclerodermatales, the Melanogastrales, the Leucogastrales and the Tulostomatales are with the Agaricales in Group 7. The Russulales are grouped with the Bondarzewiales and the Hericiales in group 3. The author's hope is that the resulting classification is a more natural one.

In the special part of the book, characteristics and affinities of each family and higher taxon, many of which are new, are detailed and illustrated with line drawings and SEM spore photographs.

THE RESUPINATEN PHELLINUS-ARTEN IN MITTELEUROPA, mit Hinweisen auf die resupinaten Inonotus-Arten und Poria expansa (Desm.) (=Polyporus megaloporus Pers.), by H. JAHN, Bibliotheca Mycologica n° 81, 152 p., 21 fig., 61 phot., 8°, paper back, reprint 1981. J. Cramer, FL 9490 Vaduz, Lichtenstein.

The text consists of a paper reprinted from the Westfälische Pilzbriefe, 4(3-6):37-108, 1966-1967 followed by an original supplement, subtitled "Nachträge 1967-1981 (Fig. 13-21)" of 43 pages. In these papers the author demonstrates the anatomical differences between the two related genera *Phellinus* and *Innonotus*. He provides comments on the characteristics and the ecology of 16 *Phellinus* species and 5 *Inonotus* species. Keys are proposed for both genera. *Boletus expansum* Desm. (syn. *Polyporus megaloporus* Pers.) was renamed *Poria expansa* in 1967 and later *Donkiopora expansa* by Kotlaba and Pouzar; this species is also considered for its similarities to *Phellinus*.

STRUKTUR UND FUNKTION MITOCHONDRIALER DNA BEI PILZEN, by H.-U. KÜCK, in Bibliotheca Mycologica n° 84, 148 p., 19 fig., 8°, paper back, 1981, J. Cramer, FL-9490, Lichtenstein.

In this thesis, the author reports the isolation and characterization of the mitochondrial DNA from two fungi, a yeast, *Saccharomycopsis lipolytica*, and a filamentous ascomycete, *Podospora anserina*. In both species the mitochondrial DNA is a circular molecule with a GC contents (27.5 and 34.0 % respectively) lower than that of the nuclear DNA. The length of the molecule reaches 15.4 µm in *Saccharomycopsis lipolytica* and 32.8 µm in *Podospora anserina*. In the later species, the mtDNA is only recognized in a juvenile state but changes into a plasmid-like DNA of maximum circular length of 9.6 µm composed of monomere of 0.75 µm in length in the senescent state of growth. The author has been able to clone such plDNA in *Escherichia coli*.

THE BIOLOGY AND CULTIVATION OF EDIBLE MUSHROOMS, by S.T. CHANG and W.A. HAEYES, xxii + 819 p.,8°, hard cover, 1978. Academic Press, New York.

Since 1965, at the International Mushroom Congress in Amsterdam, the cultivation of mushrooms other than *Agaricus bisporus* started in Western Europe, while several species where already cultivated in the Eastern world, Japan and China, f.i. *Tricholoma matsutake*.

This book is the first comprehensive treatise available on the general biology and the culture technics of the different kinds of mushrooms now in cultivation. These are the fungi that grow on almost fresh plant residues (*Lentinus, Pleurotus, Flammulina, Auricularia, Pholiota, Tremella, Agrocybe, Ganoderma, Coprinus*), the fungi that grow on only little composted material (*Volvaria, Stropharia, Coprinus*), the fungi that grow on very well composted material (*Agaricus*), the fungi that grow on soil and humus (*Lepiota, Lepista, Morchella, Gyromitra*) and the mycorrhizal fungi (*Boletus, Cantharellus, Amanita, Tuber, Morchella, Lactarius*, matsutake). The book is general and specific. It bridges the gap between researchers and growers. It shows the problems and the progress in all aspects. Written by 32 contributors from eleven countries it deals with many different ways of mushroom cultivation. Nutritional value, medical effects and economical aspects of the increasing consumption of mushrooms are also considered.

MONOGRAPH OF THE PYTHIUM, by A.J. VAN DER PLAATS-NITERINK, in Studies in Mycology n° 21, 242 p., 103 fig., 8°, paper back, 1981. Centraalbureau voor Schimmelcultures, Baarn, The Netherlands. Hfl 70.-

This revision of *Pythium* Pringsheim is mainly based on living cultures preserved at the C.B.S. and a critical review of 1133 publications. 85 species are recognized and described alphabetically, 64 from living strains. In addition, two highly cellulolytic species are treated in an appendix. The species *P. buismaniae* and *P. macrosporon* are new. 65 remaining species are classified as uncompletely known, doubtful or to be excluded. The 87 accepted species and 13 uncompletely known species are keyed out dichotomously. Off those, 81 are homothallic, 9 are heterothallic, 1 species and 5 unnamed group-species have no oogonia but sporangia and 9 species have neither oogonia nor sporangia. In such a large and difficult genus, a synoptic key might have been helpful.

FUNGAL PHYSIOLOGY, by David H. GRIFFIN, xiv + 383 p., ill., 8°, hard cover, 1981. John Wiley & Sons, Wiley-Interscience, 605 Third Avenue, New York NY 10158.

The author has made a very needed synthesis of present knowledges on the physiology of the fungi. In such a field of steady progress, he provides us with a critical analysis of the different experimental approaches used by researchers. After chapters on the specific biochemistry and molecular architecture of the fungus cell, the author considers the primary and secondary metabolism. Chapter 5 to 8 deal with the growth, its rate and regulation, its chemical requirements, the transport and absorption of the nutrients and the response to the environmental factors. Chapter 9 to 12 deal with the reproduction: the effects of environmental factors on the spore formation (including circadian rythms), the biochemical and genetical regulation of the spore formation, the dormancy and germination of spores and the interesting aspects of syngamy, like the hormonal regulation in sexual interactions. Final chapters describe the behaviour of the fungi in natural attacks and provide a rational basis for the choice of fungicides. The text is precise and well documented by data and graphs from the literature. The author also points out the gaps in the present knowledge from a dynamic point of view.

CHAMPIGNONS DE SUISSE, Contribution à la connaissance de la flore fongique de suisse, TOME 1, LES ASCOMYCETES, Photographies en couleurs, descriptions et dessins d'observations microscopiques de 390 espèces de Suisse centrale et particulièrement du canton de Lucerne, by J. BREITENBACH and F. KRÄNZLIN, French translation by J. KELLER, 310 p., 390 fig., 390 col. phot., 4°, hard cover, 1981. Ed. Mykologia, CH-6000 Lucerne, Switzerland. SFr 118.-

This album is a modern and scientific account of the Ascomycetes from Central Switzerland, but common to all European countries. It is the first volume of a series prepared by the authors with the collaboration of members of the Société Mycologique de Lucerne. It results of a methodical and precise work procedure in collecting, describing, illustrating and preserving the fungi which will surely satisfy the scientist and traine the students. 384 Ascomycetes species are treated in a taxonomical order, within 37 families. Named by their Latin and French names, each species is described and illustrated from an accurately indicated collection which is deposited in herbarium. Macroscopical features are shown on a high quality color macrophotograph and microscopical structures exhibited in line drawings. The habitat of the species, taxonomical comments and pertinent literature are also given. The keys are di- or multichotomous and require the use of a microscope.

That book is a joy for the reader also for its design and color printing. It is an invaluable contribution towards the diffusion of a scientific knowledge of these fungi.

COMPENDIUM OF SOYBEAN DISEASES, by James B. SINCLAIR, Ed. 2d ed., 104 p., ill., 4°, paper back, 1982, The American Phytopathological Society, 3340 Pilot Knob Road, St Paul, Minnesota 55121. $ 11./12.

This second edition, revised with the aid of 76 world authorities in the field, has new sections including one on diseases caused by mycoplasmalike organisms, one on diseases of unknown origin and one on disease control strategies. The other sections have gained from more informations, references and illustrations. The 44 fungal diseases of soybean take a major importance in this Compendium.

AN ANNOTATED CHECK-LIST OF FUNGI CAUSING POSTHARVEST DISEASES OF FRUTS AND VEGETABLES IN ISRAEL, by Rivka BARKAI-GOLAN, Special Publication n°194, 36 p., paper back, 1981. Division of Scientific Publications, The Volcani Center, Bet Dagan, Israel.

This little paper provides with an alphabetical listing of the concerned fungi with indication of their host, the kind of symptoms, a brief account on the distribution and the importance of the decay.

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NOTICE

INTERNATIONAL MYCOLOGICAL ASSOCIATION

RECORD OF THE BUSINESS MEETING HELD ON 26 AUGUST 1981 DURING THE XIII INTERNATIONAL BOTANICAL CONGRESS, SYDNEY

Agenda

1. President's remarks
2. Apologies for absence
3. Secretary's report
4. Treasurer's report
5. Committee reports
   (a) Nomenclature Secretariat
   (b) Asian Mycology
   (c) Latin American Mycology
6. IMA Statutes
7. Third International Mycological Congress
8. Structure of IUBS
9. Relationship with IUMS
10. XXI General Assembly of IUBS
11. Liaison office
12. Any other business

1. *President's remarks*

1. Professor C.V. Subramanian (President, IMA), welcomed members to the Business Meeting.

2. He first paid tribute to three outstanding mycologists who had passed away since IMC2, Professor Ralph Emerson, Professor F.K. Sparrow, and Dr Luella K. Weresub. Two minutes silence was observed by the whole Meeting.

3. Professor Subramanian welcomed the opportunity of mycologists participating in the Sydney Congress to meet together and the possibility of reporting on recent activities of the IMA to a wider audience than was usually possible.

4. He then proposed that the Agenda for the meeting, which had previously been circulated to affiliated organizations and members of the Executive Committee, be approved, and this was adopted by the Meeting.

2. *Apologies for absence*

5. Apologies for absence were received from three members of the Executive Committee, Dr J.A. von Arx (Treasurer, IMA), Professor J. Webster, and Dr G.C.A. van der Westhuizen.

3. *Secretary's Report*

6. Dr D.L. Hawksworth (Secretary, IMA) reported that since the IMA officers and Executive were elected at IMC2 in 1977, Professor R.A. Emerson (USA) passed away, and was replaced on the Executive by Professor A. Skirgiello (Poland). There have been a number of changes of addresses and a current list of the members of the Executive, which will serve until IMC3 in 1983,was tabled.

7. In 1978 the Executive considered submissions from the Mycological Society of Japan and the Mycological Society of India to host IMC3 and agreed that Tokyo was the most suitable centre. I would like to record the gratitude of the IMA to both Societies for their invitations. 1983 was selected as a date so that there would be a full year between the present Congress and IMC3. Precise dates were fixed to avoid a direct clash with the ISPP Congress in Australia the same year.

8. Copies of the Resolutions from IMC2 were circulated to national and international bodies, published in the *IUBS Newsletter*, and endorsed by the XX General Assembly of IUBS in Helsinki in 1979.

9. Professor Subramanian and Dr Hawksworth attended the XX General Assembly of the International Union of Biological Sciences (IUBS) to present a case on behalf of the Executive Committee for the recognition of an increased status for mycology within IUBS. As a result of discussions held in Helsinki, it was agreed to re-name the Division of Botany as the Division of Botany and Mycology, and further to create a Section of General Mycology, based on IMA, to replace the former Commission on Mycology. Professor Subramanian was also elected to the IUBS Executive as one of the representatives of the new Division at the Congress. The changes made at Helsinki pave the road for a strengthening of the voice of mycology in world biology.

10. Since IMC2, the Australian Plant Pathology Society, the International Association for Lichenology, the Society for Human and Animal Mycology, and the Societas Mycologica Fennica have all become affiliated to the IMA. A mutual affiliation with the International Association. for Plant Pathology has also been agreed in principle.

4. *Treasurer's Report*

11. Dr J.A. von Arx (Treasurer, IMA) had provided a statement of the current financial position for the information of the Meeting which showed a current balance of Hfl 27 572 at 1 July 1981.

5. *Committee Reports*

(a) Nomenclature Secretariat

12. Professor R.P. Korf (Member, Nomenclatural Secretariat), read a Report of the activities of the Secretariat to the Meeting.

13. The formal proposals for improvement of the treatment of fungi in the International Code of Botanical Nomenclature prepared by the IMA Nomenclature Secretariat, following reports of its Committees and debates at IMC2, were published by the Chairman of the Committee, Dr K.T. van Warmelo in *Taxon 28*: 424-431 (1978).

14. These proposals were considered by the Nomenclature Sessions prior to the Congress. It was unanimously accepted that the starting point date for all fungi would be changed from 1801 or 1821 to 1753 (with special provisions for names in the formerly cited "starting-point books"). The completely revised version of the Rules governing the names of fungi with pleomorphic life cycles was also accepted. Proposals to introduce living types into the Code failed, but one of the IMA's Recommendations was adopted and the Session recognized the problem. There was an impression that fresh proposals would be viewed sympathetically.

15. It had further been agreed in the Nomenclature Sessions of the Congress that three posts in the Special Committee for Fungi should be left vacant until IMC3. At IMC3 it may be proposed that this enlarged Special Committee should act as the Nomenclature Secretariat and appoint committees as required. Such a move might well eliminate the need for the present dual structure for considering problems of mycological nomenclature.

16. With regard to the question of the acceptance of living cultures as types, the present Meeting *recommended* that the Special Committee and Nomenclature Secretariat should cooperate with algologists in formulating fresh proposals.

(b) *Asian Mycology*

17. Professor Subramanian reported that he hoped to arrange a discussion meeting for Asian mycologists during 1982.

(c) *Latin American Mycology*

18. No report of recent activities was received.

6. *IMA Statutes*

19. The Meeting considered the draft Statutes of the IMA which had been drawn up following IMC1 in 1971, but had not been formally adopted by a subsequent International Mycological Congress.

20. The present structure had meant information too rarely percolated to individual mycologists, and there was a strong feeling, especially amongst Australian participants, that some form of individual membership should be retained even in countries that had national affiliated organizations.

21. The Executive Committee was instructed to take note of the views expressed and the Secretary agreed to prepare a revised set of Statutes for their consideration. Participants undertook to send any further comment they wished to be considered to the Secretary by 1 November 1981.

7. *Third International Mycological Congress*

22. The Meeting welcomed Professor K. Tubaki (Secretary-General, IMC3), who outlined the arrangements being made by the Japanese Organizing Committee. Professor N. Hiratsuka had been elected President, and Dr K. Iwata Vice-President of the Committee. The congress would be based on the Keio Plaza Hotel (Shin-juku, Tokyo) but it was expected

that most participants would stay in an adjacent business-class hotel. The First Circular had now been printed and copies were distributed to the Meeting. The Circular included a list of major topics to be included in the programme. A registration fee of about US $ 150 was anticipated. The Organizing Committee looked forward to the visit of the Secretary of the IMA to Japan following the Sydney Congress.

23. Professor T. Ahti (President, International Association for Lichenology), hoped that a lichenologist would be included in the Organizing Committee.

8. *Structure of IUBS*

24. Professor K. Esser outlined the discussions on the structure of IUBS that had taken place since the XX General Assembly of IUBS in 1979 (see para 9 above). The division of Microbiology had now left IUBS and had been formed into an International Union of Microbiological Societies (IUMS). The board of the Division of Botany and Mycology of IUBS had also considered structure at a meeting on 23 August during the Sydney Congress. The Board resolved to urge IUBS to maintain the present Division of Botany and Mycology, to recognize the Chairman of that Division as the voting member of the IUBS Executive, and to delegate budgetary responsibility for the Division on the Board. It was further proposed that the President of the Division would be that of each individual International Botanical Congress and that he would serve for three years before to three years after the Congress.

9. *Relationship with IUMS*

25. The Meeting noted the establishment of IUMS, and that it included a Division of Mycology. The Secretary summarized a letter he had received from Dr. Iwata (Chairman of that Division) hoping that the two organisations would collaborate in fostering actual co-operation in developing mycological research in all its fields. After some discussion it was agreed that the informal links that had previously existed when the Division was a Section within the Division of Microbiology of IUBS should be maintained, but it was not considered to be appropriate to enter into any formal relationship with IUMS at that time.

10. *XII General Assembly of IUBS*

26. No proposals had been received, but the Meeting agreed that the IMA should support any applications received from the International Association for Lichenology (IAL) or the International Society for Human and Animal Mycology (ISHAM) for recognition as Sections with the IUBS Division of Botany and Mycology.

27. It was agreed that the President, Secretary and (if possible) Dr.S.J. Hughes Vice-President IMA should represent the IMA (section for General Mycology) at the General Assembly.

11. *Liaison Office*

28. The secretary regretted that further progress had not been made in efforts to seek funds to establish a Liaison Office for world mycology as recommended by IMC2.

12. *Any other business*

Professor K. Esser informed the Meeting that the XIV International Botanical Congress would be held in Berlin in 1987. The venue would be a conference centre which could contain 7000 delegates and Professor Esser invited the IMA to hold IMC4 conjointly with that Congress. After some discussion, the Meeting agreed that Professor Esser should explore the possibilities further. This, and any other offer to host IMC4, would have to be considered by the Executive Committee of IMA prior to IMC3. The Executive would hope to be able to make a firm recommendation to the IMA General Assembly to be held during IMC3.

30. In closing the Meeting, the President thanked all the mycologists who had made time in their busy Congress Schedules to participate, and also paid tribute to the support he had received from the Officers of the IMA.

28 April 1982

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Secretary, IMA.

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NOTICE

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The most frequent cause for rejection on just technical grounds for manuscripts submitted to MYCOTAXON continues to be lack of attention to requirements to save space. The worst offense continues to be leaving a blank line between references cited. When retyping will not save a page, such manuscripts have been accepted, but typists must learn to try to save as much space as possible. Typing all the way to the edges of the blue rectangles called for in the instructions to authors is also essential. Too often typists leave space there.

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