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CONTENTS

A contribution to the knowledge of Corticiaceae s.l. (Aphyllophorales) in Brazil.
KURT HJORTSTAM AND VERA LUCIA RAMOS BONONI 1
Hyphodontia tenuicystidia sp. nov. (Corticiaceae) from Argentina.
KURT HJORTSTAM AND LEIF RYVARDEN 17
Studies in tropical Corticiaceae (Basidiomycetes) VII. Specimens from East
Africa, collected by L. Ryvarden. II . . . . KURT HJORTSTAM 19
New combinations in *Ophiostoma* of *Ceratocystis* species with *Leptographium*
anamorphs . . . . T. C. HARRINGTON 39
Camarops flava sp. nov., *Apiocamarops alba* gen. et sp. nov., and notes on
Camarops scleroderma and *C. ustulinoides*.
GARY J. SAMUELS AND JACK D. ROGERS 45
Chemical constituents of the stipitate hydnums from the southern Appalachian
mountains . . . . RICHARD E. BAIRD 61
Dactylifera gen. nov. (Hyphomycetes) . . . . J. L. ALCORN 71
Some new Corticioid taxa . . . . B. W. L. DE VRIES 77
Contributions to the lichen flora of British Columbia, Canada.
TEUVO AHTI, IRWIN M. BRODO, AND WILLA J. NOBLE 91
Lichens new to North America from the flora of British Columbia, Canada.
IRWIN M. BRODO, WILLA J. NOBLE, TEUVO AHTI, AND STEPHEN CLAYDEN 99
New South American polypores . . . . MARIO RAJCHENBERG 111
Taxonomy of *Onocladium flavum* and its relationship to *Malbranchea flava*.
LYNNE SIGLER, J. GUARRO, R. S. CURRAH, AND L. PUNSOLA 119
Coronoplectrum, a new lichen genus from the Namib Desert, South West
Africa/Namibia . . . . FRANKLIN A. BRUSSE 131
The Ostropalean fungi III: the Odontotremataceae. MARTHA A. SHERWOOD-PIKE 137
Endophyte-host associations in forage grasses. VII. *Acremonium chisosum*,
a new species isolated from *Stipa eminens* in Texas.
JAMES F. WHITE, JR. AND GARETH MORGAN-JONES 179
Materials for a lichen flora of the Andaman Islands — III.
P. K. SETHY, M. B. NAGARKAR, AND P. G. PATWARDHAN 191
Studies on conidiogenesis in *Rhinocladiella aquaspersa*.
T. IWATSU, K. NISHIMURA, AND M. MIYAJI 199
Entrophospora schenckii: a new species in the Endogonaceae from Colombia.
EWALD SIEVERDING AND SILVIA TORO T. 209

[CONTENTS continues overleaf]

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[CONTENTS continued from front cover]

A new species of *Melanelia* from Nepal .... THEODORE L. ESSLINGER 215
Beniowskia and its synonym *Clathrotrichum* .... RICHARD T. HANLIN 219
A new species of *Oidiodendron*.
SHUN-ICHI UDAGAWA AND NORITSUNA TOYAZAKI 233
Studies in the genus *Phoma*. VI. Concerning *Phoma medicaginis* var. *pinodella*.
JAMES F. WHITE, JR. AND GARETH MORGAN-JONES 241
Punctelia perreticulata, a distinct lichen species.
GEROULD WILHELM AND DOUGLAS LADD 249
A new species of the genus *Canoparmelia* from Argentina ... MÓNICA T. ADLER 251
Notes on the mayapple and the life history of the fungus *Septotinia podophyllina*.
J. GREMMEN 255

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A CONTRIBUTION TO THE KNOWLEDGE OF CORTICIACEAE S.L. (APHYLLOPHORALES) IN BRAZIL

by

Kurt Hjortstam

Målaregatan 12
S-44135 Alingsås, Sweden

and

Vera Lucia Ramos Bononi

Instituto de Botanica
Caixa Postal 4005
01000 Sao Paulo,SP-Brazil

Abstract

51 species of the Corticiaceae are reported from Brazil. Stereum has been omitted, as it needs a specialist-treatement. Skvortzovia g.nov. (Type:Odontia furfurella Bres.) and Melzericium rimosum sp.nov.are described.

This contribution to a supposed progress of a better knowledge of the tropical Corticiaceae was made possible by a grant to the first author from FAPESP (Foundation for science of Sao Paulo). The main purpose for the invitation was a revision of corticiaceous fungi filed at Sao Paulo (SP) herbarium.

The species are listed alphabetically and with a reference to the locality, and each specimen is cited with the SP enumeration. Some few specimens collected by K. Hjortstam are added.

List of the localities

1. Esperito Santo State, Ponta da Fruta, "Morra da Lagoa" Farm.
2. Minas Gerais State, Cambuquira.
3. Parana State, Antonina.
4. Parana State, Guaira, Sete Quedas National Park.
5. Parana State, Santarem, Rio Humaitá.
6. Rio Grande do Sul State, Gramado, Varzea Grande.
7. Rio Grande do Sul State, Pareci.
8. Rio Grande do Sul State, Pedreira, Taquari.
9. Rio Grande do Sul State, Pelotas, Agronomic Institute.

10. Rio Grande do Sul State, Porto Alegre.
11. Rio Grande do Sul State, Sao Leopoldo.
12. Rio de Janeiro State, Itatiaia National Park.
13. Rio de Janeiro State, Quatis, Monnerat, "Cachoeira" Farm.
14. Santa Catarina State, Blumenau.
15. Santa Catarina State, Itajai.
16. Sao Paulo State, Cananeia, Ilha do Cardoso.
17. Sao Paulo State, Caraguatatuba, Forest State Park of Caraguatatuba.
18. Sao Paulo State, Mogi-Guacu, Biological Station.
19. Sao Paulo State, Mogi-Guacu, "Sete Lagoas" Farm.
20. Sao Paulo State, Salesopolis, Biological Station of Boraceia.
21. Sao Paulo State, Sao Paulo, Cantareira.
22. Sao Paulo State, Sao Paulo, State Park, "Fontes do Ipiranga".

Abbreviation of collectors name

AT	A.R. Teixeira
BL	B. Lowy
BS	B. Skvortzov
BT	B.C. Teixeira
CN	J.P.da Costa Neto
CS	C.A.dos Santos
DV	D.M. Vital
ES	E.C. Santos
FN	F. Nakanechnyi
GE	G. Eiten
GG	G. Guzman
Hjm	K. Hjortstam
HR	H. Requejo
JF	J.S. Furtado
JR	J. Rick
KW	K. Wells
LE	L. Eiten
MB	M.C. Vaughan Bandeira
MC	M. Cavalcante
MF	M. Fidalgo
MM	M.C. Marino
NM	N. Moreira
OF	O. Fidalgo
OY	O. Yano
RP	R.A. Piccolo
ST	S.F.B. Trufem
VB	V.L.R. Bononi
YU	Y. Ugadim

List of species

Aleurodiscus cerussatus (Bres.) Höhn.& Litsch.,Sitzber. Akad.Wiss.Wien,Math.-nat.Kl,116:807, 1907.- Corticium cerussatum Bres.,Fungi trid.II:37, 1892.
Lit.: Eriksson and Ryvarden 1973.
Specimens: SP 156810 (RP), Hjm 16046,16055/B,16066.
Loc.: 18.
Remarks. A cosmopolitan species which preferably grows on dead, but still attached branches in more or less dry localities.

A. mirabilis (Berk.& Curt.) Höhn.,Sitzber.Akad.Wiss.Wien, Math.-nat.KI,118:818, 1909.- Psilopeziza mirabilis Berk.& Curt., Journ.Linn.Soc.Bot.10:364, 1869.
Lit.: Lemke 1964, Cunningham 1963.
Specimens: SP 107075 (OF&MF), 107249 (BS).
Loc.: 12,22.

Amylostereum ferreum (Berk.& Curt.) Boid.& Lanq.,Bull.Soc. Mycol.France 100:217, 1984.- Stereum ferreum Berk.& Curt., Journ.Linn.Soc.Bot.10:332, 1869.
Lit.: Boidin and Lanquetin 1984.

Specimen: Sao Paulo State, Campos do Jordao, on Podocarpus. Hjm 16120.
Remarks. In Brazil further known from Rio Grande do Sul (see Boidin and Lanquetin loc.cit.). In macromorphology this species is very similar to the well known *A. chaillletii* (Pers.:Fr.) Boid. However, it has somewhat smaller spores and,(according to the above specimen), also a paler fruitbody. At present the genus comprises four species that hardly can be separated microscopically, e.g. colour and size of the cystidia, hyphae, and spores.

Asterostroma cervicolor (Berk.& Curt.) Massee,Journ.Linn. Soc.Bot.25:154, 1889.- Corticium cervicolor Berk.& Curt., Grevillea 1:179, 1873.
Lit.: Hallenberg 1985.
Specimen: SP 177350 (RP).
Loc.: 16.

A. fulvum Rom., Bih.K.Svenska Akad.Handl.26:40, 1901.
Lit.: Parmasto 1970.
Specimen: SP 37721 (JR).
Loc.: 11.
Remarks. The specimen is sterile and if the determination is correct, the species does not belong in *Asterostroma* but rather in Vararia. See also Boidin (1967) and Parmasto (loc. cit.).

Basidioradulum radula (Fr.:Fr.)Nobles, Mycologia 59:192, 1967.- Hydnum radula Fr.:Fr., Syst.mycol.I:422, 1821.
Lit.: Eriksson and Ryvarden 1975.
Specimen: SP 124933 (MC).
Loc.: 18.
Remarks. The determination is somewhat doubtful as the specimen is poorly developed. The spores as well as hyphae and cystidia are, however, as in this species.

Botryobasidium curtisii Hallenb.,Iran Journ.Plant Path.14: 44, 1978.
Lit.: Hallenberg 1978.
Specimen: Sao Paulo State, Guarujá, mountain north of Guarujá, about 400 m.a.s.l. Hjm 16003.
Remarks. The specimen was connected with the anamorph, *Haplotrichum curtisii* (Berk.) Hol.-Jech.,Ceská Mykol.30:4, 1976.

Botryohypochnus biapiculatus (Rog.) Parm., Eesti NSV Tead. Akad.Toim.Biol.Seer.14:221, 1965.- Pellicularia biapiculata Rog.,Lloydia 7:71, 1941.
Lit.: Hjortstam 1983.
Specimen: SP 92422 (BL).
Loc.: 15.
Remarks. The material is scarce, but a few basidia and typical lemon-shaped and rough spores were observed. The species was originally described from a Rick specimen from Sao Leopoldo.

B. bondarcevii Parm., Eesti NSV Tead.Akad.Toim.Biol.Seer.2: 221, 1965.
Lit.: Parmasto 1965.
Specimens: SP 71510, 71511 (KW).

Loc.: 17.
Remarks. The material is compared with the type (in Tartu, No.14511). The species is, however, little known and the Brazilian specimens are the first collections since it was described. In the Brazilian specimens the aculei of the spores are generally shorter and vary in length from 2-4um, while in the type most spores have aculei 4-5 um long. The hyphae and basidia are identical the same and the basal hyphae are distinctly thick-walled and yellowish brown. SP 71511 is a very scarce specimen.

Brevicellicium olivascens (Bres.)Larss.& Hjortst., Mycotaxon 7:119, 1978.- Odontia olivascens Bres., Fungi trid.2:36, 1892.
Lit.: Hjortstam and Larsson 1978.
Specimen: Sao Paulo State, Sao Paulo, State Park, "Fontes do Ipiranga", on deciduous wood.Hjm 16098.

Candelabrochaete dispar Hjortst.& Ryv., Mycotaxon 25:546, 1986.
Lit.: Hjortstam and Ryvarden 1986.
Specimen: Sao Paulo State, Sao Paulo, State Park, "Fontes do Ipiranga", on deciduous wood. Hjm 16100.
Remarks. This species was recently described from Argentina (Iguazu) and is easily recognized because of its grandinioid fruitbody and subglobose spores measuring about 5-5.5 um in diam.

Cerocorticium molle (Berk.& Curt.) Jülich, Persoonia 8:219, 1975.- Corticium molle Berk.& Curt., Journ.Linn.Soc.Bot.10: 336, 1869.
Lit.: Jülich 1975.
Specimens: SP 142120 (RP), 142132 (VB).
Loc.: 18.
Remarks. Pantropical species and repeated described as new by different authors. It is easily recognized by a smooth fruitbody, often widedly spread over the substratum, large basidia, and ellipsoid spores that are 10-20 x 4-7 um.

Coniophora arida (Fr.)Karst., Not.Sällsk.Fauna Fl.Fenn.Förh. 9:370, 1869.- Thelephora arida Fr., Elenchus fung.I:197, 1828.
Lit.: Hallenberg 1985.
Specimen: SP 61224 (MF).
Loc.: 10.
Remarks. This specimen was first determined as C. suffocata and according to Ginns (1982) the only separating character is the encrusted hyphae. We prefer to keep this "variety" within the circumscription of C. arida.

Cystidiodontia artocreas (Berk.& Curt.ex Cooke) Hjortst., Mycotaxon 17:571, 1983.- Hydnum artocreas Berk.& Curt. ex Cooke, Grevillea 20:1, 1891.
Lit.: Hjortstam and Ryvarden 1986.
Specimens: SP 33750 (JR), 97942 (CN), 112478 (BS).
Loc.: 7,8,22.
Remarks. This species is so far only known from North-and South-America. For its correct application see Hjortstam and Ryvarden 1986.

Dacryobolus sudans (Alb.& Schw.:Fr.) Fr., Summa veg.Scand. p.404, 1849.- Hydnum sudans Alb.& Schw.:Fr., Syst.mycol.I: 425, 1821.
Lit.: Eriksson and Ryvarden 1975.
Specimens: SP 42495, 83989 (MM).
Loc.: 22.
Remarks. Widedly distributed in the boreal zone, rare in the tropical or subtropical zones (see Hjortstam 1983). In its outer appearance most tropical specimens differ in longer aculei than those from other localities, the same can be said about the Brazilian collections.

Dentipellis aff. *fragilis* (Pers.:Fr.) Donk, Persoonia 2: 233, 1962.- Hydnum fragilis Pers.:Fr., Syst.mycol.I:417, 1821.
Lit.: Jahn 1969.
Specimens: SP 103933, 103946, 103973 (BS), 141926 (OY), 177820 (VB).
Loc.: 16,22.
Remarks. The material is homogeneous and differs slightly from the well known concept of *D. fragilis* in Europe. The spores in the Brazilian specimens are smaller, and the aculeal hyphae are more closely packed and straight. Today the genus comprises about eight species of which some evidently do not belong in *Dentipellis*. *D. separans* (Peck) Brown is generally treated as a similar taxon and is said to be separated by smaller and more ellipsoid spores about 3.5-5 x 3.5 um (in *D. fragilis* subglobose, 4.5-6 x 4-5 um). However, Gilbertson (1962) found no spores at all in the type of *D. separans*. If this is true, the name seems to a nom.dub. The material cited above matches the description of *D. isidioides* (Berk.) Stalpers but according to both Reid (1956) and Stalpers (1976) this species has smooth spores. Other species, like *D. leptodon* (Mont.) Maas Geest. and *D. subseparans* Khara & Rattan seem also to be closely related, but no authentic material have been studied.
Two species described by Berk.& Curt. should also be considered. *Hydnum dissitum* (from Brazil) and *Hydnum pyramidatum* (from Cuba). The first one was included in *Dentipellis* by Maas Geesteranus (1974) while the other was discussed by Burdsall and Lombard (1976) when they treated the genus *Gloeodontia*. We agree with the latter that *H. pyramidatum* may belong in *Gloeodontia*. *H. dissitum* is misplaced in *Dentipellis* and is similar to *Gloeodontia columbiensis* Burt ex Burds. & Lomb.

Fibrodontia gossypina Parm., Consp.syst.cort. p.207, 1968.
Lit.: Eriksson et al. 1981.
Specimen: SP 156911 (VB).
Loc.: 17.
Remarks. Rather poor material. Compare also *Hyphodontia brevidens* below which in outer appearance is very similar.

Gloeocystidiellum lactescens (Berk.) Boid., C.R.Acad.sci. Paris 233:1668, 1951.- Thelephora lactescens Berk., Engl.Fl. 5(2):169, 1836.
Lit.: Eriksson and Ryvarden 1975.
Specimens: SP 157442 (VB&MC), 177308 (VB).

Loc.: 16.
Remarks. This species, or rather species-complex, needs further studies, especially as to specimens from tropical areas.

G. luteocystidiatum (Talb.) Boid., Cah.Maboké 4(1):9, 1966. -Corticium luteocystidiatum Talb.in Wakef.& Talb., Bothalia 4:941, 1948.
Lit.: Original description by the author.
Specimen: SP 97536 (BS).
Loc.: 22.
Remarks. This is the first report outside South Africa. The material at SP is fairly good and in accordance with the type (W.G.Rump,241.Kew herb.). To the description by Talbot can be added that all hyphae have clamps and the spores are strongly amyloid.
It is somewhat similar to *G. leucoxanthum* (Bres.)Boid. especially as to spores and hyphal characteristics.

G. triste Hjortst.& Ryv., Mycotaxon 25:553, 1986.
Lit.: Hjortstam and Ryvarden 1986.
Specimen: SP 157381 (VB&MC).
Loc.: 16.
Remarks. This species belongs in the same group as *G. porosum* (Berk.& Curt.) Donk, *G. porosellum* Hjortst., *G. flammeum* Boid., and *G. sinuosum* Freeman. All these species are similar as they have rough spores, hyphae without clamps (except *G. porosum*), gloeocystidia with aldehyde reaction, and similar basidia.

Hyphoderma puberum (Fr.) Wallr., Fl.crypt.Germ.p.576, 1833. -Thelephora pubera Fr., Elenchus fung.I:215, 1828.
Lit.: Eriksson and Ryvarden 1975.
Specimens: SP 97511, 98021 (BS).
Loc.: 22.
Remarks. Coll.SP 97511 has unusually long spores, about 12-14 um.

H. rude (Bres.) Hjortst.& Ryv., Mycotaxon 10:275, 1980. -Odontia rudis Bres., Ann.Mycol.18:42, 1920.
Lit.: Hjortstam and Ryvarden 1980.
Specimens: SP 103919, 103928, 103939 (BS), 142187, 142189 (VB).
Loc.: 18,22.
Remarks. The species was originally described from Brazil, Rio Grande do Sul and seems to be rather common in tropical areas.

H. setigerum (Fr.) Donk, Fungus 27:15, 1957.-Thelephora setigera Fr., Elenchus fung.I:208, 1828.
Lit.: Eriksson and Ryvarden 1975.
Specimens: SP 22639, 83949 (MM), 92453 (BL), 97568, 97571, 97599 (HR), 102302 (MS), 112669 (BS).
Loc.: 14,22.
Remarks. A cosmopolitan species. SP 83949 has shorter spores than normal and is in a young stage. It was determined by Liberta as *Peniophora polonensis* (Bres.) Höhn.& Litsch.

H. transiens (Bres.) Parm., Consp.syst.cort.p.114, 1968. -Odontia transiens Bres.in Torrend Basid.Lisb.p.72, 1913.

Lit.: Nikolaeva 1961.
Specimens: SP 103750 (BS), 112084 (MF&OF).
Loc.: 12,22.
Remarks. Both specimens at SP are pale ochraceous and the warts of the fruitbody are somewhat longer than normal. In other respects the material is typical as to density of the hyphal tissue, hyphae width, occurence of cystidia, and relatively long spores, 12(-14) um.

Hyphodontia aff. barba-jovis (Bull.:Fr.) John Erikss.,Symb. bot.Ups.16:104, 1958.-Hydnum barba-jovis Bull.:Fr., Syst. mycol.I:421, 1821.
Lit:. Eriksson and Ryvarden 1976.
Specimens: SP 71500, 103995, 106793, 106794, 112474 (BS), 109064 (OF), 124223 (VB&DV), 124936 (VB).
Loc.: 2,22.
Remarks. The material is very close to the European concept of the species, but all specimens differ by lacking clamps at many septa, especially on the hyphae in the central part of the aculei. It should be noted that Rick (1932) described Odontia crassa from Sao Leopoldo, and this taxon was neotypified by Hjortstam and Ryvarden (1982) and stated to be the same as H.barba-jovis. The neotype should be re-examined before any conclusive arrangement can be done.

H. aff. brevidens (Pat.) Ryv., Occasional pap.Farlow Herb. 18:9, 1983.-Irpex brevidens Pat., Bull.Herb.Boiss.3:55,1895.
Lit.: Hjortstam and Ryvarden 1986 and Ryvarden loc.cit.
Specimen: SP 177341 (VB).
Loc.: 16.
Remarks. This specimen exactly match specimens seen from Iguazu (Hjortstam and Ryvarden 1986) and is probably separated from H. brevidens s.str. The main difference is that the aculeal hyphae have thinner walls than normal.

H. crustosa (Pers.:Fr.) John Erikss., Symb.bot.Ups.16:104, 1958.-Hydnum crustosum Pers.:Fr., Syst.mycol.I:419, 1821.
Lit:. Eriksson and Ryvarden 1976.
Specimens: 16043, 16051 (Hjm).
Loc.: 18.
Remarks. The specimens correspond with the general concept of the species and have the same kind of basidial repetition as seen in specimens from boreal areas. The species is adapted to grow under dry conditions and can more often than other Hyphodontia species be collected on dead, but still attached branches. Mogi-Guacu is partly a typical cerrado areal though partly in a degraded condition. However, still some parts of the "Fazenda" consists of a relatively tall wood-land with a very low precipitation. The species may be compared with Aleurodiscus cerussatus which has about the same ecology and was widespread in the same locality.

H. lanata Burds.& Nakas., Mycologia 73:461, 1981.- Odontia vesiculosa G.H.Cunn.(nom.illeg.), in Trans.Roy.Soc.New Zealand 86:75, 1959.
Lit.: Burdsall and Nakasone 1981.
Specimen: SP 156848 (VB).
Loc.: 18.
Remarks. The material is well developed, but as in many spe-

cies in the section Ellipsosporae Parm., difficult to interpret as the variability is insufficiently known. The species is somewhat similar to H. nespori (Bres.) John Erikss.& Hjortst., but this species has more distinctly cylindrical spores.

H. sambuci (Pers.) John Erikss., Symb.bot.Ups.16:104, 1958. -Thelephora sambuci Pers., Myc.Eur.I:152, 1822.
Lit.: Eriksson and Ryvarden 1976.
Specimen: SP 43724 (CS).
Loc.: 22.

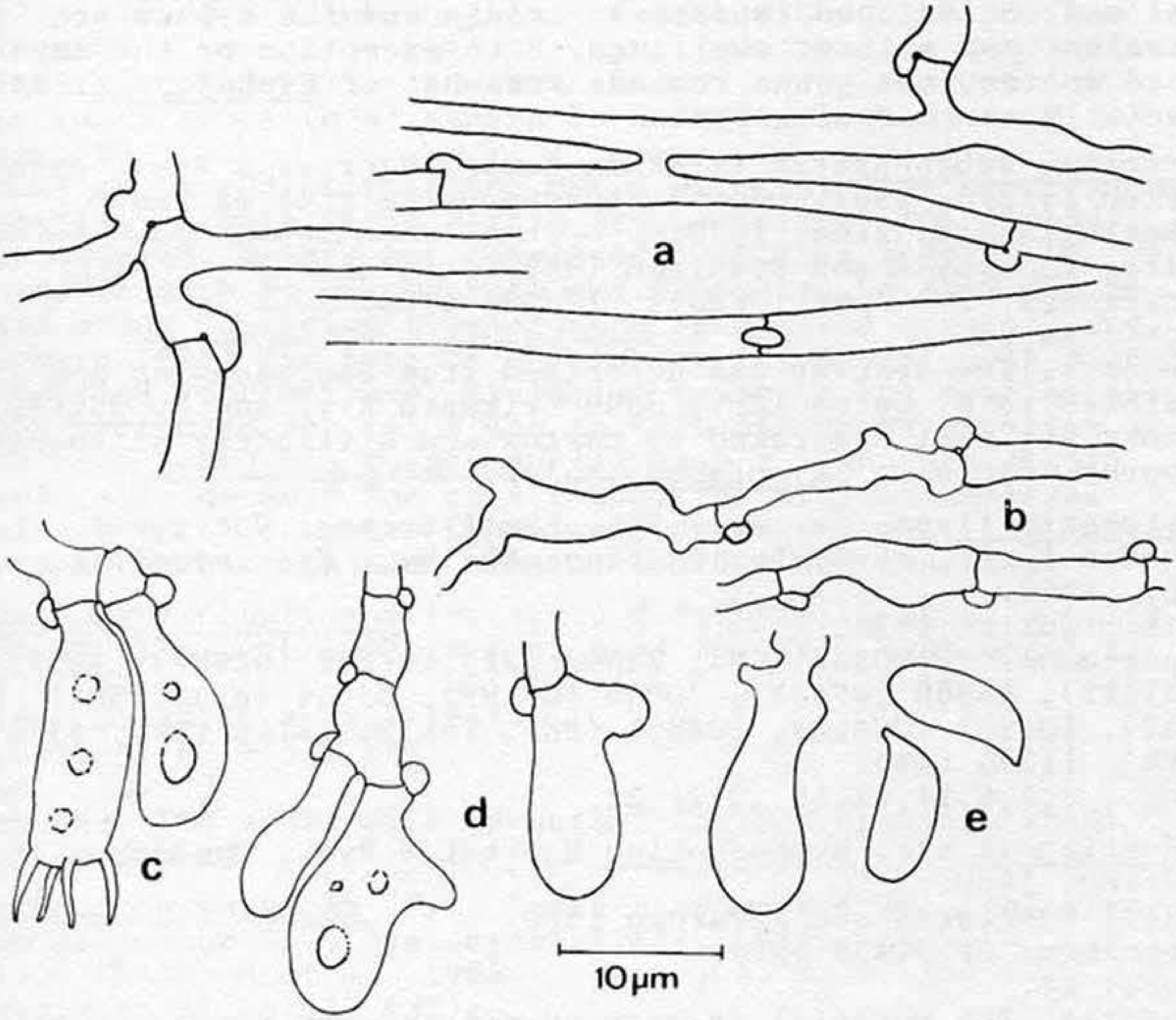
Hypochnicium punctulatum (Cooke) John Erikss., Symb.bot. Ups.16:101, 1958.-Corticium punctulatum Cooke, Grevillea 6:132, 1878.
Lit:. Eriksson and Ryvarden 1976.
Specimens: SP 97573, 97577 (HR), 97576 (BS).
Loc.: 22.
Remarks. Uniform material but with somewhat thinner fruitbodies than normal.

Laxitextum bicolor (Pers.:Fr.) Lentz, U.S.Dept.Agric.Monogr. 24:18, 1955.-Thelephora bicolor Pers.:Fr., Syst.mycol.I:438, 1821.
Lit.: Eriksson and Ryvarden 1976.
Specimens: SP 31922 (OF), 124052 (GH), 157180 (CP&OF), 141903 (VB&NM).
Loc.: 3,22.

Lopharia cinerascens (Schw.) G.H.Cunn., Trans.Roy.Soc.New Zealand 83:622, 1956.-Thelephora cinerascens Schw., Trans. Amer.phil.Soc.4:167, 1832.
Lit.: Cunningham 1963.
Specimens: SP 61432, 70987 (OF&MF), 193517 (GG&VB).
Loc.: 5,12.
Remarks. The species was surprisingly not found from more than three times as it has a cosmopolitan tropical distribution.

Melzericium rimosum Bononi & Hjortst. spec.nov.
Fructificatio resupinata, effusa, arte adnata, albida vel cremicolor, hymenium leve, distincte rimosum, margo gracilis vix observatus. Systema hyphale monomiticum; hyphis basalibus tenuitunicatis vel crassiusculis, 2.5-3(-3.5) um latis, pro parte majore rectis et uniformibus, hyalinis, hyphis subhymenialibus plus minus sinuolatis vel aliquando tumescensibus, hyphis omnibus fibulatis; cystidia nulla; basidia terminalia vel saepe lateralia, 15-18(-20) x 5-5.5(-6.5) um, tenuitunicata, 4 sterigmatibus; sporis tenuitunicatis, cylindraceis vel leviter allantoidibus, (6.5-)7-7.5(-8) x 2.5-2.8(-3) um, amyloidibus.
Holotypus: Brazil. Sao Paulo State, Sao Paulo, State Park, "Fontes do Ipiranga", Instituto de Botanica, on branches of deciduous tree. 1985.06.27-07.10. K. Hjortstam No.16095 (GB). Isotypi: in SP and Hjm private herb.

FRUITBODY resupinate, effuse, closely adnate and hardly separable from the substratum, whitish to cream-coloured, hymenium smooth but strongly cracked in minute and irregular pieces. HYPHAL SYSTEM monomitic. BASAL HYPHAE straight, commonly branched at right angles, hyaline, thin to moderately thick-walled, 2.5-3(-3.5) um wide. SUBHYMENIAL HYPHAE



Melzericium rimosum a) basal hyphae b) subhymenial hyphae c) basidia d) young pleural basidia e) spores. From the holotype.

irregularly interwoven,sinuous or/and with swellings, all hyphae with clamps.CYSTIDIA absent, but scattered hyphoids between the basidia. BASIDIA varying in shape, terminal or more commonly developed laterally on the hyphae, often with granular contents or/and with several oildrops, 15-18(-20) x 5-5.5(-6) um, normally with four sterigmata and a basal clamp. SPORES thin-walled, hyaline, smooth, (6.5-)7-7.5(-8) x 2.5-2.8(-3) um, typically cylindric or slightly allantoid, in most cases with a suprahilar depression, strongly amyloid.

Remarks. Because of the characteristic amyloid spores and laterally basidia this species may be easy to recognize. It is similar to M. udicolum (Bourd.) Hauersl. but has smaller basidia. The spores are also different and are typically cylindrical and not reniform to fabiform. Other genera that must be considered in this case are Amyloathelia (Hjortstam and Ryvarden 1979) and Amylocorticium (Pouzar 1959). The first genus is clearly defined by its terminal basidia, thick-walled spores (in KOH) and a typical pellicular (athelioid) fructification. Amylocorticium has terminal and constricted (waisted) basidia and the hyphae are straight and without swellings. With exception of the amyloid spores, the genus reminds somewhat of Hyphodontia, especially as to configuration of hyphae.

Mycoacia subconspersa (Rick ex Rambo) Hjortst.& Ryv., Mycotaxon 15:272, 1982.-Odontia subconspersa Rick ex Rambo, Iheringia Bot.5:164, 1959.
Lit.: Hjortstam and Ryvarden 1982.
Specimens: SP 47648 (OF&JF), 177384 (VB).
Loc.: 16,22.
Remarks. The species was described from Sao Leopoldo and is related to M. aurea (Fr.) John Erikss.& Ryv. and M. uda(Fr.) Donk, but well separated by narrow and distinctly allantoid spores. See also Skvortzovia below.

Mycobonia flava (Sw.:Fr.) Pat., Bull.trimest.Soc.mycol. France 10:77, 1894.-Peziza flava Sw.:Fr., Syst.mycol.II: 161, 1822.
Lit.: Jülich 1976.
Specimens: SP 60262 (CN), 22662 (JR), 31242 (OF&MF), 43575 (AT&BT), 46980 (OF&JF), 70848 (OF&MF), 83554 (BL), 83811 (AT), 106903 (GE&LE), 108801 (FN), 14132, 14146 (DV),193504 (VB), 11254 (DV).
Loc.: 2,4,6,11,12,18,20,21,22.

Odontiopsis aff. hyphodontina Hjortst.& Ryv., Mycotaxon 12:180, 1980.
Lit.: Hjortstam and Ryvarden 1980.
Specimen: SP 91439 (JF).
Loc.: 12.
Remarks. The material is very scarce and may represent an independent species. Comparable to specimens reported from Iguazu (Argentina) by Hjortstam and Ryvarden 1986. They all seem to be the same taxon and are softer than normal, but have the same short basidia so typical for Odontiopsis.

Phanerochaete filamentosa (Berk.& Curt.) Burds., Distr.Hist. Biota South Appalach.IV:Algae,Fungi p.278, 1975.-Corticium filamentosum Berk.& Curt., Grevillea 1:178, 1873.
Lit.: Burdsall 1985.
Specimen. 16102 (Hjm).
Loc.: 22.

P aff. xerophila Burds., Mycologia Mem.10:141-142, 1985.
Lit.: Burdsall 1985.
Specimen: SP 48493 (CN).
Loc.: 10.
Remarks. The material is rather scarce, but is comparable to the type of P. xerophila especially as to spore-size. There are at least two other species which must be considered viz.:P. cordylines (G.H.Cunn.) Burds. and P. corymbata (G.H.Cunn.) Burds. Both are similar to P. xerophila and apparently only ? separated by their spore- size. The acystidiate species of Phanerochaete demands perfectly developed material to be properly investigated and additional material is needed before a final determination can be reached.

Phlebia chrysocreas (Berk.& Curt.) Burds., Mycologia 67: 497, 1975.-Corticium chrysocreas Berk.& Curt., Grevillea 1: 178, 1873.
Lit.: Burdsall 1975.
Specimen: 16011 (Hjm).
Loc.: 16.
Remarks. In addition to the cited material also the type of Kneiffia chromoplumbea Berk.& Br.(described from Ceylon) was studied. We are not convinced that this species is conspecific with P. chrysocreas and probably the same can be said about Corticium flavocroceum Bres. (see Burdsall and Lombard 1975) The type of the latter is, however, in a poor condition. Furthermore, a similar taxon to the species has been collected several times in East Africa by Ryvarden. The name Grandinia sulphureo-ochracea P. Hennings should preferably be used for this taxon. The African material differs chiefly by its hyphal structure and a little longer spores but has the same kind of basidia and cystidia.

Radulomyces confluens (Fr.:Fr.) M.P.Christ., Dansk Bot.Ark. 19:231, 1960.-Thelephora confluens Fr..Fr., Syst.mycol.I: 447, 1821.
Lit.: Eriksson et al. 1981.
Specimen: SP 97532 (BS).
Loc.: 22.
Remarks. The spore-size is normal for the species, about 8-11 x 7-8 um.

Schizopora paradoxa (Fr.) Donk, Persoonia 5:76, 1967.-Hydnum paradoxum Fr., Syst.mycol.I:424, 1821.
Lit.: Eriksson et al. 1984.
Specimen: SP 141937 (ST).
Loc.: 22.

Scytinostroma albo-cinctum (Berk.& Br.) Boid.& Lanq., Kew Bull.31:621, 1976.-Stereum albo-cinctum Berk.& Br., Journ. Linn.Soc.Bot.14:66, 1875.
Lit.: Boidin and Lanquetin 1976.
Specimens: SP 31598 (MB) det. D.Reid, 14211, 156771, 156780 (VB), 142118 (RP).
Loc.: 13,18.
Remarks. All specimens except 31598 are sterile,but according to the typical skeletohyphidia and the colour of the fruitbody, it seems to us that all belong here. It should be noted that S.phaeosarcum Boid.& Lanq. (loc.cit. p.623) is known from Brazil. This species differs by its ellipsoid spores and is evidently rare.

S. portentosum (Berk.& Curt.) Donk, Fungus 26:20, 1956. -Corticium portentosum Berk.& Curt., Grevillea 2:3, 1873.
Lit.: Hallenberg 1985.
Specimens: SP 25618, 61394 (OF&MF), 45367 (ES), 107490 (VB), 142090 (RP), 157391 (OY).
Loc.: 1,9,22.
Remarks. Both 45367 and 61394 were determined as S. duriusculum by D.Reid. Compare also Hjortstam and Ryvarden 1986.

Sistotrema subtrigonospermum Rog., Univ.Iowa Stud.Nat.Hist. 17:22, 1935.

Lit.: Eriksson et al. 1984.
Specimen: SP 71551 (KW).
Loc.: 17.
Remarks. The material is scarce with only few basidia and spores observed. Earlier found among Ricks specimens from Brazil and reported by Rogers (1935).

Sistotremastrum niveocremeum (Höhn.& Litsch.) John Erikss., Symb.bot.Ups.16:62, 1958.-Corticium niveocremeum Höhn & Litsch., Sitzber.Akad.Wiss.Wien,Math-nat.Kl,117:1117, 1908.
Lit.: Eriksson et al.1984.
Specimen: SP 97665 (HR).
Loc.: 22.
Remarks. This specimen was determined as S. suecicum Litsch. ex John Erikss. by Liberta probably owing to the spores that are shorter than normal.

Skvortzovia Bononi & Hjortst. gen.nov.
Etymology: in honour of the deceased botanist Boris Skvortzov who collected corticiaceous fungi in the State of Sao Paulo in the sixties and early seventies.
Fructificatio resupinata, effusa, hymenium plus minus laxum, fragile vel mediocriter fragile, distincte aculeatum. Systema hyphale monomiticum; hyphae fibulatis; trama aculei aliquantum densi, hyphis leviter conglutinatis, tenuitunicatis vel crassiusculis; cystidia fere capitata, plus minus lageniformia; basidia clavata, relative parva, 12-15 x 3.5-4 um, 4 sterigmatibus; sporis plus minus allantoidibus, levibus, neque amyloidibus et cyanophilis, neque dextrinoidibus.
Type species: Odontia furfurella Bres.
Generitype specimen: (lectotype) U.S.A. Virginia, Great Falls, J.R.Weir No.20087. Sept.23.1921 (PBI), designated by Gilbertson 1963.

FRUITBODY resupinate, effuse, light-coloured to pale yellowish brown, hymenium distinctly odontioid, moderately fragile. HYPHAL SYSTEM monomitic, all hyphae with clamps, hyphae in the centre of the aculei slightly conglutinated, thin to moderately thick-walled.CYSTIDIA or other sterile elements more or less capitate and lageniform. BASIDIA clavate, small-sized, about 12-15 x 3.5-4 um, with four sterigmata and a basal clamp. SPORES allantoid or subreniform, thin-walled, smooth, inamyloid, acyanophilous, indextrinoid.

Skvortzovia furfurella (Bres.) Bononi & Hjortst. comb.nov.
Basionym: Odontia furfurella Bres., Mycologia 17:71, 1925.

FRUITBODY resupinate, effuse, adnate, not separable from the substratum, whitish or creamish at first, then darkening and finally pale ochraceous, distinctly odontioid with fairly brittle, more or less cylindrical or sometimes slightly conical aculei, about 0.5-1 mm long, apically smooth and in some specimens distinctly crowded, hymenium between the aculei smooth, fairly thin, concolorous with the aculei, no parts changing colour in KOH. HYPHAL SYSTEM monomitic, hyphae distinct, conglutinated in the centre of the aculei and more or less parallely arranged, moderately thick-walled, about 2-2.5(-3) um wide, with frequent clamps. CYSTIDIA scattered or in some specimens fairly frequent, projecting as much as 15-20 um above the basidia, thin-walled, lageni-

form, subcapitate, about 30-40 um long and 3 um wide near the base. BASIDIA subclavate, 12-15 x 3.5-4(-4.5) um, with four sterigmata and a basal clamp. SPORES allantoid, thin-walled, 4-5 x 1 um.
Lit.: Gilbertson 1963 with figure.
Specimens: SP 106880, 107472, 107514, 107517 (BS), 128061, 156742, 157402 (VB), Hjm 16045.
Loc.: 16,18,19,22.
Remarks. This new genus is somewhat similar to Mycoacia from which it differs by a more fragile and loose hymenium and tissue, besides smaller basidia reminding of those of Trechispora. Mycoacia is said to be a typical representant of the phlebioid fungi (Eriksson and Ryvarden 1976) preferably in the aspect of the dense palissade of narrow basidia, which is not the case with Skvortzovia furfurella. The species has a rather dense basidial layer, but the basidia are not of the same shape as in Mycoacia and for example Phlebia where most basidia are narrowly clavate.
Grandinia lunata Romell in Bourd.& Galz, is closely related to S. furfurella. It has about the same kind of basidia and aculeal hyphae, though sometimes slightly amyloid, and the spores are suballantoid or subreniform. This species has been referred to Athelopsis sub sectio Clavobasidium ad.int. by Parmasto (1968) and to Trechispora by Jülich(1975/b).However, it has evidently nothing in common with these genera.
Mycoacia subconspersa (Rick ex Rambo) Hjortst.& Ryv. is, at least microscopically, similar to S. furfurella, but lacks cystidia and has a more gelatinized tissue and a harder consistency. For the time being we prefer to retain this species in Mycoacia.
The distribution of S. furfurella is imperfectly known and previously only reported from Eastern USA by Gilbertson (1963).

Steccherinum reniforme (Berk.& Curt.) Banker, Mem.Torr.bot. Club 12:127, 1906.-Hydnum reniforme Berk.& Curt., Journ. Linn.Soc.Bot.10:325, 1868.
Lit.: Maas Geesteranus 1974.
Remarks. Numerous collections in the herbarium with some specimens labelled S. rawakense (Pers.) Banker and S. subrawakense Murill. They all seem to belong to S. reniforme. Nevertheless, the material is not homogeneous, especially as to the spore-shape, which vary from ellipsoid to more or less narrowly ellipsoid, and a more close revision of all species of Steccherinum from Brazil seems to be highly needed.

S. subochraceum Bononi & Hjortst., Mycotaxon 25:467, 1986. -Irpex hydneus Rick ex Rambo, Iheringia Bot.5:190, 1959, illegitimate name, the holotype was not mentioned in the protologue.-Steccherinum hydneum(Rick) Maas G., Persoonia 7:512, 1974.
Lit.: Maas Geesteranus 1974, Hjortstam and Bononi loc.cit. and compare the figure of S. ochraceum in Eriksson et al. 1984.
Specimens: SP 97591 (holotype, HR), 128128 (YU).
Loc.: 21,22.
Remarks. This species is confusingly similar to S. ochrace-

um (Pers.:Fr.) S.F.Gray, especially macroscopically. The spores are, however, nearly globose and not ellipsoid as in the latter species. Further, it has two kinds of cystidia. Besides skeletal cystidia also short hymenial cystidia similar to metuloids occur, especially in lower parts of the aculei. The latter specimen mentioned above is poor and no spores were found.

Subulicystidium longisporum (Pat.)Parm., Consp.syst.cort. p.121, 1968.-Hypochnus longisporus Pat., Journ.Bot.Paris 8: 221, 1894.
Lit.: Eriksson et al. 1984.
Specimens: SP 92416 (BL), 95483, 97508, 97527 (BS).
Loc.: 14,22.

Trechispora farinacea (Pers.:Fr.) Liberta, Taxon 15:318, 1966.-Hydnum farinaceum Pers.:Fr., Syst.mycol.I:419, 1821.
Lit.: Liberta 1973.
Specimens: SP 106950, 106958, 107189, 107508, 107558 (BS).
Loc.: 22.
Remarks. The species is treated in its broad sense.

Xylobolus frustulatus (Pers.:Fr.) Boid., Rev.Mycol.Paris N.S.23:341, 1958.-Thelephora frustulata Pers.:Fr., Syst. mycol.I:445, 1821.
Lit.: Jülich and Stalpers 1980.
Specimens: SP 31920 (VB), 61427 (OF).
Remarks. The first specimen is poorly developed and no spores were found in the latter. Hence, the determination is somewhat doubtful.

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HYPHODONTIA TENUICYSTIDIA SP.NOV. (CORTICIACEAE) FROM ARGENTINA

by

Kurt Hjortstam

University of Göteborg
Department of Systematic Botany
Carl Skottsbergs Gata 22
S-413 19 Göteborg, Sweden

and

Leif Ryvarden

Botanical Institute, University of Oslo
P.O.Box 1045, Blindern, Oslo 3, Norway

Abstract

The description of Hyphodontia tenuicystidia in Mycotaxon 25:558,1986 is invalid because the holotype was not mentioned in the protologue. The species is herewith redescribed.

Hyphodontia tenuicystidia Hjortst.& Ryv. spec.nov.

Fructificatio resupinata, adnata, circiter 0.1-0.2 mm crassa, pallide ochracea; hymenio levi vel parum tuberculato; systema hyphale monomiticum; subiculum indistinctum, hyphis paucis, parallele, tenuitunicatis, 2.5-3 um latis, fibulatis; hyphis subhymenialibus plus minus verticalibus, 2-4 um latis, itidem fibulatis; cystidia sparsa, tubuliformia, tenuitunicata, hyalina, 90-100 x 4-6 um, obtusa; basidia primum subclavata tum suburniformia, basaliter crassiuscula, 20-25 x 3-4 um, 4-sterigmatibus; sporis ellipsoidibus, levibus, tenuitunicatis, 5-5.5(-6) x 2.8 -3.2 um.

Holotypus: Argentina.Prov.Misiones, Iguazu Nat.Park, Cataratas de Iguazu.1-5 March 1982. L. Ryvarden 19523 (O). Isotypus: (GB).

For illustration, English description, and remarks, see Mycotaxon 25:559-560, 1986.

MYCOTAXON

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STUDIES IN
TROPICAL CORTICIACEAE (BASIDIOMYCETES) VII

Specimens from East Africa, collected by L.Ryvarden. II

by

Kurt Hjortstam

Department of Systematic Botany
University of Göteborg
Carl Skottsbergs Gata 22
S-413 19 Göteborg,Sweden

SUMMARY

42 corticioid species are reported from East Africa and the following new genera and species are described: *Botryodontia denticulata*, *Crustomyces indecorus*, *Cyanodontia* with the type *C. spathulata*, *Cystostereum kenyense*, *Gloeocystidiellum aspellum*, *G. kenyense*, and *Nodotia* (anagram of *Odontia*) with the type *N. aspera*. The following new combinations are proposed: *Boidinia lacticolor* (basionym:*Gloeocystidium lacticolor*), *Botryodontia* (basionym:*Candelabrochaete* subg.*Botryodontia*), *Botryodontia cirrata* (basionym:*Candelabrochaete cirrata*), *Crustomyces heteromorphus* (basionym:*Cystostereum heteromorphum*), *Gloeohypochnicium* (basionym:*Hypochnicium* subg.*Gloeohypochnicium*), *Gloeohypochnicium analogum* (basionym:*Gloeocystidium analogum*), *Lindtneria chordulata* (basionym:*Pellicularia chordulata*), and *Odontiopsis ambigua* (basionym:*Hydnum ambiguum*). Keys are provided to some genera with odontioid fruitbodies and to *Lindtneria*.

This is the second part of an investigation of corticiaceous fungi collected by L.Ryvarden in Eastern Africa. The locality-list is the same as in Mycotaxon 17:555-556.

BOIDINIA LACTICOLOR (Bres.) Hjortst.& Ryv. comb.nov.
Basionym: *Gloeocystidium lacticolor* Bres., Hedwigia 56:303, 1915.-*Gloeocystidiellum donkii* Rattan, Bibl.Mycol.60:111, 1977. (Isotypus SSR 5488, K!).

Specimens: Kenya (5) 8980,(6) 9689,(7)9786,9877. Malawi (11) 11303/B.
Remarks. Coll.9689 is typical while the others differ mainly by denser fructification. The isotype of *G.donkii* was examined by Freeman and according to the label he placed this species in synonymy with *G. propinguum* (Jacks.& Deard.) Parm.

This latter species has, however, decidedly smaller spores.

BOTRYOBASIDIUM PILIFERUM Boid.& Gilles,
Mycotaxon 14:295, 1982.

Specimen:Kenya (10)9420/C.
Remarks. The species is easily recognized owing to the thin-walled and protruding cystidia, subnavicular spores, and hyphae without clamps.

BOTRYODONTIA (Hjortst.& Ryv.) Hjortst. stat.nov.
Basionym: Candelabrochaete subg. Botryodontia Hjortst.& Ryv., Mycotaxon 25:545, 1986.

Generic type: Candelabrochaete cirrata Hjortst.& Ryv.
Type specimen: Argentina.Iguazu Nat.Park. L.Ryvarden 19572(0).

Fruitbody resupinate, loosely adnate, fairly thin, arachnoid or distinctly continuous, tufted and with small to relatively small aculei. Rhizomorphs conspicuous in the type. Hyphal system monomitic or dimitic-duplex in the type, hyphae thin to distinctly thick-walled, without clamps. Cystidia or hyphoid elements present, smooth or strongly encrusted. Basidia short (about 10-15(-20um), obconical to becoming short-cylindrical, with 4 sterigmata and without basal clamp. Spores about 6-7 um in diam., subglobose, thin-walled, smooth, inamyloid, indextrinoid, acyanophilous.

Remarks. The subgenus Botryodontia was proposed to accomodate Candelabrochaete cirrata which differs from other species in the genus by its shorter, mostly obconical to short-cylindrical basidia. C. cirrata is dimitic or pseudodimitic, while the new species below is a typical monomitic species. Evidently the two species are closely related as to morphology of basidia, size and appearance of spores and an aculeate fruitbody. However, a similar gross morphology does not in itself indicate a generic affinity. Under a dissecting microscope the species may for example be taken for either a Hyphodontia, Odonticium spp., or other species with a soft and aculeate surface.

BOTRYODONTIA CIRRATA (Hjortst.& Ryv.) Hjortst. comb.nov.
Basionym: Candelabrochaete cirrata Hjortst.& Ryv., Mycotaxon 25:545, 1986.

Known from South-America only.

BOTRYODONTIA DENTICULATA Hjortst. spec.nov. Fig.1.

Fructificatio resupinata, laxe adnata, mediocriter lenis, aculeis parvis, circiter 0.1-0.3 mm longis, 6-8/mm, pro parte maxima fertilibus. Systema hyphale monomiticum, hyphis basalibus sine fibulis, crassitunicatis, hyalinis, plerumque 5-6 um latis, hyphis subhymenialibus similis, sed tenuitunicatis vel crassiusculis. Cystidia vel hyphidia in hymenio adsunt, incrustatis apicalibus instructis. Basidia comparate brevia,obconica vel breviter cylindrica, circiter 10-15 x 6-6.5 um, 4 sterigmatibus. Sporis subglobosis, levibus, hyalinis, 6-6.5 x 4.5-5 um.

Holotypus: Africa.Kenya.Western Prov.,Kakamega Forest, c.13 km E.S.E.of Kakamega, alt.c.1500 m. 25.-27.Jan.1973. L.Ryvarden 9411 (0). Isotypus:in Hjm priv.herb. Paratypi: Kenya

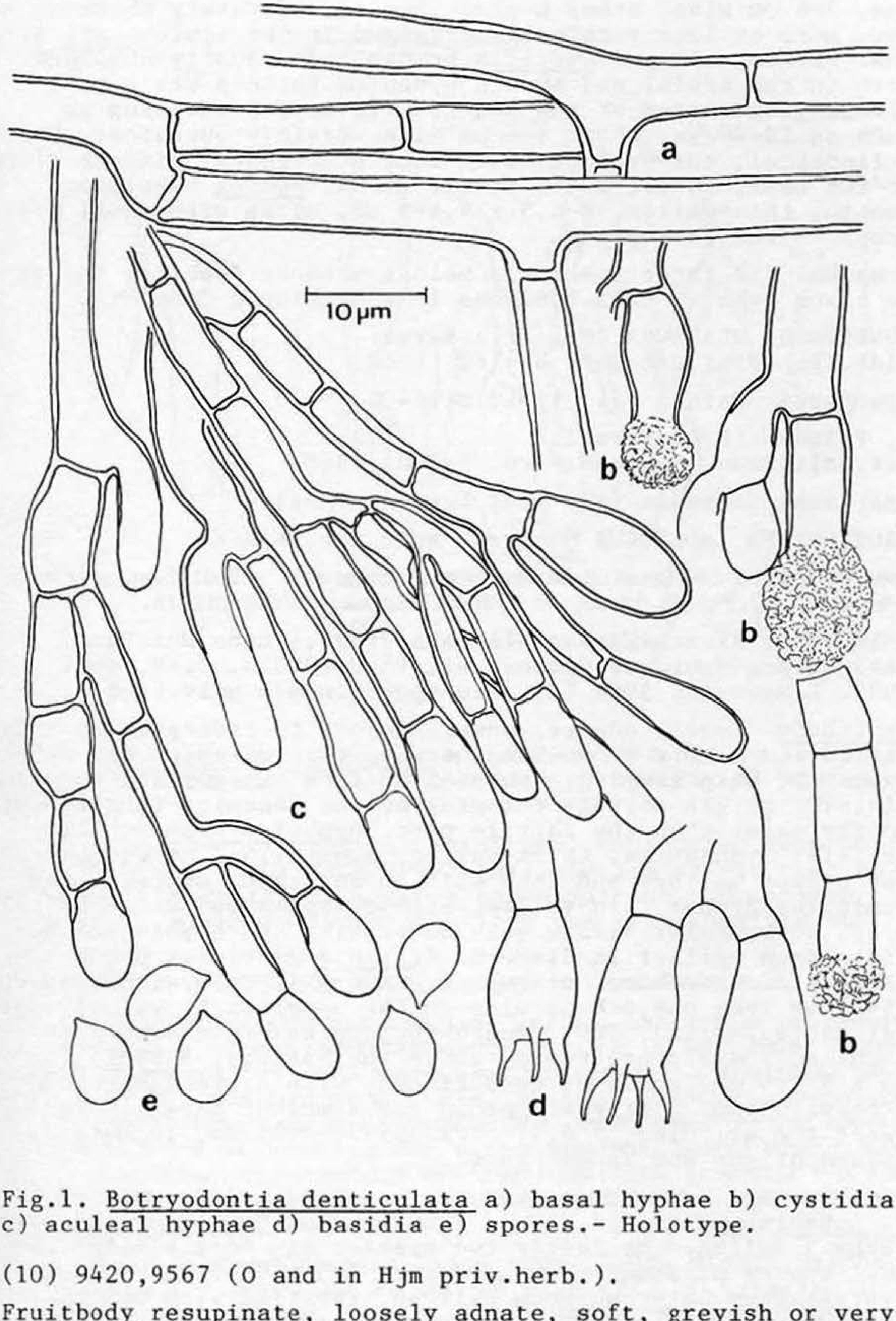

Fig.1. Botryodontia denticulata a) basal hyphae b) cystidia c) aculeal hyphae d) basidia e) spores.- Holotype.

(10) 9420,9567 (O and in Hjm priv.herb.).

Fruitbody resupinate, loosely adnate, soft, greyish or very pale yellowish grey, distinctly odontioid, with small, about 0.1-0.3 mm long and somewhat penicillate aculei, generally 6-8/mm, mostly fertile. Hyphal system monomitic, basal hyphae thick to distinctly firm-walled, smooth or slightly encrusted, 5-6 um wide, other hyphae thin to moderately thick-walled, more or less vertically arranged in the aculei, all hyphae without clamps. Cystidia or hyphoids usually abundant both in the aculei and smooth hymenium between the teeth, strongly encrusted at the subcapitate tip, projecting as much as 10-20 um, about 5-6 um wide. Basidia obconical,short-cylindrical, thin-walled, with four sterigmata, without clamp at the base, 10-15(-20) x 6-6.5(-7) um. Spores subglobose, smooth, thin-walled, 6-6.5 x 4.5-5 um, often with small oildrops in the protoplasm.

Remarks. The three specimens belong without doubt to the same taxon even if coll.9567 has less developed cystidia.

CONIOPHORA OLIVACEA (Fr.:Fr.) Karst.,
Bidr.Känn.Finl.Nat.Folk 37:162, 1882.

Specimens: Malawi (11) 11315/B,11401.

C. PUTEANA (Fr.) Karst.,
Not.Säll.Fauna Fl.Fenn.Förh. 9:370, 1868.

Specimen: Tanzania (17) 5391 (det.J.Ginns).

CRUSTOMYCES INDECORUS Hjortst. spec.nov. Fig.2.

Species habitu cum Crustomyce subabrupto congruens sed differt sporis 5-6.5(-7) x 2.5-3(-3.5) um, et cystidiis sine schizopapillis.

Holotypus: Africa.Tanzania.Arusha Prov.,Arusha Nat.Park, Lake Kusare-Ngurdoto Crater, alt.1500-1700 m. 7.-9.Febr. 1973. L.Ryvarden 9968 (O). Isotypus: in Hjm priv.herb.

Fruitbody closely adnate, membranaceous to crustaceous, stratified and with a brown zone between the subiculum and subhymenium, pale greyish, hymenial surface tuberculate to grandinioid, margin abrupt, thinning out or becoming fibrillose, mostly paler than the fertile part. Hyphal system dimitic, skeletal hyphae few, thick-walled, about 1.5-2 um wide,without clamps but now and then with adventitious septa, other subicular hyphae thin-walled, clamped and about 2-2.5 um wide, subhymenial tissue very dense with the hyphae and basidiebases diffult to discern. Cystidia generally projecting, few to fairly common, clavulate, thin-walled, hyaline, about 25-35 um long and 6-8 um wide in the upper part, without apical schizopapilla, SA-. Dendrohyphidia as a rule easily recognized, barely protruding above the basidia. Basidia 15-20 x 4.5-5 um, somewhat constricted, with 4 sterigmata and a basal clamp. Spores ellipsoid and somewhat tapering towards the apiculus, 5-6.5(-7) x 2.5-3(-3.5) um, inamyloid, acyanophilous and indextrinoid.

Remarks. The species is easy to recognize and is related to C. subabruptus (Bourd.& Galz.) Jülich and C. pini-canadensis (Schw.) Jülich. The latter two species are very similar,and have spores of about the same size, 3.5-4.5(-5) x 2-2.5 um. Cystostereum heteromorphum Hallenb. typified with material from USSR, Carpatorossia, is superficially similar to the new species and must be placed in the same genus. However, dendrohyphidia are not observed in C. heteromorphum and the tissue is more loose than in C. indecorus. Further, the spores are somewhat smaller and often agglutinated in groups of

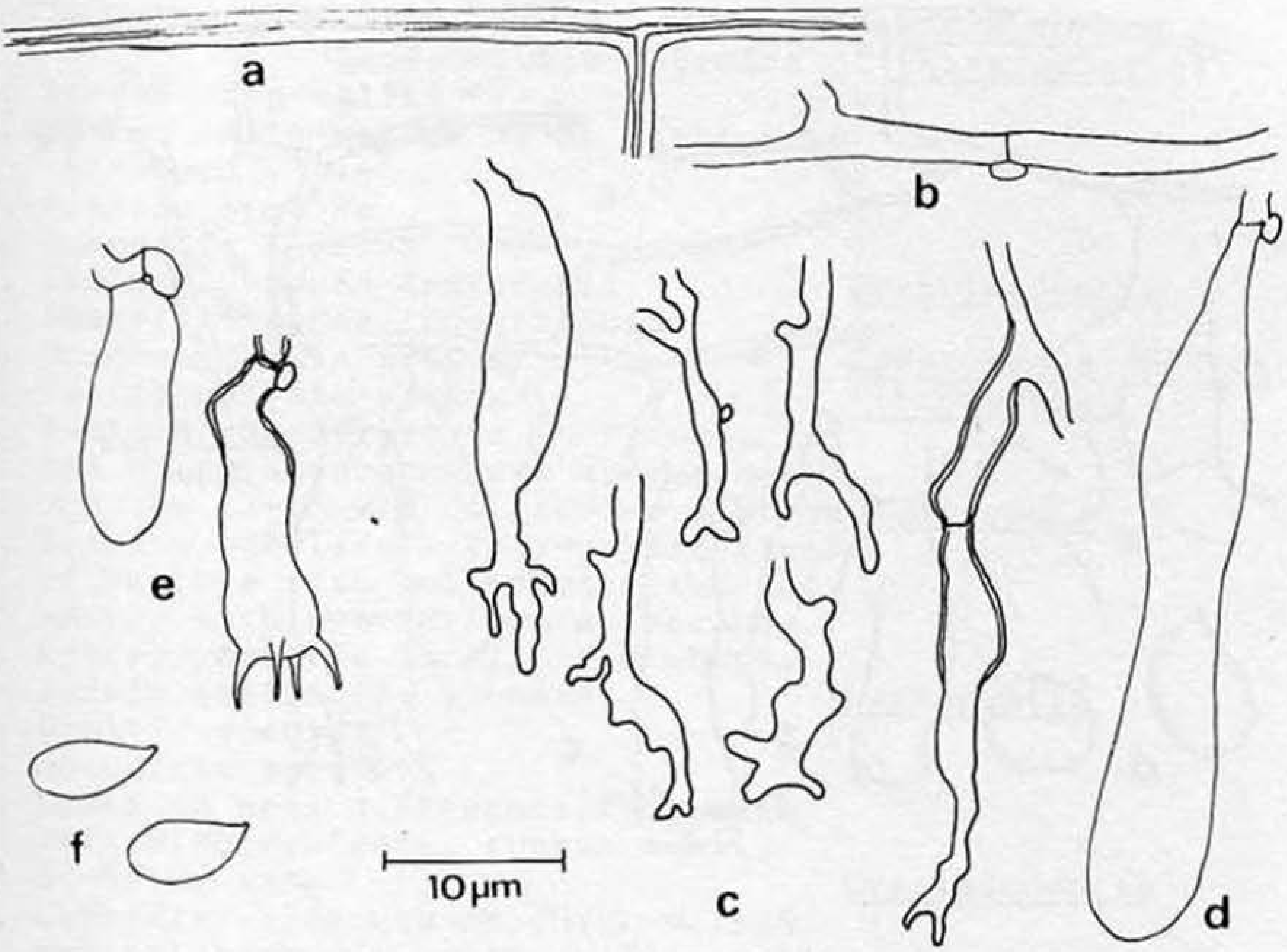

Fig.2. Crustomyces indecorus a) skeletal hyphae b) subicular hyphae c) dendrohyphidia d) cystidium e) basidia f) spores.- Holotype.

2(-4). Consequently the following new combination is proposed: CRUSTOMYCES HETEROMORPHUS (Hallenb.) Hjortst. comb.nov. Basionym: Cystostereum heteromorphum Hallenb., Mycotaxon 11: 450, 1980. Hitherto known only from the type-locality and from Iran.

CYANODONTIA SPATHULATA Hjortst. gen.nov.et spec.nov. Fig.3.

Fructificatio resupinata, satis mollis, luteola, odontioides vel hydnoides, aculeis plerumque spathulatis, circiter 1-2(-3) mm longis. Systema hyphale monomiticum, hyphis basalibus hyalinis vel subhyalinis, semper fibulatis, crassitunicatis, 5-7(-8) um latis, distincte cyanophilis, hyphis ceteris tenuitunicatis, acyanophilis. Basidia mediocriter brevia, (10-)15-18 x 5-6 um, tenuitunicata, 4 sterigmatibus. Sporis subglobosis vel ellipsoidibus, crassiusculis vel crassitunicatis, generatim 6-6.5 x 4.5-5 um, leviter cyanophilis vel distincte cyanophilis, neque amyloidibus, neque dextrinoidibus.

Holotypus: Africa.Tanzania.Tanga Prov.,Tanga distr.,Usambara Mts.,Amani,alt.800-1000 m. 18.-19.Febr.1973. L.Ryvarden 10639 (O). Isotypus: in Hjm priv.herb. Paratypi: Tanzania (22) 10596,10724.

Fruitbody resupinate, moderately soft, pale yellow, distinctly odontioid to hydnoid,or sometimes subporoid but then especially near the margin,with dense aculei, 1-2(-3) mm long,

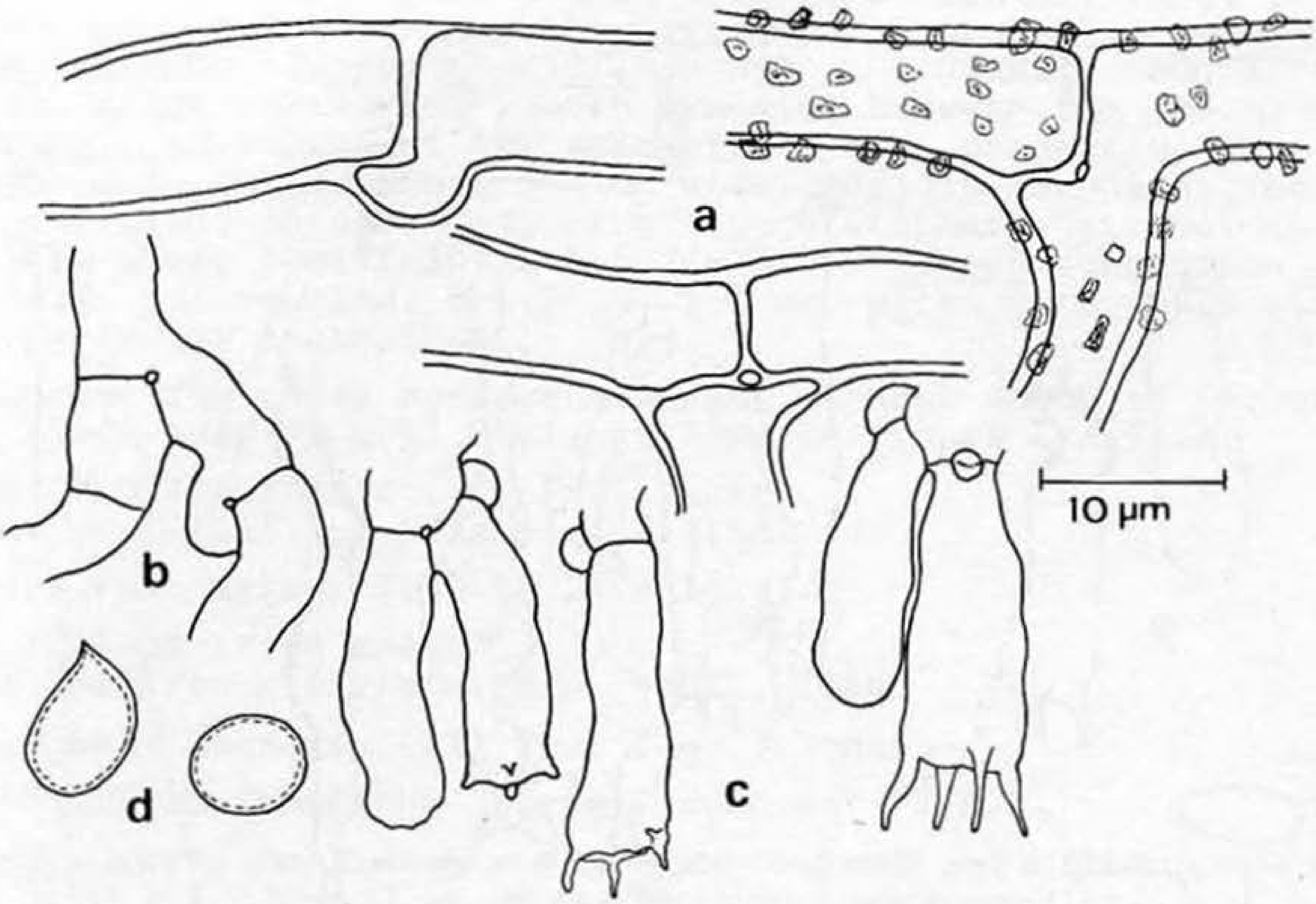

Fig.3. *Cyanodontia spathulata* a) basal hyphae b) thin-walled hypha c) basidia d) spores.-Holotype.

conical or more commonly flattened. *Hyphal system* monomitic. Subiculum composed of thick-walled hyphae, generally 6-7 um wide, with strongly cyanophilous walls, long-celled and in the centre of the aculei projecting and simulating cystidia, other hyphae (mainly in the subhymenial tissue) thin-walled and acyanophilous. *Basidia* short-clavate, (10-)15-18 x 5-6 um, thin-walled, with 4 sterigmata, the uppermost part soon collapsed. *Cystidia* absent. *Spores* 6-6.5 x 4.5-5 um, subglobose to ellipsoid, with slightly thickened walls or some spores distinctly thick-walled due to age, lightly to a more strongly cyanophilous reaction, but inamyloid and indextrinoid.

Remarks. The spores of this species remind somewhat of *Hypochnicium* and *Nodotia* (see below) , but are less cyanophilous than the former. *Cyanodontia spathulata* is, contrary to *Nodotia*, a typical monomitic species with most hyphae firm-walled and with a strong cyanophilous reaction. Another genus is *Odontiopsis* that also has a distinct aculeate hymenium and short basidia. This latter genus has, however, thin-walled spores and the hyphae, though thick-walled, are not cyanophilous.

Key to some genera with odontioid to hydnoid fruitbodies:

1. Hyphae without clamps 2
1. Hyphae with clamps 3
2. Basidia short-clavate, about 10-15 x 6-7 um *Botryodontia*

2. Basidia more or less subcylindrical, about 12-18 x 3-4.5 um — *Candelabrochaete* (compare also species of *Phanerochaete*)
3. Spores thin-walled — 4
3. Spores thick-walled or at least with thickened walls — 8
4. Dimitic species — 5
4. Monomitic species — 7
5. Skeletal hyphae dextrinoid — *Dextrinodontia*
5. Skeletal hyphae indextrinoid — 6
6. Dendrohyphidia present — *Crustomyces indecorus*
6. Dendrohyphidia absent — *Fibrodontia*
7. Basidia short-clavate, not constricted or with suburniform appearance, usually 12-15 x 5 um, spores globose — *Odontiopsis*
7. Basidia subclavate to subcylindrical, of various size but constricted and mostly with suburniform appearance, spores variable in size and shape, rarely distinctly globose — *Hyphodontia*
8. Dimitic species — 9
8. Monomitic species — 10
9. Cystidia well differentiated, with yellowish contents, spores small, 3(-4) um long — *Cystidiodontia*
9. Cystidial elements as thick-walled aculeal hyphoids, without distinctive contents, spores 7-8 um long — *Nodotia*
10. Cystidia absent, typical monomitic species, hyphae strongly cyanophilous — *Cyanodontia*
10. Cystidial elements present, hyphae without cyanophilous reaction — *Nodotia*

CYSTIDIODONTIA ISABELLINA (Berk.& Br.) Hjortst.& Ryv., Mycotaxon 25:549, 1986.- *Cystidiodontia artocreas* (Berk.& Curt.ex Cooke) Hjortst.& Ryv. pro parte.

Remarks. Similar to *C. artocreas* but microscopically easily separated by dextrinoid hyphae. For its distribution in East Africa see Hjortstam (1983) and for description and its delimitation from *C. artocreas* see Hjortstam and Ryvarden (1986).

CYSTOSTEREUM KENYENSE Hjortst. spec.nov. Fig.4.

Fructificatio resupinata, effusa, arcte adnata, crustacea, in typo distincte tuberculata. Systema hyphale monomiticum, hyphis fibulatis, tenuitunicatis vel crassiusculis, 2-4(-5) um latis. Cystidia numerosa, vesiculosa vel tubulares, inclusa vel leviter projecta, circiter 70-100 x 5-20 um, SA-, in hymenio hyphae paraphysoideae praesentes. Basidia anguste clavata, leviter constricta, 4 sterigmatibus. Sporis crassitunicatis, levibus, incoloratis, (4-)4.5-5 x 3.5-4 um, neque amyloidibus,neque dextrinoidibus, distincte cyanophilis.

Holotypus: Africa.Kenya.Nyeri Distr.,Mt.Kenya S. slope, Regati Forest St.,alt.2200-2300 m. 2.-3.Febr.1973. L.Ryvarden 9841 (O). Isotypus: in Hjm priv.herb.

Fruitbody resupinate, effuse, closely adnate, crustaceous, in the type distinctly tuberculate or with odontioid appea-

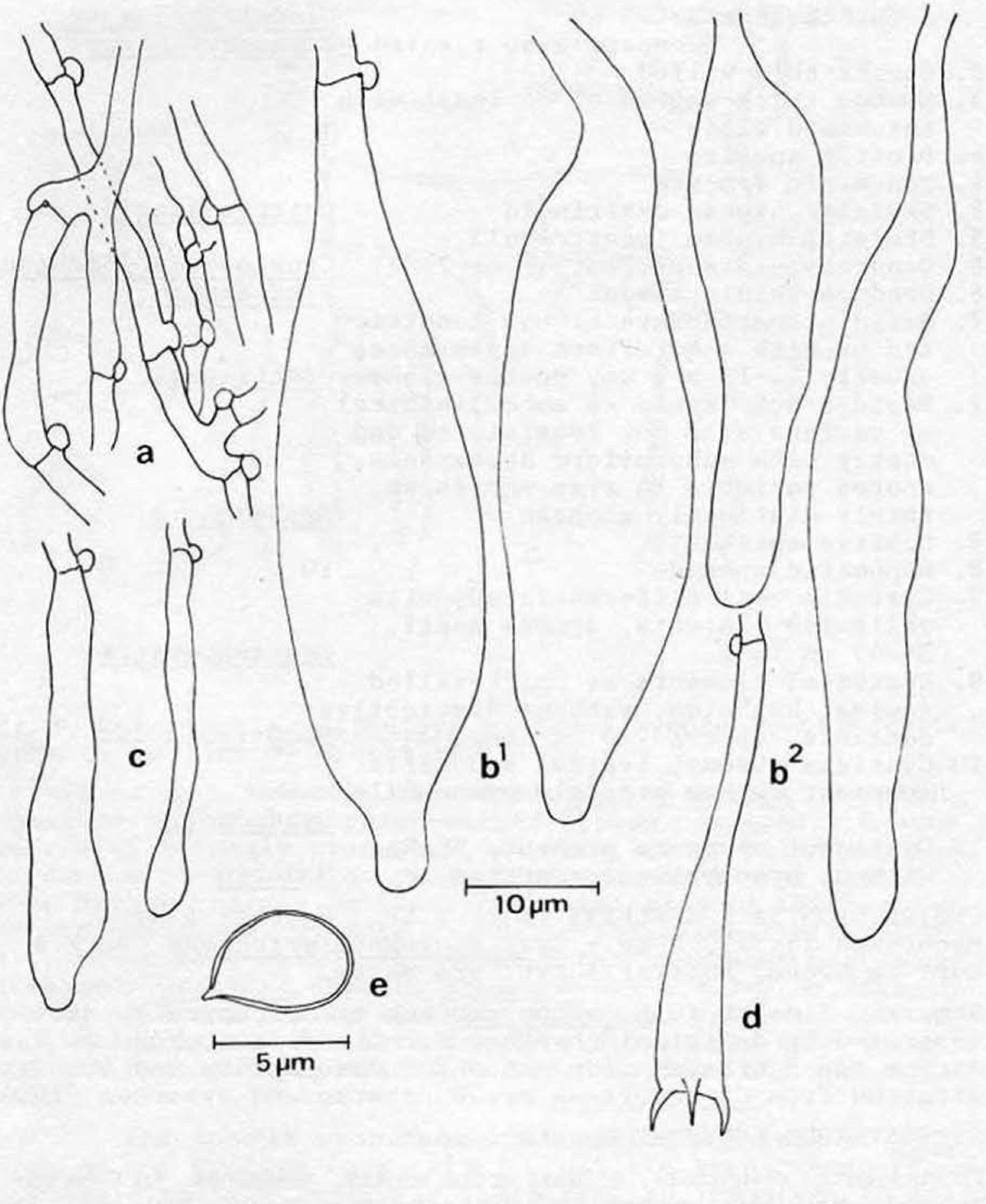

Fig.4. Cystostereum kenyense a) subicular hyphae b^1) vesicular cystidia b^2) tubular cystidium c) hyphoids d) basidium e) spore.-Holotype.

rance, pale ochraceous and with abrupt margin, hymenium somewhat reddish in KOH. Hyphal system monomitic, all hyphae with clamps, thin to moderately thick-walled, 2-4(-5) um wide, arranged in a relatively loose tissue. Cystidia of two kinds 1) vesicular, numerous, mostly embedded but now and then projecting slightly above the basidia, SA-, thin-walled or with very slight wall thickening, about 80-100 um long and approximately 10-20 um wide in the middle part 2) tubular and mostly projecting above the basidia, in less number but proportionately common, about 70 x 5-7 um. Basidia narrowly clavate, 35-40 x 5 um, with 4 sterigmata and a basal clamp. Between the basidia also numerous and slightly projecting hyphoids. Spores subglobose to ellipsoid, smooth, thick-walled, hyaline, (4-)4.5-5 x 3.5-4 um, inamyloid, indextrinoid, but with distinctly cyanophilous reaction.

Remarks. Cystostereum kenyense is separated from C. murraii (Berk.& Curt.) Pouz. by its monomitic hyphal system and distinctly thick-walled and cyanophilous spores. C. australe Nakas. (1983) seems to be extremely similar, but is described as dimitic, and with spores evidently less thick-walled. The new species is so far only known from one collection.

DENDRODONTIA BICOLOR (Talb.) Hjortst.& Ryv.,
Mycotaxon 10:273, 1980.

Specimens: Kenya (6) 9618. Tanzania (19) 10182. Additional material is examined from Uganda (herb.TRTC No. 663361, leg. R.F.Cain,H.P.Griffin,and J.C.Krug).

DEXTRINODONTIA MOLLIUSCULA Hjortst.& Ryv.,
Mycotaxon 12:173, 1980.

Specimens: Kenya (8) 9223. Tanzania (19) 10202,10236(holotype), (22) D. Taylor 1901.

FIBRICIUM CORIACEUM Hjortst.& Ryv.,
Mycotaxon 12:174, 1980.

Specimens: Kenya (7) 9779(holotype),9865.

Remarks. The only morphological difference between this species and F. lapponicum John Erikss. is the presence of cystidia in the latter.

FIBRODONTIA GOSSYPINA Parm.,
Consp.syst.cort. p.174, 1968.

Specimens: Malawi (13) 11138,11169,11187,11197.

GLOEOCYSTIDIELLUM ASPELLUM Hjortst. spec.nov. Fig.5 a-d.

Fructificatio resupinata, effusa, arte adnata, levis, cremicolor, 0.1-1.0 mm crassa, in typo 0.1-0.5 mm, margo abruptus. Systema hyphale monomiticum, hyphis rectis, crassiusculis vel crassitunicatis, 3-4(-5) um latis, fibulatis, hyalinis vel interdum infuscatis. Sulfocystidia tenuitunicata, plus minus subfusiformia, circiter 30-80 x 5-10 um. Basidia clavata, 25-30 x 5-6 um, basaliter crassiuscula, 4 sterigmata. Sporis ellipsoidibus vel anguste ellipsoidibus, nonnumquam suballantoidibus,obscure asperis, quasi 7-9 x 3.5-4.5 um, valde amyloidibus.

Holotypus: Africa.Kenya.Central Prov., Mt.Elgon, Suam Forest Station,alt. c.2100 m.23.-24.Jan.1973. L.Ryvarden 9146 (O). Isotypus: in Hjm priv. herb. Paratypi: Kenya (8) 9147, 9200.

Fruitbody resupinate, effuse, up to 1 mm thick, at first cream-coloured, then pale brown with violaceous dots,when young more or less smooth, finally cracking and distinctly rimose. Hyphal system monomitic, hyphae 3-4(-5) um wide, mostly vertically arranged, thick-walled, hyaline or yellowish brown, especially in KOH, with clamps at all septa, but rather difficult to discern. Gloeocystidia (Pseudocystidia) as a rule numerous, usually 30-80 um long but sometimes up to 100-150

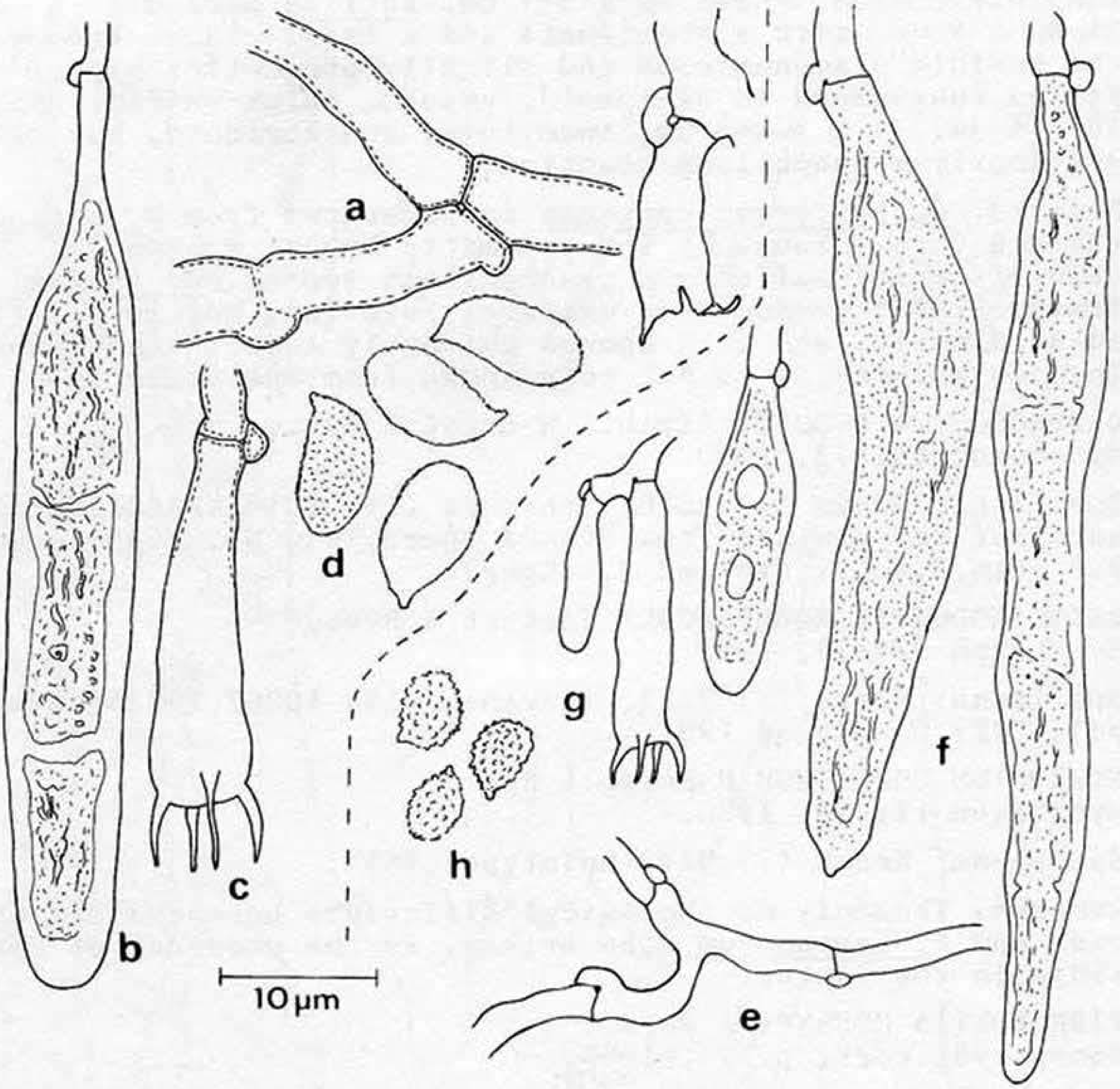

Fig.5. Gloeocystidiellum aspellum a) hypha b) cystidium c) basidium d) spores.-Holotype. Gloeocystidiellum kenyense e) basal hypha f) cystidia g) basidia h) spores.-Holotype.

um, not or slightly protruding, 5-10 um wide, in KOH with yellowish protoplasmatic contents, positive in sulphuric benzaldehyde (SA+). Basidia more or less clavate, in a fairly dense palisade, 25-30 x 5-6 um, thin-walled or at the base with slight wall thickening, with 4 sterigmata and a basal clamp, indextrinoid. Spores at first more or less ellipsoid, when fully developed narrowly ellipsoid or slightly allantoid, 7-9 x 3.5-4.5 um, seemingly smooth, but in Melzer and when empty spores are studied, finely rough, strongly amyloid.

Remarks. Gloeocystidiellum aspellum is somewhat similar to G. luteocystidiatum (Talb.)Boid. and G. leucoxanthum (Bres.) Boid. but separated by finely rough spores. Older specimens (e.g.9147 and 9200) have superficial similarities with species of Conferticium Hallenb. owing to the thickness of hyphae and basidia walls, but there is evidently no basidial repetition. The species is characteristic already to the naked eye and under a dissecting microscope, by its cracked fruitbody and colour change with a violaceous tint. Microscopically it is easy to distinguish by its rough spores, large sulphocystidia, and thick-walled hyphae.

G. CONVOLVENS (Karst.) Donk,
Fungus 26:9, 1956.

Specimens: Malawi (12) 11476. Tanzania (22) 10532.

Remarks. These specimens correspond perfectly of those from the boreal zone.

G. FLAMMEUM Boid.,
Cah. Maboké 4:7, 1966.

Specimen: Tanzania (22) 10615.

Remarks. The type of this species (LY 5580) has been studied and the Tanzanian specimen conforms, but has a distinct sulphuric reaction in the gloeocystidia. The recently described G. triste Hjortst.& Ryv. (1986) from South-America (Argentina) is similar and seems to be best delimited by a more loose,distinctly stratified tissue. Further, the colour of G. triste is more dull and the hymenium is somewhat cracked with a dark to medium brown subiculum. G. triste is recently also found in Brazil.

G. IRPISCESCENS Boid.,
Cah. Maboké 4:13, 1966.

Specimens: Malawi (13) 11209, (14) 11555,11558,(15) 11270. Tanzania (16) 9948, (19) 10226, (22) 10720, D. Taylor 1964, (20) 11021.

Remarks. The material has been compared with the type of G. irpiscescens (LY 5536) and seems related to G. lactescens (Berk.) Boid., preferably by its similar spore-morphology. Another species which, according to the description, is closely related, is Vesiculomyces epitheloides Boid.& al.(1983).

G. LUTEO-CYSTIDIATUM (Talb.) Boid.,
Cah. Maboké 4:9, 1966.

Specimens: Tanzania (16) 9939, (21) 10856.

Remarks. This species is closely related to G. leucoxanthum but can readily be separated by following characters: hyphal tissue somewhat agglutinated and dense, gloeocystidia without schizopapillae or with a moniliform shape, spores slightly allantoid or ellipsoid.

GLOEOCYSTIDIELLUM KENYENSE Hjortst. spec.nov. Fig.5 e-h.

Differt ab Gloeocystidiello poroso sporis subglobosis vel ellipsoidibus et gloeocystidiis plerumque terminalibus, in typo non sulfoaldehydibus (SA-).

Holotypus: Africa.Kenya.Eastern Prov.,Aberdare Mts., Kimakia Forest Sta., alt.2200-2400 m. 16.-18.Jan.1973. L.Ryvarden 8996 (O). Isotypus: in Hjm priv.herb.

Fruitbody resupinate, widedly spread over the substratum, at first cream-coloured with yellowish tint, then pale ochraceous, smooth or indistinctly rimose, about 0.1-0.2 mm thick, margin not differentiated. Hyphal system monomitic, hyphae thin-walled, with clamps, 2-2.5(-3) um wide, forming a fairly dense and somewhat agglutinated tissue. Gloeocystidia numerous, SA-, generally terminal, subfusiform and often with one schizopapilla, thin-walled and with oily content, varying in size but commonly 50-100 um long and about 10 um wide near the base, rarely with one or several adventitious septa. Basidia narrowly clavate, 15-20 x 3.5-4(-4.5) um, with 4 slender sterigmata and a basal clamp. Spores subglobose to ellipsoid, finely verrucose, warts visible in KOH, (3.5-)4-4.5 x 3-3.5 um, strongly amyloid.

Remarks. Gloeocystidiellum kenyense is very characteristic and easily separated from G. porosum (Berk.& Curt.) Donk by smaller spores and commonly terminal gloeocystidia which lack a sulphoaldehyde reaction. The spores of G. porosum are usually up to 5.5-6 um long, and the warts are hardly observable in KOH. The gloeocystidia are commonly lateral and with strongly sulphoaldehyde reaction. It should be noted however, that one specimen from Tanzania (17) 10027 is very similar to the type of G. kenyense, but the gloeocystidia are strongly SA+.

GLOEODONTIA DISCOLOR (Berk.& Curt.) Boid.,
Cah. Maboké 4:22, 1966.

Specimens: Tanzania (19) 10144,10206.

Remarks. These specimens conform with the description given by Burdsall and Lombard (1976) and the only material I have seen outside Africa is RLG 9964, cited by the same authors (on p. 24).

GLOEOHYPOCHNICIUM (Parm.) Hjortst. stat.nov.
Basionym: Hypochnicium subg. Gloeohypochnicium Parm.,
Consp.syst.cort.p.116, 1968.

Generic type: Gloeocystidium analogum Bourd.& Galz.
Type specimen, selected here (Lectotypus): ad truncos Fraxini et Quercus, Aveyron. Herb.Bourdot 34341/Galzin 9952 (PC!). This is a pre-1913 material (Oct.20.1911) and is in accordance with the description, but rather small and young.

Remarks. Gloeohypochnicium is separated from Hypochnicium by the SA+ gloeocystidia, and the ornamentation of the spores. The ornamentation occurs only as swellings of the walls, and not separated warts (as for example in H.punctulatum). See also Eriksson and Ryvarden (1976).

GLOEOHYPOCHNICIUM ANALOGUM (Bourd.& Galz.) Hjortst. comb.nov.
Basionym: Gloeocystidium analogum Bourd.& Galz., Soc.Myc. France Bull. 28:366, 1913.

Specimen: Malawi (12) 11486.

GYRODONTIUM BOVEANUM (Mont.) Maas G.,
Persoonia 3:157, 1964.

Specimens: Ethiopia (3) 8777. Tanzania (16) 9967.

Remarks. A pantropical species and described several times by different authors viz.: G. capense Reid (1963), Hydnum

clavarioides Berk.& Curt. (1869), H. flavidum Lloyd (1920), H. henningsii Bres. (1890) and, H. versicolor Berk.& Br. (1875). For further synonyms see Maas Geesteranus loc.cit. The oldest available name seems to be that of Montagne and is therefore used in this case.
The spores of the African specimens mentioned above are variable in size and measure 4.25-5.25(-5.5) x 2.8-3 um. The germpore is best observed in sulphuric benzaldehyde, and very few spores are distinctly dextrinoid, while all are cyanophilous. The hyphal system is typically monomitic and the hyphae lacking clamps totally. In its size of the spores, basidia, and the configuration of the hyphae, this taxon is very similar to Serpula, which however has regularly clamped hyphae.

HYDRABASIDIUM SUBVIOLACEUM (Peck) John Erikss.& Ryv., Cort.North Eur. 5:897, 1978.

Specimen: Kenya (5) 8970.

Remarks. The species has a world-wide distribution and is known from all continents. For comments of the application of the generic name see Hjortstam (1984).

HYPHODONTIA SAMBUCI (Pers.) John Erikss., Symb.bot.ups. 16:104, 1958.

Specimens: Kenya (6) 9599/B. Tanzania (21) 10899.

Remarks. The specimens differ from the strict sense in several characteristics. Firstly, 10899 has strongly encrusted cystidia with crystals from the base and up to or over the subcapitate apex, and the spores are more round than normal. Secondly, 9599/B has ellipsoid spores and smooth, less capitate cystidia. Both species can, however, easily be treated as H. sambuci in a broad sense. The species is cosmopolitan and one of the most variable taxon in Hyphodontia and needs extensively studies both to its morphology and culture characteristics.

HYPOCHNICIUM CYMOSUM (Rog.& Jacks.) Larss.& Hjortst., Mycotaxon 5:477, 1977.

Specimen: Tanzania (18) 10383.

Remarks. This species was placed in Lagarobasidium by Jülich (1977). For comments see Hjortstam and Larsson loc.cit. and Eriksson and Ryvarden (1976). The main difference from the majority of species in Hypochnicium are the morphology of cystidia and the size of the basidia. At present I prefer to maintain the species in Hypochnicium as the spores conform with the type as well with other species in the genus.

H. PUNCTULATUM (Cooke) John Erikss., Symb.bot.ups. 16:101, 1958.

Specimen: Kenya (5) 8941.

Remarks. The fruitbody is loose and fluffy and the cystidia distinctly thick-walled near the base, thus it seems to be near what has been described as H.cystidiatum Boid.& Gilles (1971). The spores are, however larger than mentioned for this species and fit well those of H. punctulatum.

H. RICKII Hjortst.& Ryv.,
Mycotaxon 15:271, 1982.

Specimen: Tanzania (18) 10247. Previously known only from South-America (Brazil and Argentina), see Hjortstam and Ryvarden (1982,1986).

H. SPHAEROSPORUM (Höhn.& Litsch.) John Erikss.,
Symb.bot.ups. 16:101, 1958.

Specimen: Tanzania (21) 10791.

H. SUBRIGESCENS Boid.,
Cah.Maboké 9:90, 1971.

Specimen: Kenya (8) 9313.

Remarks. The type at LY (5964) has been studied and there is no problem to separate this fungus from H. sphaerosporum.The latter has a much more open tissue and larger spores.

INTEXTOMYCES CONTIGUUS (Karst.) John Erikss.& Ryv.,
Cort.North Eur. 4:735, 1976.

Remarks. The only difference of importance seems to be that the fruitbody is more cartilaginous than in specimens seen from the boreal zone. In other cases the Tanzanian material agree in its spore-size, and the relatively small and stalked basidia.

JAAPIA OCHROLEUCA (Bres.) Nannf.& John Erikss., Fig.6.
Svensk Bot.Tidskr. 47:184, 1953.

Specimen: Kenya (5) 8969.

Remarks. The specimen differs by somewhat shorter and less fusiform spores.

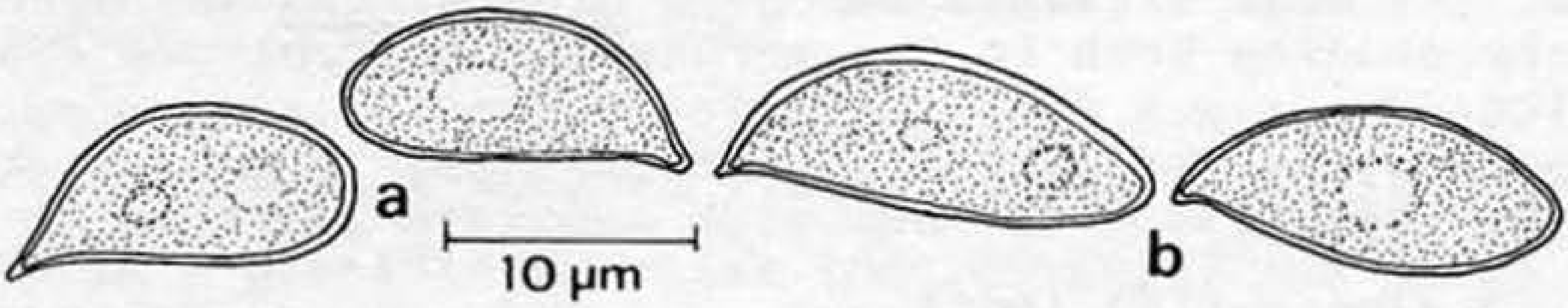

Fig.6. Jaapia ochroleuca a) spores Ryv.8969 b) Hjm 11917 Sweden.

LAETICORTICIUM aff. ROSEUM (Pers.:Fr.) Donk,
Fungus 26:17, 1956.

Specimen: Kenya. Naro Distr.,Masai Mara Game Reserve. 1973-03-21, leg. O.Hedberg 5219 (O).

Remarks. The few spores seen in the specimen are about 8-11 x 6-8 um and lies within the variation observed in L.roseum s.s. but could as well be compared with the closely related and recently described Corticium (Laeticorticium) meridioroseum Boid.& Lanq. (1983). Other specimens examined which probably belong in the genus were sterile or of other reasons indeterminable

LINDTNERIA FLAVA Parm.,
Eesti NSV Tead.Akad.Toim.Biol.17:408, 1968.

Specimens: Kenya (7) 9890. Tanzania (16) 9934.

Remarks. In addition there is one specimen from Tanzania (17) 10137 which seems to be fairly close to *L. flava*, but lacking hyphal clamps. The specimen is, however, rather poor and no basidia have been seen.
Pellicularia chordulata Rog. is another species which is extremely similar to *Lindtneria*. The most striking characters are the morphology of the basidia, which also have a distinct cyanophilous granulation, and the prominent apiculus of the spores which it shares with all other species in *Lindtneria*. Consequently, following combination is proposed: LINDTNERIA CHORDULATA (Rog.) Hjortst. comb.nov. Basionym: *Pellicularia chordulata* Rog., Farlowia 1:98, 1943.- *Cyanobasidium chordulatum* (Rog.) Jülich, Persoonia 10:328, 1979, generic type of *Cyanobasidium* Jülich, loc.cit.p.327.
For its distribution in East Africa see Hjortstam (1983).

Key to the species of Lindtneria:

1. Fruitbody distinctly poroid 2
1. Fruitbody smooth or warty to spathulate or subporoid 5
2. Cystidia present *L.baboquivariensis* (Gilbn.)Gilbn.& Ryv.
2. Cystidia absent 3
3. Spores ellipsoid, about 6-9.5 x 5-6 um *L.flava* Parm.
3. Spores globose or nearly so 4
4. Spores with prominent wing-like crests, about 5.5-7 um across *L.pterospora* Reid
4. Spores strongly spinulose, 6-8 um across excluding the spine *L.trachyspora* (Bourd.& Galz.) Pilát
5. Fruitbody rarely smooth, more commonly warted, spathulate (to subporoid), spores ellipsoid, 7-9 um long *L.leucobryophila* (P.Henn.)Jülich
5. Fruitbody smooth, pellicular, spores globose, about 5 um across 6
6. All hyphae with clamps, Australia *L.pellicularis* Jülich
6. Clamps lacking at some of the hyphal strands and on the subhymenial hyphae *L.chordulata* (Rog.)Hjortst.

The key is partly after, Eriksson and Ryvarden (1976), Gilbertson and Ryvarden (1986), Reid (1975), and Jülich (1978).

MELZERODONTIA ACULEATA Hjortst.& Ryv.,
Mycotaxon 12:178, 1980.

Specimens: Tanzania (20) 10968,11074, (22) 10540 (holotype), 10718.

NODOTIA ASPERA Hjortst. gen.nov.et spec.nov. Fig.7.

Genus cum Hypochnicio aliquantum congruens sed a qua imprimis differt

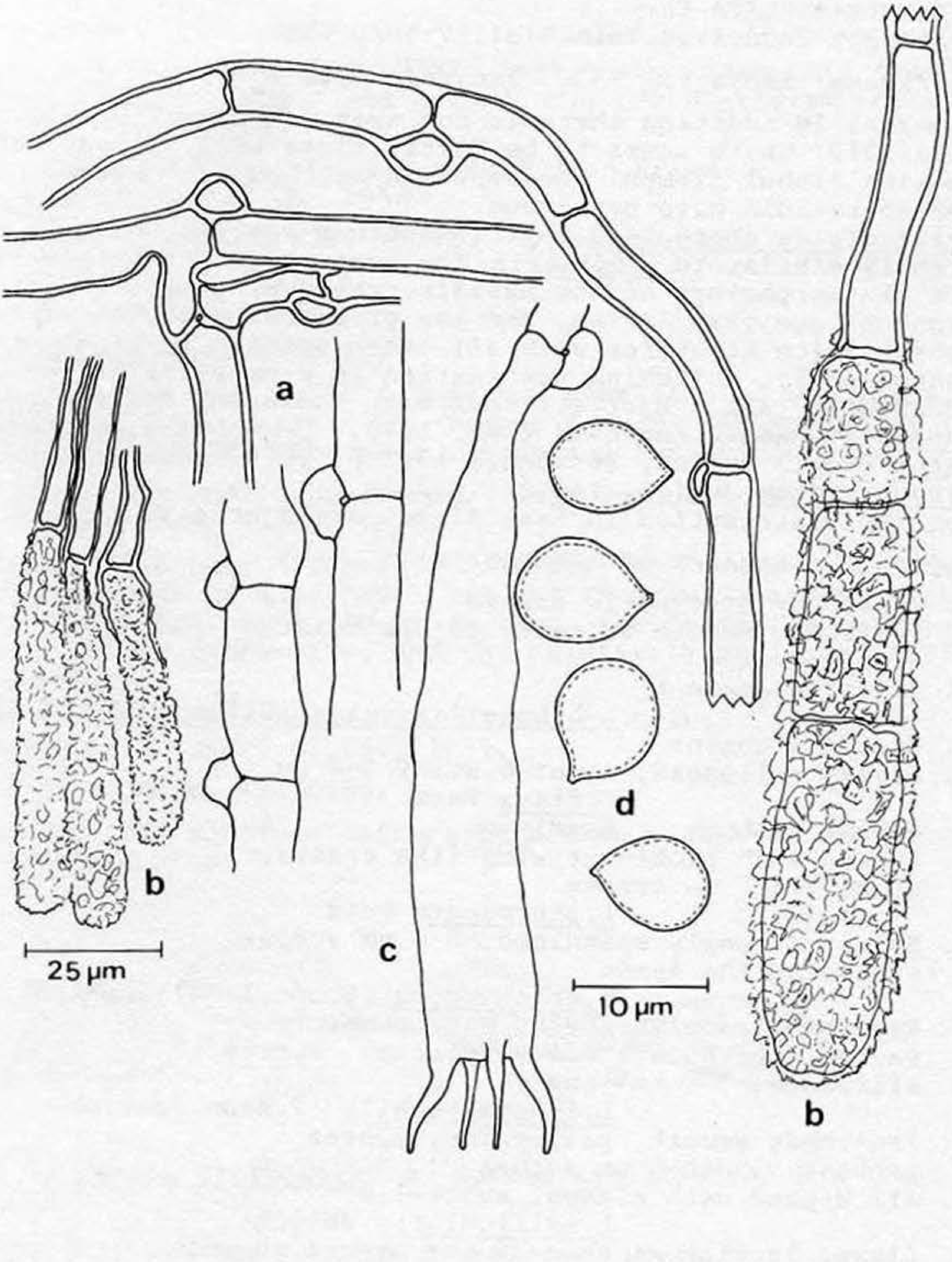

Fig.7. Nodotia aspera a) hyphae b) cystidial elements c) basidium d) spores.-Holotype.

trama aculeorum pseudoskeleticis vel hyphoideis compositum, circiter 200 um longis et sporis saepissime crassiusculis vel crassitunicatis, indistincte cyanophilis, 7.5-8 x 6.5-7.5 um. Basidia clavata, constricta, 40 -50(-60) x 6-7(-8) um, 4 sterigmatibus.

Holotypus: Africa.Tanzania.Kilimanjaro Prov., Mt.Kilimanjaro W.slope, E of Lemosho Glades, montane forest,alt.c.2400 m.15.Febr.1970. L.Ryvarden 5187 (O). Isotypus:in Hjm priv.herb. Paratypus: Kenya (5) 8994 (O).

Fruitbody resupinate, distinctly odontioid with dense and especially when aged, crowded and penicillate aculei, pale ochraceous, margin indistinct or slightly fibrillose. Hyphal system dimitic or rather pseudodimitic, with thick-walled and somewhat agglutinated hyphoids or/and cystidial elements in the centre of the aculei which arising from thick-walled basal hyphae that are clamped at every septa, up to 200 um long and with several adventitious septa along their length, apically strongly encrusted with crystalline matter. Subiculum between the aculei relatively soft, composed by thin-or thick-walled hyphae, mostly branched at right angles close to clamps, about 4 um wide. Subhymenial hyphae thin-walled or with thickened walls. Basidia more or less clavate, somewhat constricted and sinuous, 40-50(-60) x 6-7(-8) um, with 4 sterigmata and a basal clamp. Spores subglobose to ellipsoid or sometimes ovoid, smooth, moderately thick-walled to thick-walled, about 7.5-8 x 6.5-7.5 um, indistinctly cyanophilous, without amyloid and dextrinoid reaction.

Remarks. Except for the thick-walled aculeal elements the genus reminds somewhat of Hypochnicium, especially as to basidia and spores, though the latter have less wall thickening and cyanophilous reaction. The concept of Hypochnicium, as defined here, would be completely changed if dimitic/subdimitic species were included. Nodotia aspera is easily recognized because of its odontioid fruitbody, thick-walled hyphoids, and subglobose to sometimes ovoid spores. It is not a typical dimitic species like Fibricium and most species of Steccherinum as skeletals are absent in the subicular layer next to the wood.

ODONTIOPSIS AMBIGUA (Berk.& Br.) Hjortst. comb.nov.
Basionym: Hydnum ambiguum Berk.& Br., Fungi of Ceylon,Journ. Linn.Soc.Bot. 14:60, 1875.- Odontiopsis hyphodontina Hjortst. & Ryv., Mycotaxon 12:180, 1980.

Holotypus: Ceylon, Central Prov.No.974 (K!).

Remarks. The holotype at Kew is in good condition and the African specimen of Odontiopsis hyphodontina conforms exactly in both macro-and microscopical characters.
This species has also been reported from Argentina with some doubt by Hjortstam and Ryvarden (1986). These specimens seems to be congeneric, but differ from O.ambigua by a more tough consistency and less or not crowded aculei. Besides the type-locality, O. ambigua is known from but one specimen in Africa, Tanzania (20) 10949 (holotype of O.hyphodontina).

PHANEROCHAETE ARENATA (Talb.) Jülich,
Persoonia 10:334, 1979.

Specimens: Ethiopia (3) 8767. Kenya (10) 9420/B.

Remarks. For a detailed description of this species see Talbot (1948) and Burdsall (1985). It should be noted that the spores are generally longer than mentioned by Talbot and when fully developed also distinctly sigmoid.

PUNCTULARIA aff. ATROPURPURASCENS (Berk.& Br.) Petch,
Ann.Roy.Bot.Gard.Perad.6:160, 1916.

Specimens: Tanzania (17) 10116. Malawi (12) 11400/B.

Remarks.Determined with some doubt as the material is sterile (neither basidia nor spores seen). The type of *Thelephora atropurpurascens* has not been studied. According to Talbots description (1958) the African specimens correspond as to the hymenial appearance and hyphal structures.

RAMARICIUM ALBO-OCHRACEUM (Bres.) Jülich,
Persoonia 9:417, 1977.

Specimen: Tanzania (29) 11003.

Remarks. The specimen was growing on leaves. An important character, not noted before, is that a granular cyanophilous reaction occurs in some basidia. The same cyanophility has also been observed in a specimen from Finland (on mosses).

R. POLYPOROIDEUM (Berk.& Curt.) Ginns,
Bot.Not.132:98, 1979.

Specimens: Tanzania (22) 10568/B, 10607.

Remarks. Cyanophilous reaction is not observed in the basidia.

SERPULA SIMILIS (Berk.& Br.) Ginns,
Mycologia 43:230, 1971.

Specimen: Kenya (Taylor 718/C).

SISTOTREMA RESINICYSTIDIUM Hallenb.,
Mycotaxon 11:466, 1980.

Specimens: Malawi (14) 11546. Tanzania (16) 9977,(18)10352/A.

Remarks. Fairly uniform material as to its more or less grandinioid hymenium, cystidia,and spores. All specimens have, however, broader basal hyphae than reported by Hallenberg (loc.cit.) and Eriksson et al. (1984), and measure up to 6-7(-8) um in width.

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NEW COMBINATIONS IN OPHIOSTOMA OF CERATOCYSTIS SPECIES WITH LEPTOGRAPHIUM ANAMORPHS

T. C. HARRINGTON

Department of Botany and Plant Pathology
University of New Hampshire
Durham, NH 03824

In spite of arguments made by von Arx (1), DeHoog (2), and DeHoog and Scheffer (3) favoring separation of *Ophiostoma* H. & P. Sydow from *Ceratocystis* Ellis & Halst., many mycologists and pathologists continue to include species of both genera in the large and heterogeneous genus *Ceratocystis*. As recognized by Hunt (7), Griffin (5), Olchowecki and Reid (11), and Upadhyay (14), species of *Ceratocystis sensu lato* have darkly pigmented (rarely white) ascocarps, evanescent asci, and small, hyaline ascospores that may or may not have conspicuous sheaths. Ascocarps of most of the species have well developed necks and ostioles, through which the gelatinous mass of ascospores pass and accumulate at the apex in a sticky drop for insect dispersal. Non-ostiolate species (formerly placed in the genus *Europhium* Parker) are similarly dispersed following rupture of the ascocarp wall and release of the sticky ascospore mass. In his recent monograph (14), Upadhyay placed *Ophiostoma*-type species with falcate ascospores in *Ceratocystiopsis* Upadh. & Kendr., but otherwise retained *Ophiostoma* species in *Ceratocystis*.

A number of important taxonomic characters suggest that the similarities in ascocarps and ascospores of *Ophiostoma* and *Ceratocystis* are a result of convergent evolution. Cell walls of *Ophiostoma* species appear to be unique in the Ascomycotina in that they have both cellulose and chitin as major cell wall constituents (8,12). Their cell walls also contain rhamnose (13,16). Coincidental with the unique cell wall is an unusual tolerance to high concentrations of cycloheximide (6). Species of *Ceratocystis sensu stricto*, on the other hand, have a more typical cell wall chemistry (primarily chitin and no detectable cellulose or rhamnose), and, like most eukaryotes, they are sensitive to low concentrations of cycloheximide.

Anamorphs of *Ophiostoma* could be placed in up to 13 different genera (15), but most could be accommodated in *Graphium* Corda, *Leptographium* Lagerberg & Melin, or *Sporothrix* Hektoen & Perkins ex Nicot & Mariat if these anamorphic genera are considered in their broadest sense. Conidiogenesis in *Ophiostoma* is primarily holoblastic, and none of the anamorphs have deep-seated phialides (6). In contrast to *Ophiostoma*, all *Ceratocystis* spp. have *Chalara* (Corda) Rabenh. anamorphs (10), with deep-seated phialides and distinctive conidiogenesis (9).

The biologies of these two genera also differ significantly. Most *Ophiostoma* species [including *O. ulmi* (Buism.) Nannf., *O. minor* (Hedgc.) H. & P. Sydow, and *O. picea* (Munch) H. & P. Sydow] are found in the woody xylem or phloem of temperate forest trees. They are vectored primarily by subcortical insects such as bark beetles (Coleoptera: Scolytidae) or by small animals associated with these beetles (4). Sticky masses of ascospores and conidia are produced in the beetle galleries bored in xylem or phloem tissues, and the spores are passively acquired by the vectors for dispersal to new plant substrata.

Although biologically heterogeneous, *Ceratocystis sensu stricto* [including *C. fimbriata* Ellis & Halst., *C. fagacearum* (Bretz) Hunt, and *C. paradoxa* (Dade) C. Moreau] is a relatively small genus; 11 species were recognized by DeHoog (2). Included are temperate and tropical species that grow on a wide variety of herbaceous and woody plants (10). Some of the *Ceratocystis* spp. [e.g., *C. coerulescens* (Munch) Bakshi] are known to be vectored by bark beetles, but other insects such as flies (Diptera) and sapfeeding insects (Coleoptera: Nitidulidae) are generally more important in spore dispersal (4).

Accepting the arguments in favor of separating these two genera, a number of new combinations are necessary. Many of the *Ophiostoma* species with *Graphium* and *Sporothrix* anamorphs, and some of those with *Leptographium* anamorphs have already been moved from *Ceratocystis* (2,3). However, in compiling the names of teleomorphs of *Leptographium* spp., I found 11 species of *Ceratocystis* that had not yet been transferred to *Ophiostoma*. Possible synonyms, the status of *Ceratocystiopsis*, and the anamorphs of these species will be discussed in a forthcoming paper on *Leptographium*. For now, the 11 new combinations and their basionyms are given.

Ophiostoma abiocarpum (Davids.) Harrington, comb. nov.
Ceratocystis abiocarpa Davids., Mycopath. Mycol. Appl. 28:273, 1966.

Ophiostoma adjuncti (Davids.) Harrington, comb. nov.
Ceratocystis adjuncti Davids., Mycologia 70:35, 1978.

Ophiostoma aureum (Robins.-Jeff. & Davids.) Harrington, comb. nov.
Europhium aureum Robins.-Jeff. & Davids., Can. J. Bot. 46:1525, 1968.
Ceratocystis aurea (Robins.-Jeff. & Davids.) Upad., Monogr. *Ceratocystis* and *Ceratocystiopsis* :37, 1981.

Ophiostoma cainii (Olchow. & Reid) Harrington, comb. nov.
Ceratocystis cainii Olchow.& Reid, Can. J. Bot. 52: 1697, 1974.

Ophiostoma clavigerum (Robins.-Jeff. & Davids.) Harrington, comb. nov.
Europhium clavigerum Robins.-Jeff. & Davids. Can. J. Bot. 46:1523, 1968.
Ceratocystis clavigera (Robins.-Jeff. & Davids.) Upad. Monogr. *Ceratocystis* and *Ceratocystiopsis* :40, 1981.

Ophiostoma crassivaginatum (Griffin) Harrington, comb. nov.
Ceratocystis crassivaginata Griffin, Can. J. Bot. 46: 701, 1968.
Ceratocystiopsis crassivaginata (Griffin) Upad., Monogr. *Ceratocystis* and *Ceratocystiopsis* :123, 1981.

Ophiostoma grandifoliae (Davids.) Harrington, comb. nov.
Ceratocystis grandifoliae Davids., Mem. N. Y. Bot. Gard. 28:45, 1976.

Ophiostoma robustum (Robins.-Jeff. & Davids.) Harrington, comb. nov.
Europhium robustum Robins.-Jeff. & Davids., Can. J. Bot. 46:1525, 1968.
Ceratocystis robusta (Robins.-Jeff. & Davids.) Upad., Monogr. *Ceratocystis* and *Ceratocystiopsis*. :58, 1981.

Ophiostoma trinacriforme (Parker) Harrington, comb. nov.
Europhium trinacriforme Parker, Can. J. Bot. 35:175, 1957.
Ceratocystis trinacriforme (Parker) Upad., Monogr. *Ceratocystis* and *Ceratocystiopsis* :63, 1981.

Ophiostoma valdivianum (Butin) Harrington, comb. nov.
Ceratocystis valdiviana Butin, Phytopathol. Z. 109:86, 1984.

Ophiostoma wageneri (Goheen & Cobb) Harrington, comb. nov.
Ceratocystis wageneri Goheen & Cobb, Phytopathology 68:1193, 1978.

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CAMAROPS FLAVA SP. NOV., APIOCAMAROPS ALBA GEN. ET SP. NOV., AND NOTES ON CAMAROPS SCLERODERMA AND C. USTULINOIDES

Gary J. Samuels
The New York Botanical Garden
Bronx, NY 10458

and

Jack D. Rogers
Department of Plant Pathology
Washington State University
Pullman, WA 99164-6430

Camarops flava sp. nov., a yellow species with rudimentary stromata and ornamented ascospores, is described from New Zealand material. Apiocamarops gen. nov., based on A. alba sp. nov. from Brazil, Venezuela and French Guiana, has rudimentary white stromata and bicellular ascospores, the larger cell of which is brown with a germ pore and the smaller cell of which is hyaline and lacks a germ pore. Single ascospore cultures of A. alba remained sterile.

A second collection of Camarops scleroderma is reported from Brazil. The species, previously known only from the type collection made in French Guiana during the last century, is redescribed. Camarops ustulinoides is redescribed to include forms formerly placed in C. peltata.

The new taxa and redescriptions of old taxa are based primarily on collections of the senior author.

Camarops scleroderma (Mont.) Nannf., Svensk Bot. Tidskr. 66:335-376. 1972. Figs. 2C and D, 3G.

Basionym: Hypoxylon scleroderma Mont., Ann. Sci. Nat. Bot. (ser. 2) 13:350. 1840.

Stromata pulvinate to subglobose, 1.5-2 cm diam X 1.5-2.5 cm high, with narrow or broad connection to substrate, smooth, with inconspicuous umbilicate ostioles. Externally reddish brown, laccate in places. External stromatal layer ca. 1 mm thick, very hard, completely encasing perithecia and entostroma. Internal tissue just beneath hard external layer brownish, soft, bearing perithecia. Tissue just beneath perithecia white to pinkish, soft, columella-like.

Perithecia ca. 1 mm long X 0.7 mm diam, monostichous or perhaps polystichous, with periphysate neck.

Asci 8-spored, cylindrical, spore-bearing part 32-34 X 6 μm, stipitate but length of stipe unknown; ascus apex without obvious apparatus, not bluing in Melzer's iodine reagent.

Ascospores gray-brown, ellipsoidal with one end somewhat acute, laterally compressed, smooth, 5-7 X 2.9-4 X 2-2.5(-3) μm, with a germ pore at the more pointed end.

SPECIMENS EXAMINED: BRAZIL: Estado do Amazonas, Serra Araca trail leading SE from camp, first order branch of Rio Jauari, Igapo, on wood, Samuels 995 & Bowles, 16 Mar 1984 (INPA, NY) ; FRENCH GUIANA: Cayenne, on wood, Leprieur 431, May 1839 (PC; Holotype).

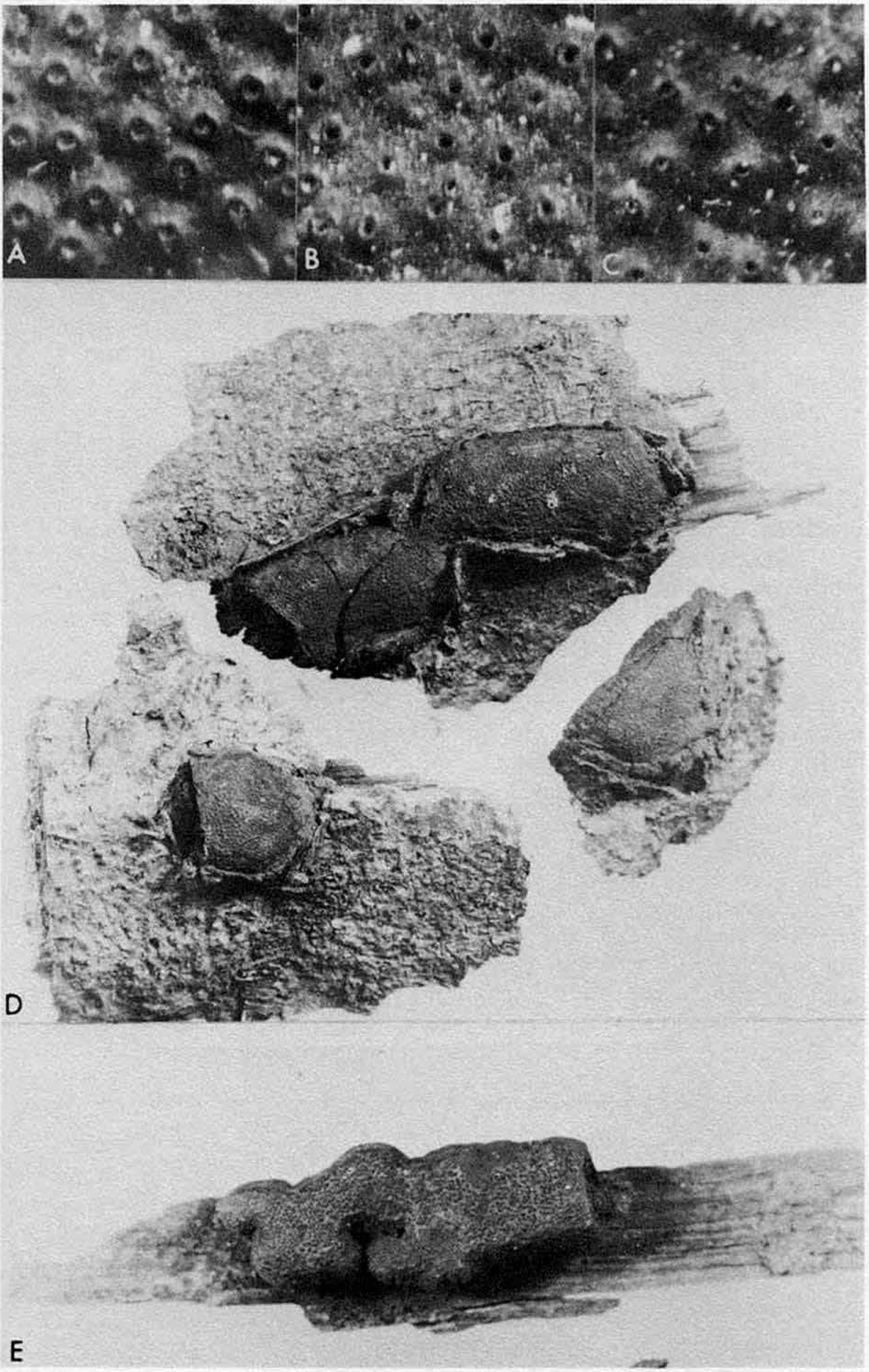
NOTES: According to Nannfeldt (1972) *C. scleroderma* has been known only from the type collection. We have redescribed the species on the basis of type material and fresh material from Brazil. Unfortunately, our material did not yield cultures.

Camarops ustulinoides (P. Henn.) Nannf., Svensk Bot. Tidskr. 66:370. 1972. Figs. 1 and 2A.

Basionym: *Nummularia ustulinoides* P. Henn., Hedwigia 36:227. 1897.
= *Camarops peltata* (Lloyd) Shear, Mycologia 30:589. 1938.
≡ *Solenoplea peltata* Lloyd, Mycol. Writ. 7:1354. 1925.

Fig. 1. *Camarops ustulinoides*. A. Ostioles with doughnut-shaped rims. B. Ostioles with conspicuous pores and inconspicuous rims. C. Ostioles without rims. D. Stromata with adhering bark. This is the stromatal configuration usually considered typical of *C. ustulinoides*. E. Stroma with abrupt steep margins which lack adhering substrate. This is the stromatal configuration usually considered typical of *C. peltata*.

Fig. 1A-C ca. X 36. Fig. 1D and E ca. 2X. Fig. 1A and B: Samuels 635; C and D: Samuels 1067; E: Samuels 750.


A
B
C
D
E

Stromata peltate, button-shaped, or loaf-shaped, 10-40 mm X 5-10 mm X 2-4 mm high, with abrupt angular to rounded margins, often with bark adhering; constricted beneath to a narrowed central connective or not at all constricted; upper surface convex to nearly plane, with punctate ostioles without rims, with slightly raised rims, or with raised circular (doughnut-shaped) rims. Externally dull brown to blackish, the rims of ostioles (when present) often darker than surrounding stroma; internally tan to black. External stromatal layer 0.5-1 mm thick, very hard, continuous, completely encasing fragile perithecia and entostroma. Entostroma cheesy to woody.

Perithecia 1-3 mm long X 0.3-0.5 mm diam, cylindrical to ellipsoidal, with periphysate neck, arranged in monostichous (perhaps occasionally in polystichous) manner.

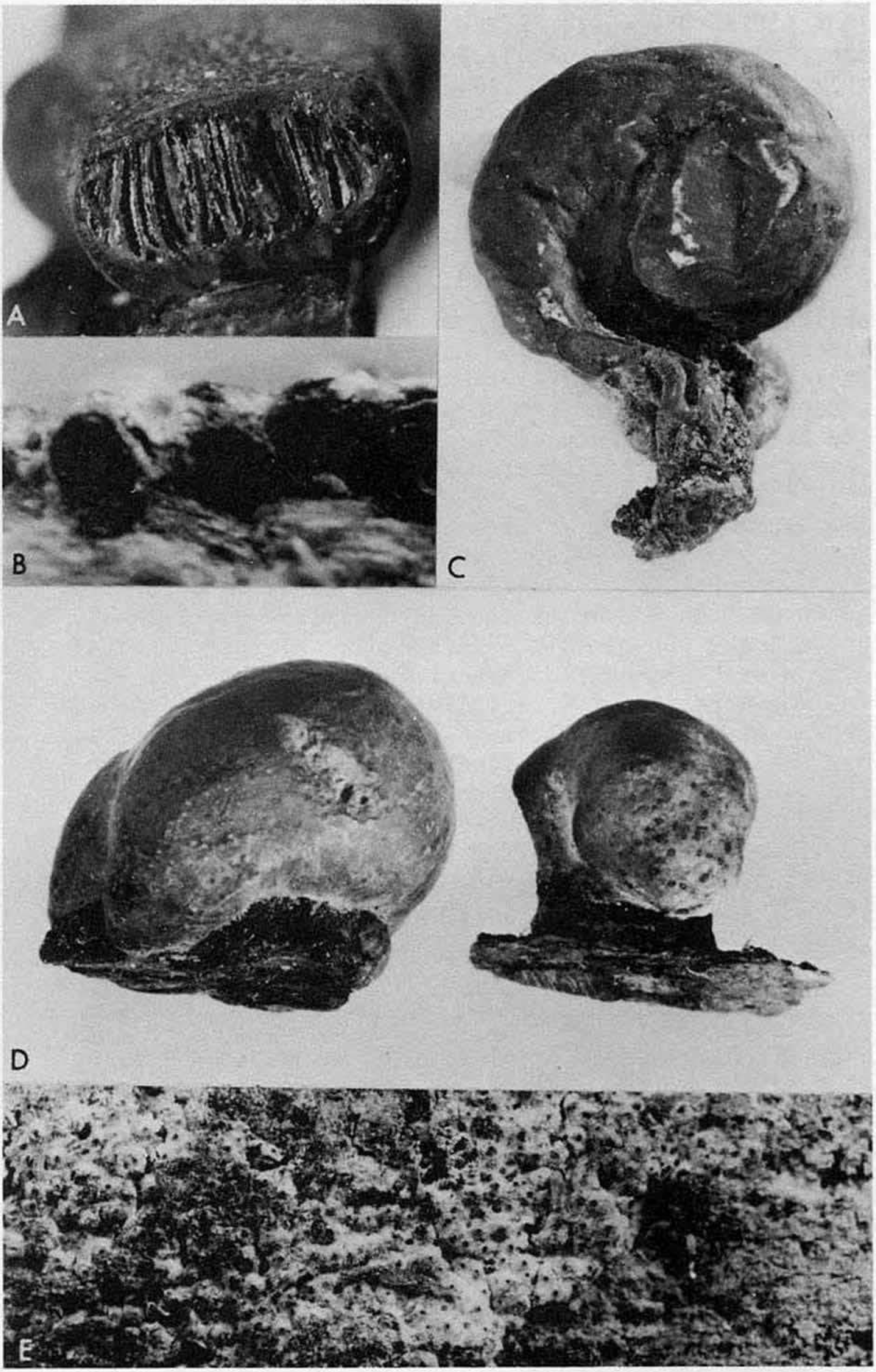
Asci 8-spored, cylindrical, the spores arranged in a partially biseriate manner, short- or long-stipitate, (18-)23-35(-50) total length X 3-5 µm diam, apex without obvious apparatus, not bluing in Melzer's iodine reagent.

Ascospores grayish to brown to dark brown, ellipsoidal with one end somewhat acute, laterally compressed, smooth, (3.7-)4-5(-6) X 2.5-3 X (1.5-)2-2.2(-2.5) µm, with a germ pore at the more pointed end.

SPECIMENS EXAMINED: BRAZIL: Sta. Catarina, on wood, leg Möller 692, ex herb. Sydow (S)(Isotype of *C. ustulinoides*); Estado do Amazonas, base of west-facing talus slope of Serra Araca, near central portion of serra about 45 min walk from lower air strip, 0° 49' N, 63° 19' W, alt. 60 m, on wood, Samuels 576, 28 Feb 1984 (INPA, NY, JDR); Serra Araca, 3 km S of central portion of serra and 8 km E of Rio Jauarí, 0° 49' N, 63° 19' W, alt. 60 m, on wood, Samuels 635, 1 Mar 1984 (INPA, NY, JDR); same collecting data, second collection, Samuels 750 (INPA, NY, JDR); same collecting data but 1 hr S of camp, Samuels 800, 6 Mar 1984 (INPA, NY, JDR); Pico Rondon, 3 km N of km 211 of Perimetral Norte highway, vic. FUNA 1 post, 1° 32'

Fig. 2. A. *Camarops ustulinoides*. Section of stroma showing elongated perithecia. B. *Apiocamarops alba*. Section through stroma and perithecia. C. *Camarops scleroderma*. Holotype stroma. D. *Camarops scleroderma*. Stromata. E. *Apiocamarops alba*. Surface of stroma.

Fig. 2A and E ca. X 6; C ca. X 2.6; D ca. X 3.3; B ca. X 36. Fig. 2A: Samuels 750; B and E: Samuels 439. C: Leprieur 431; D: Samuels 995.


A
B
C
D
E

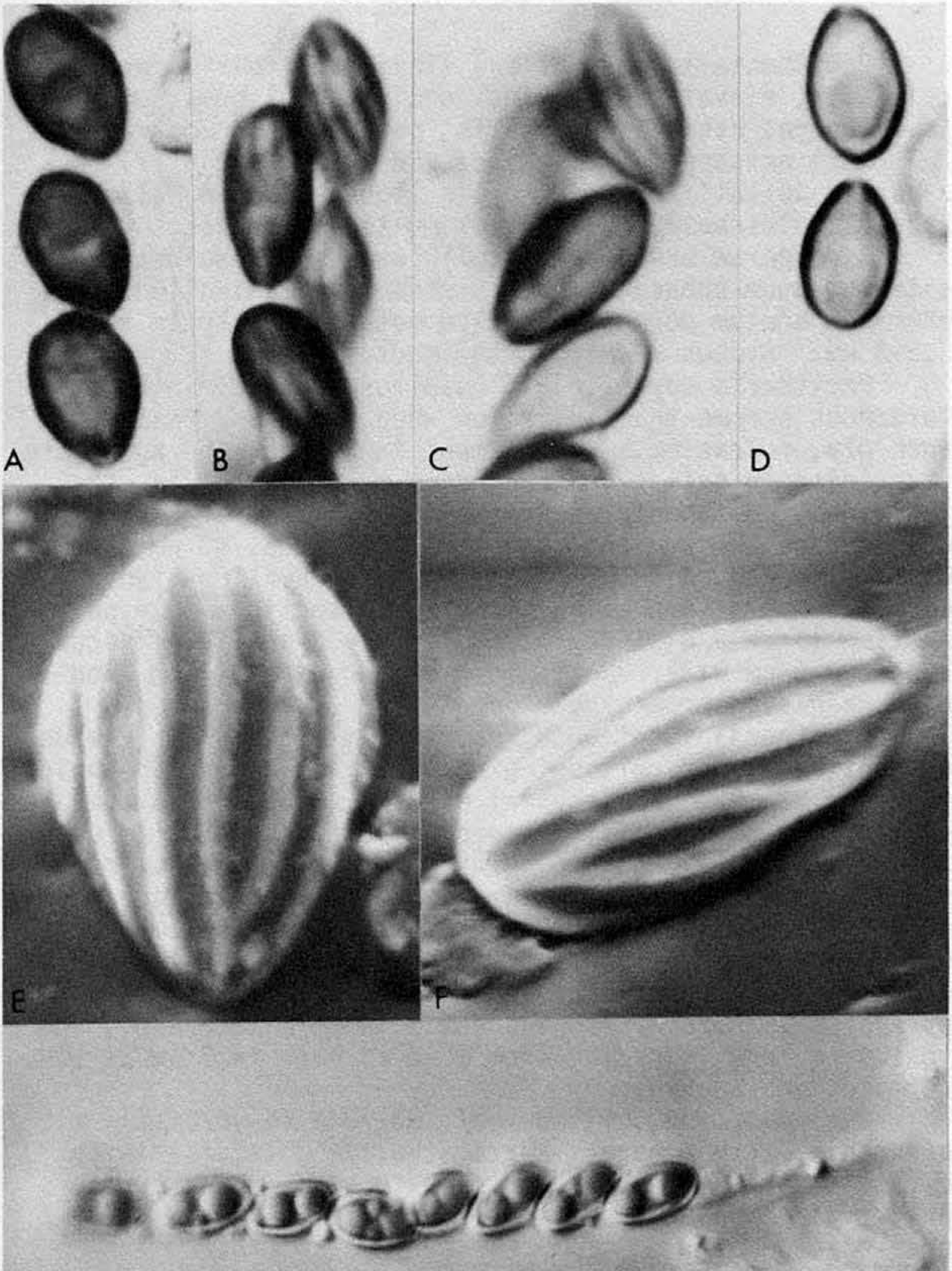
N, 62° 48' W, on log, Samuels, Pipoly & Guedes, 24 Mar 1984 (INPA, NY, JDR); FRENCH GUIANA: vic. Cayenne, on decorticated wood, Samuels 4483, Feuillet, 23 Mar 1986 (NY, JDR); km 16 on road between Sinnamary and St. Elie, 'ECEREX', ORSTOM Research Area, on log, Samuels 3917, 20-29 Feb, 1 Mar 1986 (NY, CAY, JDR); Paul Isnard area, Mts. Lucifer and Decou Decou, ca 150 km S of St. Laurent do Maroni, on log, Samuels 4169, 7-17 Mar 1986 (NY, CAY, JDR); PUERTO RICO: Mayaguez, on wood, Tucker, C. M. 424 (NY)(Isotype of *C. peltata*).

NOTES: *Camarops ustulinoides* was based on a single collection from Brazil and for many years was widely considered to be a synonym of *C. polysperma* (Mont.) J. H. Miller (Nannfeldt, 1972). Nannfeldt (1972) tentatively accepted *C. ustulinoides* as a distinct taxon. He noted the similarities between *C. ustulinoides* and *C. peltata* (Lloyd) Shear, the latter more recently redescribed by Rogers (1981). Nannfeldt (1972) moreover believed it improbable that the peltate shape of the stroma of *C. peltata* is a good species character.

Examination of recent collections of *Camarops* from South America convinces us that *C. ustulinoides* and *C. peltata* are conspecific. Stromata range in morphology from widespreading and more or less applanate, as in isotype material of *C. ustulinoides*, to loaf-shaped with a broad base to peltate, as in type material of *C. peltata*. Ostioles range from umbilicate without raised rims to conspicuous with doughnut-shaped rims. Holotype material of *C. peltata* has doughnut-shaped rims whereas isotype material of *C. ustulinoides* has inconspicuous to somewhat raised rims. Ascospores and asci of all collections are very similar. Unfortunately, we were unable to obtain cultures from any of our material.

Fig. 3. A-F. *Camarops flava*. A. Ascospores showing general morphology. B and C. Ascospores partially out of focus to show ribs. D. Ascospores showing germ pores. E and F. Ascospores showing ribs. G. *Camarops scleroderma*. Ascus with 8 ascospores.

Fig. 3A-D by brightfield microscopy. Fig. 3E and F by scanning electron microscopy. Fig. 3G by differential interference microscopy. Fig. 3G ca. X 1500; A, B, and D ca. X 2800; C ca. X 3000; F X 11000; E X 12000. Fig. 3A-F: PDD 47426; G: Samuels 995.


A
B
C
D
E
F
G

Camarops flava Samuels & J. D. Rogers, sp. nov.
Fig. 3A-F.

Perithecia in stromatibus flavis vel fulvis furfuraceis sita, elevata, ligno insidentia, subglobosa, circa 300 µm diametro; ostiolis punctatis, periphysibus instructis.

Asci octospori, cylindrici, 50-70 X (4-)5-6(-7) µm, apparatu apicali indistincto, in liquore iodino Melzeri haud caerulescente. Paraphyses multae inter ascos.

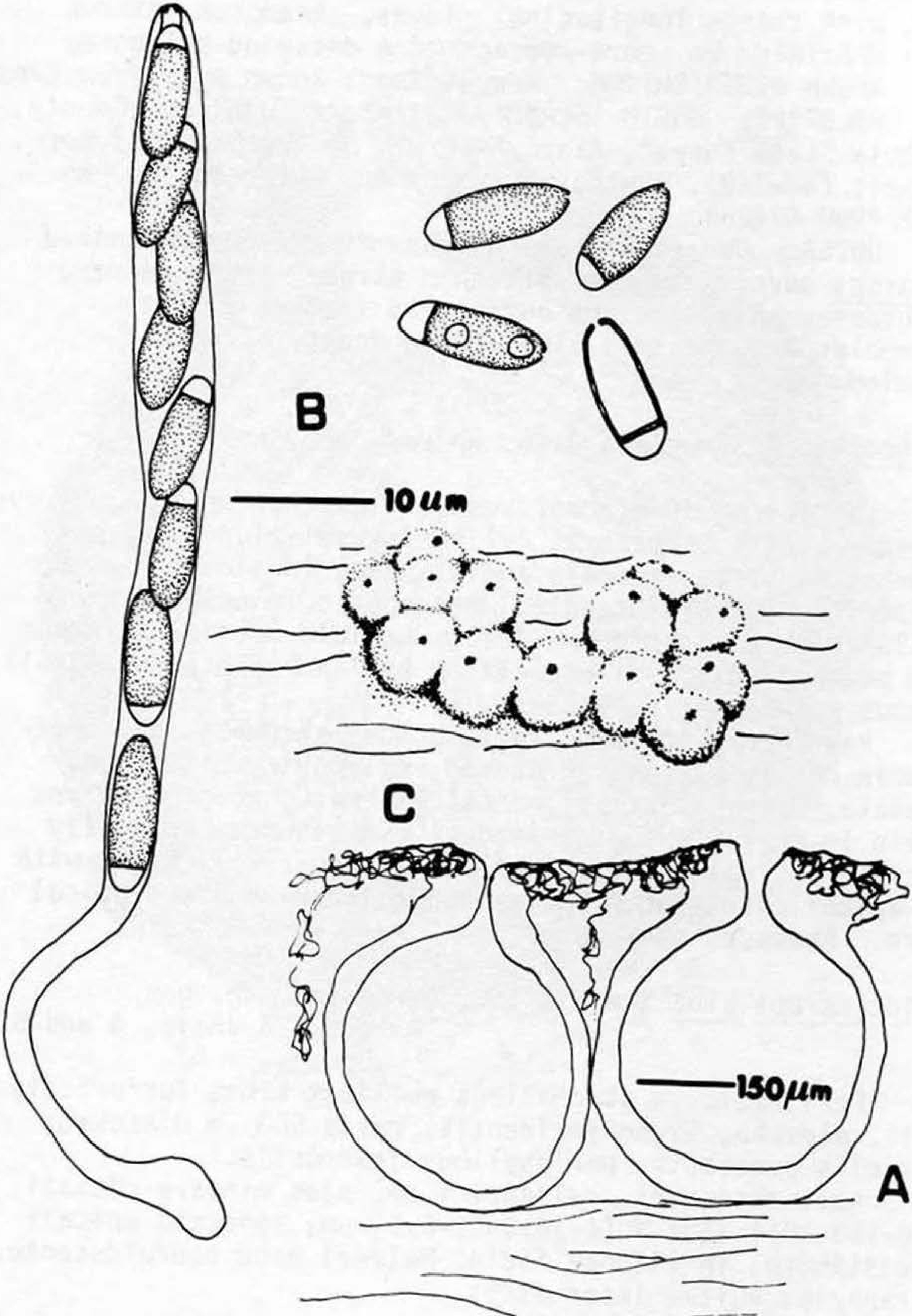
Ascosporae brunneae unicellulares, ellipsoideae, ad extremum unum subacutae, cum striis longitudinalibus, ad extremum acutum poro germinativo notatae, in totis 5-6 X 2.5-3 µm. Status anamorphosis ignotus.

Perithecia superficial, cespitose, united in a furfuraceous stroma that is yellow when fresh and yellow tan when dry, releasing a red pigment in 3% KOH; the aggregate indefinite in extent and including many perithecia, the individual perithecia separated by shallow creases. Stroma composed of two regions: surface region ca. 50 µm thick, of intertwined, much branched, septate, hyaline hyphae with many cells appearing circular in section; internal section largely disintegrated, loosely hyphal, individual hyphae 3-6 µm wide. Perithecia seated directly on wood with no basal stromal development.

Perithecia subglobose, ca. 400 µm high X 300 µm wide, nonpapillate, not collapsing when dry, black, not changing color in 3% KOH. Perithecial wall ca. 20 µm wide, composed of a single region of flattened and compressed cells with walls 0.5-1.0 µm thick, pigmented; walls of cells lining the locule thinner, disintegrating. Perithecial apex composed of a palisade of 1.5-2.0 µm wide hyphal elements which merge with periphyses within. Periphyses 1.5-2.0 µm wide, lining the ostiolar canal and continuous below with paraphyses. Paraphyses abundant between mature asci, up to 100 µm long, tapering from 5 µm at base to 3 µm at tip, septate, unbranched.

Asci 8-spored, cylindrical, 50-70 X (4-)5-6(-7) µm, apex thin, with 2 barely refractive, J- dots visible in cotton blue stain; pores not seen in base. Ascospores uniseriate becoming partially biseriate, 15-30 µm of the ascal base empty.

Fig. 4. Apiocamarops alba. A. Section through stroma. B. Ascus and ascospores. C. Habit of perithecial stroma. Samuels 439.


B
10 µm
C
150µm
A

Ascospores brown, unicellular, pip-shaped, 5-6 X 2.5-3 µm, with an inconspicuous pore at the more acute end, with coarse longitudinal ridges. Anamorph unknown.

HABITAT: On pore surface of a decaying polypore.

KNOWN DISTRIBUTION: New Zealand, known only from type.

HOLOTYPE: NORTH ISLAND: Northland, Hokianga County, Omahuta State Forest, Kauri Reserve, on decaying polypore, Samuels (82-238), Hawthorne, Johnston, Petersen, 1 June 1982 (PDD 47426).

NOTES: Camarops flava differs from other described Camarops species in its soft thin stroma and ornamented ascospores which are not noticeably flattened. It resembles Apiocamarops alba in the scanty stromatal development.

Apiocamarops Samuels & J. D. Rogers, gen. nov.

Perithecia in stromatibus mollibus furfuraceis, elevata. Asci octospori, cylindrici vel plus minusve clavati, apparatu apicali indistincto, in liquore iodino Melzeri haud caerulescente. Ascosporae inaequaliter bicellulares, ellipsoideae, leves, cellula longiore brunnea cum poro apicali, cellula altera hyalina sine poro apicali. Status anamorphosis ignotus.

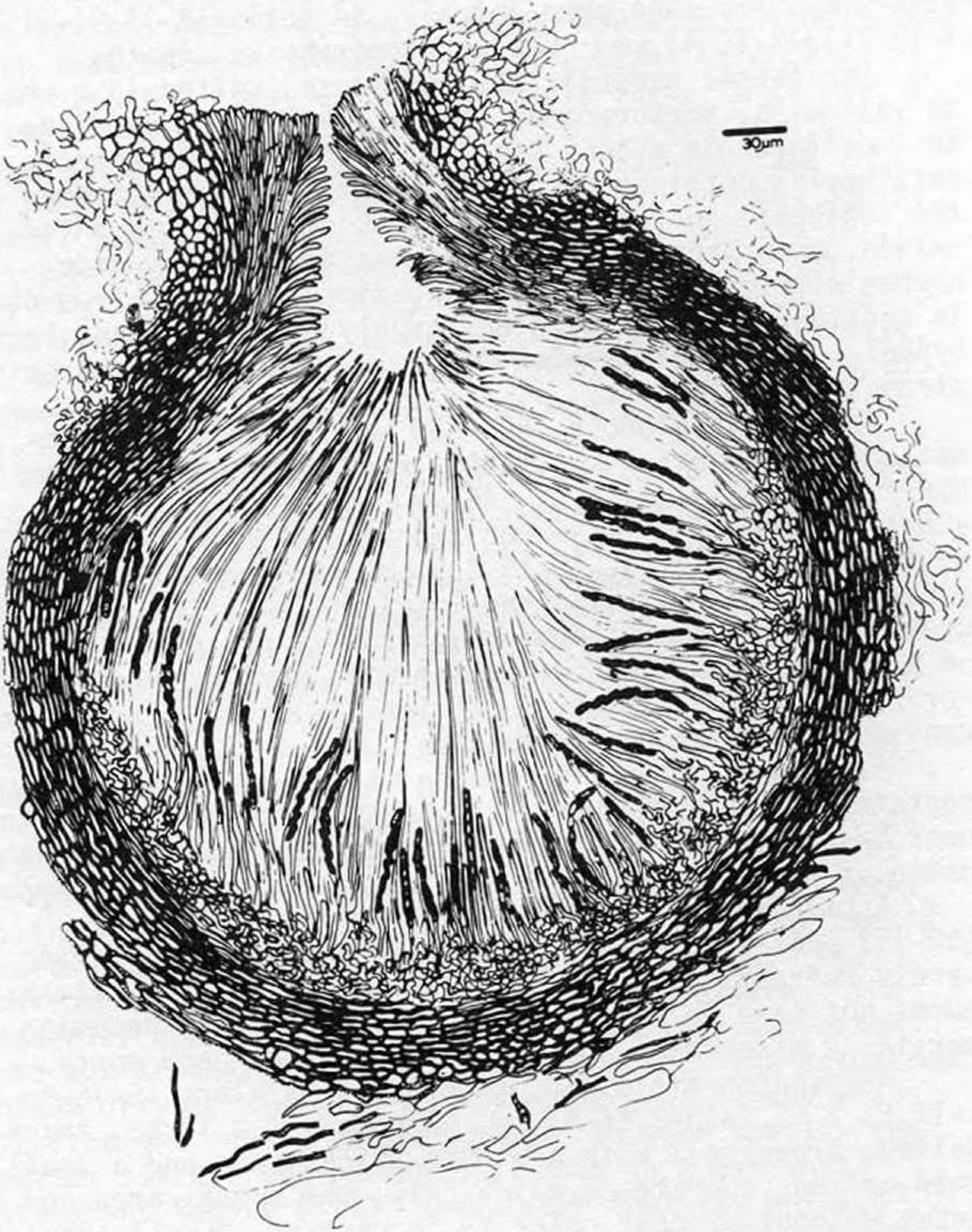
Perithecia in soft, furfuraceous stromata, the perithecia distinct. Asci 8-spored, cylindric to somewhat clavate, with indistinct apical apparatus which does not stain in Melzer's iodine reagent. Ascospores unequally bicellular, ellipsoid, smooth, the longer cell brown with an apical pore, the other cell hyaline without an apical pore. Anamorph unknown.

Apiocamarops alba Samuels & J. D. Rogers, sp. nov.
Figs. 2B and E, 4 and 5.

Perithecia in stromatibus mollibus albis furfuraceis sita, elevata, ligno insidentia, circa 500 µm diametro; ostiolis punctatis, periphysibus instructis.

Asci octospori, cylindrici vel plus minusve clavati, (50-)53-106(-130) X (4-)4.5-6(-6.5) µm, apparatu apicali indistincto, in liquore iodino Melzeri haud caerulescente. Paraphyses multae inter ascos.

Fig. 5. Apiocamarops alba. Section through perithecium. Samuels 439.


30µm

Ascosporae inaequaliter bicellulares, ellipsoideae, leves, cellula longiore brunnea cum poro apicali, cellula altera hyalina sine poro apicali, in totis (5-)6-9(-11.5) X (2.7-)3-3.7(-4) µm. Status anamorphosis ignotus.

Perithecia superficial, cespitose, united in a white to yellowish, furfuraceous stroma, the latter discrete to indefinite in extent and including many perithecia; perithecial outlines usually evident. Stroma composed of two regions: surface region ca. 50 µm thick, of intertwined, much branched, septate, hyaline, 3-4 µm wide hyphae with many cells appearing circular and 5-7 µm diam in section; internal section largely disintegrated, loosely hyphal. Perithecia seated directly on wood with no basal stromatal development.

Perithecia globose, 500-550 µm diam, nonpapillate, not collapsing when dry, black, not changing color in 3% KOH. Perithecial wall ca. 45 µm wide, composed of a single region of cells. Perithecial wall cells ellipsoid to fusoid in section, 10-15 X 5 µm, walls ca. 1 µm thick, pigmented. Cells lining the locule thin-walled, disintegrating. Perithecial apex comprising a palisade of 1.5-2.0 µm wide hyphal elements, merging with periphyses within. Periphyses 1.5-2.0 µm wide, lining the ostiolar canal and continuous below with paraphyses.

Paraphyses abundant between mature asci, filamentous, septate, 1.5-2.0 µm wide, infrequently branched, more so near base, considerably longer than asci and reaching the ostiolar opening and there continuous with the periphyses.

Asci 8-spored, cylindrical to narrowly clavate, (50-)53-106(-130) X (4-)4.5-6(-6.5) µm, apex thin, with 2 barely refractive, J- dots visible in cotton blue stain; pores not seen in base. Ascospores uniseriate becoming partially biseriate, 30-40 µm of the ascal base empty.

Ascospores ellipsoid, smooth, bicellular, (5-)6-9 (-11.5) X (2.7-)3-3.7(-4) µm, composed of a large, thick-walled, brown cell with a minute apical pore and a small, thin-walled, aporate, hyaline cell, the spores arranged in ascus without evident polarity in respect to cell type. Anamorph unknown.

HABITAT: On decorticated wood.

KNOWN DISTRIBUTION: Brazil (Amazonas), French Guiana, Venezuela.

HOLOTYPE: BRAZIL: Estado do Amazonas, Serra Araca, plateau, N side of northern mountain, 0° 57'N, 63° 22'W, 1250 m alt, cloud forest, Samuels 486, Pipoly, Prance, Bowles, 19-24 Feb 1984 (INPA)(isotypes: NY, J. D. Rogers).

ADDITIONAL SPECIMENS EXAMINED: Data as holotype, Samuels 438, (INPA, NY); FRENCH GUIANA: vic. Cayenne, on wood, Samuels 4454 & C. Feuillet, 25 Mar 1986 (NY,CAY); km 16, on road between Sinnamary and St. Elie, 'ECEREX', OSTROM Research Area, on bark, Samuels 3216, 20-29 Feb, 1 Mar 1986 (NY, CAY, JDR); ca. 10 km SW of Säul toward Mt. Galbao, on wood, Samuels 3696 & Boise, Jan-Feb 1986 (NY, CAY, JDR); ca. 17 km SW of Säul toward Mt. Galboa, 350 m, on wood, Samuels 3301 & Boise, 24, 26, 28 Jan 1986 (NY, CAY); same data, second collection, Samuels 3301 (NY, CAY); Paul Isnard area, Mts. Lucifer & Decou Decou, ca. 150 km S of St. Laurent du Maroni, on wood, Samuels 4114, 7-17 Mar 1986 (NY, CAY, JDR); VENEZUELA: Amazonas, Dpto. Río Negro, Serra de la Neblina, on wood, Rossman 2294, 1985 (BPI, JDR).

NOTES: *Apiocamarops* is clearly related to *Camarops*, but differs in some significant ways. The species of *Camarops* accepted by Nannfeldt (1972) have applanate to discrete and peltate or turbinate stromata that enclose a large number of tubular, sometimes polystichous, perithecia. Ascospores are unicellular, minute (averaging about 5 X 2-3 µm), usually flattened, dilute brown and show a minute pore at one end. *Apiocamarops* differs primarily in the thin soft white stroma and bicellular ascospores.

Stromatal form in *Camarops* is variable from species to species but all of the species accepted by Nannfeldt have the same basic stromatal anatomy: a compact, hyphal ectostroma and a loose entostroma. Individual perithecia are often seated directly on the wood substrate. The entostroma disintegrates as the perithecia expand. The perithecial apex, however, is integrated into the ectostroma and is therefore not easily removed. The ectostroma is often very hard when dry but leathery or fleshy when rehydrated and easily chipped away. In some species the stromatal surface and perithecial apex is a distinct palisade and Rogers (1981) speculated that the whitish membrane or pellicle on the stromal surface of *C. rickii* Rogers is the remains of a dehiscent ectostroma.

When viewed carefully, the stroma of *Apiocamarops alba* has the same anatomical elements as are found in species of *Camarops*. The ostiolar region of the perithecium is a palisade and formed of narrow hyphal elements; these merge into a compact, hyphal ectostroma. The perithecial apex is thus an integral part of the ectostroma. The ectostroma, exclusive of the ostiolar region, can be easily removed with a scalpel tip. There is scant entostromal tissue, possibly having disintegrated in the course of development. Each perithecium retains its integrity within the aggregate as in *Camarops*, even though they do not become compressed. The failure to compress through mutual pressure is perhaps owing to the thicker perithecial wall of *A. alba*.

Nannfeldt (1972) and Rogers (1981) described the ascal apex in *Camarops* as being simple, without obvious rings and Nannfeldt (1972) illustrated an obconical "subapical chamber" in *C. polysperma*. The ascal apex of *A. alba* is likewise thin. In developing asci a subapical chamber can be seen, but in asci with pigmented ascospores only, two minute and weakly refractive bodies are evident in the tip when stained with cotton blue and viewed with phase contrast microscopy. The apical apparatus did not stain in nigrosine, Skrip blue-black ink or congo red and was not seen when mounted in 100% lactic acid and viewed with phase contrast microscopy.

Bicellular ascospores have not been reported in *Camarops*. In a number of species of the Xylariaceae and Sordariaceae the ascospores are bicellular, having a hyaline cellular appendage at the end of the dark ascospore body. In some species of *Hypoxylon* and *Xylaria* the appendage is seen only on immature ascospores (Rogers, 1979). The dark spore body of appendaged ascospores is morphologically similar to the ascospores of species whose ascospores lack appendages. The pigmented porate spore body of *A. alba* is very like the *Camarops* ascospore. Porate ascospores are not common among pyrenomycetes and the strong similarity of this brown spore body to ascospores of *Camarops* is indicative of a close relationship. Rogers (1979) postulated that the presence of cellular appendages on xylariaceous ascospores is a primitive character and that the Xylariaceae and Sordariaceae had common, nonstromatic antecedents with bicellular ascospores. The occurrence of nearly free perithecia along with appendaged ascospores in *A. alba* suggests that ancestral boliniaceous fungi were nonstromatic with bicellular ascospores.

It seems noteworthy that in most species having apiospores the smaller of the two cells is usually oriented toward the ascus base. In *A. alba* there is no consistent orientation of the small cell. It thus follows that the germ pore likewise is not consistently oriented, although frequently the pores of the upper four spores in the ascus are oriented toward the ascus apex while the pores of the lower four spores are oriented away from the ascus apex. In species of *Camarops* both apical and basal orientation of the pore is found within the same perithecium (Nannfeldt 1972, Rogers 1981).

Ascospores from French Guiana specimens 3816 and 4459 germinated on corn meal dextrose agar after 5 days at ca. 21C. Germination occurred by the issuance of a short germ tube from the ascospore pore. Colonies grew to only about 3 mm diam in one month and produced no sporulating structures.

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CHEMICAL CONSTITUENTS OF THE STIPITATE HYDNUMS FROM THE SOUTHERN APPALACHIAN MOUNTAINS

Richard E. Baird[1]

Department of Botany
University of Florida
Gainesville, Florida 32611

ABSTRACT

An analysis of chemical constituents (terphenylquinones) was made for species of Bankera, Hydnellum, Phellodon, and Sarcodon occurring in the southern Appalachian Mountains. The presence of terphenylquinones proved useful in identification of species of stipitate hydnums. This information, however, must be correlated with micro- and macromorphological characters.

INTRODUCTION

Fries (1958) first used chemical compounds, obtained from sporophore tissue extracts and spotted on thin-layered chromatography (TLC) plates, as a diagnostic aid in identification of various Hymenomycetes. Further studies showed that chemotaxonomic characters in the classification of basidiomycetous fungi were important in understanding their species concepts (Tyler and Malone, 1960; Tyler and Smith, 1963; Benedict et al. 1966; Arpin, 1967; Robbers et al. 1964). These researchers found that a variety of compounds such as urea, carotenoids, isoxazole, ibotenic acid, and cyclopeptides may be useful in classification.

Preliminary chemotaxonomic studies of the stipitate hydnums showed that certain terphenlyquinones such as atromentin, aurantiacin, and thelephoric acid occurred in sporophores of seven species of Hydnellum (Sullivan, 1966; Khanna et al., 1965; Bresinsky and Rennschmid, 1971). Hall (1968) conducted a thorough chemotaxonomic study of the Hydnaceae of western Washington and found the three terphenylquinones in sporophores of Hydnellum, Hydnum (=Sarcodon), and Phellodon species. Previous research by Hall (1983) indicated that the terphenylquinones (atromentin, aurantiacin, thelephoric acid) could be consistently

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extracted from the sporophores of the stipitate hydnums, while their occurrence varied according to genus and species. Sullivan (1966) reported that sporphores of Hydnellum zonatum (Batsch) P. Karst. (=H. concrescens) (Pers.) Banker) contained aurantiacin, which is not found in the morphologically similar H. scrobiculatum (Fr.) P. Karst. Later, Hall (1968) reported that aurantiacin was present only in sporophores of several species of Hydnellum, and was absent from Hydnum and Phellodon species. Because of the reported generic and species variability of the terphenylquinones in sporophores of the stipitate hydnums, a study of the distribution of the three terphenlyquinones and their taxonomic signifcance for southern Appalachian Mountain taxa was undertaken. This research was done in conjunction with a thorough analysis of macroscopic and microscopic characters of the stipitate hydnums from this geographical region (Baird, 1986).

CHEMICAL ANALYSIS

A microchemical analysis of terphenylquinones present in the basidiocarps, specifically atromentin (At), aurantiacin (Aur), and thelephoric acid (Th), was conducted. The techniques used were similar to those of Hall (1968), which consisted of placing 0.5g of a dried, powdered sporophore from each collection into a soxhlet extractor, and subjecting the material to a series of solvents of increasing in polarity. The chemicals used were petroleum ether (24 hrs), diethyl ether (24 hrs), chloroform (24 hrs), and 70% ethanol (24 hrs). The petroleum ether and chloroform were used as defatting agents and the extracts obtained were discarded. The diethyl ether and 70% ethanol extracts believed to contain the three terphenylquinones were spotted on Brinkman polyamide 6 precoated plastic plates and run in methanol-formic acid (1:1) and methanol-chloroform-water-glacial acetic acid (54:36:6:1) for comparison.

Hall (1968), listed the colors (Kornerup and Wanscher 1962) equivalent to the three terphenlyquinones and their ranges in R_f values. These values and colors were used for comparison in this study. Furthermore, standards of atromentin, thelephoric acid (obtained from Dr. A. Bresinsky, University of Regensburg, Germany), and aurantiacin (obtained from Dr. L. R. Brady, University of Washington) were spotted on plates for comparison to the spots obtained from the species of stipitate hydnums observed in this work.

RESULTS AND DISCUSSION

The R_f values and colors for the standard terphenlyquinones are found in Table 1. The R_f values and colors were used for comparisons of the sporophore compounds.

BANKERA

Bankera fuligineo-alba (Schmidt:Fr.) Pouz. was found to contain thelephoric acid (Table 2), and this chemical was observed when run on either solvent system. No other Bankera species was found in the southern Appalachian Mountains, thus no comparisons between the other taxon was made. Bresinsky and Rennschmid (1971), however, reported that *B. fuligineo-alba* and *B. violascens* (Alb. & Schw.:Fr.) Pouz. have thelephoric acid. These data indicate that all species of *Bankera* contain thelephoric acid.

HYDNELLUM

The three terphenylquinones (aurantiacin, atromentin, and thelephoric acid) were all identified from sporophores of various species of *Hydnellum* (Table 3). Sporophores of two very similar species, *H. earlianum* Banker and *H. aurantiacum* (Batsch:Fr.) P. Karst., were found to contain aurantiacin. *Hydnellum ferrugipes* Coker and *H. complicatum* Banker also contained aurantiacin, but no other species of *Hydnellum*, *Sarcodon*, or *Phellodon* observed in the study exhibited this compound. Sullivan *et al.* (1967) reported that sporophores of *H. scrobiculatum* contained aurantiacin, but Hall (1968) did not find aurantiacin in *H. scrobiculatum*. The sporophores of *H. scrobiculatum* in this study also lacked this compound. *Hydnellum caeruleum* (Hornem:Fr.) P. Karst., which is similar to *H. ferrugipes* was found to have aurantiacin (Montfort *et al.* 1966). Gripenberg (1956, 1958) reported aurantiacin in *H. aurantiacum*.

Sporphores of all species of *Hydnellum* observed in this study contained atromentin except for those of *H. concrescens* and *H. scrobiculatum*, which are morphologically similar. Euler *et al.* (1965) observed this compound in *H. diabolus* Banker. *Hydnellum geogenium* (Fr.) Banker was reported by Bresinsky and Rennschmid (1971) to be the only species of *Hydnellum* lacking thelephoric acid, and results obtained in this study verify that work for the taxa covered. In addition, no other known terphenylquinones were observed from sporophores of this species. Sporophores of *H. geogenium* were found to contain several unknown compounds. Two large, trailing, yellowish-colored spots, unique in this study, were noted, appearing identical to the sulfur-yellow color present on the pileus and spines of this species. A bluish-green spot, similar to the ones found in sporophores of *S. atroviridis* (Morg.) Banker and *S. scabripes* (Pk.) Banker, was also present in the extract from *H. geogenium*. Because the unidentified yellowish spots present (in association with the bluish-green one) are unique to *H. geogenium*, identification of sporophores of this species by chemotaxonomic studies alone may be possible.

PHELLODON

Only thelephoric acid was present in the sporophores of the *Phellodon* species (Table 4). This is contrary to Hall (1968), who observed atromentin in sporophores of *P. melaleucus* (Fr.) P. Karst. Even though thelephoric acid was the only terphenylquinone found in this genus, several unknown compounds were observed. Sporophores of *P. alboniger* (Pk.) Banker, *P. confluens* Pers., *P. melaleucus*, and *P. niger* (Fr.) P. Karst. all contained a similar unknown bluish-green compound that was also observed in two *Sarcodon* species and *Hydnellum geogenium*. Sporophores of *P. confluens* and *P. niger* contained yellowish-colored spots, partially obstructed by the bluish-green spots. These yellowish spots had different R_f values than the ones found in H. geogenium and, therefore, probably are different compounds.

SARCODON

Thelephoric acid was present in all extracts from sporophores of Sarcodon species (Table 5) from the southern Appalachian Mountains. Hall (1968) also found thelephoric acid present in sporophores of the Sarcodon species of western Washington. However, this study adds data for S. atroviridis and S. joeides (Pass.) Bat., not included in Hall's (1968) study. Sporophores of S. atroviridis contained two unknown bluish-green compounds, one of which was also present in sporophores of S. scabripes.

CONCLUSIONS

The results of this study indicate that sporophores of species of all stipitate hydnums from the southern Appalachian Mountains contain thelephoric acid (which suggests a relationship to the Thelephoraceae), but that generic separation based on this compound is impossible. Atromentin was restricted to sporophores of Hydnellum and Sarcodon species, and its presence is potentially useful in the identification of these taxa. Aurantiacin was observed in the sporophores of species of Hydnellum, and its presence may be of some value in separating species in this genus. The unknown bluish-green compound, found particularly in the genus Sarcodon, seems to be a good character for the identification of S. atroviridis and S. scabripes, but the compound would have somewhat limited value for the segregation of Phellodon species. The yellowish spots noted in the sporophores of H. geogenium are diagnostic for this taxon. More studies of the small yellow spots found in extracts of sporophores of the Phellodon species should be conducted before their potential as a taxonomic character is determined.

The terphenylquinones are considered to be of importance in separating the species of stipitate hydnums. This information, however, must be correlated with macroscopic and microscopic characters. The presence of specific terphenylquinones alone however, can be used for delineation of genera only to a limited extent.

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Table 1. Migration Values and Colors of Three Terphenylquinones on Polyamide Plates for Methanol/Glacial Acetic Acid (M/G) and Methanol/ Chloroform/Glacial Acetic Acid (M/C/G) Solvent Systems.

	R_f X 100	R_f X 100	
Terphenylquinone	M/G	M/C/G	Color*
Aurantiacin	69 - 81	30 - 45	(5A4)
Atromentin	45 - 62	< 15	(18A3)
Thelephoric Acid	< 5	< 5	(12B3)

*Kornerup and Wanscher (1981).

Table 2. Occurrence of Aurantiacin (Aur.), Atromentin (At.), and Thelephoric Acid (Thel.) from Extracts of Sporophores of one Bankera Species Spotted on Polyamide Plates.

	TENN Coll.		Aur.		At.		Thel.
Specific Epithet	No.	M/G	Mc/G	M/G	M/C/G	M/G	M/C/G
fuligineo-alba	18867	-	-	-	-	+	+
	20063	-	-	-	-	+	+
	22237	-	-	-	-	+	+

M/G = Methanol/Glacial Acetic Acid
M/C/G = Methanol/chloroform/Glacial Acetic Acid

Table 3. Occurrence of Aurantiacin (Aur.), Atromentin (At.), and Thelephoric Acid (Thel.) from Extracts of Sporophores of *Hydnellum* spp. Spotted on Polyamide Plates.

Specific Epithet	Collection Number	Aur. M/C	Aur. M/C/G	At. M/C	At. M/C/G	Thel. M/C	Thel. M/C/G
aurantiacum	TENN 6482	+	+	+	−	+	+
	TENN 10906	+	+	+	−	+	+
	TENN 41502	+	+	+	−	+	+
complicatum	TENN 43726	+	+	+	+	+	+
	BPI 1328	+	+	+	+	+	+
concrescens	TENN 43537	−	−	−	−	+	+
	TENN 43538	−	−	−	−	+	+
	TENN 43539	−	−	−	−	+	+
diabolus	TENN 18306	−	−	+	+	+	+
	TENN 18673	−	−	+	+	+	+
	TENN 29472	−	−	+	+	+	+
earlianum	TENN 14420-A	+	+	+	+	+	+
	TENN 18668	+	+	+	+	+	+
	TENN 23131	+	+	+	+	+	+
ferrugipes	TENN 3134	+	+	+	+	+	+
	TENN 19219	+	+	+	+	+	+
	TENN 36165	+	+	+	+	+	+
geogenium	BPI s.n.	−	−	−	−	−	−
	NCSU G 1908#	−	−	−	−	−	−
ferrugineum	MICH H 8982	−	−	+	+	+	−
	NCSU G 534#	−	−	+	+	+	−
scleropodium	TENN 23196	−	−	+	+	+	+
	TENN 23218	−	−	+	+	+	+
	TENN 29410	−	−	+	+	+	+
scrobiculatum	TENN 43533	−	−	−	−	+	+
	TENN 43534	−	−	−	−	+	+
	TENN 43536	−	−	−	−	+	+
spongiosipes	TENN 43627	−	−	+	−	+	+
	TENN 43673	−	−	+	−	+	+
	TENN 43674	−	−	+	−	+	+
suaveolens	TENN 43671	−	−	+	+	+	+
	NCSU G 1328#	−	−	+	+	+	+
	NCSU G 1911#	−	−	+	+	+	+

M/G = Methanol/Glacial Acetic Acid
M/C/G = Methanol/Chloroform/Glacial Acetic Acid
\# NCSU G = NCSU Grand Coll.
MICH H = MICH K. Harrison Coll.

Table 4. Occurrence of Aurantiacin (Aur.), Atromentin (At.), and Thelephoric Acid (Thel.) from Extracts of Sporophores of *Phellodon* spp. Spotted on Polyamide Plates.

Specific Epithet	TENN Coll. No.	Aur.		At.		Thel.	
		M/G	M/C/G	M/G	M/C/G	M/G	M/C/G
alboniger	18309	–	–	–	–	+	+
	18674	–	–	–	–	+	+
	30270	–	–	–	–	+	+
confluens	17129	–	–	–	–	+	+
	27468	–	–	–	–	+	+
	35569	–	–	–	–	+	+
fibulatus	43904	–	–	–	–	+	+
	43944	–	–	–	–	+	+
melaleucus	5223	–	–	–	–	+	+
	14692	–	–	–	–	+	+
	18682	–	–	–	–	+	+
niger	24552	–	–	–	–	+	+
	30277	–	–	–	–	+	+
	30297	–	–	–	–	+	+
putidus	12382	–	–	–	–	+	+
	14679	–	–	–	–	+	+
	5224	–	–	–	–	+	+
tomentosus	6495	–	–	–	–	+	+
	9661	–	–	–	–	+	+
	39077	–	–	–	–	+	+

M/G = Methanol/Glacial Acetic Acid.
M/C/G = Methanol/Chloroform/Glacial Acetic Acid.

Table 5. Occurrence of Aurantiacin (Aur.), Atromentin (At.), and Theleporic Acid (Thel.) from Extracts of Sporophores of *Sarcodon* spp. Spotted on Polyamide Plates.

Specific Epithet	Collection Number	Aur.		At.		Thel.	
		M/G	M/C/G	M/G	M/C/G	M/G	M/C/G
atroviridis	TENN 29923	-	-	+	+	+	-
	TENN 36149	-	-	+	+	+	-
	TENN 44051	-	-	+	+	+	-
cristatus	TENN 22082	-	-	-	-	+	+
	TENN 44010	-	-	-	-	+	+
	TENN 44055	-	-	-	-	+	+
imbricatus	TENN 6285	-	-	-	-	+	+
	TENN 12893	-	-	-	-	+	+
	TENN 14691	-	-	-	-	+	+
joeides	TENN 18648	-	-	+	+	+	+
	NCU C 11884	-	-	+	+	+	+
	NCU C 12592	-	-	+	+	+	+
piperatus	TENN 22083	-	-	-	-	+	+
	TENN 26027	-	-	-	-	+	+
	TENN 36149	-	-	-	-	+	+
scabripes	MICH S 10272#	-	-	-	-	+	-
scabrosus	TENN 12917	-	-	-	-	+	+
	TENN 12918	-	-	-	-	+	+
	TENN 19209	-	-	-	-	+	+
stereosarcinon	TENN 12342	-	-	-	-	+	+
	TENN 12343	-	-	-	-	+	+
	TENN 13058	-	-	-	-	+	+
underwoodii	TENN 10409	-	-	-	-	+	+
	TENN 44048	-	-	-	-	+	+
	TENN 44049	-	-	-	-	+	+

M/G = Methanol/Glacial Acetic Acid
M/C/B = Methanol/Chloroform/Glacial Acetic Acid
NCU C = NCU Coker Coll.
MICH S = MICH Smith Coll.

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DACTYLIFERA GEN. NOV. (HYPHOMYCETES)

J.L. ALCORN

Plant Pathology Branch,
Department of Primary Industries, Indooroopilly,
Queensland 4068, Australia

A new genus is proposed to accommodate a dematiaceous hyphomycete with unusual staurospores isolated from leaf lesions on **Chrysopogon latifolius** S.T. Blake (Poaceae) in Australia. The host was pressed and dried on collection, and isolation was attempted 19 days later following surface sterilization in sodium hypochlorite (ca. 1% available chlorine). Approximately one third of the platings yielded the fungus described below. The only other species isolated was **Curvularia lunata** (Wakker) Boedijn. Leaf lesions are scattered, amphigenous but more distinct on the abaxial surface, brown (often with purplish margins), more or less rectangular, vein-limited, ca. 2-4 x 1 mm. Conidiophores and conidial fragments of a **Cercospora** sp. were found on one lesion. No conidia or conidiophores of **Dactylifera australiensis** were detected, and no attempt has been made to establish whether this fungus is pathogenic.

Dactylifera gen. nov. (Deuteromycotina, hyphomycetes)
(Etym. [L.] dactylifer, finger-bearing)
Stromata nigra, cylindrica, simplicia vel ramosa, setosa. Conidiophora macronematosa, mononematosa, olivaceobrunnea, simplicia vel ramosa, recta vel flexuosa, cylindrica, multiseptata, laevia, parietibus crassis, ad basim saepe tumida. Cellulae conidiogenae in conidiophoris incorporatae, cylindricae, terminales demum intercalares, indeterminatae, sympodiales, monotreticae vel polytreticae, cicatricatae. Conidia acropleurogena, sicca, olivaceobrunnea, distoseptata, corpore centrali globoso vel obovoideo septato, pedicello cylindrico vel conico truncato septato, et brachiis sursum radiantibus septatis cylindricis vel ad basim dilatatis.
Sp. typ. **Dactylifera australiensis** sp. nov.

Stromata black, cylindrical, simple or branched, setose, sometimes also bearing conidiophores. Conidiophores macronematous, mononematous, single or in small fascicles, mid olivaceous brown and paler at the tip, simple or once branched, straight or flexuous, smooth, cylindrical, multiseptate, thick-walled, often swollen at the base. Conidiogenous cells integrated, terminal, becoming intercalary, cylindrical, indeterminate, sympodial, monotretic or polytretic, cicatrized. Conidia solitary, dry, acropleurogenous, olivaceous brown, distoseptate, with a central sparingly septate obovoid or globose, thick-walled body, a cylindrical to conical septate pedicel, and septate arms radiating upwards from the upper portion, cylindrical or flared where they join the spore body.

Dactylifera australiensis sp. nov. (Fig. 1)
Stromata usque ad 5500 µm longa, 125-260(-340) µm lata. Conidiophora in stramini **Tritici** in agaro TWA semi-immersa 115-320 µm longa, ad basim amplificatum 10-25 µm diam., ad apicem 7.5-10 µm diam. Conidia 63-105 x 55-110 µm; corpus 27-38 µm diam., pariete 5-7.5 µm diam., 0-2 distoseptatum; brachia (3-)4-5(-7), 20-58 µm longa, ad basim 9-16 µm diam., ad apicem 5-10 µm diam., 1-4 distoseptata; pedicelli 17-30 µm longi, prope corpus 10-16 µm diam., prope hilum 5-9 µm diam., 1-3 distoseptata. Hilum 4-5 µm diam.
Ex laesionibus foliis **Chrysopogonis latifolii**, prope Anaburroo, Northern Territory, Australia, R.A. Peterson, 24 March 1985, BRIP 14658 holotypus, IMI 298704, DAR 55944 isotypi.

Hyphae on PDA are subhyaline to mid olivaceous brown, septate, branched, uniform in width, smooth or sometimes slightly roughened, 2.5-6 µm diam. Linear growth rate on PDA is greatest at ca. 31°C, with a radial increase of 28 mm in 9 days. Stromata are formed freely on PDA and V-8 juice agar, up to 5500 µm long, 125-260(-340) µm diam. On tap water agar + wheat straw conidiophores occur singly or in small fascicles with the individuals united at the base and widely divergent, mid olivaceous brown and paler at the tip, 115-320 µm long after 22 days, 10-25 µm diam. at the swollen base, 9-12.5 µm just above the base, and 7.5-10 µm

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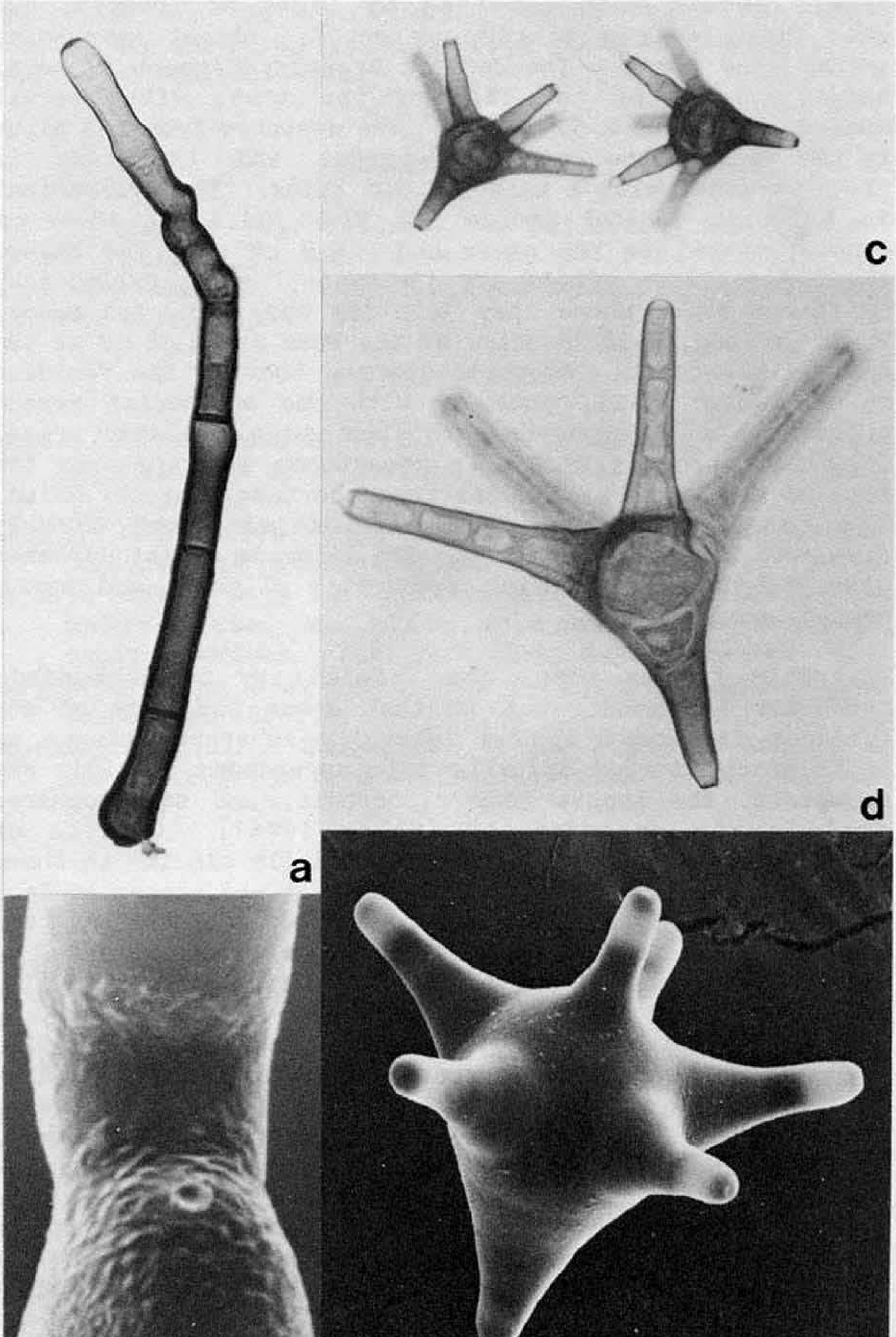
Fig. 1. (a) Conidiophore (b) Roughened conidiogenous node (c-e) Conidia [a, d x 550; b x 4500; c x 260; e x 1000]


a
b
c
d
e

at the apex. The conidiophores and conidiogenous cells appear smooth when examined by light microscopy, but scanning electron microscopy reveals slight roughening around some pores. The conidia are mid olivaceous brown, usually paler at the tips of the arms, with overall dimensions 63-105 x 55-110 µm. The distance from the hilum to the apex of the body is 48-60 µm, and the body is 27-38 µm diam. with a wall 5-7.5 µm thick. The cylindrical to truncate conical pedicel is 17-30 µm long, 10-16 µm diam. proximal to the spore body, 5-9 µm near the hilum, and 1-3 septate. There are (3-)4-5(-7) arms, cylindrical or flared below where they join the body of the spore, 20-58 µm long, 9-16 µm diam. at the base and 5-10 µm at the apex, 1-4 septate. Septation in the body of the conidium is variable (0-2), commonly with one sub-median septum delimiting a large upper cell from which the arms arise. Germination occurs by single germ tubes emerging from the tips of one or more arms and from the base near the hilum. The basal germ tube grows semi-axially and usually displaces the hilum slightly. The hilum is a flat darkened disk 4-5 µm diam. which protrudes slightly and has a central pore.

This fungus shows some similarity to **Hughesinia** Lindquist & Gamundi, but in that genus the body of the conidium is formed by 2-4 laterally adherent columns of cells which diverge apically into appendages, conidia are euseptate, the hyphae bear hyphopodia, and conidiophores proliferate percurrently (Ellis 1976). Conidia of **Shrungabeeja** Rao & Reddy are superficially similar to those of **Dactylifera** but arise holoblastically and appear to lack septa in the body of the spore (described as 'hollow'), the appendages are only sometimes septate, and the conidiogenous cell grows percurrently (Rao & Reddy 1981). In **Cacahualia** Mercado & Castañeda the conidia are pentaradiate with branches arising from a central 2-celled body, but the branches terminate in narrow hyaline cylindrical or filiform cells radiating from the branch tips (Mercado & Castañeda 1984). As with **Shrungabeeja**, conidiogenesis is holoblastic followed by percurrent conidiophore proliferation. **Cacahualia** may be a later name for **Sopagraha** Subramanian & Sudha (1979), with a microconidial **Selenosporella** state at the ends of the conidial arms (B.C. Sutton, pers. comm. 1986). **Weufia** Bhat & Sutton has enteroblastic tretic conidiogenesis and distoseptate conidia, but the conidia are V-shaped and constantly 2-armed, with a single vertical septum separating the two arms (Bhat & Sutton 1985). It would broaden the circumscription of this genus unnecessarily to include **D. australiensis.**

ACKNOWLEDGEMENTS

I thank Mr R.A. Peterson for collecting the specimen which yielded **D. australiensis**, Dr B.C. Sutton for taxonomic comments and Mr D.H. Gowanlock for the scanning electron micrographs.

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SOME NEW CORTICIOID TAXA

B.W.L. de Vries*

Biological Station of the Agricultural University,
Kampsweg 27, 9418 PD Wijster, the Netherlands

SUMMARY

Two new species, viz. Hyphoderma cryptocallimon, and Trechispora kavinioides, and two new varieties, viz. Repetobasidium americanum var. bisporum and Cerinomyces crustulinus var. latisporus are proposed. Melzericium spec. B. de Vries 4166 and Trechispora farinacea f. elevata are provisionally described as new. Hyphoderma tsugae is synonimised with H. pallidum.

INTRODUCTION

During mycological research on juniper scrubs from 1969 onwards, and supplemented by research in artificial conifer plantations, several resupinate fungi have been collected which could not be identified with the current taxonomic literature on this group. Accordingly these taxa are described in this paper. Herbarium specimens are conserved at the Biological Station in Wijster (WBS).

1. Hyphoderma cryptocallimon B. de Vries, spec. nov.

Basidioma resupinato-effusum, adnatum, 0.1 mm crassum, cremeum vel argillaceum, pilosum. Sporae 8.0-11.0(-12.0) x 4.5-6.0(-7.0) µm, laeves, ellipsoideae, tenuitunicatae, non amyloideae. Basidia 25-70 x 7.5-10 µm, clavata, leviter sinuosa, tetraspora. Cystidia 80-150(-190) x 8-12 µm, emergentia 40-80 µm, (sub)cylindracea, versus apicem clavata, sub apice constricta, cum globula resinosa, crassitunicata, versus basim tunica ad 1.6 µm. Hyphae tenuitunicatae, fibulatae, 3-5 µm latae. Ad lignam Juniperi communis. -Holotypus: B.W.L. de Vries 3774, 31.X.1978, Tannenberg, Haltern Holtwick, Westphalia, Federal Republic of Germany, WBS.

Etymology: crypto, hidden, secret; callimon, beauty.

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* Communication No. 316 of the Biological Station Wijster Dr. W. Beyerinck, Wijster; Agricultural University, Wageningen.

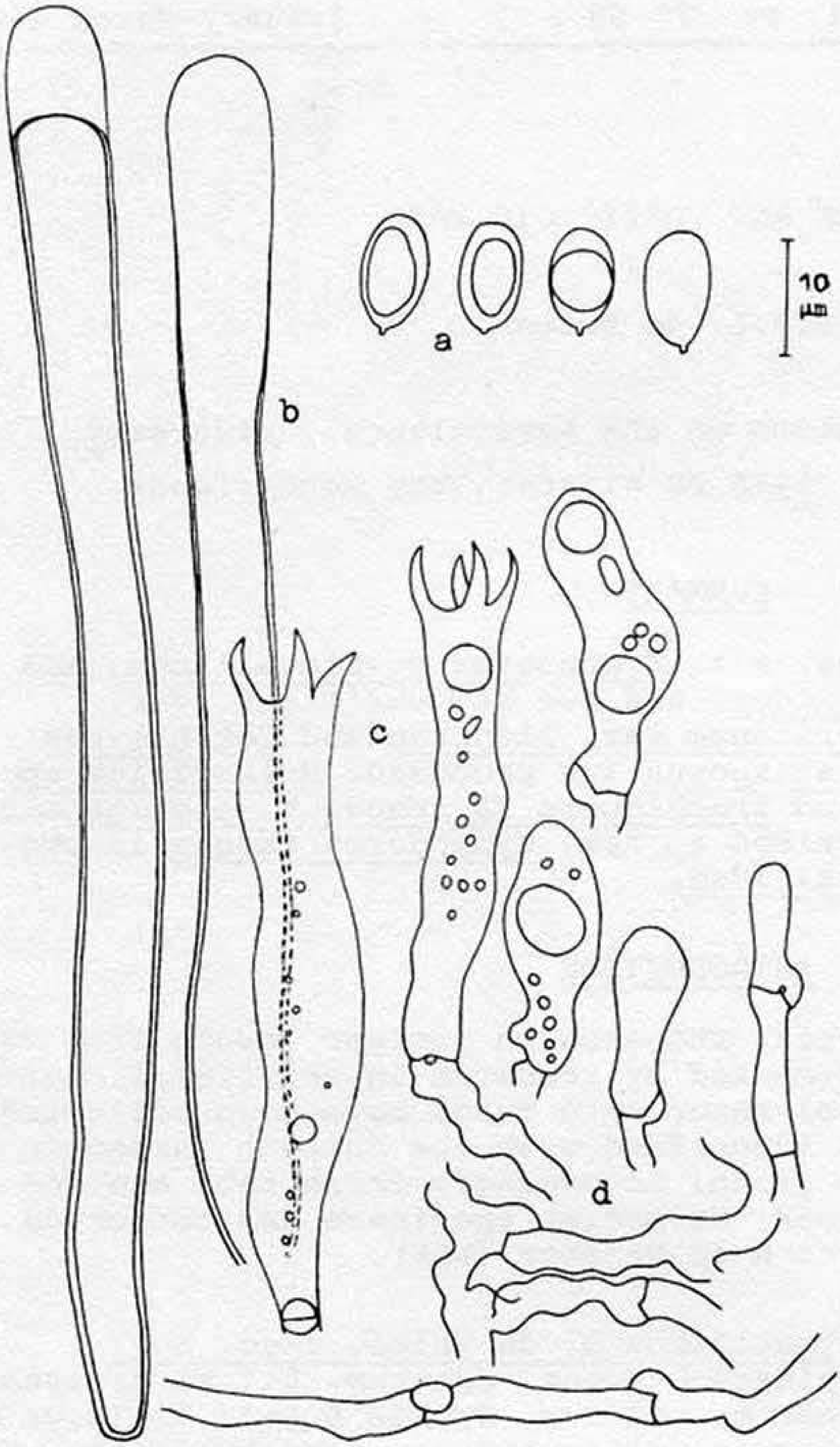


Fig. 1. Hyphoderma cryptocallimon type, WBS
a) spores b) cystidia c) basidia d) hyphae

Fruitbody whitish to loam-coloured, continuous or minutely porose or subreticulate, especially near margin. Margin thinning out, pruinose or shortly arachnoid. Subiculum white. Surface tomentose-pilose because of projecting Cystidia. Thick parts (when dry 100-140 µm) sometimes cracking on drying. Spores 8.0-11.0(-12.0) x 4.5-6.0(-7.0) µm, Q = (1.4-)1.6-2.2, smooth, ellipsoid-subcylindrical, thin-walled, not amyloid, with oil drops. Basidia 25-70 x 7.5-10 µm, clavate or subclavate, often sinuous and constricted, guttulate, 4-spored. Cystidia 80-150(-190) x 8-12 µm, emergent for 1/2 to 3/4 of length (40-80 µm), subcylindrical, apex gradually dilatating, lower part mostly thick-walled (wall up to 1.6 µm), sometimes ensheathed by narrow hyphae originating in the subhymenium; apex obtuse, often secondarily septate, thin-walled, below apex with slight constriction bearing globose glittering matter and agglutinated spores. Hyphae thin-walled, 3-5 µm wide, richly branched; basal hyphae more or less parallel to the substrate and sometimes thick-walled in or near the substrate. Clamps present at all primary septa.

On Juniperus communis L. growing on poor, more or less sandy soil. Known from the Federal Republic of Germany, Sweden and the Netherlands. Oct.-Nov.

Collections examined: Federal Republic of Germany: Wachendorf near Lingen, 4.XI.1969, De Vries 488; Lüneburger Heide, Totengrund, 12.X.1974, De Vries 2072; Haltern Holtwick, Tannenberg, 31.X.1978. De Vries 3774 (holotype). Sweden: Dalby near Lund, 14.X.1975, De Vries 3055. The Netherlands: Elspeet, 21.X.1974, De Vries 1994; 't Harde, 15.XI.1974, De Vries 1995; Denekamp, 14.XI.1974, De Vries 1996.

Material of the first gathering (De Vries 488) has been sent to Dr. J. Eriksson. According to him this collection represented a new species and it was provisionally described in Eriksson & Ryvarden (1975) under the name Hyphoderma sp. De Vries 488. More collections of this undescribed species have been made afterwards, and the material was also in a better state of development. Thus the species is now validly described.

2. Trechispora kavinioides B. de Vries, spec. nov.

Basidioma resupinato-effusum, hydnoideum, pro parte pulverulentum, cremeum vel argillaceum. Systema hyphale monomiticum. Sporae 3.0-4.0 x 2.0-2.8 µm, laeves, tenuitunicatae, inamyloideae. Basidia 10-15 x 4.5-6 µm, fibulata, tetraspora. Cystidia absentia. Arthrosporae 8-18 x (5-)7-12 µm, variabilissimae, tunica metachromatica 0.5-1 µ crassa.

Trechisporae cohaerentis affine, sed differt arthrosporis et basidiomate hydnoidea. Physodontiae lundelii affine, sed differt cystidiis absentibus. Terrestre ad acus Juniperi communis.-Holotypus: B.W.L. de Vries 2083, 18.XI. 1974, Wachendorf, Lingen, Niedersachsen, Federal Republic of Germany (WBS).

Etymology: kavinioides, resembling a species of Kavinia.

Fruitbody resupinate, loosely adnate, soft and fragile, bluntly warted to slenderly aculeate, cracked between warts or aculei, cream to loam-coloured. Aculei in dry state up to 0.6 mm long, irregularly arranged or mixed with warts or membranaceous or arachnoid or floccose areas.Floccose areas predominantly in the marginal zone. Spores 3.0-4.0 x 2.0-2.8 µm, smooth, (moderately) thin-walled, thickness not passing 0.2 µm, inamyloid. Basidia 10-15 x 4.5-6 µm, shortly cylindrical to clavate, clamped, 4-spored, a few with slightly thickening wall. Cystidia absent. Floccose zone consisting of arthroconidia, produced in chains, separated by small clamps (remnants of clamp still visible on young conidia

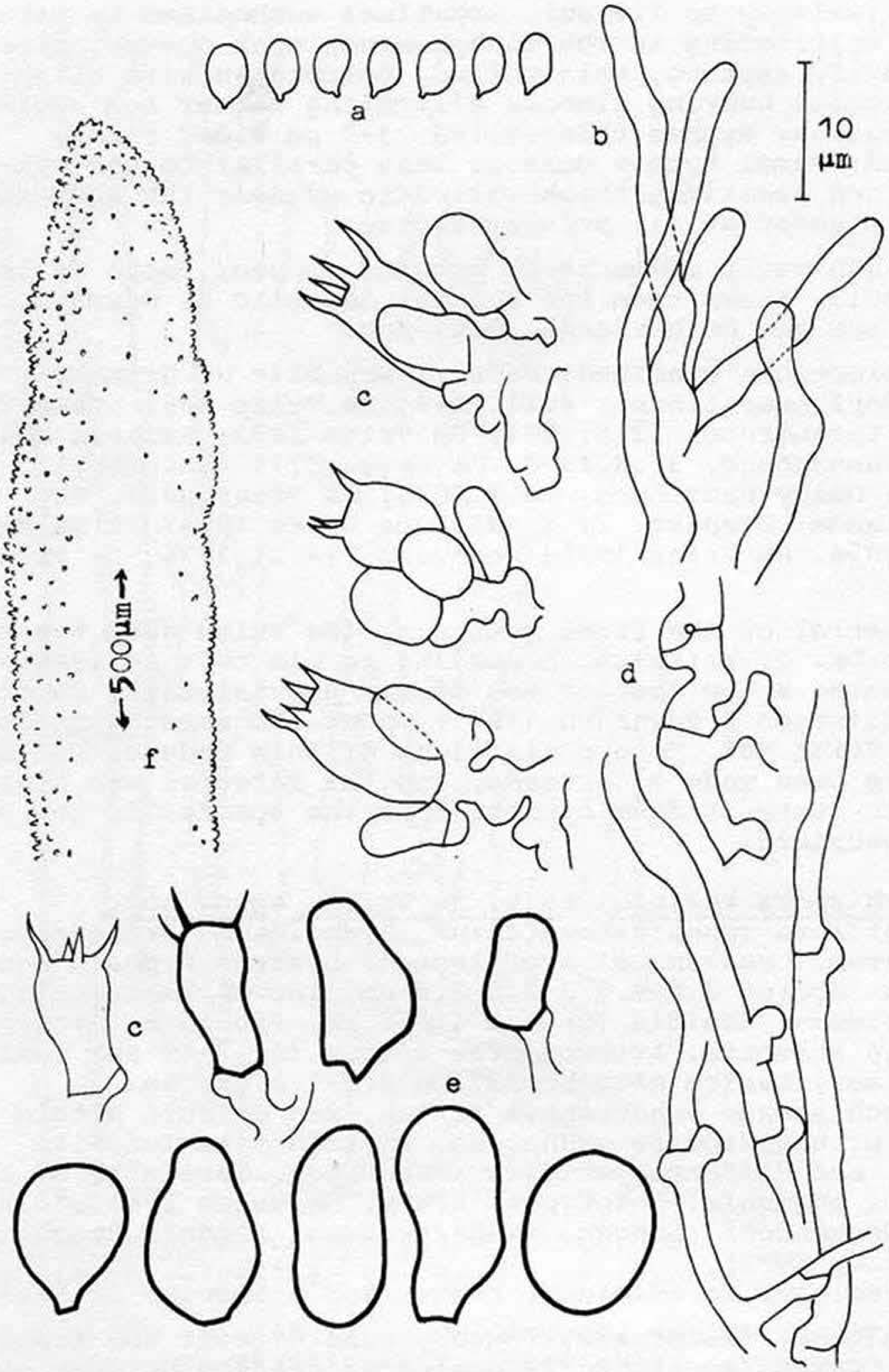


Fig. 2. Trechispora kavinioides, type WBS.
a) spores b) hyphae in spine tip c) basidia
d) hyphae e) arthrospores f) habit of spine

(apiculus-like). Conidia variable in shape, cylindrical to generally (sub)globose, rounding off after separation, becoming slightly thick-walled. 8-18 x (5-)7-12 µm, with homogeneous contents. Wall up to 1.0 µm thick and smooth, becoming violaceous in Congo Red, not staining in eosin and Melzer's reagens.

Hyphal system monomitic, hyphae (1.5-)2-3.5 µm broad, very thin-walled, clamped, with subhymenial swellings up to 5 µm. No straight subicular hyphae present.

In a dry little hole; on needles of Juniperus communis. Known only from the type locality.

Collection examined: Federal Republic of Germany, Niedersachsen, Lingen, Wachendorf, 18.XI.1974, De Vries 2083.

At first sight this species seems to show some affinity with Physodontia lundellii Ryv. & Solheim. However, no cystidia could be found and the arthrospores do not correspond to the gloeocystidia with granular contents. For the time being I prefer therefore to keep this taxon in genus Trechispora P. Karst., especially as thick-walled elements that can serve as asexual propagules appear to be not exceptional in Trechispora farinacea (Liberta, 1973). Trechispora kavinioides belongs to subg. Laevispora Parm., where it is the only hydnoid species close to T. cohaerens (Schw.) Jülich & Stalpers.

Brevicellicium olivascens (Bres.) Larsson & Hjortst. differs in much broader subhymenial elements (up to 10 µm broad) and subglobose spores which measure 3.5-5.0 µm. The genus Mucronella shows some superficial likeliness but differs in broader hyphae and especially its amyloid spores.

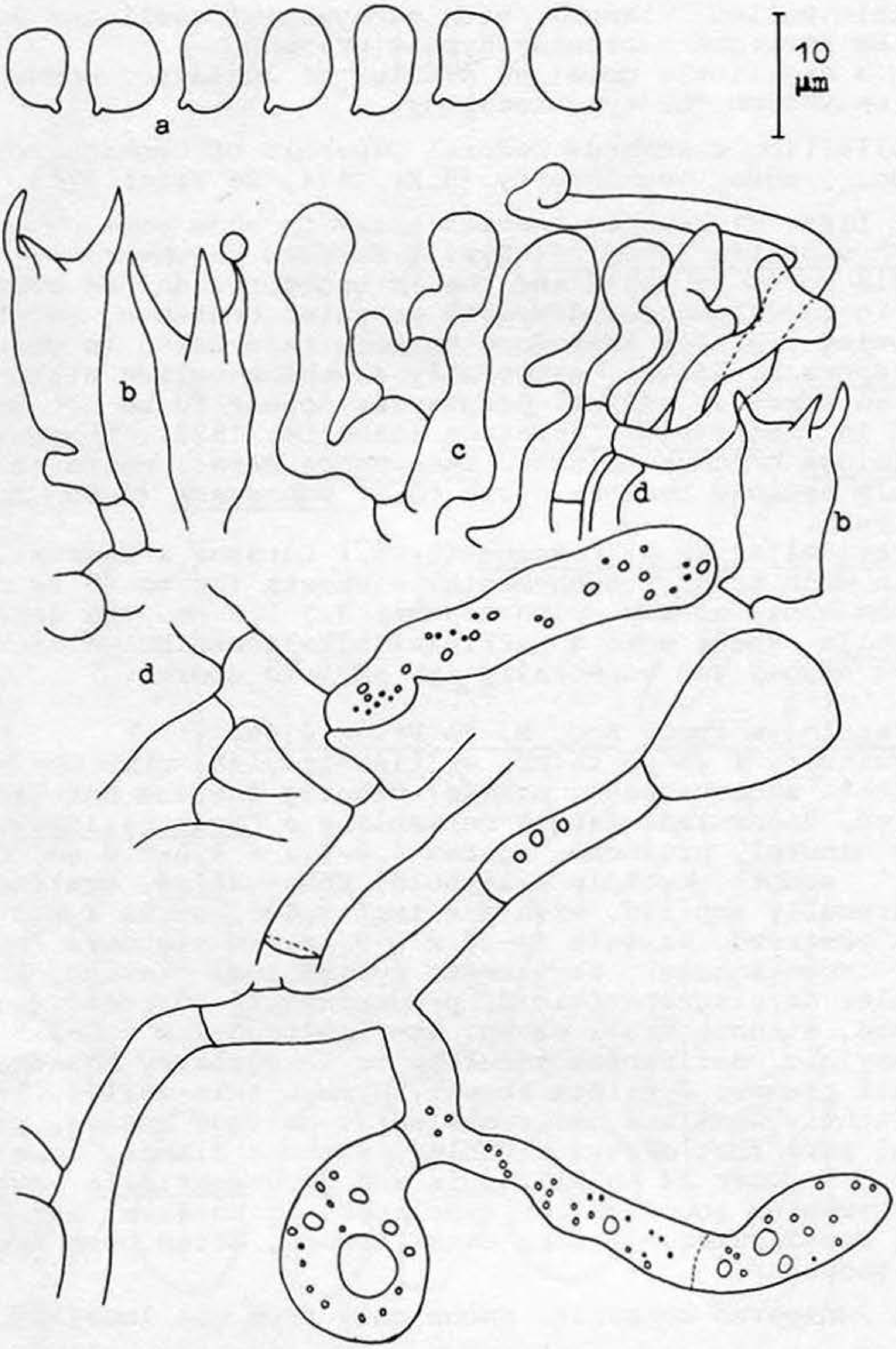
3. Melzericium spec. nov. B. de Vries 4166.

Fruitbody ± 25 µm thick, whitish-greyish, minutely felty, cohaerent, subceraceous, margin thinning out and not differentiated, under lens (40 x) resembling a Ceratobasidium, and partly minutely pruinose. Spores 6.0-9.0 x 4.0-6.0 µm, Q = 1.2-1.7, smooth, broadly ellipsoid, thin-walled, hyaline, conspicuously amyloid, with distinct apiculus; no sporerepetition observed. Basidia 13-17 x 6-9 µm, in clusters (hymenium discontinuous), obovate to cylindrical clavate, some irregular or pleurobasidioid, predominantly 4-spored, partly 2-spored, without basal clamp. Sterigmata 5-7 x 1.5-2.5 µm, tips amyloid. Basidioles torulose or irregularly boneshaped, in small groups. Cystidia absent. Hyphae thin-walled, 3-6(9) µm, slightly undulate and ramified at oblique angles, with central pore (not always visible), without clamps; some septae irregular as in Oliveonia and Hyphodontiella. Hyphae in subhymenium short-celled, inflated, up to 9 µm, not easily distinguishable from basal hyphae, often both types glued together.

On Juniperus communis. Known only from one locality. Oct.

Collection examined; Denmark, Bjaergby, 23.X.1980, De Vries 4166.

Unfortunately this collection consists of one specimen that is in bad condition, being partly overgrown by an imperfect fungus, Verticillium, possessing straight hyphae with somewhat thickened walls and without central pore, and subcylindrical, occasionally 1-septate non amyloid conidia. The unwelcome parasite can create some confusion, and for that reason it was considered better to refrain from a formal description as new species. I hope that this description will



Melzericium spec. BdV 4166, WBS.
a) spores b) basidia c) basidioles d) hyphae

give the opportunity to Danish mycologists in making more and better collections of this taxon with its unusual combination of characters.

The generic disposition of the species seems to be somewhat controversial. On the one hand it seems related to the Xenasmataceae (Oberwinkler, 1965) on account of its thin, subceraceous basidiocarp, amyloid spores and its pleuromorphic or flexuouse basidia. However, its basidia are not so frequently and distinctly bi- or more radicate as in Aphanobasidium Jülich. Moreover, in the latter genus the hymenium is coherent and continuous, resulting in a waxy consistence.

On the other hand the basidia and hyphae are reminiscent of the Ceratobasidiaceae (Martin, 1948), especially as they are relatively broad and clampless. However, no spore-repetition has till now been observed in our new fungus.

The indistinct flexuose structures between the basidia (Fig. 3c), and the presence of inflating or glued subhymenial elements is a good argument to decide in favour of a disposition in the genus Melzericium Hauerslev. However, the hyphae in this genus are said to be clamped and septatonodulose. For the time being, however, it probably is better to expand the generic diagnosis of Melzericium than describe a new genus for this rather badly developed specimen.

A relationship between Xenasmataceae and Ceratobasidiaceae, as suggested by Oberwinkler (1965: 65) with Paulicorticium as a link seems now quite reasonable in view of this species. It makes it also plausible that the phylogenetic position of Melzericium must be sought more near the xenasmatoid Corticiaceae and less near Hyphoderma, as suggested by Eriksson & Ryvarden (1976). A possible generic relationship between Melzericium and Xenasma has been supposed by Jülich & Stalpers (1980) too.

4. Repetobasidium americanum Erikss. & Hjortst. var. bisporum B. de Vries, var. nov.

A typo differt basidiis bisporis, sporis latioribus, 8.0-11.0 x 5.0-6.0 µm et cystidiis ampullaceoribus subulatioribusque. Ad lignum Juniperi communis.- Holotypus: B.W.L. de Vries 4482, 30.XI.1981, Biological Station Wijster, prov. Drenthe, the Netherlands (WBS).

Fruitbody very thin, subinvisible, pruinose, greyish cream to slightly brownish, margin thinning out and invisible. Spores 8.0-11.0 x 5.0-6.0 µm, Q = 1.6-2.1, ellipsoid to shortly cylindrical with slight lateral depression, filled with two to many oildrops, inamyloid. Basidia 10-13(-17) x 6.5-8.5 µm 2-(3-)spored. Cystidia 28-47 x 5-7.5 x 0.5-2(2.5) µm, conical or fusiform, occasionally septate, often ampulliform at the base, mostly subulate at the apex but sometimes obtuse. Hyphae 2-3(-4) µm broad, thin-walled, with clamp-connections.

Growing on two different pieces of Juniper branches that have been laid in a Molinia vegetation. Known only from the type locality where it has been found once. Nov.

Collection examined: the Netherlands, prov. Drenthe, Wijster, Biological Station, 30.XI.1981, De Vries 4482.

The main difference between this taxon and var. americanum is to be found in the 2-(3-)spored basidia of the former and 4-spored basidia of the latter. The other differences with the type variety seem to be more gradual. Var. americanum was found in three other collections, and two of these gatherings differed from the holotype (Eriksson & al., 1981) in having somewhat larger spores as can be seen from

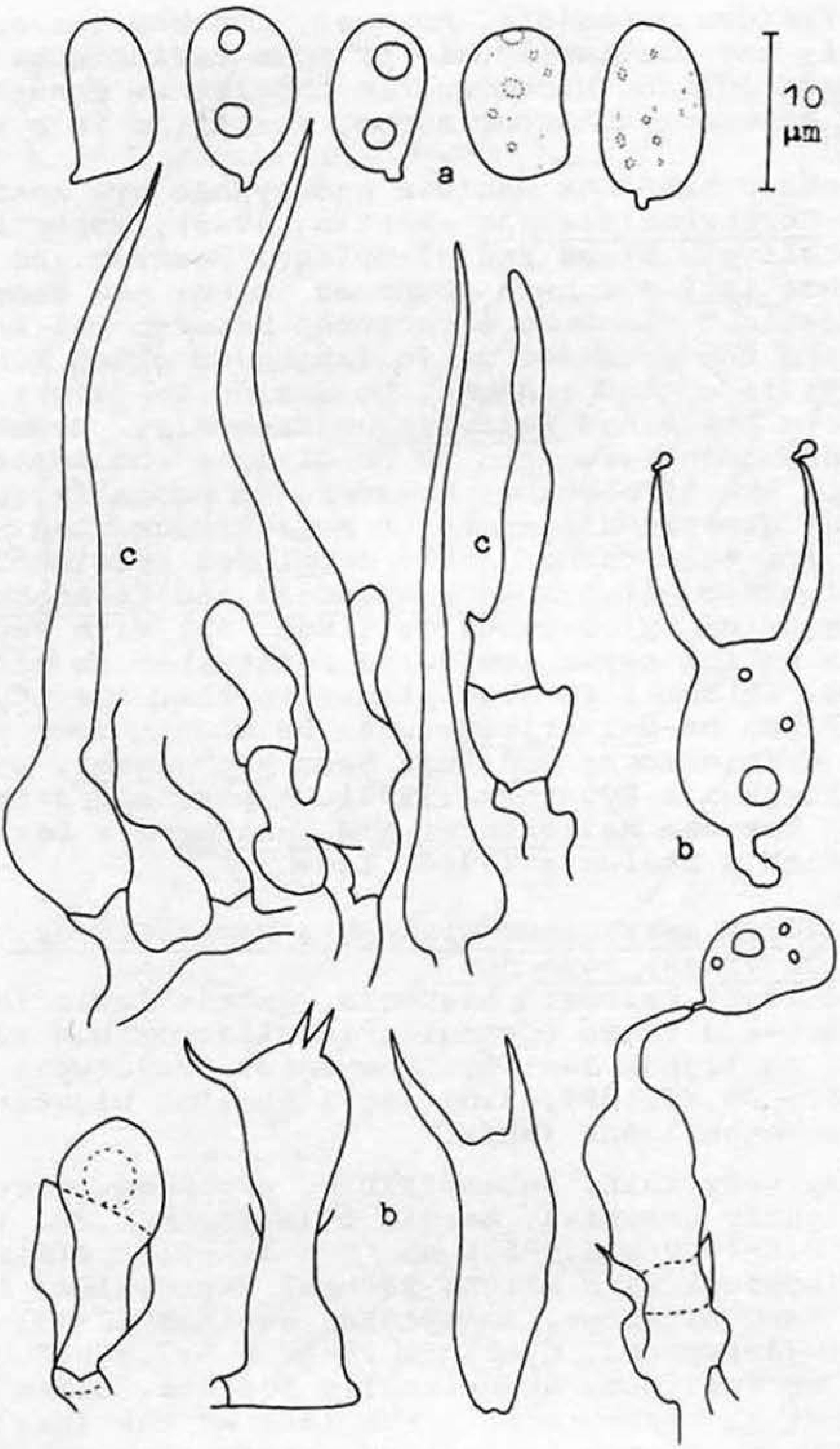


Fig. 4. Repetobasidium americanum var. bisporum type, WBS
a) spores b) basidia c) cystidia

Table 1.

Despite the somewhat greater spore length of collection 4938 and 4939, there is no reason to include these in R. vile, as that species is characterised by much narrower allantoid spores with a much higher 1/b-ratio.

It should be noted, however, that the above-mentioned Drenthian collections deviated from typical var americanum by the short subbasidial elements, thus without a basidial stalk. It seems not unlikely that these basidial stalks develop only under favourable conditions. Upon identification of these four collections the spore dimensions are regarded as of more importance than the size of the subhymenial elements. The shape of the cystidia is also very variable in all of the collections studied, mostly being somewhat inflated just above their bases (4-spored collections) This inflation is particularly distinct in var. bisporum (De Vries 4482).

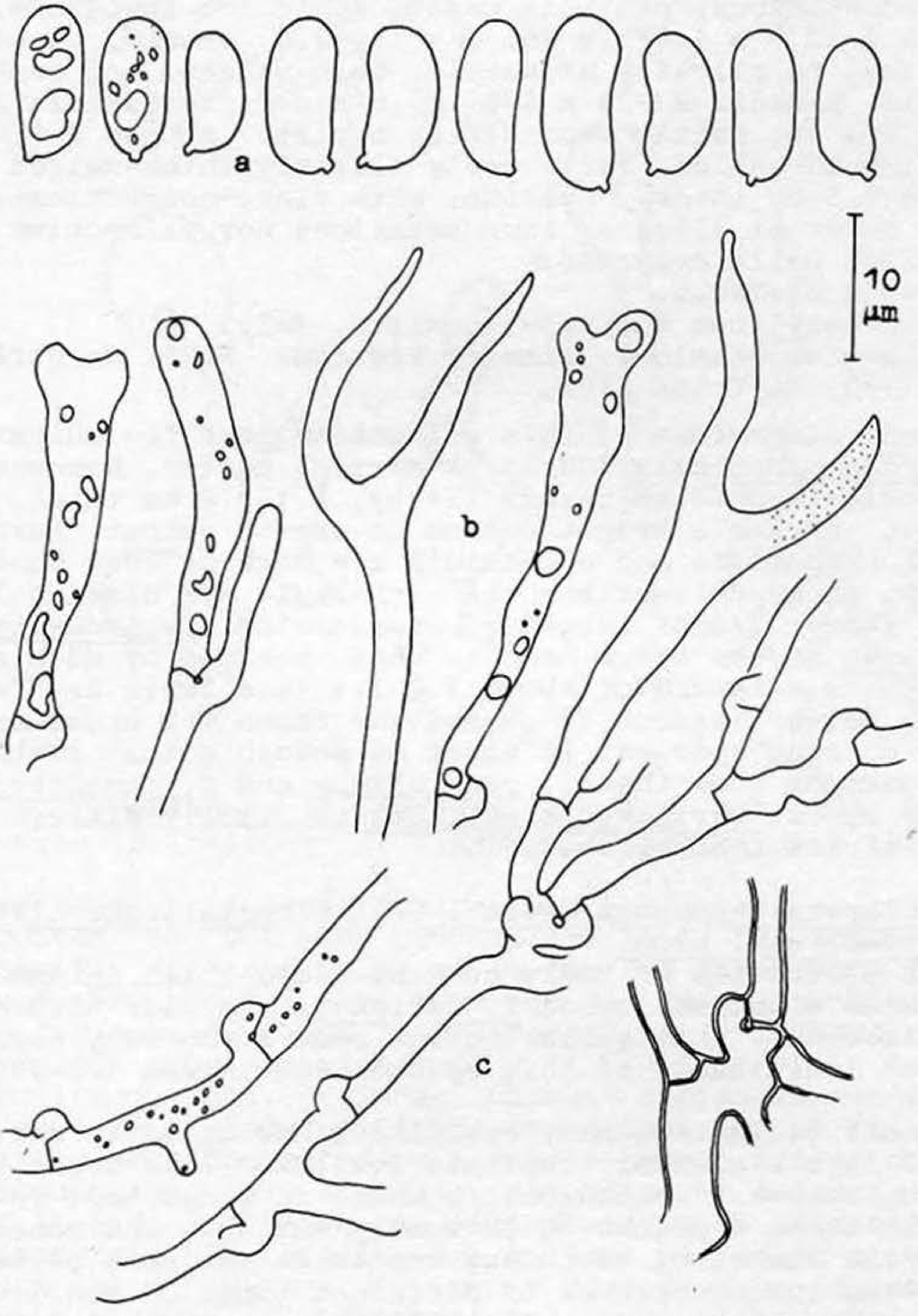


Fig. 5. Cerinomyces crustulinus var. latisporus type. WBS
a) spores b) basidia c) hyphae

5. Cerinomyces crustulinus (Bourd. & Galz.) Martin var. latisporus B. de Vries, var. nov.

A typo differt sporis latioribus, 8.0-12.0 x 4.0-5.0 µm. Ad lignum Taxus baccatae.- Holotypus: B.W.L. de Vries 4103, 24.VII.1980, Forêt de Beffou, Bretagne, France (WBS).

Fruitbody resupinate, completely attached to the wood, ceraceous, about 1 cm wide, drying up to a subinvisible, transparant film, 50 µm thick, margin with whitish, more or less discontinuous, pruinose parts, subiculum invisible. Spores 8.0-12.0 x 4.0-5.0 µm, Q = 1.9-2.6, smooth, broadly cylindrical to slightly allantoid, thin-walled, not septate, inamyloid. Basidia 23-33 x 4-5 µm, clamped. Epibasidia 2, 16-22 x 2-3 µm, partly secondarily septate. Hyphae 2-3(-4) µm wide, thin-walled, but locally slightly thick-walled (wall to 0.5 µm thick), hyaline, with clamp-connections; neither external slime or incrustrations nor refractive gelatinised walls observed.

On wood of Taxus.

Known only from the type locality. July.

Collection examined: France, Bretagne, Forêt de Beffou, 24.VII.1980, De Vries 4103.

Spore dimensions of this collection seem to indicate Cerinomyces canadensis (Jacks. & Martin) Martin. However, that species should be rather fleshy, 0.1-0.2 mm thick, cracking, and has a bright chrome to orange colour. Furthermore the probasidia and epibasidia are more or less equally long, but in my collections the epibasidia are distinctly shorter (about 2/3 of length of probasidia). Cerinomyces crustulinus on the other hand is characterised by much narrower spores with a Q of about 3.0-3.4 (see Table 2). For the time being I prefer to regard the taxon as a broad-spored variety of that species. It might be possible that further investigations show that C. crustulinus and C. canadensis are very close. Cerinomyces pallidus is clearly different on account of its small probasidia.

6. Trechispora farinacea (Pers.: Fr.) Liberta forma elevata B. de Vries, nom. prov.

In a plantation of badly growing Picea abies in the Netherlands a collection of T. farinacea was made with aberrant characters. This gathering was made among many normally developed individuals of this species (estimated 100-300/ 1000 m^2).

In this collection many basidioles had apically differentiated into a slender, capitate cystidium-like organ, with thickish, somewhat metachromatic walls in Congo Red. The length of these elements is extremely variable and consequently the number of secondary septae is variable as well. Considering the occurrence of different kinds of conidia in the genus Trechispora (Liberta, 1973), it is tempting to regard these elements as asexual propagules too, but no germination in these elements has been observed, although these cells separate easily in squash preparations.

These elements do neither conform to the chlamydospores of T. alnicola (Bourd. & Galz.) Liberta, nor with the arthro-

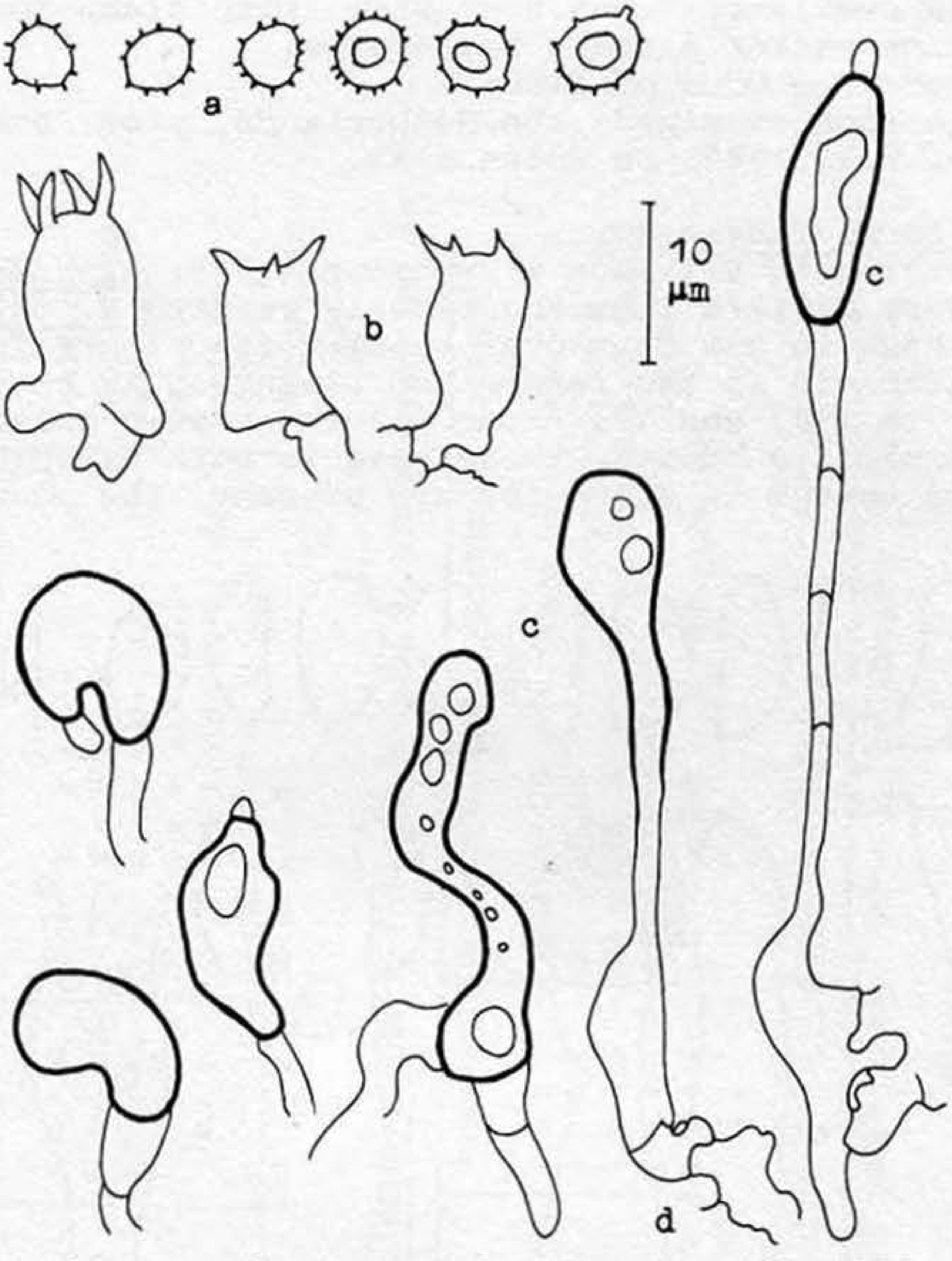


Fig. 6. Trechispora farinacea f. elevata BdV 4953, WBS
a) spores b) basidia c) elevated elements d) hyphae

spores of T. farinacea. Besides, both elements originate in the context and not from basidioles. As it was found growing between T. farinacea I regard it for the time being as a form of that species, but I am not yet certain whether such a modification deserves formal recognition. I therefore propose only a provisional name.

Fruitbody thin, pruinose, without a hydnoid tendency, greyish like a bloom of flour; under lens (40 x) consisting of little dots connected by a subtle hyphal net or more continuous, minutely floccose, extending to 0.5-2 cm. Spores 3.5-4.5(-5.0) x 3.0-4.0 µm, echinulate, with spines 0.3-0.6 µm, inamyloid. Basidia 10-15 x 6-7 µm, mostly as pleurobasidia (as often occur in poorly developed young Corticiaceae), with (2-)3-4 sterigmata and basal clamp. Basidiole-stalk very thin-walled and slender, 1-2 µm broad and with 0-3 secondary septae. Elevated elements becoming slightly thick-walled (to 0.5 µm), violacous in Congo Red, with one or two guttules, often crowned with a basidiole remnant (11-15(-24) x 6-7(-8) µm. Hyphae irregular and ampulliform, thin-walled, inclusive swellings 1.8-5.5 µm wide, with clamp-connections. Crystalline matter present but scarce.

On decaying wood of Picea.

Collection examined: the Netherlands, prov. Drenthe, Dwingelo, 8.XI.1983. De Vries 4953.

7. Hyphoderma tsugae Burt.

According to Eriksson & Ryvarden (1975) Hyphoderma tsugae Burt differs from the closely related H. pallidum (Bres.) Donk in one character solely, viz. spore form, being ellipsoid in the former and allantoid in the latter. However, in 1983 and 1984 some specimens were observed that are intermediate between these taxa as both ellipsoid and allantoid spores in side-view are present. The occurrence

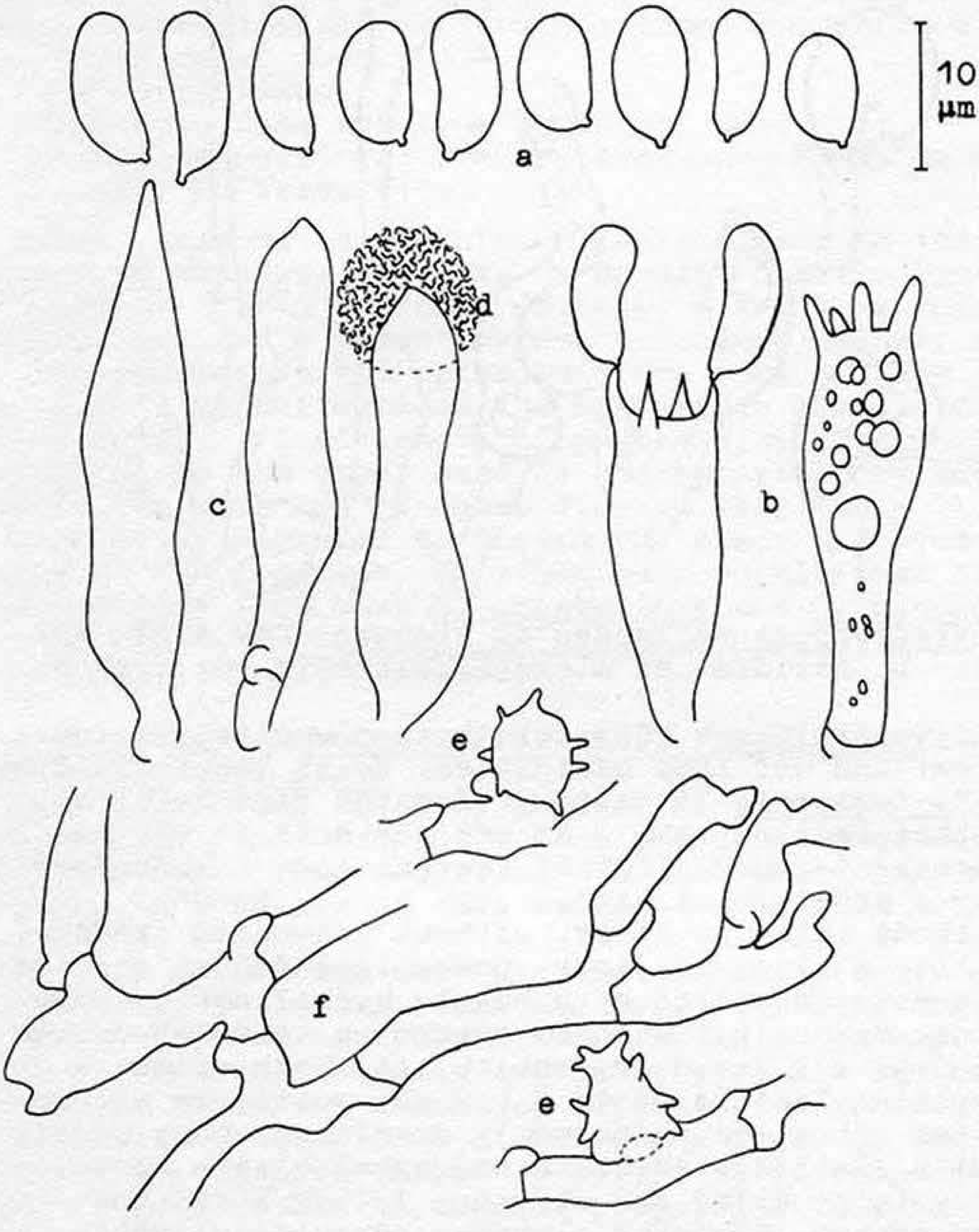


Fig. 7. Hyphoderma pallidum BdV 5115, WBS
a) spores b) basidia c) cystidia
d) resinous matter e) echinocysts f) hyphae

Table 1. Comparison of spore dimensions of five collections of R. americanum and two collections of R. vile, partly compiled from Bourdot & Galzin (1982) and Eriksson & al. (1981).

collection	spores (µm)	spores (q)	cystidia (µm) length x width x width (top)	substrate
americanum (holotype)	6-7.5 x 3.5-4.5	1.6-2.1	35-45 x 5 x 1.5-2	conifer
americanum De Vries 4677	6-7.5 x 3-4	1.7-2	32-45 x 6-9 x 1-3	Pseudotsuga
americanum De Vries 4939	6.5-8(9) x 3.5-4.5	1.6-2.4	32-74 x 6-9 x 1-2.5(4)	Juniperus
americanum De Vries 4938	6.5-8(10) X 3.5-4.5	1.7-2.2	29-59 x 6 x 0.5-2(2.5)	Picea
" 2 spored De Vries 4482	8-11 x 5-6	1.6-2.1	28-47 x 5-7.6 x 0.5-2(2.5)	Juniperus
vile Eriksson	6-8(12) x 2-3(3.5)	2.8-4.0	25-40 x 5-7(10) x 1.5-2	conifers
vile Bourd. et Galz.	4.5-7 x 2-3	2-3 ?	40-75 x 6-8	Populus Pinus

Table 2. Comparison of different taxa of Cerinomyces, partly based on Bourdot & Galzin (1928) and Martin (1949, 1952).

collection	spores (µm)	spores (q)	probasidia (µm)	thickness, colour
C. crustulinus B. et G.	9-12 x 3-4	± 3	30-45 x 3-4	thin pale isabella
J. Eriksson nr. 8194	7-12 x 2.5-4	± 3-3.4	20-25 x 5-6	thin greyish, pale
De Vries nr. 4103	8-12 x 4-5	1.9-2.6	23-33 x 4-5	± 50 µm greyish, pale
C. canadensis Martin	11-13.5 x 4.5-5	± 2.4-2.7	30-33 x 3.5-5	0.1-0.2 mm orange
C. pallidus Martin	(6)7-8(9) x (3)4-4.5	± 1.7-2	11-13 x 3-4	greyish pale

Table 3. Comparison of collections of H. pallidum and H. tsugae see Eriksson & al. (1975).

description, collection	allantoid resp. ellipsoid spores (µm)		echinocysts	substrate
H. pallidum	7-9(-10) x 2.5-3.5(4)	absent	present	pref. conifers
De Vries 5115	8-10(11) x 3-4	7-9 x 4-5	present	Picea
De Vries 4859	9-11 x 3-4	9-10 x 4-5.5	absent	Pinus
L. Spoormakers 5083	absent	7-9 x 4-5	present	Pinus
H. tsugae	absent	8-10 x 4-5	absent	Pinus

of echinocysts (said to be another character of H. pallidum) in these collections was not correlated with spore form as can be seen from Table 3.

The measurements of Table 3 were made in amounts in Congo Red - ammoniacal ± 5 %. Spored mounted in water have for a long time impressed sides and are thus broadened like an empty tube. Even when studied in ammonia part of the spores still appear to be broad in side view, slightly more slender in front view and oval in basal view. So the ventral side can be variable. This perhaps can explain the occurrence of both types of spores, resulting in a variable spore form. Considering the above I propose to reduce H. tsugae as a synonym of H. pallidum.

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CONTRIBUTIONS TO THE LICHEN FLORA OF BRITISH COLUMBIA, CANADA

TEUVO AHTI

Dep't of Botany, University of Helsinki,
SF-00170 Helsinki, Unioninkatu 44, Finland

IRWIN M. BRODO

Museum of Natural Sciences, National Museums of Canada
Ottawa, Ontario K1A 0M8, Canada

and WILLA J. NOBLE

Box 512, Ucluelet, B.C. V0R 3A0, Canada

SUMMARY

The following new nomenclatural combinations are made: *Arthothelium macounii* (Merr.) Noble, *Aspicilia laxula* (H. Magn.) Brodo, *Cladina stellaris* var. *aberrans* (des Abb.) Ahti, *Lecania hassei* (Zahlbr.) Noble, *Melanelia sorediata* (Ach.) Goward & Ahti, *Nephroma helveticum* subsp. *sipeanum* (Gyeln.) Goward & Ahti, *Polysporina urceolata* (Anzi) Brodo, *Pyrenula occidentalis* (R.C. Harris) R.C. Harris, and *Xanthoparmelia somloënsis* (Gyeln.) Hale. *Pseudocyphellaria anomala* Brodo & Ahti is a new species (type from the state of Washington).

In the course of preparing "The Second Checklist of the Lichens of British Columbia" (Noble et al., 1986), a number of nomenclatural problems came to light. The purpose of this paper is to introduce the necessary validating combinations for these names, with discussions and explanations as appropriate.

Arthothelium macounii (Merr.) Noble, comb. nov. *Arthonia macounii* Merr., Ottawa Naturalist 28: 36. 1914. Type: *Macoun*, Sidney, "On young firs" (FH; isotype: CANL).

The holotype of *Arthonia macounii* in the Farlow Herbarium consists of three bark patches glued to one piece of cardboard. One patch is primarily *Opegrapha herbarum* Mont. The other two patches are both *Arthothelium* species, one of them *A. spectabile* Flot. ex Mass., with ellipsoid spores having 1-2 longitudinal septa, black ascocarps, and a KOH- epithecioid layer. The second *Arthothelium* has similar-sized spores ((25-)28-32(-38) x (8-)10-13 µm) but they are clavate with the end cell enlarged and accounting for up to 1/3 of the spore length; very few longitudinal septa are present, and then only in the tail portion; the ascocarps are reddish brown, 0.5-1.3 mm wide; and the epithecioid layer is KOH+ purple. From the more important aspects of the spore description in the protologue, it seems clear that this thallus should be regarded as the lectotype, and it is so designated here. Merrill's description does not agree with this specimen in all particulars, however, apparently because he included some observations derived from the *A. spectabile* specimen. The spores were reported as 40-47 x 13-14 µm (none of the spores even approached this length), the large end cell of the spores is noted as "at times irregularly divided," and the ascocarps are described as 0.1-0.5 mm wide.

Aspicilia laxula (H. Magn.) Brodo, comb. nov. *Lecanora laxula* H. Magn., Kungl. Svensk. Vetensk. Handl. ser. 3, *17(5)*: 65. 1939. Type: Norway, Opland: "Ringebu 1928 *Magnusson 11474a*, On stone fence, ca. 185 m." (UPS).

Although the B.C. record of this species is not absolutely confirmed (see Brodo, 1976), it is clear that the type belongs to the genus *Aspicilia*. The specimens named as *A. laxula* in CANL come very close to *A. caesiocinerea* (Nyl.) Arn. and should be restudied in the context of a revision of the genus.

Cladina stellaris var. **aberrans** (des Abb.) Ahti, comb. nov. *Cladonia alpestris* (L.) Rabenh. f. *aberrans* des Abb., Bull. Soc. Sci. Bretagne 16 (hors sér. 2): 93. 1939. Type: U.S.A., Alaska, Bering Sea, St. Paul Island, *J.M. Macoun*, 1897, Canad. Lich. 171 (W; isotypes: CANL, US). *Cladina aberrans* (des Abb.) Hale & W. Culb., Bryologist 73: 510. 1970 (as "*C. abberans*").

This is a psoromic acid strain of *C. stellaris* and is morphologically indistinguishable from var. *stellaris*. It has been variously treated as an unnamed chemotype, a form, a variety, or even as as a distinct species. In a recent synopsis of *Cladina* (Ahti, 1984), it was not considered worthy of nomenclatural recognition. Because the strain is common in some areas, however, (e.g., Alaska and Japan), and absent or rare over most of the range of *C. stellaris*, it is here recognized as a variety for those who want to emphasize its phytogeographic importance. It is expected to be widespread in the poorly explored NW corner of British Columbia.

The date of the lectotype collection is 1897, not 1894 as given by Ahti (1961). James M. Macoun (the son of John Macoun) was not in Alaska in 1894, and his handwriting was unclear.

Lecania hassei (Zahlbr.) Noble, comb. nov. Placolecania hassei Zahlbr.in Hasse, Bryologist 17: 61. 1914. Type: U.S.A., California, "On shaded sandstone bowlders (sic), Topanga Canyon, Santa Monica Mountains" (W, not seen; isotype, FH)

The type of Placolecania hassei is a direct match for the B.C. material. A very similar taxon, however, is Lecania dudleyi Herre (Proc. Wash. Acad. Sci. 12: 188. 1910). If the latter proves to be conspecific, the name would have priority.

The growth form of L. hassei is intermediate between Solenopsora and Lecania. The thallus is usually better developed than that of a typical crustose Lecania (although occasionally it is reduced to an areolate condition), but is not really as developed as the squamulose to placoidal thallus of a typical Solenopsora. Indeed, on a much reduced scale, the thallus of S. holophaea (Mont.) Samp. is quite similar. The latter is a European species growing in rock crevices also in maritime locations.

In L. hassei, arcuate conidia are produced by exobasidial fulcra which, following Zahlbruckner (1926), definitely places it in the genus Lecania. Although Zahlbruckner was aware of this character as shown by notes and drawings that accompany the type, he later combined the epithet in the genus Solenopsora himself (Zahlbruckner, 1928), suggesting that he actually placed more importance on the thallus morphology than on the conidia in separating the two genera.

Lecanora ochrococca (Nyl.) Clauz. & Roux, Likenoj Okcid. Eur. 826. 1985. Lecidea ochrococca Nyl., Öfvers. Kongl. Vetensk.- Akad. Förh. 17: 297. 1860; Lich. Scand. 206. 1861. Type: Norway; 1847, W.P. Schimper (not seen). Lecanora phaeobola Tuck., Genera Lich. 115. 1872. Type: California, Bolander, 1872 (FH, not seen).

The British Columbia material was initially identified as Lecidea ochrococca based on descriptions in Duncan (1970) and comparisons made with Scottish specimens borrowed from BM. Careful examination of these specimens revealed clumps (or layers) of algae in the ascocarps. T. Ahti and T. Goward checked Nylander's specimens of L. ochrococca at H-NYL and, although the type could not be found, other authentic material identified by Nylander (sine loco, ex Herb. Carroll; H-NYL no. p.m. 5001c) proved to be the same as the B.C. specimens. The specimens, furthermore, contain algae in the apothecial margins.

The algae, although always present, can perhaps be easily overlooked since the dark colour of the apothecial margin is more reminiscent of a *Lecidea* than a *Lecanora*, and thus the algal layer is not expected. In fact, the species superficially resembles *Protoparmelia badia* (Hoffm.) Hafellner, something noted by Tuckerman (1882) in a discussion of the conspecific California taxon, *Lecanora phaeobola*. Santesson (1984) listed *L. phaeobola* as a synonym under *Lecidea ochrococca*.

Melanelia sorediata (Ach.) Goward & Ahti, comb. nov. *Parmelia stygia* β. [=var.] *P. sorediata* Ach., Lichenogr. Univ. 471. 1810. Type: Sweden (lectotype, H-ACH 1414G, selected here). *Parmelia sorediata* (Ach.) Th. Fr., Lichenes Arctoi 56. 1860, nom. illeg., non *P. sorediata* (Ach.) Tuck. 1847. *Imbricaria sorediata* (Ach.) Arnold, Flora 53: 210. 1870.

Parmelia sorediosa Almb. in Krok & Almquist, Svensk Fl. 2, Kryptogamer, ed. 6: 134. 1947. Type: homotypic with *P. stygia* var. *sorediata* Ach. *Melanaria sorediosa* (Almb.) Essl., Mycotaxon 7: 47. 1978.

The oldest epithet at the species level, *sorediata*, was not usable in the genus *Parmelia* because of Tuckerman's combination which refers to *Pyxine sorediata* (Ach.) Mont. It must be used, however, when the species is placed in the new genus *Melanelia* since its legitimate publication at the species level dates from *Imbricaria sorediata* (Ach.) Arnold 1870.

The new combination is published here assuming that *Melanelia* Essl. will be conserved against *Pleurosticta* Petrak 1931, as proposed by Esslinger (1980), or that *Melanelia* subg. *Olivascentes* (Harm.) Essl. (= *Pleurosticta*) is excluded from the genus *Melanelia*.

If the genus *Melanelia* is not recognized as distinct from *Parmelia*, but is regarded as a subgenus of the latter, as originally proposed by Esslinger (1977), the following corrections to the citation by Esslinger should be noted. The correct name seems to be *Parmelia* subg. *Melaenoparmelia* (Hue) Räsänen, Kuopion Luonnon Yst. Yhd. Julk., ser. A, 5 (= Suomen jäkäläkasvio) 37. 1951 (as 'alasuku' = subgenus). The correct, original spelling is *Melaenoparmelia*, rather than "*Melanoparmelia*," which is a common, incorrect citation. The basionym is *Parmelia* subg. *Euparmelia* sect. *Melaenoparmelia* Hue, Nouv. Arch. Mus. d'Hist. Nat. Paris, sér. 4, 1: 138. 1899.

Nephroma helveticum subsp. **sipeanum** (Gyeln.) Goward & Ahti, comb. nov. *Nephroma sipeanum* Gyeln., Ann. Crypt. Exot. 4: 147. 1931. Type: Oregon, Jackson Co., Eagle Point, on oak, *Gooding* (isotypes: Sipe, BPI, MSC). *N. helveticum* var. *sipeanum* (Gyeln.) Wetm.

This taxon, discussed by Wetmore (1960) in detail, seems to fit the modern concept of a subspecies very well with a rather well-defined, west-coast distribution and disjunct populations in the Great Lakes region.

Pertusaria geminipara (Th. Fr.) Knight ex Brodo, Bryologist 87: 105. 1984.

Brodo (1984) ascribed this combination to Knight, but Knight (1883) only stated that "*Lecanora gemmifera*, Th. Fries should ... be transferred to *Pertusaria*," which is not considered to fulfill the requirements of Art. 33.1 for a valid publication. (Note that "*gemmifera*" is only an orthographic lapsus, and does not invalidate the name.) Brodo (1984), however, actually made the new combination because he cited the basionym. He ascribed the combination to Knight, and therefore a strict interpretation of Rec. 46E requires that the designation be accepted, although it was actually made erroneously. (In fact, the recommendation is in need of rewording!)

Polysporina urceolata (Anzi) Brodo, comb. nov.
Sarcogyne urceolata Anzi, Comment. Soc. Crittogamolog. Ital. 1(3): 157. 1862. Type: "L. rar. Lang. exs. n. 285" (not seen). *Polysporina urceolata* (Anzi) R. Sant., Lichens of Sweden & Norway, p. 256, comb. inval. (Art. 33.2). - B.C., Liard River Basin: Fairy Lake, 57°20'N, 123°56'W, alpine ridges and meadows at 1625 m, on protected vertical surface of boulder, *Brodo 21632* (CANL). N.W.T., District of Franklin: Bathurst Island, *Brodo 19303*, *19304* (CANL).

Pseudocyphellaria anomala Brodo & Ahti, sp. nov. *Sticta limbata* var. *anomala* G.K. Merrill, Lich. Exs. I, no. 25. 1909, nom. nud. *Pseudocyphellaria anomala* G.K. Merrill ex H. Magnusson, Meddel. Göteb. Bot. Trädg. 13: 248. 1939, nom. inval. (Art. 36.1).

Sicut *Pseudocyphellaria anthraspis* (Ach.) H. Magn., sed lobis minus reticulatis, abundanter soralia laminalia efferentibus, subtus pseudocyphellis irregularibus, saepe elongatis, vix verruciformibus et tomento tenui, raro fertilis.

Typus: U.S.A. Washington, King Co.: Summit, on trees, 1908, *A.S. Foster* (Merrill: Lich. Exs. I, no. 25) (holotypus, CANL; isotypus, H).

Although *P. anomala* has been reported in numerous papers, it was never validly published. Indeed, Magnusson (1939) provided a thorough description in English but failed to describe it in Latin. To make the author citation simpler, we are deliberately excluding G.K. Merrill and H. Magnusson from the authorship, although we realize this procedure does not do justice to the originators of the name.

Ohlsson (1973) called P. anomala a sorediate counterpart of P. anthraspis and reported two identical chemical strains in both species. The two species are, however, by no means identical in gross morphology (see also Krog, 1968).

Pseudocyphellaria anthraspis (Ach.) H. Magn., Meddel. Göteb. Bot. Trädg. 13: 248. 1939.

This same combination was proposed as new by Galloway & James (1977: 102), but was first validly published by Magnusson, though only in passing within a discussion of P. anomala.

Pyrenula occidentalis (R.C. Harris) R.C. Harris, comb. nov. Pyrenula neglecta R.C. Harris subsp. occidentalis R.C. Harris, Michigan Botanist 12: 51. 1973. Type: U.S.A., Washington, Gate, Foster (Merrill, Lich. Exs. I, no. 275) (holotype: MSC; isotypes: CANL, FH, FH-Riddle, MICH).

Xanthoparmelia somloënsis (Gyeln.) Hale, comb. nov. Parmelia somloënsis Gyeln., Fedde, Repertor. 29: 156/396. 1931. Type: Hungary, Veszprém, Doba, mountain Somló, Gyelnik (lectotype: BP).

Most of the reports of X. taractica (Gyeln.) Hale in North America and Europe actually refer to this species.

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LICHENS NEW TO NORTH AMERICA FROM THE FLORA OF BRITISH COLUMBIA, CANADA

IRWIN M. BRODO

Museum of Natural Sciences, National Museums of Canada
Ottawa, Ontario K1A 0M8, Canada

WILLA J. NOBLE

Box 512, Ucluelet, B.C. V0R 3A0, Canada

TEUVO AHTI

Dep't of Botany, University of Helsinki,
SF-00170 Helsinki, Unioninkatu 44, Finland

and STEPHEN CLAYDEN

Dep't of Human Environmental Science,
Kings College London, University of London,
London SW10 QX, U.K.

SUMMARY

One genus (Poeltinula) and 43 species from British Columbia are reported as new to the lichen flora of North America.

During the past decade, a great deal of work has been done on the lichens of British Columbia, mainly connected with studies of the Queen Charlotte Islands (IMB), the northern Rocky Mountains (IMB and SC), the coastal Douglas Fir zone (WJN), and the interior mountains (TA). The results of this work were incorporated into a revised checklist of the Lichens of British Columbia (Noble et al., 1986). By coincidence, Robert Egan is in the final stages of preparing a revised checklist of the lichens of Canada and the U.S.A. Dr. Egan very generously allowed us to examine his manuscript and determine which of our records were new for the continent (north of Mexico). We are publishing a list of these species to give us the opportunity of citing specimens and discussing the taxa, something that could not conveniently be done in the B.C. Checklist itself. Determinations were made by one of the authors, and vouchers can be found in CANL, UBC, or H, as noted in the annotations.

Acarospora asahinae H. Magn. - B.C. Saltspring Island, Mt. Maxwell, elev. 589 m, Noble 7356 (UBC).

The B.C. material agrees with the description of A.asahinae in the C- cortex, plane squamules with a black lower surface, small and rimless apothecia, and high hymenium. It differs, however, in the dissection of the algal layer by hyphal strands, a feature not mentioned for A. asahinae, although Magnusson regarded the character as reliable for distinguishing species, as is the dark (or light) lower surface. Two Scandinavian species, A. insolata H. Magn. and A. molybdina (Wahlenb.) Mass., possess both characters. The latter forms well delimited orbicular patches with very distinct marginal lobulae. The former also has contiguous areoles, however, and is also similar to our material in habitat preference (granitic rocks on hilltops). Its separation from A. asahinae and A. smaragdula (Wahlenb.) Mass. requires further study.

Arthonia aspersa Leighton - B.C., SE Vancouver Island area, Coastal Douglas Fir Wet subzone, Noble 5021A (UBC).

A. hypobela (Nyl.) Zahlbr. - B.C., Vancouver Island: Ucluelet, Little Beach, on log, partially shaded, Noble 7300 (UBC).

Aspicilia karelica (H. Magn.) Oxner - B.C., Queen Charlotte Islands, Skidegate Inlet: Torrens Island, Brodo 17295; Robbers Island, Brodo 11169 (CANL). Halfmoon Bay, N. of Sechelt, 49°32'N, 123°59'W (CANL).

A. leprosescens (Sandst.) Hav. - B.C., SE Vancouver Island area, Noble 503, 1466 (UBC).

Two of the B.C. collections produced red needles in KOH (indicating the presence of norstictic acid). Although there are no reports of A. leprosescens containing this substance, the slow reaction might well have gone unnoticed. Indeed, there are only two, very short, modern descriptions of this species (Duncan 1970, Fletcher 1975). Aspicilia mastrucata (Ach.) Th. Fr. is somewhat similar and contains norstictic acid, but it is described as sorediate, not with papillate, branched or simple isidia as seen in our material. In British Columbia, A. leprosescens is strictly a seashore species; A. mastrucata is a northern mountain species.

Bacidia egenula (Nyl.) Arn. - B.C., Vancouver Island: Ucluelet, Little Beach, on log, partially shaded, Noble 7299 (UBC).

Bellemerea diamarta (Ach.) Hafellner & Roux, Bull. Soc. Bot. Centre-Ouest, n. sér., 15: 129. Urceolaria diamarta Ach., Meth. Lich. 151. 1803. Aspicilia diamarta (Ach.) Boist. - B.C., Blue River, 52°06'N, 119°20'W, Pinus contorta woods, elev. 685 m, Brodo 15786A (CANL).

We agree completely the segregation of *Bellemerea* from *Aspicilia* as explained and illustrated in Clauzade & Roux (1984). The new genus comprises most species of the so-called "*Aspicilia cinereorufescens*-group" (with the exception of *A. myrinii* (Fr.) Nyl.) The halonate spores and ascus tip both are reminiscent of the genus *Porpidia*.

Biatorella hemisphaerica Anzi - B.C., Liard River-Basin: Fairy Lake, 57°20'N, 123°56'W, alpine ridge, on moist peat at 1645 m, *Brodo 21722* (CANL).

Caloplaca atroflava (Turn.) Mong. - B.C., SE Vanvouver Island area, Coastal Douglas Fir Dry subzone, *Noble 836*, *4179* (UBC).

The material from B.C. was originally determined as a saxicolous form of *C. holocarpa* (Hoffm.) Wade since corticolous specimens of the latter are known from the same area. It differs from *C. holocarpa*, however, in its much better developed thallus, darkening disk, slightly larger spores, and noncalcalcareous substrate. Saxicolous *C. holocarpa* is reported to be a calcicole (Duncan 1970).

C. irrubescens (Nyl.) Blomb. - B.C., SE Vancouver Island area, Coastal Douglas Fir Dry Subzone, *Noble 641*, *4217A* (UBC).

This addition to the North American flora should be regarded as tentative, pending a revision of all the lobate *Caloplacae* in North America. The B.C. material agrees well with descriptions of *C. lobulata* sensu Rudolph (1955) and Wetmore (1967), which may be synonymous with *C. marina* (Wedd.) Zahlbr. (see Santesson 1984). Its separation from *C. sipeana* H. Magn. and *C. bolacina* (Tuck.) Herre also requires further study.

Our material is minutely squamulose or crustose-areolate, with unoriented, scattered areoles, not continuous even when clustered. The areoles are 0.2-0.9 mm wide, initially slightly irregular, but becoming sublobate with margins appearing almost free from the substratum. The thallus is ± flat, smooth, and shiny, and is yellow-orange or orange, with a black prothallus sometimes becoming extensive, especially on igneous rocks..

Cladonia macroptera Räs., J. Jap. Bot. 16: 149. 1940. - Type: Japan. Honshu. Prov. Shinano, Mt. Yatsugatake, 1918, *Yasuda 498* (lectotype and isolectotype, selected here: H): contains fumarprotocetraric acid and traces of protocetraric acid, substance Cph-2 and an unknown compound (TLC). - B.C., Queen Charlotte Islands, Moresby Island: Tasu Sound, Fairfax Inlet, shady *Tsuga heterophylla* forest, near sea-level, forest floor, *Ahti 38512* (CANL, H, UBC).

This is a little-known species previously only reported from East Asia. Soon after the description appeared, Asahina (1940) accepted the species, collecting it at the type locality in Japan and describing two new formae (f. *ramosa* Asah. and f. *subnuda* Asah.) under it. Later (Asahina 1950) he included the type within *C. scabriuscula* f. *elegans* Robb. and the formae within *C. furcata* f. *regalis* Flörke. Still later (e.g., Asahina 1969, 1971) he accepted the specific status of *C. macroptera* again.

Cladonia macroptera is very similar to *C. scabriuscula* (Del.) Nyl., but is more robust (the B.C. material has podetia that are ca. 10 mm tall and 1.5-3 mm thick), rather sparsely branched and regularly provided with 3-5 mm wide, deeply laciniate podetial squamules; the stereome is thick (ca. 100-150 µm, cf. Asahina 1940), and so hard and horny that it is difficult to cut with a razor blade. There are no soredia, but some granules may be present on the podetial surface near the tips, where the otherwise continuous cortex is somewhat disintegrated in patches. Good photographs were published by Asahina (1940: Fig. 64; 1971: Fig. 66).

Cladonia macroptera is particularly common in the mountains of China; a good specimen was distributed in Wei, Lich. Sin. Exs. 33 (H) and many specimens are present in PC. It seems to be a species of moist forests, which is in accordance with its occurrence on the Queen Charlotte Islands. In the field, it appeared distinct from the extremely variable local morphotype of *C. furcata* (Huds.) Schrad. that is also called *C. herrei* Fink ex Hedr.

C. wainii Sav. - B.C., Queen Charlotte Islands: Moresby Island, Takakia Lake, in heath at 610 m, subalpine, *Brodo 10989*, Kootenay Inlet, in damp moss hummocks on bluff, *Brodo 12157*; Graham Island, Port Chanal off Athlow Bay, among needles of *Pinus contorta* at summit of bluff, at 97 m, *Brodo 10423* (CANL).

The relationship between *C. wainii* and *C. pseudorangiformis* Asah. will be the subject of a separate paper (Ahti in prep.). The two taxa are identical in chemistry.

Diploschistes bisporus (Bagl.) J. Steiner - B.C., SE Vancouver Island area, Saltspring Island, on HCl-sandstone, *Noble 2111B* (UBC).

In European descriptions of *D. bisporus* (e.g., Poelt 1969, Ozenda & Clauzade 1970), the apothecial size is given as greater than that seen in the single B.C. collection (up to 1.2-1.5 mm vs. 0.3-0.6(-0.8) mm).

Lecanactis patellarioides (Nyl.) Vain. - B.C., SE Vancouver Island area, CH zone at a maritime site, *Noble 4465* (UBC).

Lecanactis patellarioides is distinguished from *L. megaspora* (Merr.) Brodo by the small, black, epruinose ascomata and the large, acicular spores. The pycnidia of the two spcies are also very different: in *L. megaspora* they are comparatively large and stalked and extrude pycnoconidia, whereas in *L. patellarioides* they are small, adnate, and do not extrude pycnoconidia.

Bacidia clementis Hasse, described from California, differs only in its possession of slightly wider spores: 60-80 x 4-5 µm (Hasse 1913); otherwise, it matches *L. patellarioides* completely. Mention is made of a yellowish grey to brown hypothecium, paraphyses not being coherent, and the hymenium not reacting with IKI except for the asci which turn yellow. This strongly suggests that *Bacidia clementis* may well be a species of *Lecanactis*. The type requires examination.

Lecania thallophila H. Magn. - B.C., Liard River Basin: Wokkpash Lake, subalpine ridge, growing on *Placynthium* sp. on boulder by subalpine lake, 58°27'N, 124°53'W, *Brodo 21482* (CANL). N.W.T., District of Franklin: Bathurst Island, Polar Bear Pass area, on boulder in gravelly limestone tundra, 75°46'N, 98°27'W, *Brodo 19373* (CANL).

Both these specimens were growing together with *Toninia kolax* Poelt.

Lecanora contractula Nyl. - B.C., Vancouver Island, Banfield Marine Station, 48°70' N, 125°10'W, on rocky shore, *Benton* & *Richardson* (CANL). Nova Scotia, Cape Breton County: Mainadieu, ...marine rocks... about 3 m above the sea in the upper spray zone, *Lamb 6918* (CANL); Lunenburg County: Blue Rocks, near Lunenburg, 44°22'N., 64°13'W, shoreline rocks, *Brodo 18880* (CANL).

The Nova Scotia specimens, including the Lamb collection published as "*Lecanora* sp." in Lamb (1954) were identified by Poelt (*in litt.*). The B.C. collection, listed as "*Lecanora* sp." in Benton et al. (1977) is identical with the east coast material.

L. epanora (Ach.) Ach. - B.C., Wells Gray Prov. Park, S end of Clearwater Lake, Falls Creek, 700 m, on schistose mica rocks, *Ahti* & *Goward 38502* (H, UBC).

This species typically occurs as a photophobous lichen of shaded overhangs, particularly on metal-rich rocks (e.g., Earland-Bennett 1975).

L. intumescens (Rebent.) Rabenh. - B.C., Revelstoke, on alder trees, *Macoun 225* (CANL).

The B.C. specimen is essentially identical with European material, but two specimens tentatively named as *L. intumescens* from Oregon (Josephine County, near Six-Mile Creek: *Pike 628A* & *1160* [CANL]) lack psoromic acid and may be distinct.

L. mughicola Nyl. - B.C., Liard River Basin: Wokkpash Lake, subalpine ridges, on dead spruce stump at 1495 m, 58°27'N, 124°53W, *Brodo 21375* (CANL).

L. persimilis (Th. Fr.) Nyl. - B.C., Liard River Basin: Wokkpash Lake, in spruce forest, on *Populus balsamifera*, 58°27'N, 124°53'W, *Brodo 21579* (CANL).

Lecidea phaeops Nyl. - B.C., Queen Charlotte Island, Graham Island: Ian Lake, on rock on beach, *Brodo 18438*; Moresby Island: Takakia Lake, at 588 m, on lakeshore rocks in subalpine area, *Brodo 10903*, Barry Inlet, mountain on S side of Inlet, on partially shaded boulder on ridge at 610 m, *Brodo 14200*, base of Moresby Mountain, on rock near stream, *Brodo 10778*; Kunghit Island: S of Rainy Islands, on exposed bluff rocks, *Brodo 17608* (CANL).

The distinctiveness of this species vis-à-vis other lecideoid genera was pointed out by Brodo (1986).

Lempholemma isidioides (Nyl. ex Arn.) H. Magn. - B.C., Liard River Basin: Wokkpash Lake, along lake shore on exposed pebbles, 1250 m, 58°27'N, 124°53W, *Brodo 21610* (CANL).

The determination of this specimen was based on its resemblance to Magnusson's *Lich. Sel. Scand. Exs. 299*, and a Havaas collection (Norway, Hordaland, Vaotekleivberget, 20-8-1952) both in CANL. It requires confirmation.

Lopadium disciforme (Flotow) Kullh. - Numerous specimens from B.C., Newfoundland and other provinces in Canada (CANL, H).

There is a recent tendency in Europe to recognize this species as distinct from *L. pezizoideum* (Ach.) Körber (Poelt & Vězda 1981, Santesson 1984, Sérusiaux et al. 1985). *Lopadium disciforme* is primarily corticolous, and *L. pezizoideum* is an arctic, terricolous species. The distinguishing characters have not fully been worked out, but the apothecial margins of *L. disciforme* are normally soot-black, and those of *L. pezizoideum* are copper brown.

Micarea cinerea (Schaerer) Hedl. - B.C., Vancouver Island, Ucluelet, Terrace Beach, 48°55', 125°32'W. Cobble Beach, on shaded old driftwood log, *Noble 6569* (UBC).

M. lithinella (Nyl.) Hedl. - B.C., SE Vancouver Island area, Hornby and Thetis Islands, on sandstone or loose cobble, *Noble 2760*, *3135B* (CANL).

Our material had a KOH- hymenium, in agreement with the decription and comments given by Coppins (1983). The specimens have not been compared with reliably identified material, however, and so the report should be regarded as tentative.

Ochrolechia szatalaënsis Vers. - B.C., 34 miles S of Princeton, along Skagit River, 49°08'N, 120°54'W, elev. 670 m, *Thuja-Picea* forest at edge of stream, on dead twigs of *Thuja*, *Brodo 8516*, *8519*; 14 miles S of Squamish, 49°29'N, 123°13'W, at a stream, elev. 213 m, on *Alnus*, *Brodo 8156*; Gulf Islands: Saltspring Island, 48°47'N, 123°31'W, open hemlock-oak stand on slope, elev. 590 m, on *Quercus garyana*, *Brodo 13865* (CANL). U.S.A., Montana, Ravalli County: Kootenay

Creek Canyon, Bitterroot Range, elev. 1380 m, on bark, *Abies grandis* forest, *McCune 10783* (CANL). Oregon, Linn County: Lebanon, Peterson Butte, 44°30'N, 122°49'W, *Quercus garryana* stand in a protected valley, *Pike 2431* (CANL).

This species growns on wood and bark. The bark-inhabiting specimens seem to develop a thick thallus and have been named as *O. farinacea* Howard (Howard, 1970). Lignicolous specimens can have an extremely thin thallus. One specimen cited above (*Brodo 8516*) was chromatogrammed by Chicita Culberson and Anita Johnson and was found to contain variolaric, murolic, and neodihydromurolic acids. Hanko et al. (1986) also recorded murolic and other acids from a European strain of *O. szatalaensis*. The apothecial and thalline tissues are, in any case, C+ yellow, not red.

Although mentioned in a list of lichens from Washington by Ryan (1985), *O. szatalensis* is being noted here for the additional records and comments.

Opegrapha ochrocheila Nyl. - B.C., SE Vancouver Island area and Hornby Island, *Noble 2728*, *5420* (UBC).

Redinger (1936-38) described the pycoconidia of *O. ochrocheila* as 10-12 x 0.7 µm and Ozenda & Clauzade (1970) and Poelt (1969) followed or agreed with him. The larger pycnoconidia of the B.C. collections agree more with those of *O. rufescens* Sandst., which is known to occur on the Queen Charlotte Islands (Lichenes Canadenses Exsiccati no. 136). However, the small spores, pruina, and the KOH+ reaction of the exciple rather than the thallus agree better with the descriptions of *O. ochrocheila*. The two taxa may, in fact, not be distinct; Hawksworth et al. (1980) treated *O. rufescens* as a synonym of *O. ochrocheila*.

Peltigera neopolydactyla (Gyeln.) Gyeln. Numerous specimens in CANL from B.C., Alberta, Manitoba, Ontario, Quebec, Newfoundland, Prince Edward Island, New Brunswick, Nova Scotia, N.W.T., New York, Washington, Oregon, Alaska.

The North American material of this species was largely reported as *P. polydactyla* var. *dolicorrhiza* Nyl. (e.g., Thomson 1950). *Peltigera neopolydactyla* was apparently first recorded for North America by Ahti & Vitikainen (1977). It is listed here for the additional state and provincial occurrences.

P. ponojensis Gyeln. - Numerous specimens in CANL, from B.C., Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Newfoundland, New Brunswick, Nova Scotia, Yukon, N.W.T., Minnesota, Michigan, South Dakota, Colorado, Oregon, Washington, Wyoming, Idaho, Ohio, Iowa, Kansas, Vermont, New York, and Utah.

This badly overlooked, widespread species described from the Kola Peninsula, N.W. Russia, was reinstated by Vitikainen (1981).

Pertusaria rhodoleuca Th. Fr. - B.C., Queen Charlotte

Islands, Moresby Island: Jedway, on shoreline rocks at edge of beach, *Brodo 12473* (CANL), and others.

This species will be discussed fully in a forthcoming paper (Brodo in prep.) with respect to *P. subplicans* Nyl. and the genus *Ochrolechia*.

Phlyctis speirea Merr. - B.C., Vancouver Island, Saanich Peninsula, *Noble 4136, 7383* (UBC).

Merrill (1913) described *P. speirea* from material collected by John Macoun in Sidney on the Saanich Peninsula. As Merrill himself admitted, the species is very close to *P. argena* (Spreng.) Flot. differing, he said, in thallus colour and aspect of the apothecia. *Phlyctis argena* is an abundantly sorediate species that is rarely fertile. European specimens of *P. argena* do indeed look lighter in colour, but this is caused by the extensive production of soredia and the resulting exposure of the medulla. Nonsorediate portions of the thallus are the same colour as *P. speirea*.

The fertile verrucae of *P. speirea* are not at all sorediate despite their cracking open irregularly or becoming heavily pruinose. The lichen may be considered as another example of an esorediate-fertile "primary" species with *P. argena* being its corresponding sorediate-sterile "secondary" species in the now well-documented principle of species pairs in lichens (Poelt 1972).

The common, fertile, European *Phlyctis* is *P. agelaea* (Ach.) Flot. It has 2(-4) spores per ascus with the spores apiculate and 45-90 x 20-35 µm.

Placopsis cribellans (Nyl.) Räs. - B.C., Bella Coola, Clayton Falls Creek, 52°21'N, 126°49'W, dense forest at sea level, *Ohlsson 2130B*, Kitimat Arm at Emsley Pt, 53°53'N, 128°46'W, at sea level, *Ohlsson 2524* (CANL).

Although reported by Lamb (1947) from two localities in Alaska, this species was not listed in Hale & Culberson's checklist (1970). Karl Ohlsson collected and correctly identified these specimens 15 years ago, but the records were never published.

Poeltinula* cfr. *cerebrina (DC.) Hafellner , Beih. Nova Hedw. 79: 330. 1984. *Encephalographa cerebrina* (DC.) Mass. - B.C. Liard River Basin, Wokkpash Lake, on calcareous rock on a subalpine ridge, 1615 m, 58°27'N, 124°53'W, *Brodo 21516B* (CANL).

This report is based on a single specimen collected in the northern Rocky Mountains. It is certainly a species of *Poeltinula*, a genus recently segregated from *Encephalographa* by Hafellner (1984) on nomenclatural as well as taxonomic grounds. The specimen, however, is not a perfect match for *P. cerebrina* nor for *P. cacuminum* (Asta, Clauz. & Roux) Clauz. & Roux (see Clauzade & Roux 1985). Our specimen has broadly ellipsoid, one-septate, halonate spores, but the spores are consistently hyaline rather than brownish as has been reported for *P. cerebrina*, and they are 12.3-13.0 x 8.1-9.0 µm rather than (14-)16-22 x 8-12(-14) µm as given by Clauzade & Roux (1985). One specimen (hb. UPS) collected by Arnold in Tirol, Austria was very similar and had hyaline spores, but the spores were larger. Until additional material is collected, we are regarding the specimen as close enough to *P. cerebrina* to bear its name.

Polysporina urceolata (Anzi) Brodo, Mycotaxon (in press). *Sarcogyne urceolata* Anzi, Comment. Soc. Crittogamolog. Ital. 1(3): 157. 1862. *Polysporina urceolata* (Anzi) R. Sant., comb. inval. (Art. 33.2). - B.C., Liard River Basin: Fairy Lake, 57°20'N, 123°56'W, alpine ridges and meadows at 1625 m, on protected vertical surface of boulder, *Brodo 21632* (CANL). N.W.T., District of Franklin: Bathurst Island, *Brodo 19303*, *19304* (CANL).

Porocyphus kenmorensis (Holl. ex Nyl.) Henssen - B.C., Roberts Creek, Sunshine Coast, 49°25'N, 123°37'W, on granitic rock, *Coursley* & *Noble 3375B* (UBC).

A duplicate of this specimen was identified by A. Henssen.

Protoblastenia incrustans (DC.) J. Steiner B.C., Liard River Basin: Fairy Lake, 57°20'N, 123°56'W, alpine ridges and meadows, on exposed boulder at 1625 m, *Brodo 21665* (CANL). N.W.T., District of Franklin: Bathurst Island, Polar Bear Pass area, 75°44'N, 98°23'W, on outcrop at river, *Brodo 19232*, 75°42'N, 98°10'W, on exposed limestone boulder on ridge top, *Brodo 19424* (CANL).

Rhizocarpon atroflavescens Lynge - B.C., Liard River Basin: Wokkpash Lake, subalpine ridges, 1630 m, 58°27'N, 124°53W, on exposed HCl- rock facing north, *Brodo 21307* (CANL); N.W.T., District of Franklin: Cornwallis Island, Cape Martyr, *H.B. Collins Jr.*, 1949 (CANL 6112).

Rinodina excrescens Vain. - B.C., Vancouver Island, Victoria, on isolated old *Quercus garryana* beside road, *Noble 7409* (UBC, CANL).

Schadonia alpina Körber Synonym: *Lopadium alpinum* (Körber) R. Sant., *L. gemellum* (Anzi) Stizenb. - B.C., Queen Charlotte Islands, Long Inlet, off Skidegate Inlet: Josette Point, on branch of *Picea*, *Brodo 11460B* (CANL).

This species is listed in Egan's draft of the new checklist of the lichens of North America, but it is included here to establish a specimen citation.

Staurothele ambrosiana (Mass.) Zsch. - B.C., Whirlpool Canyon of Liard River, Mile 538.5 of Alaska Highway, 59°35'N, 127°02'W, elev. 457 m, on rocks, *Thomson 18483* (CANL).

S. rupifraga (Mass.) Arn. - B.C., Vancouver Island, Kennedy Lake, on Port Alberni Highway, very shaded rock rising out of a ditch at the base of a cliff; rock HCl+, Noble 7260 (UBC).

Toninia kolax Poelt (See Lecania thallophila above.)

U. alpina Mot. - B.C., Mt. Robson Prov. Park, Kinney Lake, elev. 915 m, 53°06'N, 119°10'W, J. Marsh 1135 (CANL). Alberta. Numerous specimens in CANL named by Herre or Bird.

U. inflata Del. - B.C., Vancouver Island, Brooks Peninsula, 50°10'N, 127°45'W, on Picea sitchensis trunk, Schofield 77072 (CANL).

Verrucaria prominula Nyl. - B.C., SE Vancouver Island area, Saltspring Island, Noble 2247A (UBC).

V. tectorum (Mass.) Körber - B.C., SE Vancouver Island area, Hornby Island, Noble 2831B (CANL).

Hawksworth et al. (1980) regarded V. tectorum as only a form of V. viridula.

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MYCOTAXON

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NEW SOUTH AMERICAN POLYPORES[1]

Mario Rajchenberg[2]

Departamento de Ciencias Biológicas
Facultad de Ciencias Exactas y Naturales
Ciudad Universitaria 4° piso II pab.
1428 Buenos Aires, Argentina

SUMMARY

Three new polypores are described from southern South America, viz. **Microporellus iguazuensis**, **Phellinus uncinatus** and **Rigidoporus umbonatipes**. The generic position of the first species is discussed.

? **Microporellus iguazuensis** sp. nov.

Basidiocarpo lateraliter stipitato, merismatoideo, sublignoso; pileis flabellatis vel spathulatis, 2-5.5 x 1.5-4.5 cm, margine regulari, cum incisuris longitudinalis, leviter pubescentibus zonatisque, vinosis bubalinis, castaneis pallidique cinnamomeis. Stipite laterali, erecto, 3-4 x 0.3-0.5 cm, pubescenti vel glabro, sepiaceo; poris circularis, 1.5-2 per mm, tubis decurrentibus versus stipite, poris elongatis, daedaleis vel laminaribus. Systema hyphis dimiticis; hyphis generativis non fibulatis, 1.5-3 µm diam., hyalinis, parcis ramosis; hyphis skeletibus 3-5 µm diam., tumescentibus in 5% KOH usque ad 10 µm latus, dextrinoideis in massa. Basidiis clavatis 23-31 x 8-9 µm; sporis late ellipsoideis vel obovatis, hyalinis, 7-9 x 5-6 µm, IKI-, acyanophilicisque. Holotypus: Argentina, Misiones, Parque Nacional Iguazú, ad viam Apepú, leg. J.E. Wright M-3379, 8-III-1980; herb. BAFC n° 30708.

Fruitbody laterally stipitate, merismatoid, sub-woody; pilei 2-5.5 x 1.5-4.5 cm, flabellate-spathulate, some with longitudinal incisions, some fusing laterally; margin regular, some incurved when dry (Fig. 1); pilear surface slightly pubescent, slightly zonate with vinaceous buff, light cinnamon and light chestnut zones, all with a light pinkish lilaceous shade; stipe erect and lateral, 3-4 x 0.3-0.5 cm, sepia, pubescent or glabrous, slightly wrinkled longitudinally; pores 1.5-2 per mm, round or angular towards the margin, elongating, becoming daedaloid and laminar towards the stipe, pale luteus in dry condition; tubes decurrent towards the stipe; context up to 1.5 mm thick, tubes up to 1 mm long, both concolorous with the

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[1] This paper is part of a project on Argentine wood-rotting fungi subsidized by the Argentine National Research Council (CONICET). PRHIDEB paper n° 19.

[2] Member of the research career of the above Council.

pore surface.

Hyphal system dimitic; generative hyphae simple septate, 1.5-3 µm diam, hyaline, thin to slightly thick-walled, sparsely branched; skeletal hyphae 3-5 µm diam, swelling up to 10 µm in 5% KOH, not branched, with hyaline, thickened walls, somewhat dextrinoid in masse, giving a positive metachromatic reaction in cresyl blue; both types of hyphae are abundantly present in the context and the dissepiments (Fig. 2).

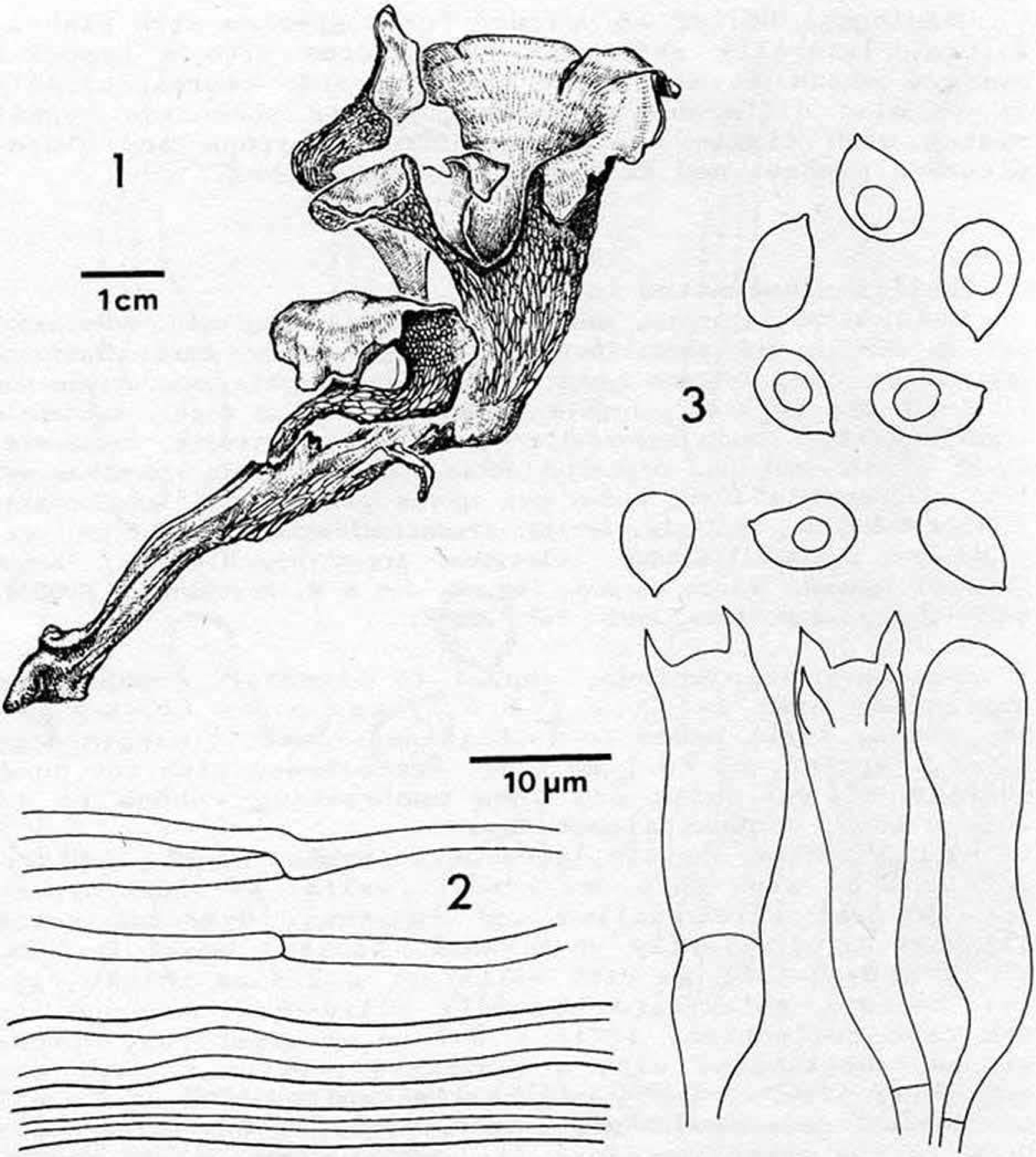
Basidia clavate, 23-31 x 8-9 µm, tetraspored, sterigma up to 6 um long; spores broadly ellipsoid, obovate, hyaline, 7-9 x 5-6 µm, with thin to slightly thickened walls, IKI-, acyanophilous (Fig. 3).

Substrate and rot unknown.

Remarks: **M. iguazuensis** is a highly distinct species on account of its laterally stipitate fruit body with flabelliform merismatoid pilei, its dimitic hyphal system (either in the context or in the trama) with narrow simple septate generative hyphae, relatively large basidia and large obovate spores.

Microporellus Murr., as exemplified by two species currently included in the genus, viz. **M. obovatus** (Jungh.) Ryv. and **M. defibulatus** Reid (see Ryvarden and Johansen 1980 for a description), is defined by its laterally stipitate fruitbodies (some presenting a tapering base) with flabelliform to spathulate pilei, small pores, monomitic context and dimitic dissepiments (with skeletal hyphae), and by its obovate spores. **M. obovatus** is different from **M. iguazuensis** on account of its smaller pores and spores, and clamped generative hyphae. **M. defibulatus** differs in its smaller pores and spores, its lateral (not erect) stipe and in the hyphal construction of the fruitbodies (monomitic in the context with wide simple-septate generative hyphae and dimitic with skeletal hyphae in the dissepiments). The congeneric relationship of **M. iguazuensis** with the other species is doubtful because of its very narrow generative hyphae, the dimitic construction throughout the fruitbody and the large pores and spores. In any case, the inclusion of all the three species in **Microporellus** is erroneous as it has been shown (David and Rajchenberg, 1985: 303) that the type species of the genus, **Polyporus dealbatus** Berk. & Curt., exhibits a set of characters lacking in the other species, viz.: centrally stipitate fruit bodies, dimitic hyphal system throughout the fruit body, with clamped generative hyphae and dextrinoid skeletal hyphae, ventricose apically encrusted cystidia and broadly ellipsoid, weakly dextrinoid spores. Nevertheless, the creation of a new genus in the Polyporaceae to accomodate these species does not seem advisable until adequate studies -including cultural features and interfertility tests- can be carried out to better evaluate their relationship with other genera.

Pseudophaeolus Ryv. includes a species with stipitate fruitbodies, dimitic hyphal system with (mostly) simple-septate generative hyphae and skeletals, and oblong ellipsoid to cylindric spores, but the dissepiments present



Figs. 1-3. **Microporellus iguazuensis** (BAFC 30708, holotype). 1. General aspect of the fruitbody; 2. simple-septate generative hyphae and skeletal hyphae; 3. basidia and spores.

distinct gloeopleurous hyphae and the fruit bodies are associated with buried roots or grow from a pseudosclerotium.

Heterobasidion Bref. also presents a dimitic hyphal system with simple septate generative hyphae and dextrinoid skeletals, but fruitbodies are sessile and fomitoid, they have gloeopleurous hyphae that protrude into the hymenium and the spores are minutely echinulate.

Meripilus Karst. includes (mostly) sessile species with a sarcodimitic construction (Corner, 1984: 193) with simple septate generative hyphae and inflated skeletal cells, and subglobose spores.

Henningsia Möller is defined for a species with flabelliform, laterally stipitate fruitbodies with a hymenial surface which is initially thelephoroid; microscopically it is also different on account of its monomitic hyphal system with simple septate generative hyphae and gloeopleurous hyphae, and its small globose spores.

Phellinus uncinatus sp. nov.

Basidiocarpo lignicola annuo vel biannuo, resupinato, pulvinato, pallido umbrino vel isabellino; poris (4)-5-6 per mm; margo distincto usque 1 mm lato. Systema hypharum dimiticum; hyphis generativis non fibulatis 2-3 µm diam., hyphis skeletibus 2-4 µm diam., castaneis crassitunicatis. Setis hymenialis uncinatis, ventricosis, castaneis, 25-35 x 6-12-(12) µm, crassitunicatis. Basidiis molariformibus vel late ellipsoideis 10-11 x 8-9 µm; sporis globosis vel subglobosis, 5.5-7 x 5-6.5 µm, hyalinis, leviter crassitunicatis usque 0.8 µm, dextrinoideis cyanophilicisque. Holotypus: Argentina, Misiones, Parque Nacional Iguazú, tracto Macuco, leg. D. Job & M. Rajchenberg M-3608, 6-IV-1984, ad Bambuseae; herb. BAFC 29836.

Fruitbody lignicolous, annual to biannual, resupinate, pulvinate, oval 4-8 x 1-3 x 0.15 cm; pores (4)-5-6 per mm, round, light umber to isabelline (Rayner); margin distinct, regular, up to 1 mm wide, concolorous with the pore surface or yellowish and then contrasting; tubes up to 0.7 mm long; context almost absent.

Hyphal system dimitic; generative hyphae simple septate 2-3 µm diam with thin and hyaline walls; skeletal hyphae 2-4 µm diam thick walled and chestnut. Hymenial setae slightly to distinctly ventricose, hooked, brown in KOH, 25-35 x 6-12-(16) µm with walls up to 2.5 µm thick (Fig. 4); basidia molariform, broadly ellipsoid, numerous in the type collection, 10-11 x 8-9 µm, tetraspored; spores globose-subglobose, with a flattened portion towards the apiculus, 5.5-7 x 5-6.5 µm, hyaline, with walls up to 0.8 µm thick, dextrinoid and cyanophilous, with a big oily drop in the cytoplasm (Fig. 5); cystidioles present, thin-walled, hyaline, claviform to ventricose with a tubular tip that projects beyond the hymenium.

On Bambuseae.

Material studied: Argentina, Misiones, Iguazú Nat'l Park, Macuco path, leg. D. Job & M. Rajchenberg M-3608, 6-IV-1984, on Bambuseae (BAFC 29836, holotype). Ibid., leg. R. Singer & A.P.L. Digilio M-76, 26-II-1949, "ad chusqueam emortuam in sylva humeda" (BAFC 24090). Ibid intangible zone, leg. D. Job, 27-IX-1984 (BAFC 30296).

Remarks: the species is unique with its hooked hymenial setae, its dextrinoid[3] globose-subglobose spores and its peculiar substrate. It certainly pertains to the group of taxa around **Ph. punctatus** (Fr.) Pil. The latter differs in totally lacking hymenial setae and presenting thicker fruitbodies.

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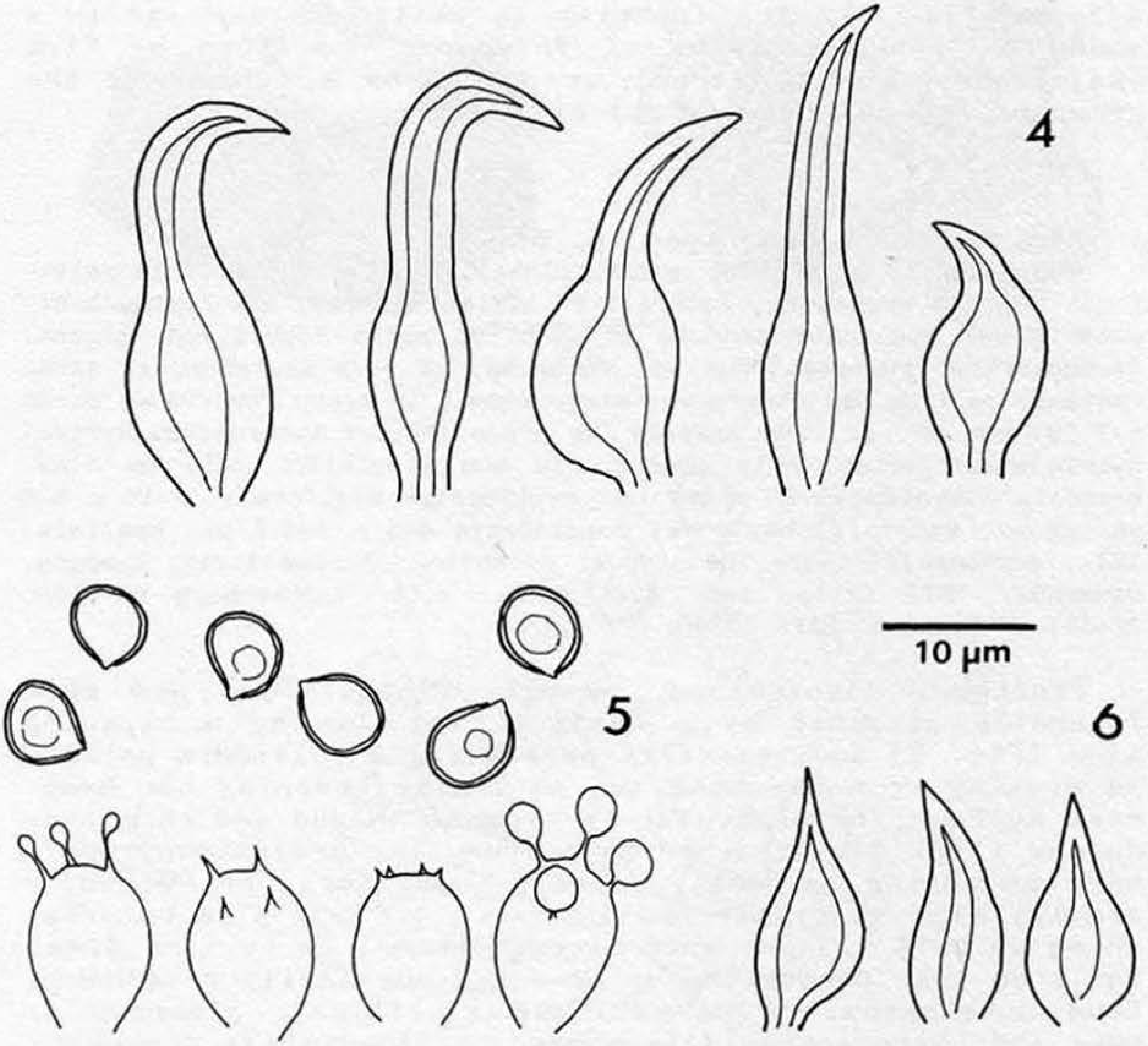
[3] The dextrinoid reaction may be weak depending upon material.



Figs. 4-5. **Phellinus uncinatus** (BAFC 29836, holotype). 4. Hymenial setae; 5. basidia and spores. Fig. 6. **Poria bambusarum** (PACA, lectotype FR 18570), hymenial setae.

Wright, Deschamps and Blumenfeld (1986) included the specimens here described under **Ph. uncinatus** as **Ph. rickianus** Wright & Deschamps (in Wright and Blumenfeld, 1984: 414). The latter was a new name proposed for **Poria bambusarum** Rick (1937: 146) because it was incorrectly assumed that the combination in **Phellinus** Quél. was preoccupied by **Ph. bambusarum** (Pat.) Pat. This is not the case as the correct epithet published by Patouillard (1900: 97) was **Ph. bambusinus** (Pat.) Pat. based on **Polyporus bambusinus** Patouilard (1891: 101). Therefore, **Poria bambusarum** Rick should still be a valid combination within **Phellinus.** Nevertheless, the study of the lectotype of **Poria bambusarum** Rick, viz. FR 18570, Brazil, Sao Leopoldo, 1932 (PACA) has shown that it represents another fungus. Spores are somewhat smaller, 5-6 µm diam and present a slight dextrinoid reaction, and hymenial setae are smaller, straight, acuminate and with a ventricose base, 16-20 x 5-7 µm (Fig. 6). Its identity is still unclear and in a study on type specimens of Polypores described by Rick (Rajchenberg, unpublished) it has been referred to the group of **Ph. punctatus** (Fr.) Pil.

Rigidoporus umbonatipes sp. nov.

Basidiocarpo lignicola, annuo, flabelliformi cum pellicula volviformi deorsum crescenti, lateraliter affixo cum basi attenuata, orbicularis vel buccinato pendulo ab stipite; pileo fibrilloso, glabro, irregulariter pubescentibus vel scruposo, in vivo alutaceo, in sicco castaneo pallido vel cineraceo; margo tenui, in sicco incurvato; poris 5-7-(8) per mm, in vivo cremeis, in sicco leviter incarnatus. Systema hyphis monomiticis; hyphis generativis non fibulatis, 3-10 µm diam. Basidiis clavatis 15-23 x 6-7 µm; cystidiolis mamiformis 12-15 x 5-8 µm adsunt; sporis globosis vel subglobosis 4-5 x 4-4.5 µm, hyalinis, IKI-, acyanophilicisque. Holotypus: Argentina, Buenos Aires, Campana, Otamendi, INTA Delta, leg. J.E. Wright & M. Rajchenberg BA-3133, 20-III-1979; herb. BAFC 30390.

Fruitbody lignicolous, annual, flabelliform and then laterally attached by a distinct umbo or by a tapering base (Fig. 7) and typically presenting a volviform pellicle growing from the base and partially covering the hymenial surface, or orbicular to trumpet shaped and then pendulous (Fig. 8), attached by a stem-like projection, solitary or fusing laterally, rarely cupuliform, erect and/or sessil; size generally small, up to 2.5 x 1.5 cm but reaching up to 6 x 5 cm; when several fused, up to 5 cm diam, the stem-like projection up to 5 x 2 mm, easily detachable from substratum; pilear surface fibrillose, glabrous or here and there irregularly pubescent to slightly scrupose, homogeneously beige or Raffia (MP[4] 11C2 and 11E5) drying light chestnut to greyish (MP 14AB5), azonate or with greyish zones at the base and light chestnut towards the margin; margin acute, generaly incurvate when dry; context cream, thin to 2-(3.5) mm thick, woody; tubes up to 2.5 mm long, white when fresh, slightly pinkish red when dry and cereous; pores round to angular, 5-7-(8) per mm.

Hyphal system monomitic; generative hyphae simple septate, 3-10 µm diam with hyaline, thin to 2 µm thickened walls; hyphae of the pilear surface wide, 5-10 µm diam, thin-walled; those of the stem-like projection and umbos are thick walled, present very few septa and may be confused with skeletal hyphae.

Basidia claviform, 15-23 x 6-7 µm, tetraspored; cystidioles few, mammiform, 12-15 x 5-8 µm, staining evenly with phloxine; cystidia absent; spores globose to subglobose, 4-5 x 4-4.5 µm, thin walled, IKI-, acyanophilous, generally presenting an oily drop in the cytoplasm (Fig.9).

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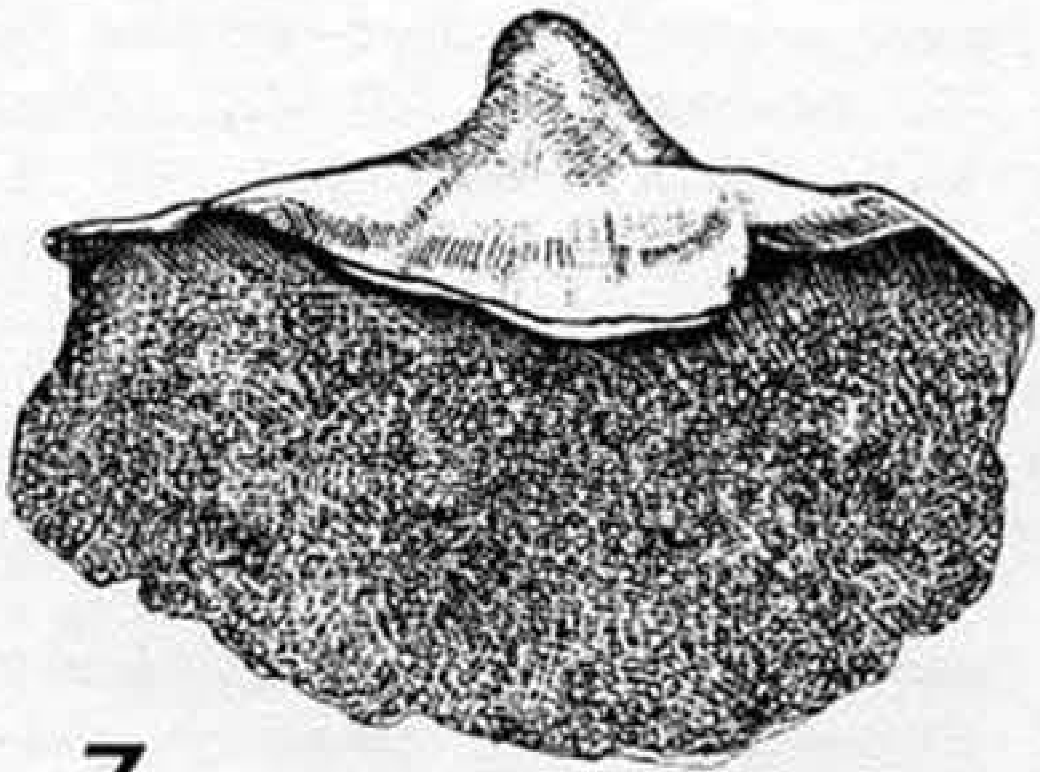
[4] Maerz, A. and M.R. Paul, 1930. A dictionary of Color. Mc Graw-Hill, New York, 207 p.



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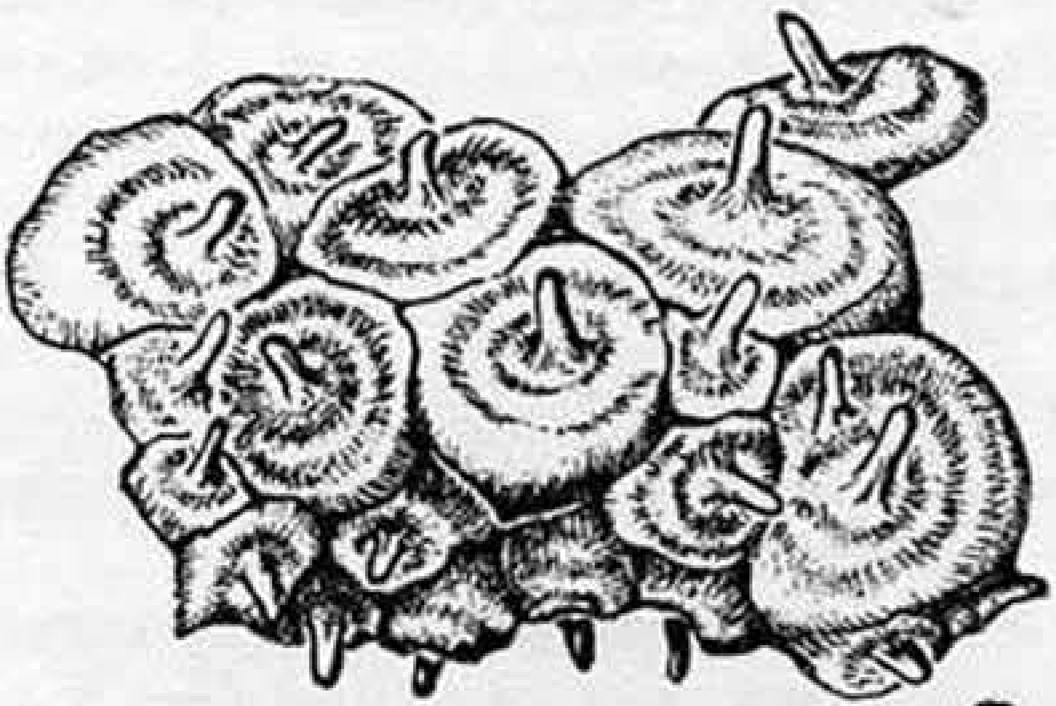

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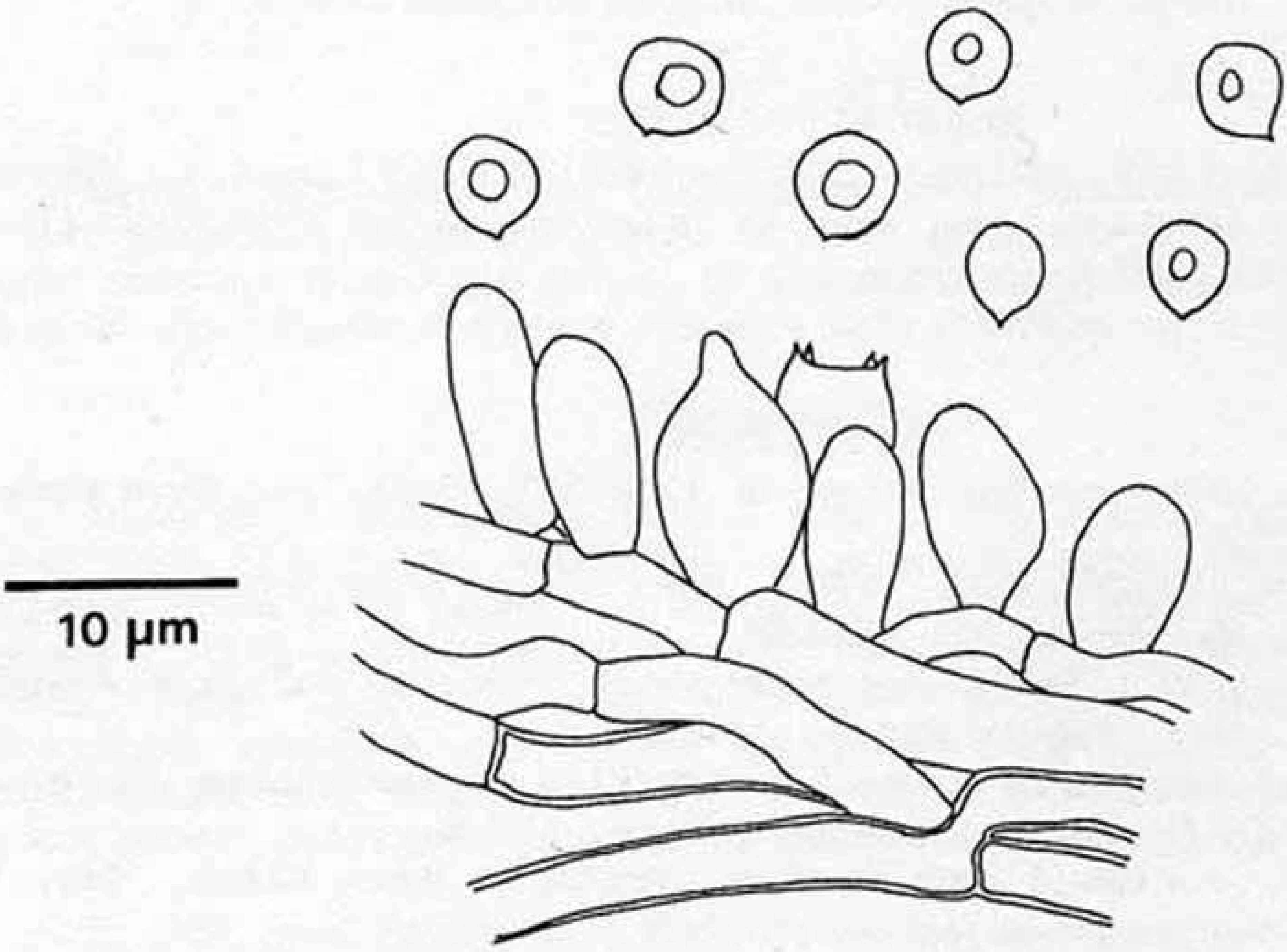

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Figs. 7-9. **Rigidoporus umbonatipes.** 7. General aspect of the fruitbody, hymenial surface showing the volviform pellicle (from BAFC 28529). 8. General aspect of the fruitbody, pilear surface showing fused orbicular fruitbodies with central stem-like projections (from BAFC 30390, holotype). 9. Hymenial characters.

Material studied: Argentina, Buenos Aires, Campana, Otamendi, INTA Delta, leg. J.E. Wright and M. Rajchenberg BA-3133, 20-III-1979 (BAFC 30390, holotype); ibid, leg. ipse BA-3134, on **Pinus** sp. (BAFC 30420); Ensenada, Punta Lara, leg. H.D. Ber, 28-IV-79 (BAFC 28527); ibid., leg. E. Rodríguez (BAFC 23699); ibid., leg. J.E. Wright, 11-IX-68 (BAFC 30397); ibid., A° Las Cañas, leg. J. Deschamps and G.S. Rovetta BA-1972, 3-XI-72, on fallen trunk of **Salix humboldtiana** (BAFC 28511). Misiones, Guaraní, El Soberbio, km. 27, leg. C. Gómez 1137, 1196 and 1197, 22-IV-66 (BAFC 30391, 30392 and 30393). Tucumán, Tafí, Tafí Viejo, leg. L. Bettucci and T. Guerrero, 7-II-65 (BAFC 28529); Capital, Sierra de San Javier, Parque de Aconquija, leg. R. Singer T-1031, 24-XI-50, "ad lignum indet. in silva subtropicali, 900 m, loco humido" (LIL 4118); ibid., leg. A.P.L. Digilio and R. Singer T-733, 29-X-49 (BAFC 29977).

Remarks: Rigidoporus umbonatipes recalls **Tyromyces cerifluus** (Berk. & Curt.) Murr. (= **T. revolutus** (Bres.) Bond. & Sing.) and **T. catervatus** (Berk.) Cunn. because of its pendulous growth habit, and when erect may recall **Microporellus obovatus** (Jungh.) Ryv., but they differ radically by their clamped generative hyphae and their spores. **M. defibulatus** Reid differs because of its dimitic hyphal system with skeletal hyphae and the general morphology of the fruitbody.

Microscopically the species comes close to **Rigidoporus microporus** (Fr.) Overeem (= **R. lignosus** (Kl.) Imaz.) which differs by its bigger, more massive, harder and dimidiate fruitbodies with zonate-sulcate pilei and with persistent mamiform cystidioles which stain strongly with phloxine.

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Drs. J.E. Wright (Buenos Aires University) and L. Ryvarden (Oslo University) are deeply acknowledged for critically reviewing the MS.

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TAXONOMY OF *ONCOCLADIUM FLAVUM* AND ITS RELATIONSHIP TO *MALBRANCHEA FLAVA*

LYNNE SIGLER[1], J. GUARRO[2], R. S. CURRAH[1] AND L. PUNSOLA[2]

[1]University of Alberta Microfungus Collection and Herbarium
Devonian Botanic Garden, Edmonton, Alberta, Canada T6G 2H7
[2]Dpto. Biologia y Microbiologia, Universidad de Barcelona,
Facultad de Medicina, Reus, Tarragona, Spain

ABSTRACT

Based on new collections of *Oncocladium flavum* Wallroth from Canada and Spain, we have established *Malbranchea flava* to be a synananamorph of *Oncocladium flavum*. Another collection from Spain differed in its cultural morphology and is described as the new variety *Oncocladium flavum* var. *robustum* Sigler & Guarro var. nov.

INTRODUCTION

Oncocladium flavum Wallroth is a striking fungus characterized by thick-walled hyphae which bear regular verticils of 3-5 reflexed branches. These hyphae occur on keratinous substrates in ascoma-like aggregates which resemble the mesh-like ascomata composed of thick-walled branched hyphae typical of many members of the Onygenales (Currah, 1985). Closely associated with the verticillately-branched hyphae is an arthroconidial anamorph characterized by rhexolytically-dehiscing conidia. Although Wallroth considered *O. flavum* to be a hyphomycete, the taxonomic disposition of the fungus has been questioned by others who observed ascospores in some collections.

In 1976, based on reports in the literature that ascospores had been found in some specimens, and on the cultures and specimens then available, Sigler & Carmichael (1976) suggested that *O. flavum* may represent a heterothallic ascomycete having a *Malbranchea* anamorph. Since the connection between the *Oncocladium* appendages and the arthroconidial fungus could not be proven, they named the anamorph *Malbranchea flava*, a species distinguished by its lemon to golden yellow colonies and development of rhexolytically-dehiscing arthroconidia on straight fertile hyphae.

Two factors have hindered attempts to resolve the taxonomic disposition of *Oncocladium flavum*: 1) Material from the keratinous substrate is frequently mixed with other fungi. 2) The verticillately-branched hyphae have not been obtained in agar culture, although an arthroconidial fungus has been isolated on several occasions.

Since the taxonomy of *Oncocladium flavum* has been unstable due to confusion arising from the presence of other fungi in collections, we briefly review the history of the name *O. flavum* and of the specimens previously available for study. The discovery of new collections of *O. flavum* in Alberta, Canada, and in Spain provided an opportunity to obtain pure cultures from freshly-collected material. In this study, we examined the growth habit of conidial isolates from the new collections on agar media and on keratinous substrates. Several isolates maintained in the University of Alberta Microfungus Collection (UAMH) as *M. flava* were also grown on keratinous substrates. The development of the characteristic *Oncocladium* appendages in several of the isolates on keratinous media established the connection between *Oncocladium flavum* and *Malbranchea flava*.

One collection of *Oncocladium flavum* from Spain yielded several conidial isolates which differed in colony appearance and growth rate from *Malbranchea flava*, and these isolates are described here as a new variety of *Oncocladium flavum*.

NOMENCLATURAL HISTORY

A great deal of confusion surrounds the taxonomy of *Oncocladium flavum* since unequivocal observations have not hitherto been made on the relationship between the appendages, ascospores and arthroconidia reported to occur in this fungus.

Although the history of the name *O. flavum* was reviewed by Sigler & Carmichael (1976, pp. 448-451), pertinent information is summarized here (Table 1). In 1900, A.L. Smith observed ascus-like groups of spores within the cluster of branched hyphae and named the fungus *Gymnoascus verticillatus*. However she stated, "the specimens were all too old to determine the connection of the ascus-like groups with the interior branches." The type specimen of *G. verticillatus*, deposited in the BM (now Herb. K), was examined by Balfour-Browne and Stockdale at the request of Orr and Kuehn (1963), who then transferred the species to their new genus *Actinodendron*. They reported "arthrospores probably present" and these were illustrated in their Fig. 6.

In 1968, Hughes examined Wallroth's type specimen of *Oncocladium flavum* and noted that the reflexed appendages of *O. flavum* appeared to be identical to those of *Actinodendron verticillatum*. Since he observed arthroconidia but no ascospores in Wallroth's type, Hughes suggested that *O. flavum* could be an anamorph of *Actinodendron verticillatum*. Orr & Kuehn (1971) then rejected *Actinodendron* on the basis of Hughes' findings and the fact that ascospores had been reported only in Smith's type.

Sigler & Carmichael (1976) described *Malbranchea flava* based on several isolates of an arthroconidial fungus. One of these, UAMH 1589, from which the type of *Malbranchea flava* is derived, had presumably been cultured from a specimen (OAP 19-317) which displayed the appendages typical of *O. flavum*.

Table 1. Nomenclatural History

1. Names proposed for anamorphs

Oncocladium flavum Wallroth 1833, Flor. Crypt. German. p. 289	Based on verticillately-branched hyphae and minute globose spores (arthroconidia fide Hughes, 1968)
Malbranchea flava Sigler & Carmichael 1976, Mycotaxon 4:488	Based on arthroconidial anamorph, verticillately-branched hyphae not seen

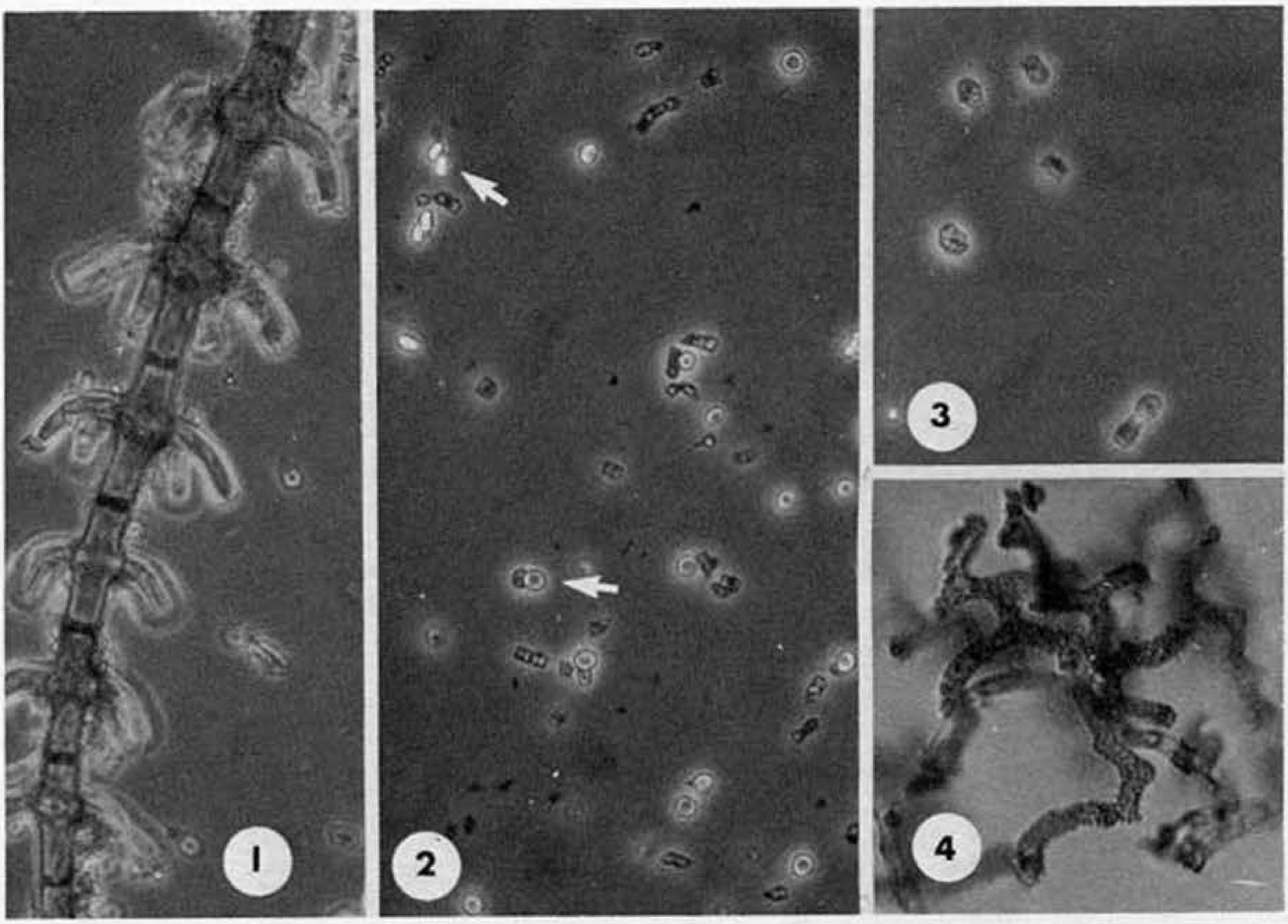
2. Names proposed for presumed teleomorph

Gymnoascus verticillatus A.L. Smith 1900, J.R. Micro. Soc. 1900:423	Based on verticillately-branched hyphae and clusters of presumed ascospores
Actinodendron verticillatum (Smith) Orr & Kuehn, 1963 Mycopath. Mycol. Appl. 21:212	Later rejected by Orr & Kuehn, 1971

HISTORICAL REVIEW OF SPECIMENS

Despite the striking appearance of *O. flavum*, it appears to have been encountered infrequently and there are few specimens available for study. Table II reviews the specimens which have been examined by various workers. Several observations can be made. First, both verticillately-branched hyphae and arthroconidia have been observed in all specimens. Secondly, material from the keratinous substrates is freqently mixed with other fungi. The presence of ascospores in some specimens has created uncertainty about the disposition of *Oncocladium flavum* as an ascomycetous or hyphomycetous fungus. Ascospores have been reported or observed in 4 of 9 specimens. In each of the three specimens examined by us, the ascospores belonged to different taxa (*Gymnascella aurantiaca, G. calcarea* and *Aphanoascus fulvescens*). We have not seen Dennis' specimen which was reported to have ascospores. We have examined Smith's type specimen of *Gymnoascus verticillatus*. Several aggregations of reflexed appendages were removed for microscopic examination and found to contain several different fungi including *Oncocladium flavum, Gymnascella aurantiaca, Chrysosporium merdarium* and asperulate hyphae resembling *Nannizziopsis vriesii* (Figs. 1-4).

Thirdly, only a few attempts have been made to isolate *Oncocladium flavum* in agar culture and most of these have been reported as unsuccessful. From the California material, Orr & Kuehn (1963) reported, "it was not possible to isolate this fungus but several cultures were isolated and designated OAP 19-317." Two arthroconidial isolates labelled OAP 19-317 were deposited in UAMH and described as *Malbranchea flava* (Sigler & Carmichael, 1976). UAMH 1589 is the type of *Malbranchea flava*.



Figs. 1-4. *Gymnoascus verticillatus* TYPE. 1. Verticillately-branched hypha typical of *O. flavum*, x335. 2. Ascospores (arrows) of *Gymnascella aurantiaca* interspersed with *Malbranchea* arthroconidia. 3. Conidia of *Chrysosporium merdarium*. 4. Asperulate hyphae characteristic of *Nannizziopsis vriesii*. 2,3,4 x445.

Table II. Review of Specimens Available and Observations On Structures Present

Specimen/ Material	Examined/Reported By	Verticillately Branched Hyphae	Arthroconidia	Ascospores	Other Fungi Present	Pure Culture Attempted
Herb.STR. T, O. flavum	Hughes, 1968	+	+	-		
Herb.BM T, G. verticillatus !	Sigler & Currah	+	+	+[1]	Gymnascella aurantiaca[1] Chrysosporium merdarium	
Szathmary ex soil, Hungary		+	+	-	Arthroderma Microsporum	Unsuccessful
Plunkett ex soil, Calif.	Orr & Kuehn, 1963	+	+[2]	-	Arthroderma M. gypseum G. pannorum	OAP 19-317[2] =UAMH 1589 T, M. flava UAMH 1879
Herb.K Dennis on feathers	Apinis, 1964	+	+	+	Chrysosporium ? merdarium	
Apinis on dead bird	Apinis, 1964	+	+	-	Chrysosporium ? merdarium	
IMI 10030! Stockdale on wool	Sigler & Carmichael, 1976	+	+	-		Unsuccessful (Stockdale)
IMI 100445! on wool	Sigler & Carmichael, 1976	+	+	+[3]	Aphanoascus fulvescens[3]	
Sydow 4031 Mycotheca Marchica Herb.K! TRTC!	Currah, 1985	+	+	+[4]	Gymnascella calcarea[4]	

Table III. New Records of ***Oncocladium flavum***

Specimen	Substrate/Source	Verticillately Branched Hyphae	Arthroconidia	Ascospores	Other Fungi Present	Culture of Arthroconidial Fungus
UAMH 4788	Soil by keratin bait, Spain Guarro FFBA 277[4]	+	+	+[1]	Chrysosporium spp. Gymnascella aurantiaca[1]	UAMH 4473[2] UAMH 4793-4797[3]
UAMH 4804	coyote dung Alberta Currah	+	+	-	Chrysosporium UAMH 4823	UAMH 4805-4807[3]
FFBA 329[4]	Soil by keratin bait, Spain	+	+	-	?	UAMH 4565[2]

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[1] Not isolated in culture
[2] Mass-conidial isolate
[3] Single-condial isolates
[4] Dept. of Biology & Microbiology, University of Barcelona, Reus, Spain

NEW RECORDS OF *ONCOCLADIUM FLAVUM*

New discoveries of *O. flavum* in Alberta and Spain (Table III) provided an opportunity for microscopic examination of freshly-collected material and for cultural studies. In Alberta, *O. flavum* (UAMH 4804) was observed growing on coyote dung collected from the U. of A. Devonian Botanic Garden in May 1981 and maintained in a damp chamber for several months. Two additional collections (FFBA 277 =UAMH 4788 and FFBA 329 =UAMH 4565) were obtained in Spain by keratin baiting of soil. Single-conidial cultures were obtained from two specimens (UAMH 4788 and 4804). Light microscopic examination of the three specimens (Table III) revealed alternate arthroconidia produced among a mass of hyphae and thick-walled appendages, in addition to spores belonging to other fungi. In both UAMH 4804 and 4788, we observed *Chrysosporium* conidia, and Chrysosporia were obtained in culture. In UAMH 4788 we also observed ascospores identifiable as *Gymnascella aurantiaca* (not obtained in culture). *G. aurantiaca*, the same species occurring in the type of *Gymnoascus verticillatus*, is a relatively common species which is primarily coprophilous (Currah, 1985).

MATERIALS AND METHODS

Isolation in Agar Culture: Media for primary isolation consisted of phytone-yeast extract agar (PYE, BBL) and Mycosel agar (MYC, BBL) which contains the antifungal antibiotic cycloheximide. Mass-conidial and single-conidial cultures were obtained by transferring small fragments of mycelium and arthroconidia interspersed with the *Oncocladium* appendages to PYE and MYC respectively. Single germinating arthroconidia were removed from the MYC plates with a fine needle and transferred to new PYE plates. From the Alberta specimen (UAMH 4804) we obtained three single-conidial isolates (UAMH 4805-4807) (Table III) and from the Spanish specimen (FFBA 277 =UAMH 4788), one mass-conidial isolate (UAMH 4473) and five single-conidial isolates (UAMH 4793-4797). From the other Spanish collection (FFBA 329) only a mass-conidial isolate was obtained (UAMH 4565).

Growth on Non-keratinous and Keratinous Substrates: The non-keratinous medium used was oatmeal-salts agar (OAT) (Medium E of Weitzman & Silva-Hutner, 1967), a medium in common use to promote development of ascigerous states of Onygenales (Padhye & Carmichael, 1973). Each of the newly-obtained mass- and single-conidial isolates was grown on OAT incubated at 25°C under intermittent fluorescent light (about 10 hours daily) for 6-9 wk and examined weekly for development of appendages and ascospores.

Because the verticillate appendages were known only from keratinous substrates and had not been previously obtained on agar media, we attempted to prove the connection between *Oncocladium flavum* and *Malbranchea flava* by growing the fungus on two keratinous substrates. The keratinous medium consisted of local garden soil placed in 60mm diam glass Petri dishes and overlaid on one-half with sheep wool and on the other half with feathers. The Petri plates were sterilized by autoclaving.

All of the newly-isolated strains and several isolates maintained in UAMH as *Malbranchea flava* were grown on the keratinous medium. Conidial suspensions were prepared for each of the isolates in 1 ml sterile distilled water and several drops from each suspension were inoculated to both keratinous substrates on the soil. Additional sterile distilled water was added to the soil as required to provide a moist environment. The cultures were incubated under the same conditions as the OAT plates and checked weekly for 2 mo, then monthly for 9 mo before being discarded. The cultures were examined using a dissecting microscope for development of appendages and a portion of the growth was removed periodically for light microscopic examination.

Many of the isolates grown on the keratinous substrates were mass-conidial isolates. No attempt was made to conduct extensive mating tests; only the single-conidial isolates obtained from each specimen were mated by inoculating mixed conidial suspensions to the keratinous subtrates. The duration and conditions of incubation were as described above.

RESULTS OF GROWTH STUDIES

The three single-conidial isolates (UAMH 4805-4807) obtained from the Alberta collection appeared identical in their colonial and microscopic morphology to *Malbranchea flava*. None of the isolates developed *Oncocladium* appendages on OAT agar, but one strain (4807) developed a few appendages after growth for 21 da in slide culture (Fig. 3) using Pablum cereal agar (CER) without antibiotics (Padhye & Carmichael, 1973) as the growth medium.

The mass- and single-conidial isolates (UAMH 4473, 4793-4797) obtained from the Spanish collection (4788) appeared similar to *Malbranchea flava* in their microscopic morphology but differed from *M. flava* in their faster growth rate and buff rather than yellow colonies. None developed appendages on OAT agar.

All of the fungi grown on the keratinous medium grew well on wool but poorly on feathers. Table IV lists the results of that study. Of 10 isolates with a colonial morphology typical of *M. flava*, 6 developed *Oncocladium* appendages within 3-6 wk (Fig. 5). Four isolates, including the type of *M. flava* and another isolate from the same collection (OAP 19-317) produced only poorly-differentiated thick-walled, pale brown hyphae (Fig. 6). These hyphae resemble in morphology the basal region of the *Oncocladium* appendage which is thinner and paler, with short lateral branches occurring more or less at right angles (See Fig. 9, arrows).

The next 8 strains listed in Table IV include the mass- and single-conidial isolates (4474, 4793-4797) from the Spanish collection of *O. flavum*, in addition to two others having similar buff colonies. Sigler & Carmichael (1976) treated UAMH 1956 in *M. flava* even though its colonies were unusual in being creamy-white. None of the buff isolates developed *Oncocladium* hyphae; these isolates may have some other type of nutritional requirements. For now, we are treating this group as a variety of *Oncocladium flavum* since it is similar in its microscopic morphology but differs in colony appearance and growth rate. Additional collections may lead to a change in status.

Microscopic examination of all cultures at 9 mo revealed no ascospores.

DISCUSSION AND TAXONOMIC PART

The development of *Oncocladium* hyphae from isolates identifiable by their microscopic and colonial morphology as *Malbranchea flava* has confirmed that *O. flavum* and *M. flava* are connected and that *O. flavum* is a hyphomycetous fungus. The genus *Oncocladium* was proposed by Wallroth for a fungus with distinct verticillately-branched hyphae (fide Hughes, 1968). Wallroth did not clarify the nature of the spores, simply describing them as minute and globose. *Oncocladium* antedates *Malbranchea* which was described by Saccardo in 1882. However, we do not consider *Malbranchea* to be a synonym of *Oncocladium*, but rather *Malbranchea flava* to be a synanamorph of *Oncocladium flavum*.

In the naming of pleoanamorphic fungi with distinct conidial types, it is now generally accepted that the generic name should be based on the conidial type which is the most distinct and/or most stable (Hennebert & Weresub, 1979; Weresub, 1979; Carmichael, 1981; Gams, 1982). The convention we follow, therefore, is to apply the Linnaean binomial to the most distinctive anamorph and to use a cross-reference name for the synanamorph (Sigler & Carmichael, 1976; Carmichael, 1979).

In this case, as Hughes (1968) stated, "the characteristic feature of *Oncocladium flavum* is the regularly septate hyphae, which are pale brown to dark brown, expanding gradually toward the distal end." *Oncocladium* was described first and is the most distinctive state and we retain it as the name to apply to the anamorph characterized by the verticillate structures. The arthroconidial synanamorph can be referred to *Malbranchea*.

Table IV. Development of ***Oncocladium*** Hyphae in Isolates Grown on Wool on Soil (9 Mo)

UAMH#	Source	Oncocladium Hyphae	Colony Color
1589*	T, M. flava ex Plunkett OAP 19-317	PD	Y
1879*	ex Plunkett OAP 19-317	PD	Y
2859	ex Devroey RV-19535a	+	Y
2860	ex Devroey RV-19535b	+	Y
2864*	ex Szathmary (0-3512)	PD	Y
4564	ex Guarro FFBA 281	PD	Y
4565*	ex Guarro FFBA 329	+	Y
4805*	ex Currah UAMH 4804	+	Y
4806*	" "	+	Y
4807*	" "	+	Y
1956	ex Varsavsky EV5V	-	B
4473*	ex Guarro FFBA 277	-	B
4474	ex Guarro FFBA 278	-	B
4793*	UAMH 4788 ex Guarro FFBA 277	-	B
4794*	" "	-	B
4795*	" "	-	B
4796*	" "	-	B
4797*	" "	-	B

* -strains reported or known to have been isolated from specimens of ***Oncocladium flavum***
PD -poorly differentiated, thick-walled, pale brown hyphae with short lateral branches
\+ -verticillately-branched hyphae
Y -yellow colony typical of ***M. flava***
B -buff colony

Oncocladium flavum Wallroth 1833 var. **flavum** **Figs. 5-7, 12.**
Flor. Crypt. German p. 289
= *Gymnoascus verticillatus* A.L. Smith 1900, J. Roy. Microscop. Soc. London 1900:423 (*nomen confusum*)
≡ *Actinodendron verticillatum* (Smith) Orr & Kuehn 1963, Mycopath. Mycol. appl. 12:212

Synanamorph: *Malbranchea* an. *Oncocladium flavum*
≡ *Malbranchea flava* Sigler & Carm. 1976, Mycotaxon 4:451

Although the synanamorphs have been described and illustrated separately in previous publications (Orr & Kuehn, 1963; Hughes, 1968; Sigler & Carmichael, 1976;

Figs. 5-7. *Oncocladium flavum* var. *flavum* (5-UAMH 2859; 6-1879; 7-4807). 5. Verticillately-branched appendages occurring on wool on soil after 26 d, x445..6. Poorly-differentiated, thick-walled, branched hyphae on wool after 9 mo, x335. Compare morphology with basal region of *Oncocladium* appendage in Fig. 9 (arrows). 7. Branchlet of *Oncocladium* appendage bearing hyaline hyphal filament (arrows) which undergoes rhexolytic dehiscence. Appendage developed in slide culture after 21 da, x560. Figs. 8-11. *O. flavum* var. *robustum* (8,11a-4793; 9,10-4788; 11b-4794). 8. Alternate arthroconidia borne on straight, branched fertile hyphae, x445. 9. *Oncocladium* appendage bearing verticils of reflexed branchlets in broad apical region, tapering at the base and bearing short straight, lateral branchlets (arrows), x170. 10. On soil by keratin baiting (photograph from color transparency). 11. Colonies after 21 da at 25°C, x0.7. a. on PYE. b. on CER.


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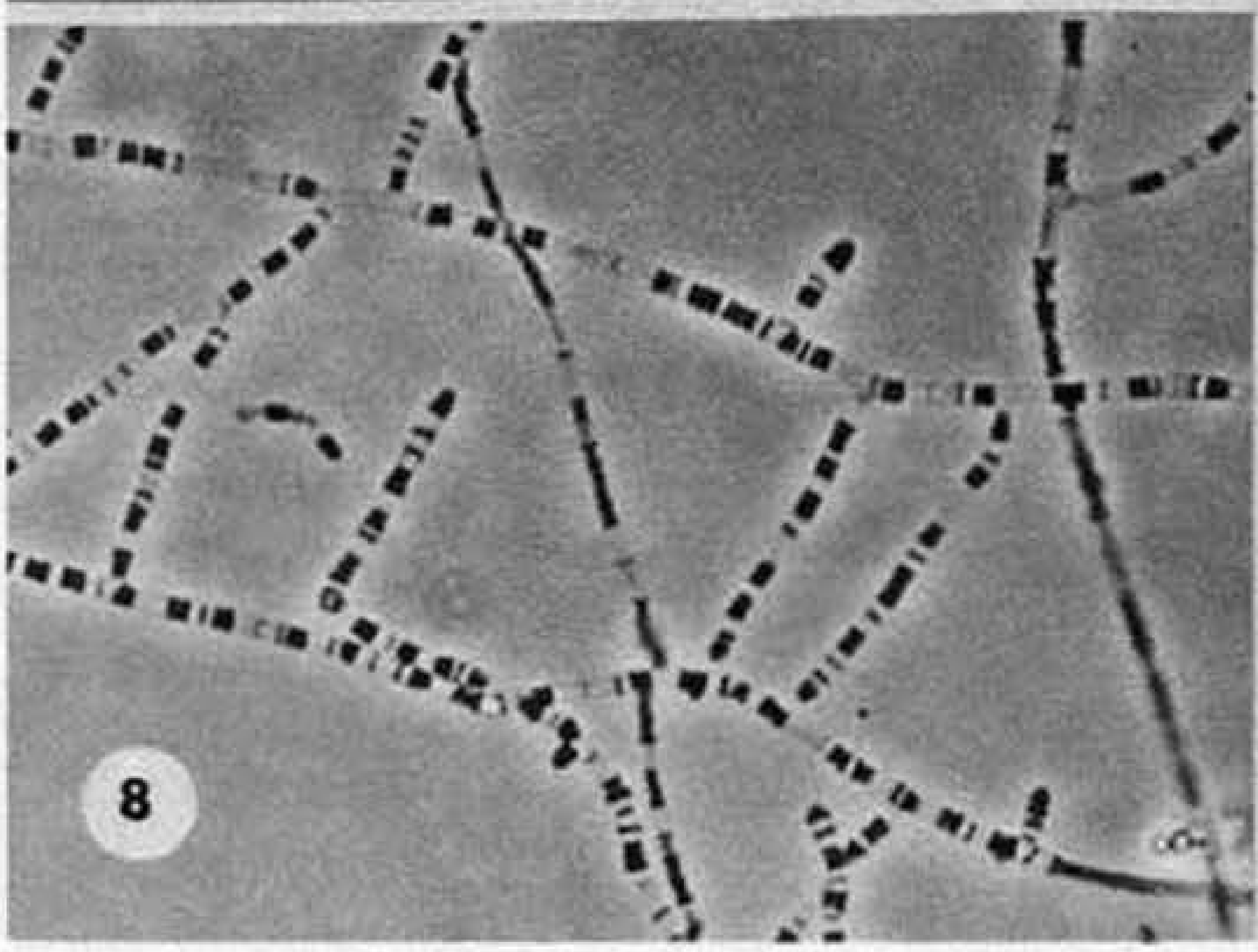
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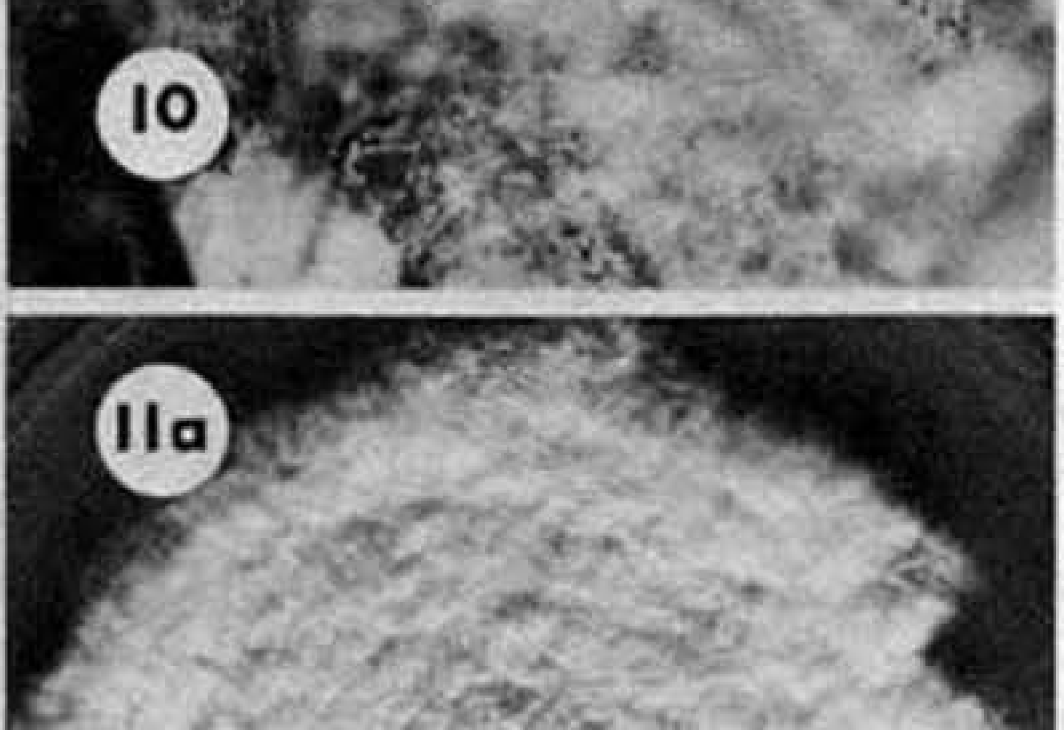
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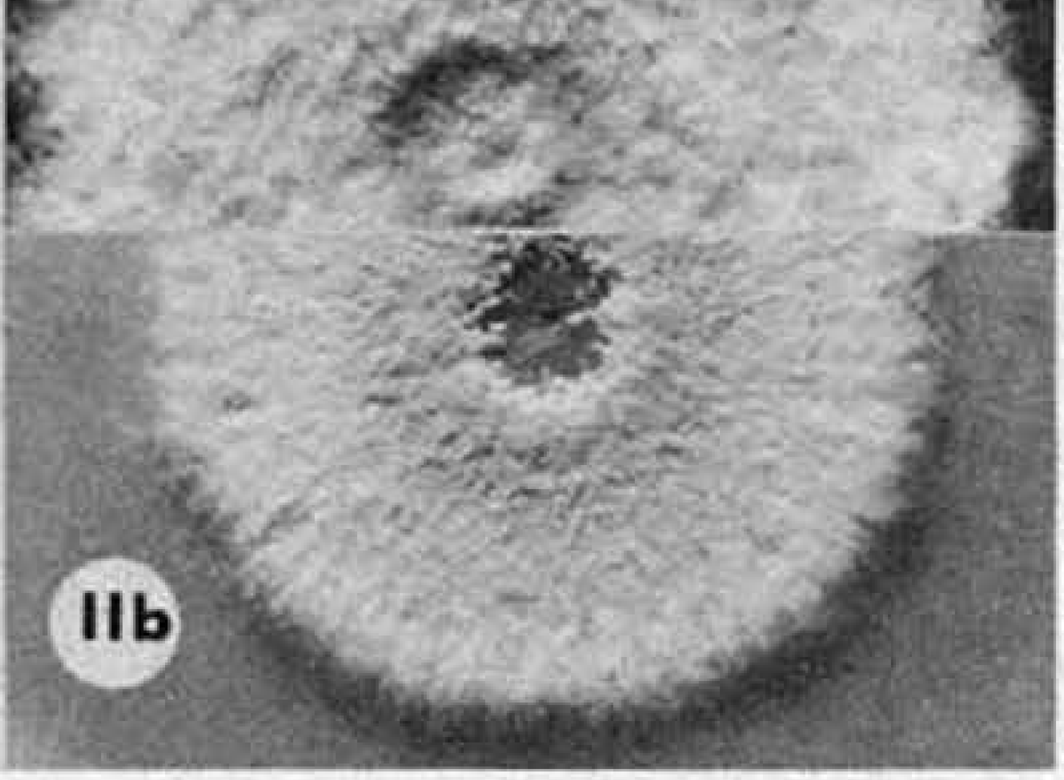
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Currah, 1985), we provide a brief description of the holomorph.

Conidial apparatus consisting of a more or less globose structure composed of a mass of arthroconidia surrounded by loosely intertwined, thick-walled, branched, septate hyphal appendages. **Hyphal appendages** in the basal region, narrow, 1.5-2 µm wide, pale yellow-brown, with short truncate lateral branches arising more or less at right angles; in the apical region, gradually broadening to 10-11 µm wide, becoming thick-walled, golden-brown, truncate at the apex or subtended by a hyaline hyphal filament which undergoes rhexolytic dehiscence, regularly septate, each cell 22-40 µm long, bearing regular verticils of 3-5 branchlets curving toward the base of the appendage. **Branchlets** in the apical region, 0-1 septate, reflexed, or if 1-septate, becoming truncate due to rhexolytic dehiscence of terminal cell; branchlets in the basal region less curved, bearing hyaline hyphal filaments (Fig. 7, arrows) which divide to form alternate arthroconidia and undergo rhexolytic dehiscence. **Arthroconidia** (*Malbranchea* synanamorph) arising from straight, branched fertile hyphae, separated from each other by short empty segments divided by 1 or more septa; arthroconidia cylindrical, hyaline, later greenish-yellow, 2-3 x 2.5-5.5 µm, released by rhexolytic dehiscence.

Colonies on PYE on cellophane 39-61 mm diam in 21 da, lemon-yellow becoming dark gold, sulphur-yellow to greenish-yellow, powdery, rarely woolly, dense, dry undulate, sometimes lifting off cellophane and developing fissures. Growth on CER similar but colonies flat with slower growth rate, 26-39 mm diam in 21 da. Opt. growth temp. 18-25°C; max. 30°C.

Oncocladium flavum Wallr. 1833 var. **robustum** Sigler & Guarro, var. nov. **Figs. 8-11.**

Appendicibus flavo-bruneis, crassitunicatis, septatis, laxiter intertextae; cellulae ad apice incrassatum ramulorum verticillatus, cellulae ad basis angustum. Arthroconidia (*Malbranchea* synanamorpha) cylindrica, directa, laevia, hyalina 2-2.5(3) x (1.5)2-3.5(5) µm.
Coloniae in agaro ad 25°C moderatim rapide crescunt, cremeae, vel fulvae, densae, pulveraceae, siccae, planae. Incrementum tardum ad 30°C, nullum ad 37°C.

Holotypus: UAMH 4788 ex solo, Hispania, 1983, J. Guarro (FFBA 277).

Conidial apparatus, hyphal appendages and arthroconidia as described above for var. *flavum*.

Colonies on PYE on cellophane growing more rapidly, 60-70 mm diam in 21 da at 25°C, creamy-white then buff, dense, powdery, flat, with irregular margin. Growth on CER similar but colonies less dense and slower growing, 50 mm diam in 21 da. Colonies at 30°C, 3-5 mm diam in 11 da. Opt. growth temp. 18-30°C; no growth at 37°C.

Holotype: UAMH 4788 from arable soil by keratin bait, Rubi, Catalunya, Spain, 1980, by J. Guarro (FFBA 277). (Permanent microscopic slide.)

Living strains represented by ***Malbranchea*** synanamorph: 1956, soil, Argentina, Varsavsky (EV 5V), 1961, from Orr O-3596; 4473, soil, Rubi, Catalunya, Spain, 04-80, Guarro (FFBA 277); 4474, forest soil, Tarrega, Catalunya, Spain, 01-80, Guarro (FFBA 278); 4793-4797, single-conidial isolates ex type (4788), UAMH, L. Sigler, 1983.

Orr & Kuehn (1963) observed some differences in the length of the verticil-bearing cells and suggested that these differences may prove of value in differentiating among species of *Oncocladium*. In the single collection of var. *robustum*, the verticil-bearing cells measured 30-40 µm. In the Alberta collection of var. *flavum* the length of the cells varied from 20-30 µm on wool to 26-36 µm on dung. We suspect this variation arises more from the growth coniditions than from species differences.

Although both varieties have been found associated with keratinous substrates, their keratinolytic activity appears to be minimal, as measured by their limited capacity to degrade human hair *in vitro* (see Sigler & Carmichael, 1976). Isolates of both varieties grew well on wool but not on feathers. When the wool was examined microscopically after 9 mo, its structural integrity remained intact, suggesting little keratinolytic activity. On the natural substrate, *O. flavum* is often found associated with onygenalean fungi which are keratinolytic, e.g. *Aphanoascus fulvescens, Chrysosporium evolceanui.* The keratinolytic activity of these fungi may allow the later establishment of *Oncocladium flavum*.

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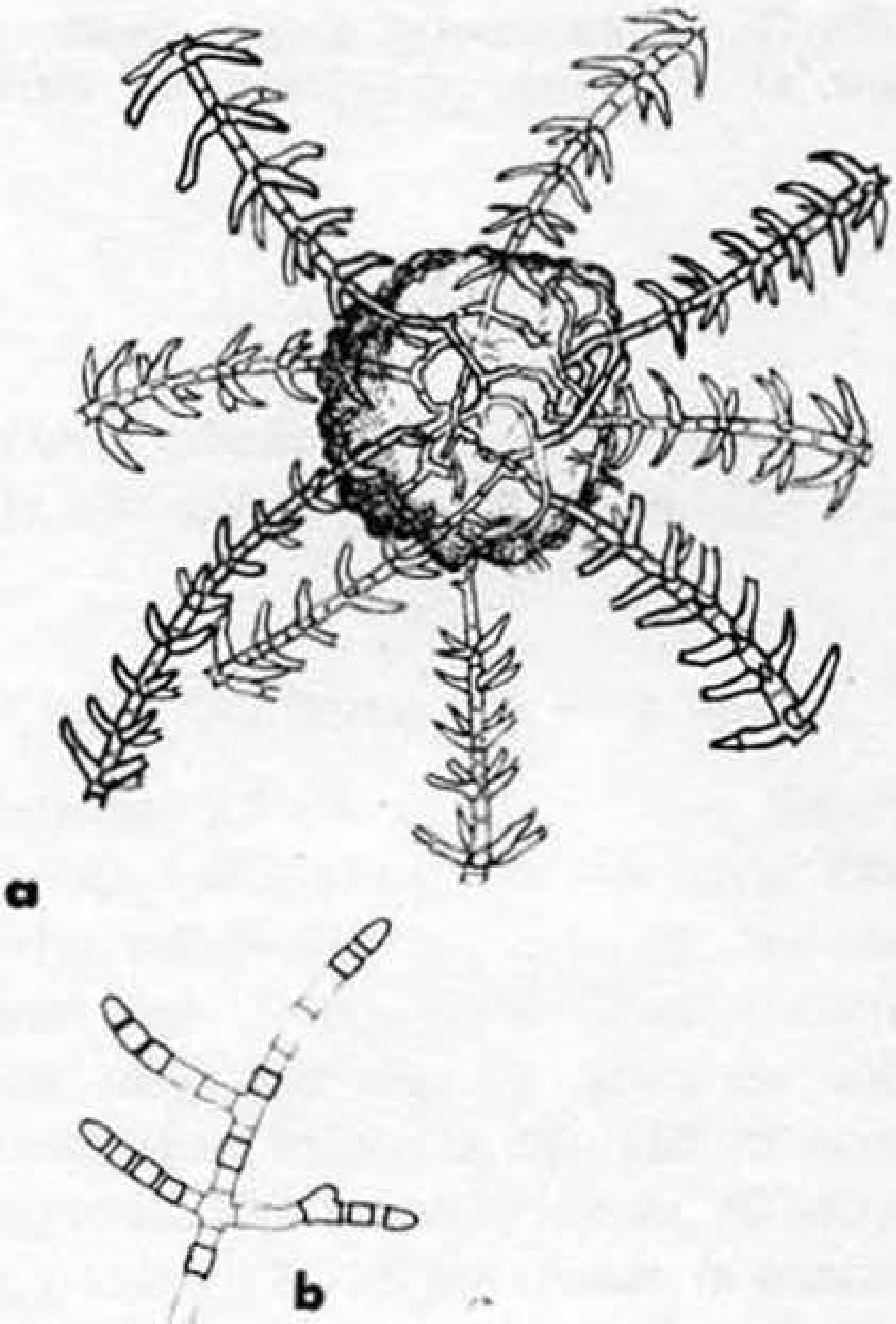

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Fig. 12. *Oncocladium flavum.* (UAMH 4804). a. Conidial apparatus consisting of arthroconidia loosely intertwined with radiately-arranged appendages, x160 (approx.). b. Arthroconidia of the *Malbranchea* synanamorph, x500 (approx.).

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MYCOTAXON

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CORONOPLECTRUM, A NEW LICHEN GENUS FROM THE NAMIB DESERT, SOUTH WEST AFRICA/NAMIBIA

FRANKLIN A. BRUSSE

Botanical Research Institute,
Private Bag X101, PRETORIA,
SOUTH AFRICA.

ABSTRACT

A new lichen genus *Coronoplectrum*, is described from the Namib Desert of South West Africa/Namibia, with one species *C. namibicum*. The affinities of the genus are discussed.

CORONOPLECTRUM NAMIBICUM Brusse, *gen. et sp. nov.*

Thallus fruticosus, saxicola, 1.5 cm altus, 2–4 mm diametro. *Superficies* glauca, rugosa vel lacunosa, emaculata, isidiis sorediisque destituta. *Cortex* 50–70 μm crassus, obscure paraplectenchymatus, cellulis 5–9 μm diametris, cum granulis inspersis. *Stratum gonidiale* 20–40 μm crassum, algis *Trebouxiis*, 6–15 μm diametris. *Medulla* alba, solida, plectenchymata. *Apothecia* lecanorina (fig. 6), terminalia, solitaria, usque ad 1 cm diametris, convoluta. *Hypothecium* hyalinum, 90–110 μm crassum, paraplectenchymatum, cellulis 5–14 μm diametris. *Hymenium* hyalinum, 50–60 μm altum, J+ caeruleum. *Paraphyses* fere simplices, graciles, 0.8–1.0 μm crassae, in gelatina arcte inclusae, ecapitatae. *Asci* clavati, cum tholis J+ caeruleis (fig. 2). *Ascosporae* octonae, hyalinae, simplices, quasi ellipsoideae, 7.0–9.5 × 4.0–5.5 μm. *Pycnidia* globosa, fere terminalia, circa 150 μm alta et 100 μm lata. *Pycnidiosporophorae* ut in *Parmelia*. *Pycnidiosporae* hyalinae, aciculares, 8–15 × 0.8 μm, exobasidiales. *Thallus* atranorinum, acidum sticticum, acidum hyposticticum, et terpenum ignotum continens.

TYPUS: SOUTH WEST AFRICA/NAMIBIA, Skeleton Coast, the Laguneberg near 'Mile 72', on the ground. *R.P. Beckett 12*, 8.i.1986 (PRE), fig. 1.

Thallus fruticose, saxicolous (or on hard ground), 1.5 cm high, 2–4 mm diam. *Surface* glaucous, rugose to sublacunose, emaculate, without isidia or soredia. *Cortex* 50–70 μm thick, granular inspersed, indistinctly paraplectenchymatous, cells 5–9 μm diam. *Algal layer* 20–40 μm thick; algae *Trebouxia*, 6–15 μm diam. *Medulla* white, solid, plectenchymatous (rather dense, but not at all fused into cartilaginous tissue or strands). *Apothecia* lecanorine (fig. 6), terminal, solitary, up to 1 cm diam., convoluted. *Hypothecium* hyaline, 90–110 μm thick, paraplectenchymatous, cells 5–14 μm diam. *Hymenium* hyaline, 50–60 μm high, J+ blue. *Paraphyses* simple, slender, 0.8–1.0 μm

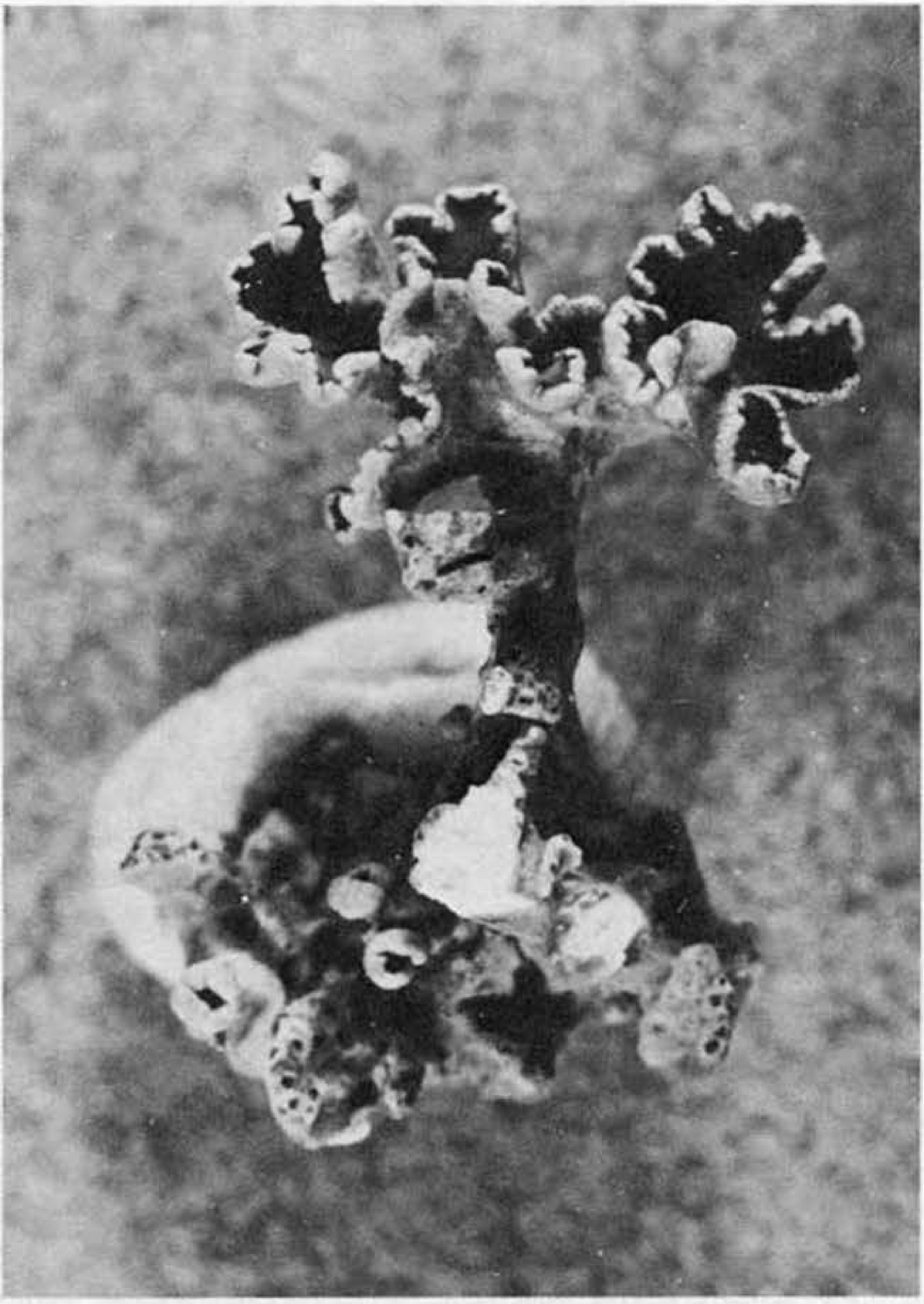
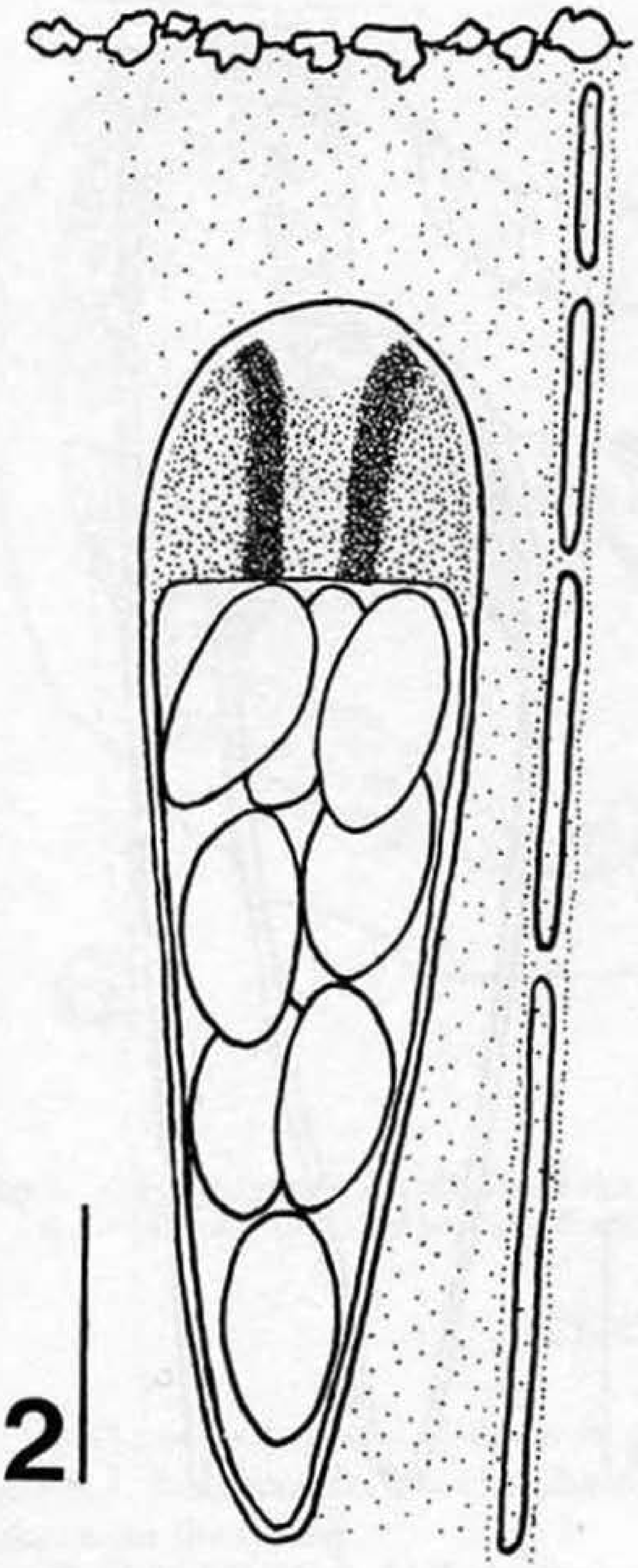


Fig. 1. *Coronoplectrum namibicum* Brusse, habit. *R.P. Beckett 12*, holotype. Scale in mm.

thick, strongly gelled, ecapitate. *Asci* clavate, tholus J+ blue (fig. 2). *Ascospores* eight, hyaline, nearly ellipsoid, 7.0–9.5 x 4.0–5.5 µm. *Pycnidia* globose, commonly apical on prominences or short branches, about 150 µm deep, and 100 µm broad. *Pycnidiosporophores* as in *Parmelia*. *Pycnidiospores* acicular, hyaline, 8–15 x 0.8 µm. *Chemistry*: Atranorin in the cortex, stictic and hypostictic acids, and an unidentified terpene in the medulla.

Etymology: The genus name is derived from the Greek, *coronos* (χορωνος) meaning crown, and *plectron* (πληκτρον) meaning anything to strike with, hence a cock's spur.

This new lichen resembles a *Ramalina* in thallus appearance, but the ascospores of the latter are two-celled and often curved. The ascospores of *Coronoplectrum*, on the other hand are one-celled, but are not quite ellipsoid either, because the poles are slightly off-centred on the same side. Moreover, the tholus of *Ramalina* has an inverted cup of strongly amyloid material in it (fig. 3), whereas that of *Coronoplectrum* has a cylinder of J+ strongly blue (presumably starch or starch-like) material (fig. 2). The paraphyses of *Ramalina* are also loose and capitate, unlike those of this new genus.



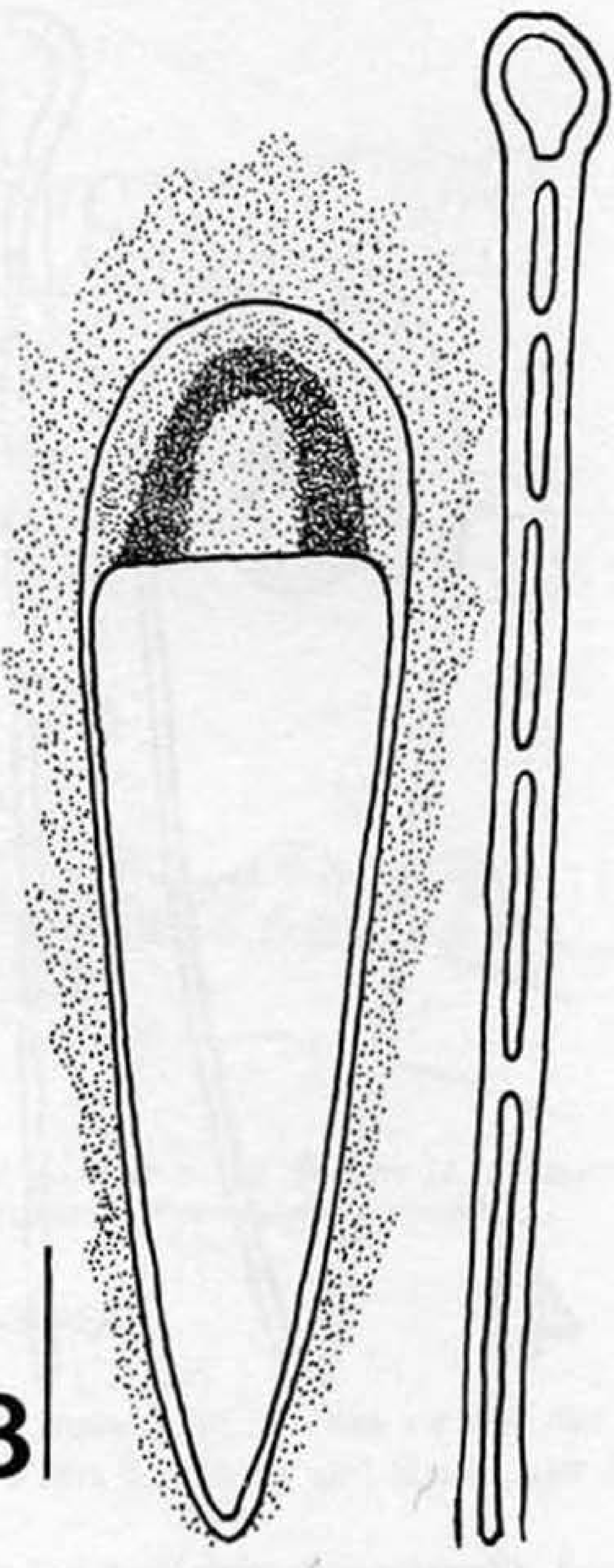


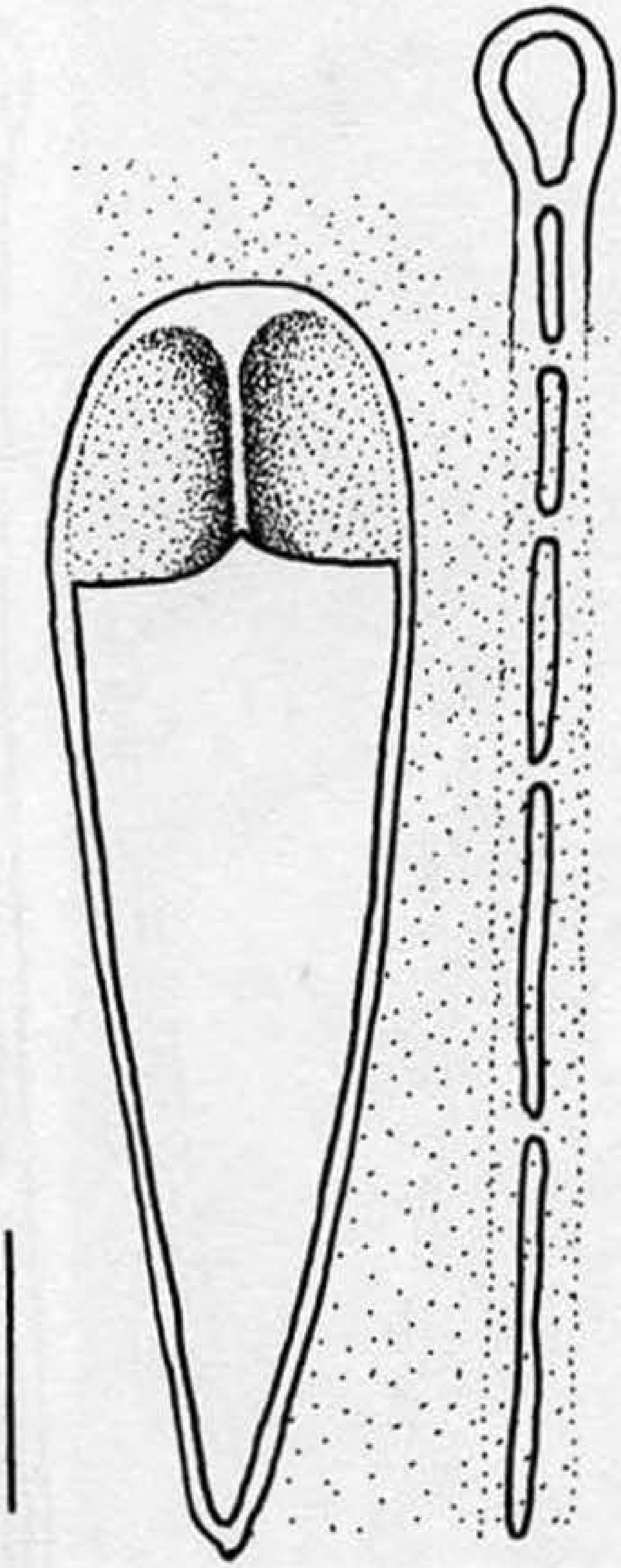
Fig. 2. *Coronoplectrum namibicum* Brusse, ascus and paraphysis. *R.P. Beckett 12*, holotype. Bar = 10 μm.

Fig. 3. *Ramalina fraxinea* (L) Ach., ascus and paraphysis. *P. Cretziou PRE 1680* (PRE). Bar = 10 μm.

The Antarctic genus *Himantormia* M. Lamb, also has simple ascospores (but with centred poles), but the tholus has a narrow channel in it (fig. 4). The tips of the paraphyses are loose and capitate, but are otherwise strongly gelled.

Evernia, which is confined to the northern hemisphere, also has simple ascospores, but here the whole tholus is strongly amyloid (or at least in the upper parts), with a rather clearly defined non-amyloid central channel, which is more oblique than is usual (fig. 5). The tholus of *Usnea* is also wholly amyloid, but the central channel is less clearly defined, and is almost vertical.

Other genera assigned to the Usneaceae, either have cartilaginous central strands in the medulla, as in *Usnea* itself (see Krog 1976 for a discussion of genera with cartilagin-



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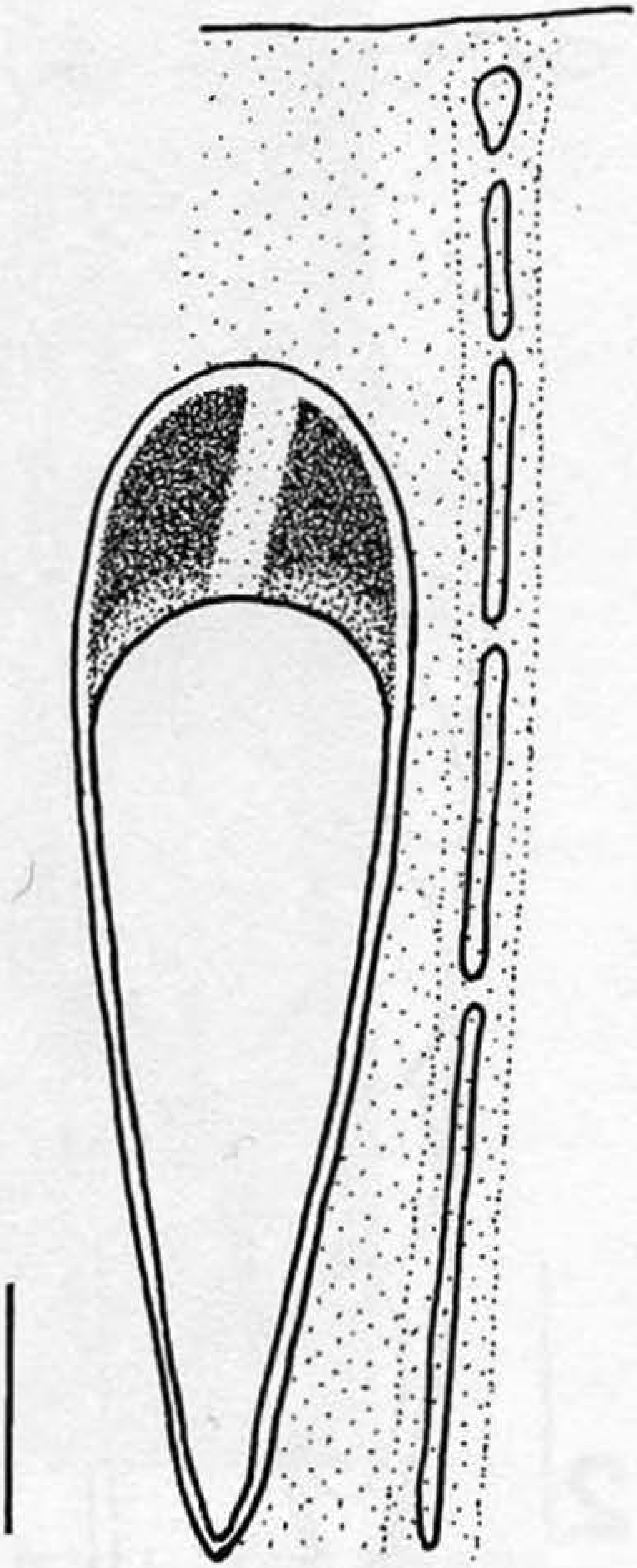

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Fig. 4. *Himantormia lugubris* (Hue) M. Lamb, ascus and paraphysis. *R.I.L. Smith* 172 (PRE). Bar = 10 µm.

Fig. 5. *Evernia prunastri* (L) Ach., ascus and paraphysis. *Arnold Lichen Exsiccati* 1019b (PRE). Bar = 10 µm.

ous strands), or are hollow within with mechanically supporting cartilaginous cortices (Brodo & Hawksworth, 1977).

Despite the abundance of lichens in the Namib, the number of species present is not inordinately high (at least as far as the macrolichens are concerned). In addition, the number of endemic genera is low, with *Santessonia* Hale & Vobis (1978; Serusiaux & Wessels, 1984) and this new genus, being the only strictly endemic lichen genera so far. *Combea* de Not. (Roccellaceae) is almost endemic, but extends into the south-western Cape, with its mediterranean climate.

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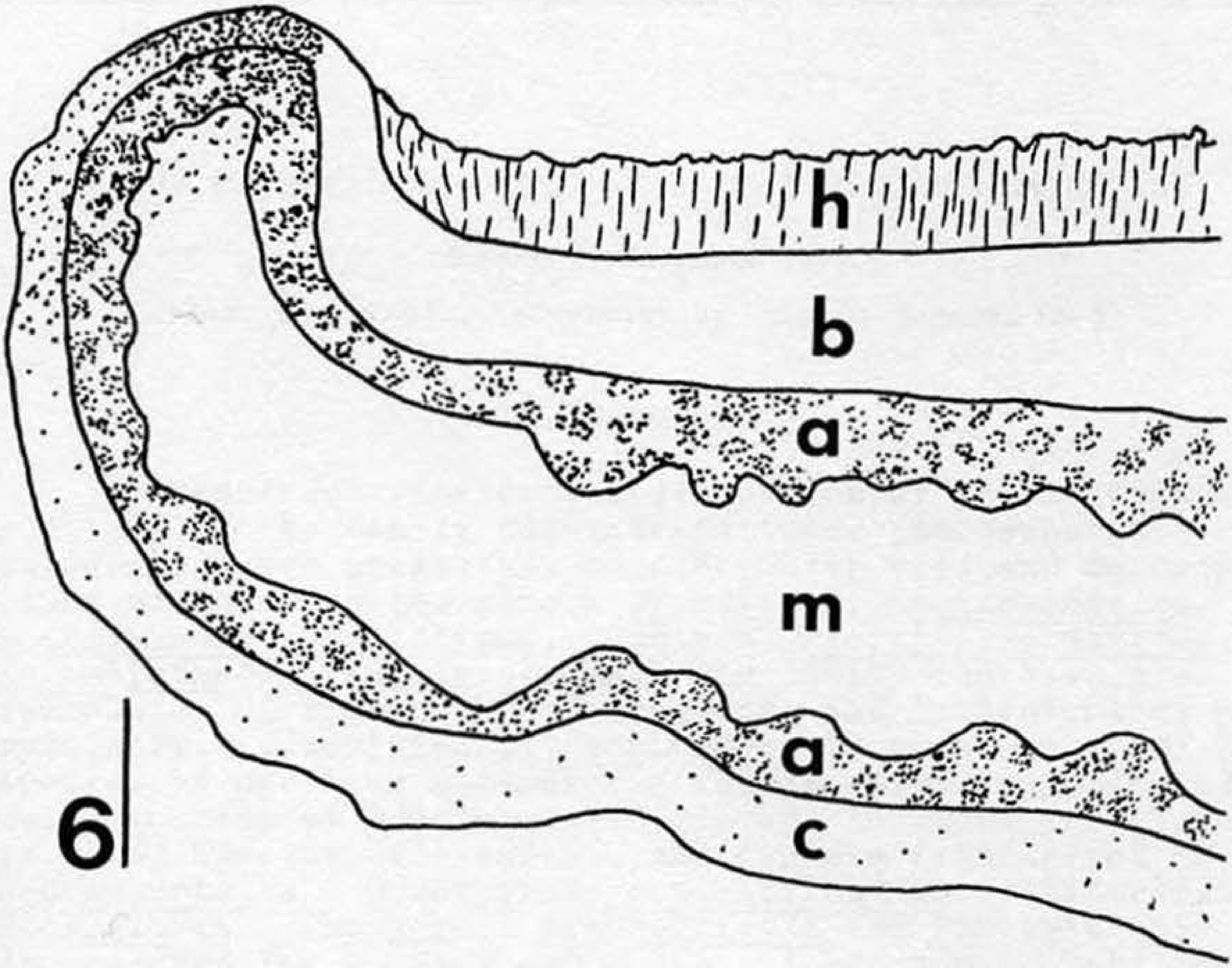

Fig. 6. *Coronoplectrum namibicum* Brusse, section of the apothecium. *R.P. Beckett 12*, holotype. Bar = 100 μm. (a = algal layer, b = hypothecium, c = cortex, h = hymenium, m = medulla.)

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THE OSTROPALEAN FUNGI III: THE ODONTOTREMATACEAE

Martha A. Sherwood-Pike

Geology Department, University of Oregon, Eugene, OR 97403

SUMMARY

A formal description and discussion of the systematic position of the family Odontotremataceae (Ascomycetes: Ostropales) are presented, together with keys and descriptions of the accepted genera Bryodiscus, Coccomycetella, Lethariicola, Odontotrema, Odontura, Pleospilis, Skyttea, Stromatothecia, and Xerotrema. The family consists predominantly of lignicolous saprophytes and lichenicolous parasymbionts. A revision of Odontotrema is presented. Of 26 species at one time included in the genus, 9 are accepted as valid species of Odontotrema. Six are included in Xylopezia as valid species or synonyms, and two are transferred to Coccomycetella. Odontotrema concentricum is transferred to Ocellularia. The genera Paschelkiella and Phragmiticola are erected for O. pini and O. rhopalospermum respectively. Odontotrema oregonense is described as new.

INTRODUCTION

Odontotrema was originally described by Nylander (1858) as a genus of lichens, characterized by having an inconspicuous crustose thallus (actually bleached, unlichenized wood) and erumpent dark-colored ascocarps with dentate margins. The genus was monotypic, based on O. phacidioides Nyl.

Subsequently Nylander (1861) reintroduced Odontotrema in the more widely circulated Lichenes Scandinaviae, with O. minus as the only included species and without a direct reference to the earlier publication. The generic diagnoses are, however, nearly identical, and there can be little doubt that the same genus was intended. The place of publication of Odontotrema is usually incorrectly given as Nylander (1861) p. 249 (Saccardo, 1889; Clements and Shear, 1931; Farr et al., 1979).

Saccardo (1889) and Rehm (1887-96) treated Odontotrema as a genus of nonlichenized fungi, belonging to the Stictidaceae and distinguished from similar genera (e.g. Cryptodiscus Corda) by the combination of a dark dentate margin and 3-septate spores. Saccardo and Saccardo (1906) segregated those species (including the type) with 1-septate spores into the subgenus Trematodontium.

While it was being used as a fungal genus by mycologists, *Odontotrema* continued to be regarded as a lichen genus in the lichenological literature (Leighton, 1879; Knight, 1883), a circumstance which led to bibliographic confusion since names introduced in the lichenological literature were often overlooked by Saccardo. Zahlbruckner (1922), who compiled lichen names published before that date, did not consider *Odontotrema* to be lichenized.

The only attemptto deal systematically with the taxonomy of *Odontotrema* and its allies has been that of Von Höhnel (1917). Von Höhnel considered the genus to be of uncertain affinity, intermediate between the Pezizales and Phacidiales, with some characters of the Stictidaceae, Pyrenopezizeae, Heterosphaeriae, Patellariaceae, and Cenangiaceae. He suggested that the genus bore some relationship to *Sphaeropezia* Sacc. Of the species previously accepted in *Odontotrema*, only *O. minus* was retained in the genus. *Odontotrema diffidens* was transferred to *Sphaeropezia* on the strength of its graminicolous habit, and *O. inclusum* and *O. pini* were transferred to *Phragmonaevia* (a generic name of uncertain application: see Hein, 1976; Sherwood, 1977). *Odontotrema belonosporum* became the type of the new monotypic genus *Coccomycetella*, characterized as being a lignicolous analogue of *Coccomyces*, and *O. hemisphaericum* was made the type of *Xylopezia*, regarded as closely related to *Colpoma* Wallr. and *Therrya* Sacc. *Odontotrema subintegrum* was regarded as lichenized.

Von Höhnel's circumscription of the Phacidiales differs significantly from the one usually recognized today, and consequently his characterization and redisposition of the species of *Odontotrema* requires reassessment.

Nannfeldt (1932) discussed *Odontotrema* briefly, suggesting that it was a member of the Helotiales, but that its family placement was uncertain. The genus has not been treated in recent general works on discomycetes (Seaver, 1952; Korf, 1973; Dennis, 1978). Sherwood (1977) accepted it as ostropalean, suggesting a connection with *Cryptodiscus*, and provided an illustration of *O. minus*. Holm and Holm (1977) labelled it a "genus of uncertain affinity," declining to place it in a family.

It has become evident as a result of continued studies on lignicolous and lichenicolous discomycetes by the present author and colleagues (Sherwood et al., 1980; Sherwood and Coppins, 1981; Hawksworth and Sherwood, 1982) that *Odontotrema* is far from being an isolated genus. Other genera whose mode of ascocarp development and ascus structure suggest *Odontotrema* include the lichenicolous genera *Lethariicola* (1 species), *Skyttea* (10), and *Pleospilis* (1), the bryophilous genus *Bryodiscus* (3), *Stromatothecia*, which parasitizes *Nothofagus*, and the lignicolous genera *Odontura* (1), *Coccomycetella* (1), and *Xerotrema* (1). This assemblage was formally described as a new family of Ostropales, the Odontotremataceae, by Hawksworth and Sherwood (1982). The purpose of this paper is to expand upon the brief familial characterization provided there, provide keys to and descriptions of accepted genera, and address questions of synonymy and circumscription in *Odontotrema*.

THE FAMILY ODONTOTREMATACEAE

Ascocarps ascohymenial in development, hemiangiocarpic, apothecioid, immersed or erumpent, determinate, marginate, single or immersed in a stroma, roughly circular in outline, opening by a circular pore or radial fissures to expose the deeply urceolate disc(Fig. 1, A-E). Excipulum hyphal, usually dark colored and in some genera carbonaceous, typically lined with periphysoids. Paraphyses simple or branched near the base, septate. Asci functionally unitunicate, cylindrical, sessile or nearly so, with thin lateral walls and a thickened apex, I-, with or without an apical pore. Ascospores ovoid, sigmoid, or filiform, hyaline, simple, transversely euseptate or muriform. Anamorphs unknown.

Saprobic, chiefly on wood in xeric situations, or lichenicolous (and then usually parasymbiotic).

TAXONOMIC RELATIONSHIPS

The Odontotremataceae and Stictidaceae are similar in ascus structure, sequence of ascocarp development, and substrate ecology, and would appear to be closely related. Failure on the part of previous investigators to recognize the similarity is due on the one hand to the meager attention accorded Odontotrema and its allies by systematic mycologists and on the other hand to emphasis of a single character - the filiform spore - in the Ostropales.

The essential characters of the order Ostropales may be summarized as follows: Fruitbodies ascohymenial, hemiangiocarpic, perithecioid in early stages of development. Asci cylindrical, functionally unitunicate, at maturity with thin lateral walls and a more or less prominent nonrefractive apical cap, I- or diffusely I+ blue, never with a distinct I+ blue apical ring. Paraphyses present, septate, simple or branched, not anastomosing. Accessory characters which are frequent in this order but uncommon in more 'typical' discomycetes of the Pezizales and Helotiales include filiform, muriform, and sigmoid ascospores, tough reviving ascocarps, periphysoidal hyphae, hyphae of exceptionally narrow diameter, and I+ blue hymenial gel.

The majority of ostropalean fungi occur either as saprophytes on the aerial surfaces of plants, often in xeric situations, or as parasymbionts on lichen thalli. Many of the unusual characters found in the order represent adaptations to an exposed situation and are also found in the fruiting structures of epiphytic lichens.

The distinctions between the three families currently accepted in the Ostropales (Hawksworth et al., 1983) are outlined below.

Stictidaceae: Ascocarps minute to fairly robust, sometimes carbonized, usually with a marginal crystalline layer. Ascospores typically long-filiform. Mostly saprophytes on wood and coarse herbaceous stems.

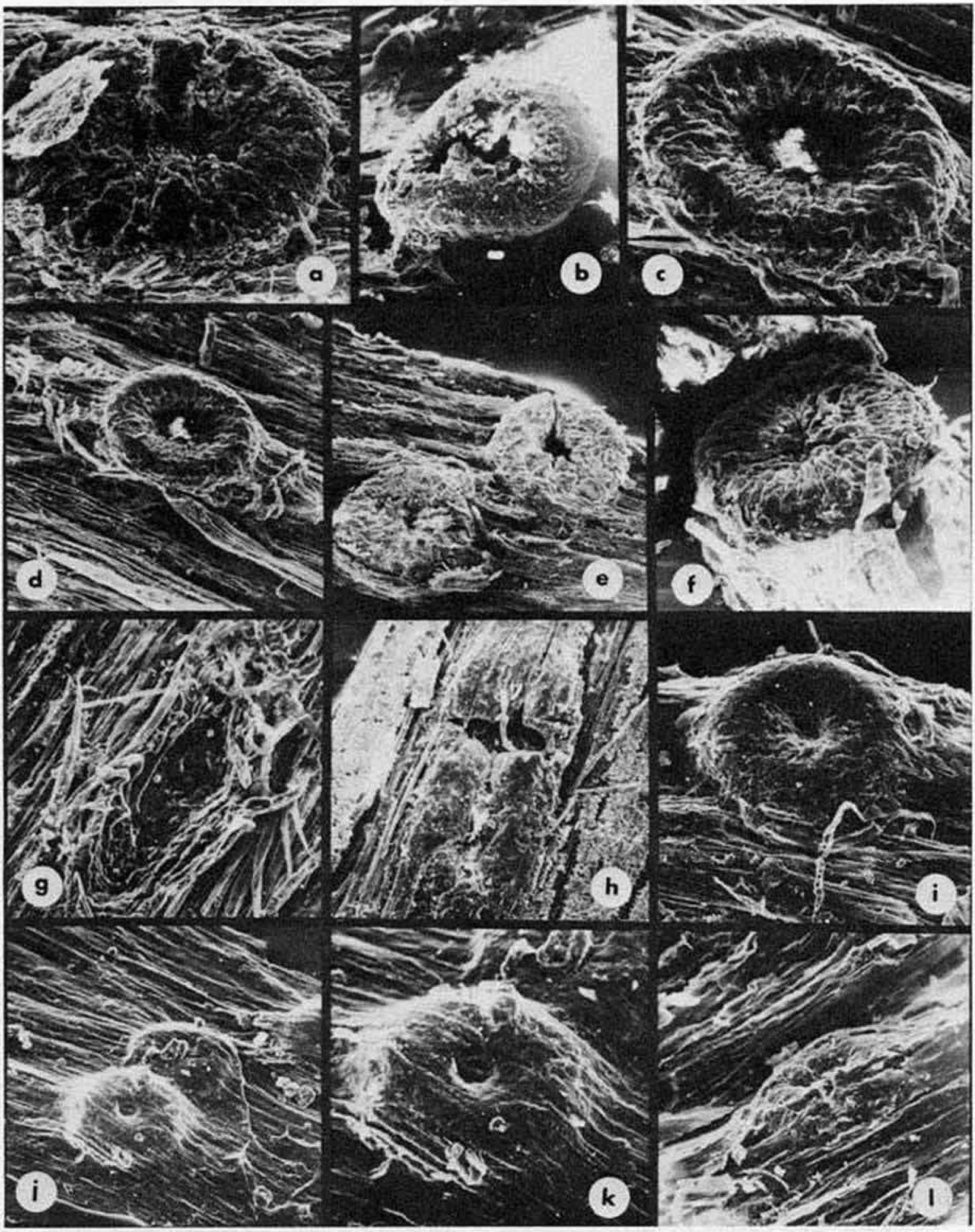

Figure 1. Scanning electron micrographs of odontotremataceous ascocarps. a. *Coccomycetella richardsonii*. b. *Odontotrema inculatum*. c. *Odontotrema majusculum*. d. *Odontotrema minus*. e. *Odontotrema phacidiellum*. f. *Odontotrema longius* (=*Durella atrocyanea*). g. *Phragmiticola rhopalospermum*. h. *Mycowinteria anodontum*. i. *Xylopezia hemisphaerica*. H. *Xylopezia inclusa*. All approximately x75; specimens are those indicated for the species in figs. 1-13.

Odontotremataceae: Ascocarps minute, orbicular, often carbonized; pore margin often with teeth or short hairs, not crystalline. Spores typically not filiform; ovoid, cylindric, or sigmoid. Saprophytes on wood or parasymbionts on lichens, one species parasitic.

Tryblidiaceae: Ascocarps heavily carbonized, orbicular or elongate, opening by stellate fissures or a longitudinal slit. Ascospores thick-walled, transversely septate or muriform, typically I+ purplish. Saprophytes on thick bark of living trees.

The genus Cryptodiscus, with few-septate spores and a noncrystalline, non-carbonized margin, is intermediate between the Stictidaceae and Odontotremataceae. Differences in covering layer construction and ascospore anatomy clearly differentiate the Tryblidiaceae from the other two families. The Tryblidiaceae share some characters with both the Stictidaceae and the lichenized Graphidales, and may be a genuine intermediate between the two.

ECOLOGY AND DISTRIBUTION

What little is known of the ecology of the Odontotremataceae must be deduced from field observations and herbarium data, since cultural studies have never been undertaken in this group.

With the exception of two doubtful species of Odontotrema described from India, all members of the Odontotremataceae have either a temperate or a boreal-alpine distribution. This reflects in part the preferred collecting localities of the few mycologists who have studied these fungi but may well be a real phenomenon. If their distribution parallels that of the Stictidaceae (a reasonable assumption) they should also occur at high elevations in the tropics.

Most odontotremataceous fungi are known from a small number of collections, typically from a restricted geographic area. Of the better-known species, Odontotrema minus and Odontura rhaphidospora are widely distributed in Scandinavia and the mountains of central Europe. Odontotrema majusculum, O. cassiopes, Coccomycetella richardsonii, Xerotrema megalospora, and Paschelkiella pini occur both in Europe and North America. Skyttea nitschkei occurs both in Europe and South America.

The lignicolous Odontotremataceae do not appear to be very host-specific, although there is a tendency for a given species to favor either hard decay-resistant wood or softer, more degraded substrates. The majority occur on conifer wood. Whether this reflects the chemical and physical properties of the substrate, a coevolutionary relationship, or the predominance of conifers in alpine and boreal vegetation is uncertain.

The known species of Bryodiscus are all restricted to bryophytes; B. arctoalpinus and B. grimmiae are specific to

Andraea and *Grimmia* respectively, while *B. hepaticarum* has a wider host range. *Odontotrema cassiopes* occurs only on *Cassiope tetragona*, and *O. plantagineum* may be restricted to *Plantago*. *Stromatothecia* is almost certainly restricted to *Nothofagus*.

Most of the remaining genera and species of Odontotremataceae occur on lichens. Most are highly host-specific, often being restricted to a single species of host. The lichenicolous Odontotremataceae are essentially unknown outside of Europe.

Many Odontotremataceae exhibit morphological adaptations which can be correlated with the relatively harsh environments in which these fungi grow. The tough, melanized ascocarps, which close upon drying, protect the hymenium from light and physical disruption. Tissues composed of narrow-diameter hyphae cemented in a gel retain their structural integrity even after repeated desiccation and rehydration. Some of the unusual spore characters may be associated with increased impaction effeciency on aerial substrates of narrow diameter (sigmoid, filiform, and large spores), the need for the energy reserves of a large propagule, or increased structural stability effected by compartmentalization (muriform spores). These observations are discussed in detail by Sherwood (1982).

Odontotremataceous fungi exploit various energy sources. *Bryodiscus* parasitizes mosses; the mycelium enters and kills host cells. *Stromatothecia* is also believed to be parasitic. *Odontura*, *Xylopezia*, and most species of *Odontotrema* are probably saprophytes, living on dead plant material without associated algae. Other species (*Paschelkiella pini*, *Xerotrema megalospora*) occur in casual association with algae, from which it has been speculated that they derive a portion of their nutrition (Sherwood and Coppins, 1980). The lichenicolous genera (*Skyttea*, *Pleospilis*, *Lethariicola*) all fruit on relatively healthy portions of lichen thalli, and are believed to be parasymbiotic, that is, to derive their nutrition from living algal cells within the host lichen.

KEY TO GENERA

Numbers of species in a genus are indicated in parenthese following the generic name. No attempt has been made here to include unrelated genera which might be confused with *Odontotrema*. Descriptions of genera and species appear in alphabetic order following the key. The bitunicate genera *Xylopezia* and *Mycowinteria* are treated in detail in a separate paper (Sherwood-Pike and Boise, 1986).

1. Ascocarps ascolocular, with pseudoparaphyses branched and anastomosing apically. Asci thick-walled, ? bitunicate ... 2
1'. Ascocarps ascohymenial, with true paraphyses with free apices; asci not appearing bitunicate ... 3

2(1). Ascospores transversely septate. *Xylopezia* (5)
2'. Ascospores muriform. *Mycowinteria* (1)
3(1'). Ascospores muriform. *Xerotrema* (1)
3'. Ascospores simple or transversely septate ... 4
4(3'). On non-vascular cryptogams (lichens or bryophytes) 5
4'. On vascular plants ... 8
5(4). Ascospores filiform, long-cylindrical, or sigmoid . 6
5'. Ascospores ovoid or short-cylindrical ... 7
6(5). Ascospores long-cylindrical to filiform, multiseptate. On bryophytes. *Bryodiscus* (3)
6'. Ascospores sigmoid, 1-septate. On lichens. *Pleospilis* (1)
7(5'). Ascocarps with marginal hairs. Spores 0-1(-3) septate. On various lichens. *Skyttea* (10)
7'. Ascocarps without marginal hairs. Spores 3-septate. On *Letharia*. *Lethariicola* (1)
8(4'). Asci thin-walled, with a well-defined I+ blue apical ring (immersed Dermateaceae will key here). *Phragmiticola* (1)
8'. Asci without a well-defined I+ blue apical ring, mostly with a thick apical cap ... 9
9(8'). Ascospores ovoid or short-cylindrical ... 10
9'. Ascospores long-cylindrical or sigmoid ... 11
10(9). Ascocarps black, typically carbonaceous, radially striate; hymenial gel usually I+ blue. *Odontotrema* (10)
10'. Ascocarps brown, smooth, non-carbonized; hymenial gel I-. *Paschelkiella* (1)
11(9'). Apothecia immersed in a common stroma. Parasitic on *Nothofagus* . *Stromatothecia* (1)
11'. Apothecia solitary to gregarious. Saprophytes ... 12
12(11'). Asci 4-8 spored. *Coccomycetella* (1)
12'. Asci polysporous. *Odontura* (1)

ALPHABETICAL LISTING OF GENERA AND SPECIES

1. *Bryodiscus* Hein, Müller & Poelt, Svensk Bot. Tidskr. 65: 357 (1971).
Holotype species: *Bryodiscus grimmiae* Hein, E. Müller & Poelt

Ascocarps more or less superficial in leaf axils, globose, opening by a broad pore, radially striate. Margin black, partially carbonized, of small-celled pseudoparenchyma, lined internally with a layer of hyaline vertically-oriented cells. Asci cylindrical, thin-walled laterally, with a thickened apical cap, diffusely I+ blue, 4-8 spored. Paraphyses simple, septate. Ascospores long-cylindrical to filiform, transversely multiseptate.

Parasitic on bryophytes, northern Europe. Döbbeler and Poelt (1974) assigned the genus to the Dermateaceae, indicating that its affinities within the family were uncertain. The Dermateaceae sensu Nannfeldt (1932) and other authors has served in recent years as a repository for genera of immersed discomycetes (e.g. *Cryptodiscus*, *Pseudographis* Nyl.

Propolomyces Sherw., *Odontotrema*) whose development and ascus structure had not been studied in sufficient detail to allow definitive placement in a modern system of classification. Morphologically, *Bryodiscus* is much closer to *Odontotrema* and its allies than to *Dermea* Fr. *Bryodiscus* is readily separated from the other genera of the Odontotremataceae by its multiseptate spores and bryophilous growth habit.

There are three species of *Bryodiscus*, which can be distinguished as follows (key translated from Döbbeler and Poelt, 1974):

1. Mature spores 4-celled, mostly under 50 µm long. Ascocarps over 250 µm broad, not white-pruinose. On mosses. ... 2
2. Mature spores mostly 12-16 celled, 58-65 µm long. Ascocarps 150 - 250 µm broad, with a white-pruinose covering layer. On a variety of leafy liverworts; rarely on mosses. *B. hepaticarum*
    2(1). Spores thickened at both ends, 40-50 µm long. Asci 60-75 x 7-8 µm. On *Andraea.* *B. arctoalpinus*
    2'. Spores filiform, of equal thickness throughout their length, 32-40 x 1-1.5 µm. On *Grimmia.* *B. grimmiae*

1. *Bryodiscus arctoalpinus* Döbb. & Poelt, Svensk Bot. Tidskr. 68: 370 (1974).

2. *Bryodiscus grimmiae* Hein, E. Müller & Poelt, Svensk Bot. Tidskr. 65: 357 (1971).

3. *Bryodiscus hepaticarum* Döbb. & Poelt, Svensk. Bot. Tidskr. 68: 374 (1974).

Döbbeler and Poelt (1974) provide detailed descriptions of these species.

2. *Coccomycetella* Höhnel, Ann. Mycol. 15:309 (1917)
Holotype species: *Odontotrema belonosporum* Nyl.
[=*C. richardsonii* (Leight.) Sherw.]

Ascocarps immersed, solitary, orbicular, becoming partially erumpent, opening by a broad dentate pore. Margin black, carbonized, of small-celled textura intricata, with an internal periphysoidal layer. Asci cylindrical, with thin lateral walls and a thickened apex, I-, 4 or 8-spored. Ascospores long-cylindrical, sigmoid, with pointed ends, transversely septate. Paraphyses septate, unbranched; hymenial gel I+ blue.

On decorticated wood, chiefly of conifers, alpine and boreal, Europe and North America. *Coccomycetella* is distinguished from *Odontotrema* on the basis of ascospore shape and from *Odontura* on the basis of ascospore number. There is a single species, *C. richardsonii*.

Von Höhnel (1917) described *Coccomycetella* as a wood-inhabiting *Coccomyces,* bearing the same relationship to that genus that *Colpoma* does to *Lophodermium*. The asci

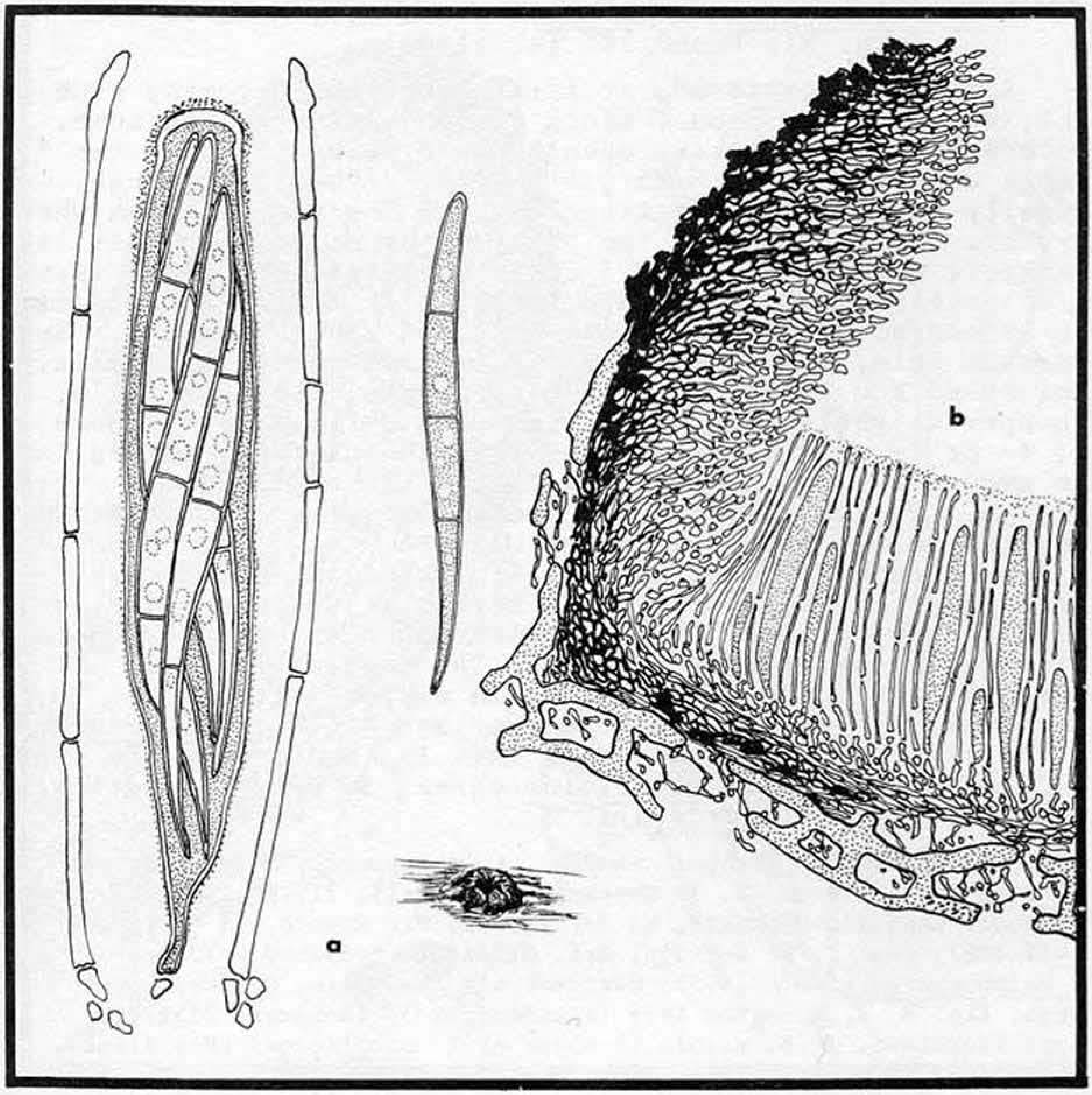

Figure 2. *Coccomycetella richardsonii*. a. Asci, paraphyses, and spores, x1500. b. Margin in cross section, x375. c. Habit sketch, x15. Drawn from Sherwood & Pike, 15.VIII.1978.

and ascocarp structure of *Coccomycetella* are, however, clearly not hypodermataceous, but are very similar to those of *Odontotrema*.

1. *Coccomycetella richardsonii* (Leighton) Sherw., *comb. nov.* (Fig. 1a, 2 a-d).

≡ *Odontotrema richardsonii* Leighton, J. Linn. Soc. (London) 9: 200 (1867)
= *Odontotrema belonosporum* Nyl., Obs. Pez. Fenn. 1: 34 (1868)
    ≡ *Crumenula belonospora* (Nyl.) Karst., Myc. Fenn. 1: 211 (1871)
    ≡ *Godronia belonospora* (Nyl.) Sacc., Michelia 2: 329 (1880)
    ≡ *Coccomycetella belonospora* (Nyl.) Höhnel, Ann. Mycol. 15: 309 (1917)

= *O. belonosporum* f. *simplicior* Wainio, Meddel. Soc. Faun. Fl. Fenn. 10: 147 (1883)

Apothecia scattered, at first immersed, becoming erumpent, 0.4 - 0.5 mm diam., black or somewhat grey-pruinose, globose, at first closed, opening by a pore to expose the deeply urceolate disc. Margin heavily carbonized, rough, radially striate, contracting and covering the hymenium when dry, ca. 60-70 µm thick, the outer layer of more or less isodiametric carbonized cells 5 µm in diameter, the inner layer of colorless cells oriented perpendicular to the surface of the ascocarp and imbedded in a gel, 3-4 µm in diameter. Subhymenium thin, resting on a layer of dark carbonized cells. Asci 60-65 x 6 (-8) µm, cylindric-clavate, nearly sessile, the apex slightly thickened, without a defined apical pore, I-, 4- or 8- spored; ascospores sigmoid-fusiform, coiled in the ascus, 1-3 (-5) septate, multiguttulate, 35-46 x 2 - 2.5 (-3) µm. Paraphyses filiform, mostly simple, 1.0 µm thick. Hymenial gel I+ blue. Anamorph unknown.

On bleached decorticate conifer wood, Scandinavia and North America. This species is better known as *Odontotrema belonosporum*, a later synonym which has been used in several different senses (Groves, 1965). The combinations in *Godronia* and *Crumenula* are based on misidentifications. Groves cited H-Karsten 2151 (a specimen of *Godronia urceolum*) as the type of *O. belonosporum*; this is incorrect. The type of *O. belonosporum* f. *simplicior* agrees in every respect with with that of *O. richardsonii*.

SPECIMENS EXAMINED: Europe: Sweden: Lule Lappmark, Muddus National Park, on *Picea* lignum, B. J. Coppins & L. Tibell, 21.VII.1977 (E). Finland: Lapponia Kemensis, ad Jerisjärvi, Par Muonio, på tallgren, 2.VII.1867, leg. J. P. Norrlin, det. Nylander, presumed holotype of *O. belonosporum* (H-NYL 4405); Ostrobottnia australis, Quarken, near Vaasa, leg. A. J. Malmgren 1859 (misidentified) (H-Karst. 2151); Lapp? Vasknieni, 1878, Wainio (?cotype of f. *simplicior*) (H); Kianta, Lehtovaara, 1879, E. Wainio (?cotype of f. *simplicior*) (H). USSR: Lps. Petsamo, Kuvernoorinkorki, ad corticem pini, 22.vi.1931, leg. V. Räsänen (H). North America: USA: Oregon, Jefferson Co., Camp Sherman, on wood of *Pinus*, 15.VIII.1978, leg. M. Sherwood & L. Pike; Oregon, Linn/Lane co. line, 2.IV.1984, leg. M. Sherwood-Pike (OSC); Oregon, Klamath Co., Odell Creek,10.VI.1984, leg. M. Sherwood-Pike; *Ibid*, Odell Lake, 7.VI.1984 (ZT). Canada: Fort Enterprise, no. 159, presumed holotype of *O. richardsonii* (K).

3. *Lethariicola* Grummann, Sydowia 22: 221 (1969)

Holotype: *Lethariicola sipei* Grummann, l.c.

Apothecia globose, densely gregarious, at first immersed, becoming erumpent, opening by means of radial fissures. Marginal hairs absent; margin thick, carbonized, of narrow interwoven hyphae imbedded in a brown matrix which becomes opaque and carbonaceous towards the exterior. Asci cylindrical, with a prominent apical thickening transversed by a median I- nonrefractive pore. Ascus membrane externally I+ diffusely blue; hymenial gel I-. Asci 8-spored. Paraphyses numerous, septate. Ascospores 3-septate, ovoid.

On lichen thalli. The only species, *L. sipei*, was des-

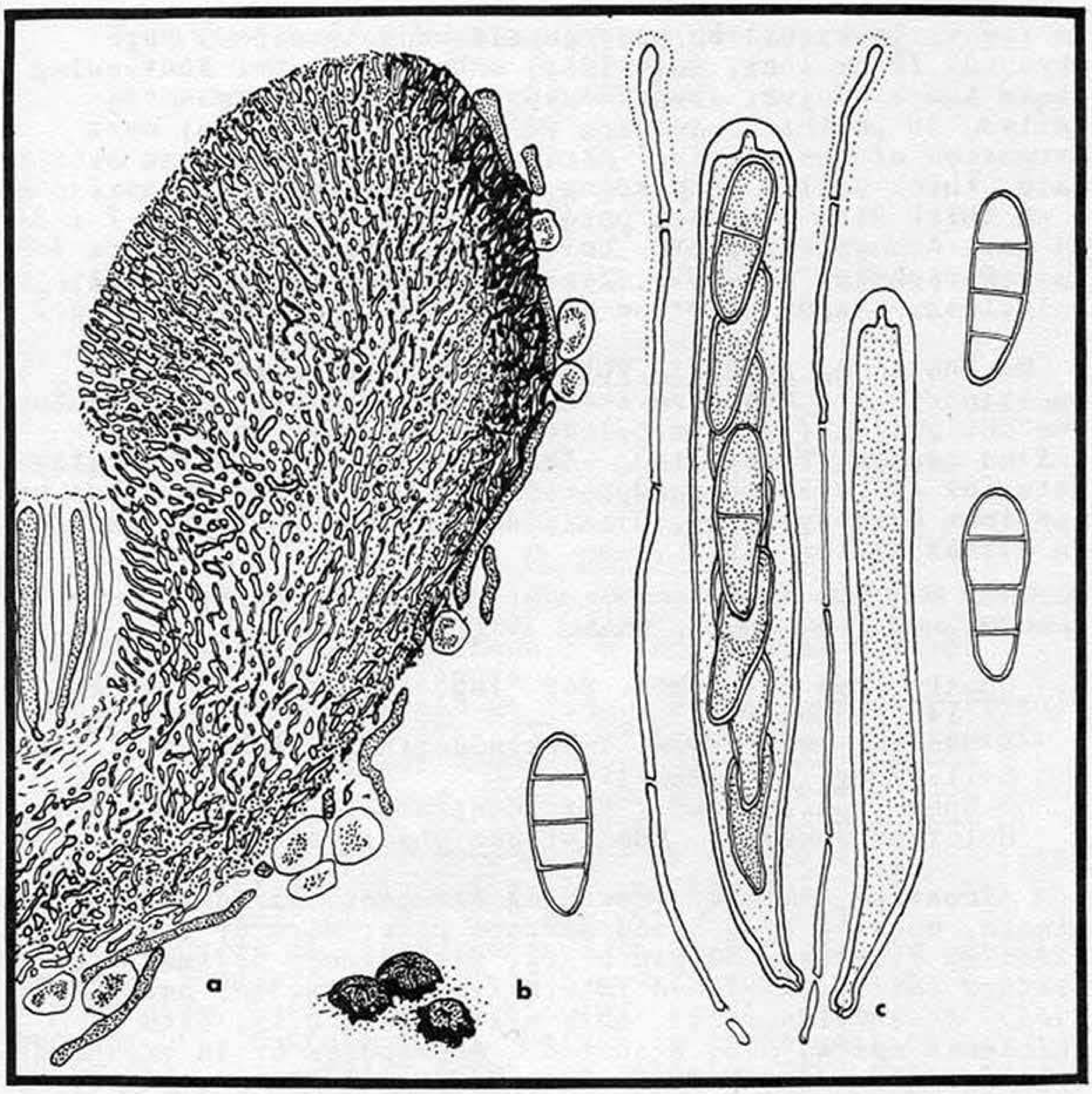

Figure 3. *Lethariicola sipei*. a. Cross section of margin, x375. b. Habit sketch, x15. c. Asci, paraphyses, and spores, x1500. Drawn from the holotype.

cribed from a single collection from Crater Lake in the western United States. A lichenicolous growth habit and very robust margin with poorly developed periphysoids distinguish *Lethariicola* from *Odontotrema*.

1. *Lethariicola sipei* Grummann, Sydowia 22: 221 (1969)
(Figure 3, a-c)

Apothecia densely gregarious to confluent, at first immersed, becoming erumpent, circular in outline, depressed-globose in cross section, remaining for a long time closed, opening by radial fissures, black, .3 - .5 mm diam. Margin in cross section up to 140 μm thick, of interwoven hyphae with the lumina 1.5 - 2.5 μm in diameter and thick, brown gelatinized walls, becoming brittle and carbonaceous towards the exterior; hyphae parallel to the surface of the ascocarp in the region of the flanks, vertically-oriented in the vicinity of the pore in closed ascocarps. Periphysoids 10 µm long, colorless, unbranched, not continuing above the hymenium. Subhymenium colorless, very small-celled, 20 µm thick, resting on a thick (40-50 µm) dark extension of the margin. Asci cylindrical, becoming saccate, thick-walled when young, with a distinct apical cap 2 µm thick with a median pore, 8-spored, 60-65 x 6.5-7 (-8-9) µm. Ascospores ovoid, colorless, 3-septate, 12-14 x 4-5 µm. Paraphyses numerous, filiform, unbranched, septate, colorless. Ascus membrane diffusely I+ blue; hymenial gel I-.

On thalli of Letharia vulpina, western United States. In addition to the type specimen, David Hawksworth has examined one collection (IMI 308462) collected by Amy Rossman in Yakima county, Washington. The original description cites material as having been deposited in both B and ORE, but no specimen corresponding to this description could be located in either OSC or ORE.

SPECIMEN EXAMINED: North America: USA: On Letharia vulpina, Crater Lake National Park, Oregon, August, 1953, F. Sipe 1227 (B).

4. Odontotrema Nyl., Mém. Soc. Imp. Sci. Nat. Cherbourg 5: 143 (1858)
≡ Odontotrema subgen. Trematodontium P. Sacc. & D. Sacc., Syll. Fung. 18: 150 (1906)
= Sphaeropezia Sacc., Bot. Centralbl. 18: 253 (1884).
Holotype species: Odontotrema phacidioides Nyl.

Ascocarps immersed, becoming erumpent, orbicular, determinate, opening by a broad dentate pore, more or less radially striate. Margin black, carbonized, of small-celled textura intricata, lined internally with hyaline periphysoids. Asci cylindrical, thin-walled laterally, with a thickened apical cap, 8-spored. Ascospores ovoid or short-cylindrical, 1-3 septate. Paraphyses filiform, septate, simple or sparingly branched. Hymenial gel I+ or I-. Anamorphs unknown.

Saprophytic on wood or coarse herbaceous stems, Europe and North America.

The taxonomic and nomenclatural history of Odontotrema has been summarized in the general introduction to the family, above.

KEY TO SPECIES

1. Growing on leaves or herbaceous stems ... 2
1'. Growing on wood or bark ... 5
    2(1). Margin reduced, without a prominent periphysoidal layer; epithecium brown. On Plantago. O. plantagineum
    2'. Margin thick, with prominent periphysoids; epithecium colorless ... 3
3(2'). Margin noncarbonized, fleshy. On culms of Nardus. O. diffidens
3'. Margin carbonized ...4

4(3') On leaves and stems of alpine Rosaceae; spores 10-17 x 2-3 µm. O. alpinum

4'. On Cassiope tetragona; spores 10-12 x 3 - 4.5 µm. O. cassiopes

5(1'). Ascospores 4.5-6 µm broad ... 6

5' Ascospores less than 4.5 µm broad ... 7

6(5). Spores 3-septate. O. minus

6'. Spores 1-septate. O. phacidioides

7(5'). Ascocarps robust, strongly erumpent, black, shining, up to 1.0 mm diam, spores 3 - 4.5 µm diam. O. majusculum

7'. Ascocarps smaller; spores 1.5-3.5 µm diam ... 8

8(7'). On bark. Margin white-pruinose. O. inculatum

8'. On decorticate wood. Margin black. ... 9

9(8'). Margin of ascocarp pale, obscurely fimbriate. O. oregonense

9'. Margin of ascocarp black, not fimbriate. O. phacidiellum

1. Odontotrema alpinum (Sacc.) L. Holm, Bot. Notiser 132: 80 (1979). (Figure 4)

≡ Heterosphaeria alpina Sacc., Michelia 2: 165 (1880)
≡ Sphaeropezia alpina (Sacc.) Sacc., Bot. Centralbl. 18: 253 (1884)
≡ Phacidium alpinum (Sacc.) E. Müller & Von Arx, Phytopath. Z. 24:360 (1955)
= Phacidium sieversiae E. Müller, Sydowia 12:207 (1958)
≡ Odontotrema sieversiae (E. Müller) Di Cosmo, Nag Raj & Kendrick, Can. J. Bot. 61: 42 (1983)

Ascocarps at first immersed in leaf tissue or petioles, becoming erumpent and at length nearly superficial, 0.4-0.6 mm diam, dark brown, orbicular, barely radially striate, opening by a dentate pore. Margin in cross section ca 70 µm thick, externally dark, the cellular structure obscured by amorphous granular inclusions, internally lined with branched periphysoids 1.5 µm diam widely spaced in a gel. Asci cylindrical, becoming slightly saccate at maturity, 55-60 µm long, 5 µm broad at the apex, the cap 2 µm thick with a median pore, 8-spored. Ascospores cylindric fusiform, (10-) 14-17 (-24 fide Muller, l.c.) x 2.0 - 3.0 µm, 3-septate. Paraphyses filiform, septate, 1 µm diam, not enlarged or branched apically. Hymenial gel I+ blue.

On leaves and petioles of herbaceous alpine Rosaceae, central Europe. The above description is taken from type and authentic specimens of Phacidium sieversiae on Sieversia (=Geum). The synonymy with O. alpinum is based on Holm's (1979) redescription of O. alpinum based on Saccardo's immature type specimen. Holm described the spores of O. alpinum as being 10-14 x 2 µm; Muller gives the spore dimensions of Phacidium sieversiae as 16-24 x 1.5-2 µm. I found no spores longer than 17 µm in the material that I examined, and suspect that the differences in spore dimensions between the types of O. alpinum and P. sieversiae are the result of differences in maturity.

Odontotrema alpinum is the type of Sphaeropezia, but

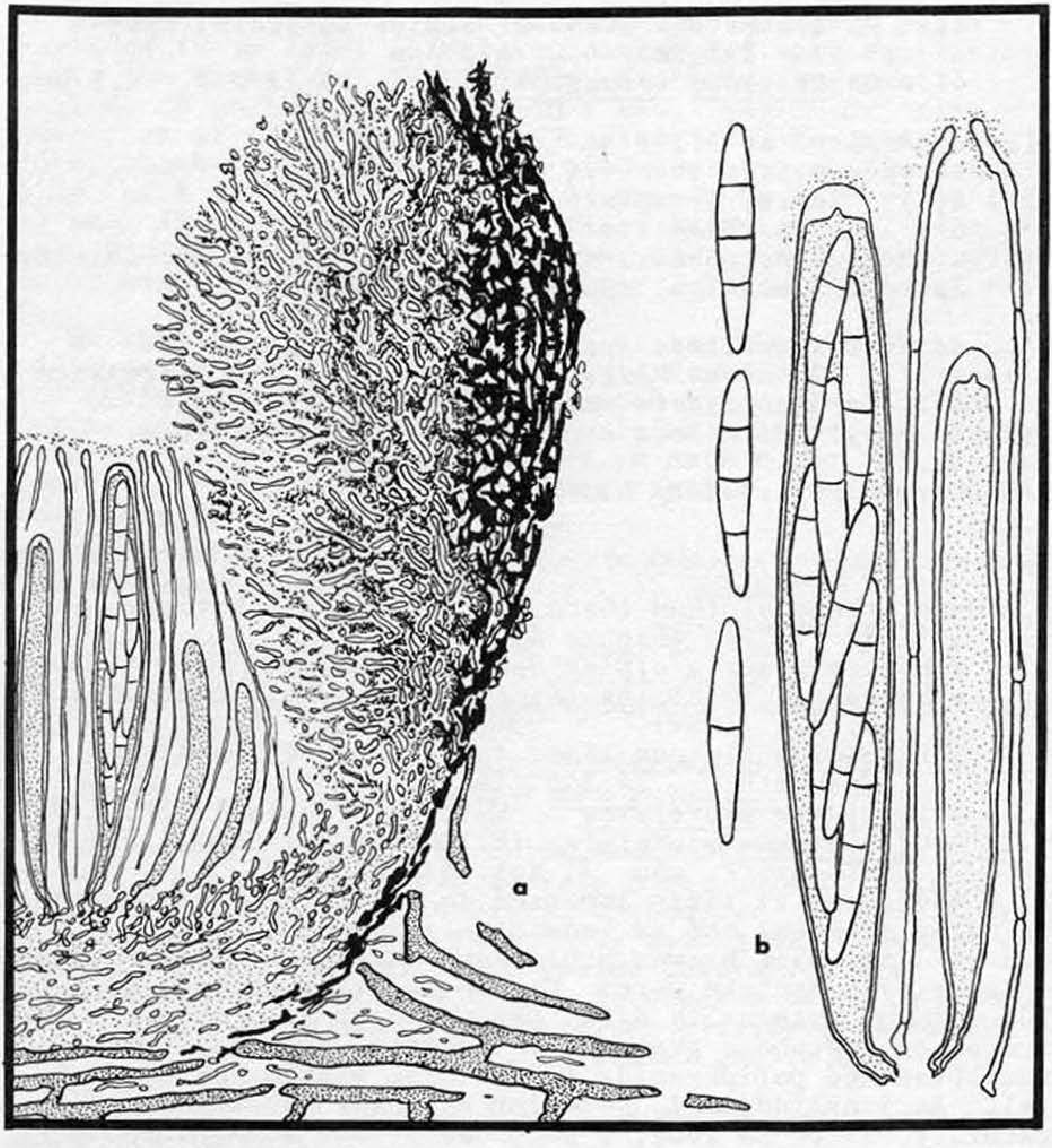

Figure 4. Odontotrema alpinum . a. Cross section of ascocarp, x750. b. Asci, paraphyses, and spores, x1500. Drawn from Müller, 28.8.1961.

is, as Holm (1979) concluded, 'in every respect a typical Odontotrema.'

SPECIMENS EXAMINED: Europe: France: Val Gueyras, St. Véroeu, auf Sieversia montana, 25.8.1954, leg. E. Müller, holotype of Phacidium sieversiae (ZT); Switzerland: Kt. Graubünden, auf Sieversia reptans, 23.8.1961, leg. E. Müller & R. A. Shoemaker.

2. Odontotrema anodontum Nyl., Flora 52:411 (1869)
= Mycowinteria anodonta (Nyl.) Sherw., Brittonia 38: 37 (1986)

Odontotrema anodontum is an older name for the fungus more commonly known as Winteria lichenoides (Rehm ex Sacc.) Rehm. The systematics of this and other excluded species referred to Xylopezia are discussed in a separate paper

(Sherwood-Pike and Boise, 1986).

3. Odontotrema belonosporum Nyl.
   = Coccomycetella richardsonii (Leight.) Sherw., q.v.

4. Odontotrema cassiopes (Rostr.) L. Holm, Sv. Bot. Tidskr. 69:147 (1975)
   ≡ Metasphaeria cassiopes Rostr., Consp. Fl. Grennland 3: 561 (1888)

Apothecia immersed, scattered, 250-200 µm diam, radially fissured, opening by a broad dentate pore. Subhymenium and basal excipulum hyaline, of small-celled textura angularis; upper margin thick and inrolled, heavily carbonized, with a thin internal periphysoidal layer. Asci cylindric, ca. 65 x 6 µm, 8-spored, with a thickened apical cap, I+ diffusely blue. Ascospores uniseriate, 10-12 x 3-4.5 µm, ellipsoidal, hyaline, 3-septate. Paraphyses filiform, septate, not apically thickened.

On dead leaves of Cassiope tetragona, Scandinavia, Greenland, and northern Canada. The above description is taken from Holm (1975).

5. Odontotrema concentricum Stirton, Trans. Proc. New Zealand Institute 16:406 (1883)
   ≡ Ocellularia concentrica (Stirton) Sherw., comb. nov.

Examination of the type specimen reveals this to be a corticolous lichen in the Thelotremataceae. The ascospores measure 30-50 x 6-9 µm, with lenticular cells.

SPECIMEN EXAMINED: New Zealand: Dr. C. Knight, recd. 11/83, holotype or isotype of Odontotrema concentricum (K).

6. Odontotrema diffidens Rehm, Ber. d. naturh. Ver. Augsburg 26:64 (1882) (as "diffindens") (Figure 5)
   ≡ Pyrenopeziza diffidens Rehm, Ascom. #256 (1875) (nom. nud.)
   ≡ Sphaeropezia diffidens (Rehm) Höhnel, Ann. Mycol. 15: 307 (1917)
   = Heterosphaeria nardicola Rehm, Ascom. #268 (1875) (nom. nud.)
   ≡ Crumenula nardicola (Rehm) Rehm, Ber. d. naturh. Ver. Augsburg 26: 67 (1882)

Apothecia solitary or gregarious, becoming erumpent and at length nearly superficial, circular in outline and in cross section, 0.5-0.7 mm diam, dark brown, not noticeably rough at low magnification, splitting open by 5 or 6 irregular radial fissures to expose the pale, deeply urceolate disc, closed when dry. Margin in cross section ca 75 µm thick, the basic structure consisting of loosely interwoven slender hyphae 1.5-2.0 µm in diameter immersed in a gelatinous matrix, the inner layer colorless or nearly so, periphysoidal, ca. 45 µm thick; periphysoids much-branched, hyphal rather than pseudoparenchymatous, the outer layer ca 30 µm thick, dark brown, the pigment localized as amorphous granules interspersed between the marginal hyphae. Basal

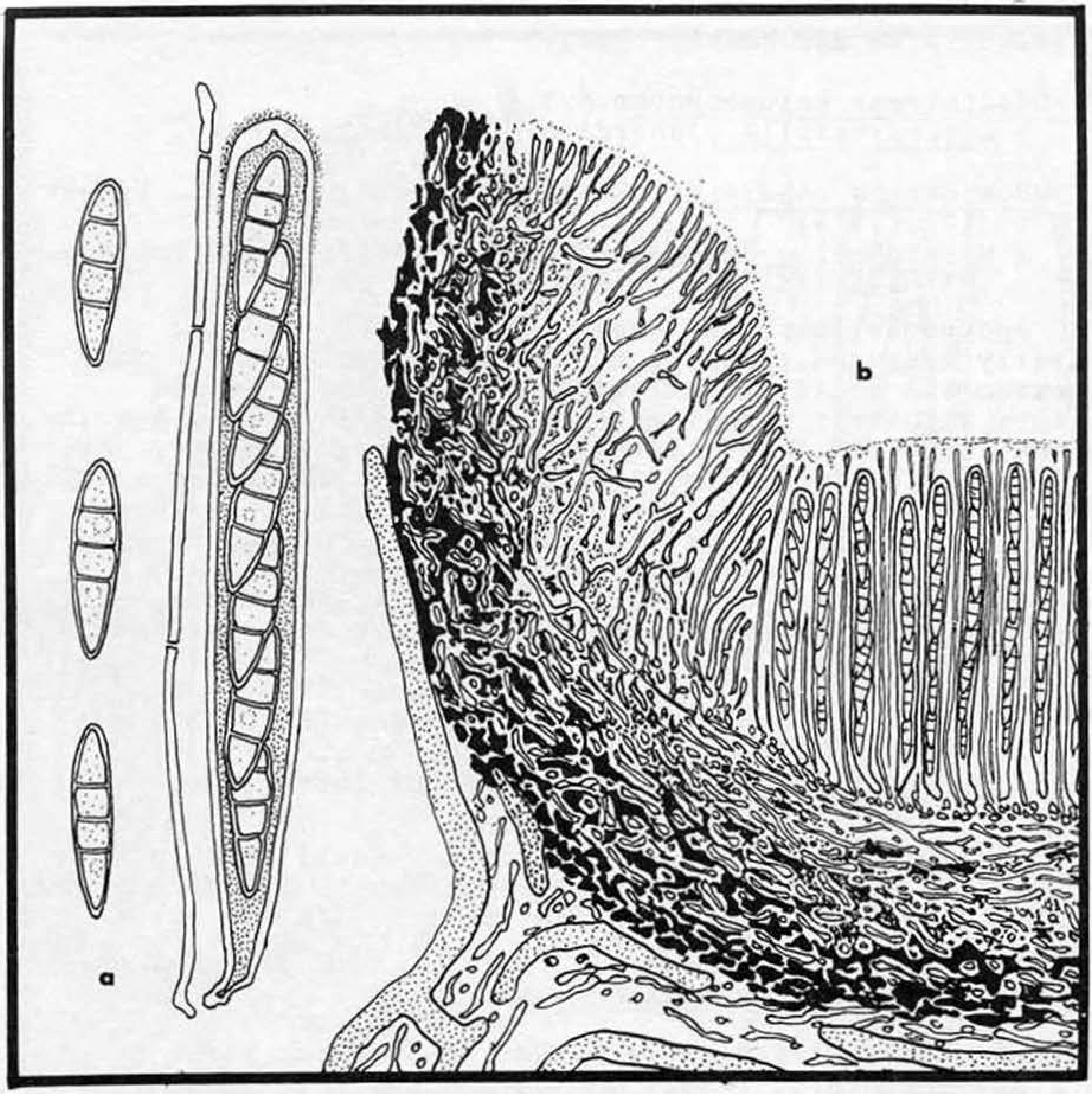

Figure 5. Odontotrema diffidens. a. Ascus, paraphysis and spores, x1500. b. Cross section of ascocarp, x450. Drawn from Rehm, Ascomyceten 256 (K).

stroma ca. 25 µm thick, with a structure similar to the outer layer of the excipulum, separated from the hymenium by 20 µm of nearly colorless loosely interwoven hyphae. Asci cylindrical, nearly sessile, 55-70 x 6 (-8) µm, the apex 3 µm thick, with a definite nonrefractive pore, the outer wall coated with diffusely I+ blue gel, 8-spored. Ascospores uniseriate, fusiform, thin-walled, 11-14 x 2.5-4 µm (12-15 x 4-5 µm fide Rehm). Paraphyses filiform, septate, mostly unbranched, 1 µm thick.

On dead leaves of Nardus stricta, Carex, and other grasslike monocots in glacial moraines, Switzerland and Tyrol. Rehm's description of ascospores 12-15 x 4-5 µm, constricted at the septa, suggests that he saw more mature material than the specimen I studied. Despite the unusual host this appears to be a good Odontotrema.

Because of its unstable substrate, O. diffidens is necessarily a more ephemeral fungus than the lignicolous Odontotremas, and exhibits several distinctive morphological adaptations reflecting its atypical ecology. As in Helotiales, the asci mature over a short period of time and most of the asci within an ascocarp are at approximately the same stage of development. The asci pack the hymenium, leaving little room for paraphyses, which are less numerous than in other species of Odontotrema. The margin becomes dark but not carbonized, and still exhibits its original cellular structure. It is apparent that the bulk of the pigmentation develops not in the walls of the hyphae themselves but in the gelatinous matrix which surrounds them, resulting in the final irregular and somewhat crumbly texture which characterizes the surface of the typical odontotremataceous ascocarp. This same type of pigmentation can also be seen in O. minus, and is probably characteristic of the genus as a whole. It is also found in some Rhytismataceae (David Minter, personal communication). The distinctiveness of the excipular structure of Odontotrema can be appreciated by comparing it with the superficially similar dermateaceous genus Pyrenopeziza, in which the dark outer excipulum is composed of relatively large, tightly-packed polygonal or globose cells, and the pigmentation is localized in the cell walls.

SPECIMENS EXAMINED: Europe: Auf Nardus stricta, Oetz Tyrol, leg. Rehm 8.1874, Rehm Ascomyceten 256, presumed type of O. diffidens S,K). Switzerland: Kt Graubünden, on Carex aterrima, 31.7.1977, leg E. Müller (ZT).

7. Odontotrema firmatum Nyl., Flora 64:188 (1881)

Odontotrema firmatum is a synonym of Xylopezia hemisphaerica (Fr.) Sherw. The genus Xylopezia Höhnel, whose affinities lie within the Loculoascomycetes, is discussed in a separate paper (Sherwood-Pike and Boise, 1986).

8. Odontotrema furfuraceum Lorton, Bull. Soc. Mycol. France 30: 226 (1914).

Minute, 0.5 mm diam, immersed in wood, black, the margin sparsely fringed with 15 x 4 µm, 1-2 septate brown hairs, copiously white-pruinose. Asci oblong-cylindric, short-stipitate, 70 x 15 µm. Paraphyses bent and rugulose, not branched. Spores ovoid, elongate, 3-septate, constricted at the septa, 15 x 6 µm. (Translation of original description).

On decaying limbs of Robinia pseudacacia on the ground, Issy l'Ereque.

The place of deposition of the type of this species is unknown; it is not at PC. The description, if accurate, suggests that the species is not an Odontotrema, but its exact systematic position is unclear.

9. Odontotrema hemisphaericum (Fr.) Rehm in Rabenh., Krypt.-Fl. 2, 1(3): 205 (1888)

≡ Xylopezia hemisphaerica (Fr.) Sherw., Brittonia 38: (1986)

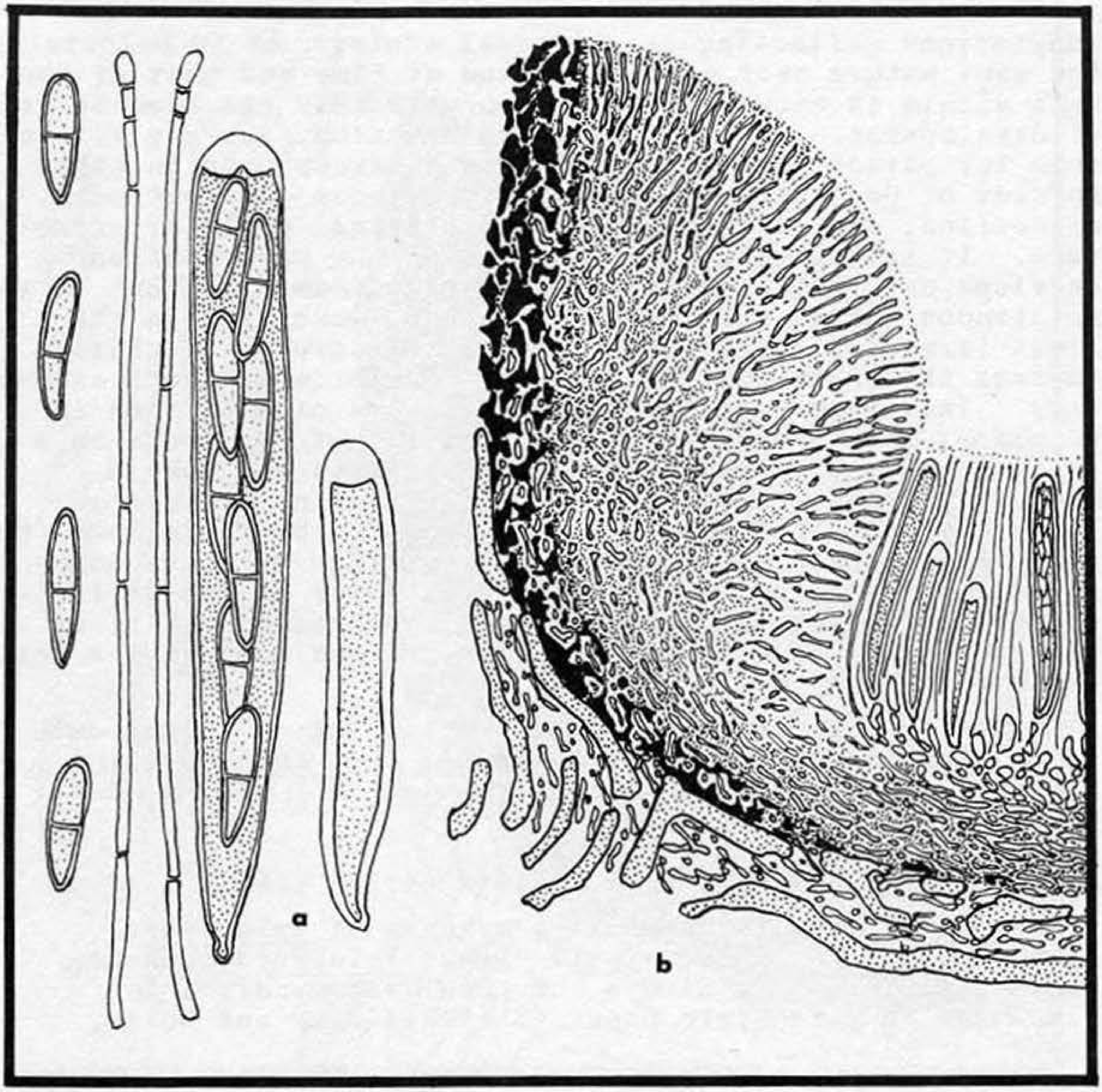

Figure 6. Odontotrema inculatum. a. Asci, paraphyses and spores, x1500. b. Cross section of ascocarp, x450. Drawn from the holotype.

9. Odontotrema inclusum (Pers.) P. Karst., Rev. 146 (1885)
≡ Xylopezia inclusa (Pers.) Sherw., Brittonia 38: 42 (1986)

The systematics of Xylopezia are discussed in a separate paper (Sherwood-Pike & Boise, 1986).

11. Odontotrema inculatum (P. Karst.) P. Karst, Acta Soc. Flora Fenn. 2(6): 146 (1885) (Figure 1b; 6)
≡ Encoelia inculata P. Karst., Bidrag Kannedom Finlands Natur Folk 19:220 (1871)
≡ Cenangium inculatum (P. Karst.) Sacc., Syll. Fung. 8: 567 (1889)

Ascocarps scattered to gregarious or becoming confluent on bark, at first immersed, becoming partially erumpent, 0.5-0.7 mm diam., orbicular, black with a whitish pruina, opening by a dentate pore to expose the deeply urceolate pale ochraceous disc, the margin delicately radially striate.

Margin in cross section up to 100 µm thick, the outermost portion consisting of widely spaced hyphae and coarse black granular material, lined on the inner face with ca. 80 µm of gelatinous tissue consisting of a median layer of more-or-less randomly oriented hyphae imbedded in brown gel and an inner layer of branched hyaline periphysoids 1.5 µm diam., widely spaced in a gel. Subhymenium ca. 30 µm thick, composed of interwoven hyphae 1-2 µm diam. imbedded in a brownish gel, without a blackened basal layer. Asci cylindrical, with an apical cap 3.0 µm thick with a median indentation, 55-60 x 6-7 µm, 8-spored. Ascospores irregularly biseriate, colorless, obovate-obclavate, 1-septate, 8-12 x 2.5 - 3 (?-3.5) µm. Paraphyses filiform, numerous, mostly unbranched, septate, 1.0 µm diam. below, enlarged to 1.5-2.0 µm above, imbedded in an I+ gelatinous matrix.

On bark of Picea excelsa, Finland. This species is unquestionably an Odontotrema, differing from O. minus in having a thicker margin and smaller 1-septate spores. It is known only from the type specimen.

SPECIMEN EXAMINED: EUROPE: Finland: Tavastia australis, Tammela, Mustiala, ad corticem Abietis in pariete, 13.IV.1869, leg et det. P. A. Karsten, holotype of O. inculatum (H-Karst 2150).

12. Odontotrema ipomoeae Tilak, Mycopath. Mycol. Appl. 28: 81 (1966)

"Apothecia scattered and variously oriented on dead stems and twigs, black, broadly ellipsoid, 270-480 x 180-250 µm, opening by narrow cleft. Outermost wall cells heavily thickened. Asci originating from basal hymenial layer, hyaline, bitunicate, shortly pedicellate, cylindrical to clavate, paraphysate, 100-130 x 15-18 µm. Paraphyses grow much above the asci and form epithecium-like structure. Ascospores hyaline, somewhat biseriate, ellipsoid, transversely septate, transverse septa up to 8, measuring from 35-45 x 8-12 µm." (Original description by Tilak, l.c.)

On dead twigs of Ipomoea sp., India. I received no answer to inquiries for the type of this species, supposedly deposited in the herbarium of Marathwada University. There is nothing in the description to suggest that it is an Odontotrema. The combination of very large ellipsoid transversely septate spores and black ascocarps opening by a longitudinal slit suggest a lichenized fungus with an inconspicuous thallus, such as Graphis or Opegrapha, rather than an inoperculate discomycete.

13. Odontotrema longius Nyl. in Leighton, Lichenfl. p. 389 (1871) (Fig. 1 F)
=Durella atrocyanea (Fr.) Höhnel, Ann. Mycol. 16: 210 (1918)

The above synonymy was noted by Dennis (1956), and is confirmed by numerous specimens in Kew Herbarium.

Leighton sent a specimen to Nylander with the query 'Is this Odontotrema phacidioides? The sporidia are twice the size of your O. minus and 3-septate.' Nylander annotated this specimen with spore measurements and the name O. longius Nyl., and sent Leighton a description of the species, which

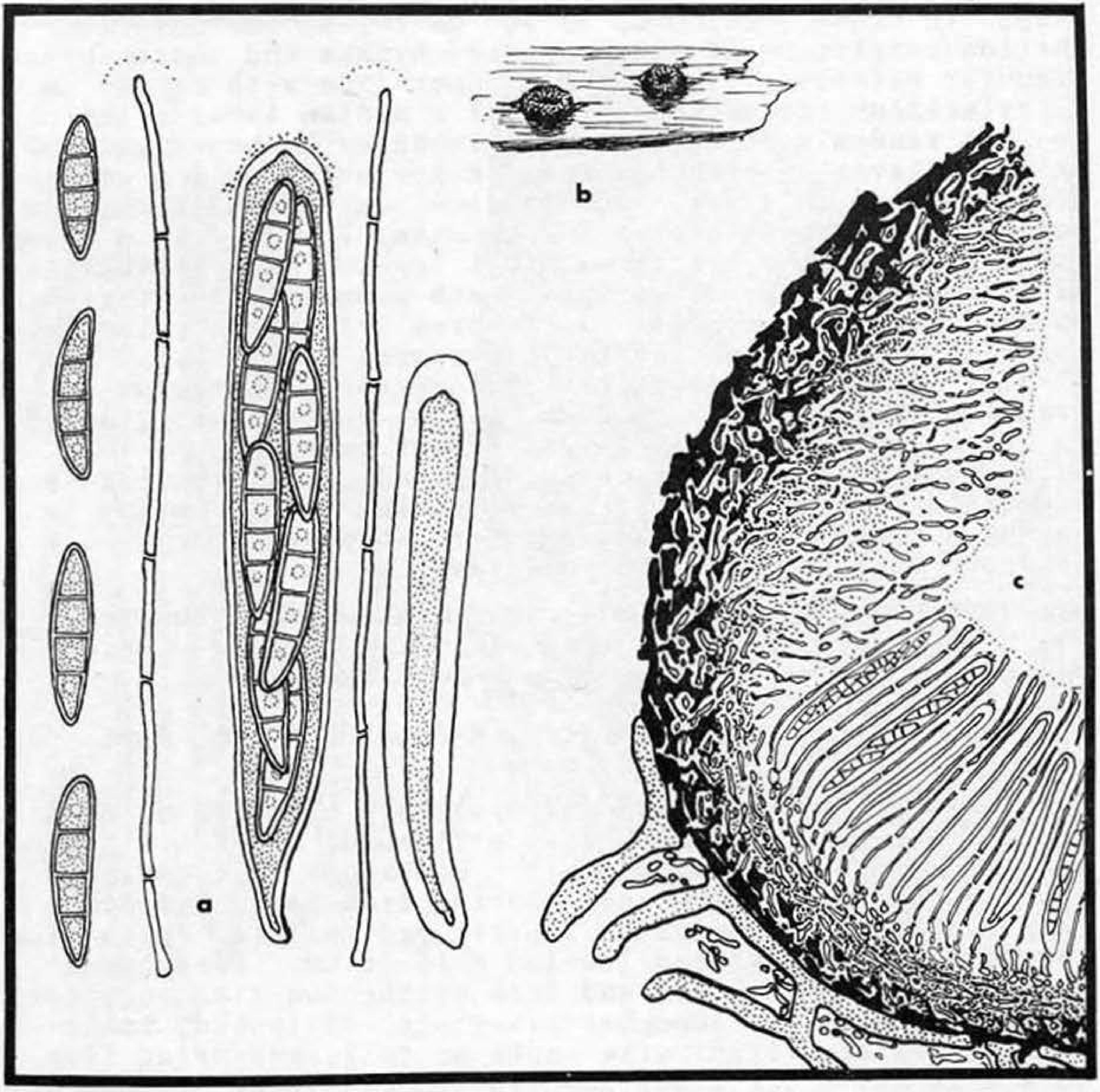

FIGURE 7. Odontotrema majusculum. a. Asci, paraphyses and spores, x1500. b. Habit sketch, x15. c. Cross section of ascocarp, x450. Drawn from California Fungi 1287 (H).

Leighton published. This specimen (H-Nyl 4400) in Nylander's herbarium, although without collection data, must be regarded as the holotype, since it is the only specimen definitely known to have been examined by Nylander when he drew up the description. Leighton's Lichenes Brittanici Exsiccati 409, also mentioned in the protologue, is consequently a paratype, unless it is a duplicate of the material sent to Nylander. Nylander's specimen contains both Durella atrocyanea and Xylopezia hemisphaerica. It is probable that the description was based on the former, but the two species have similar ascospores, and the statement in the protologue that the margin is '...eventually obliterated' may refer to the Xylopezia.

SPECIMENS EXAMINED: Europe: England: Powyn, 1875, WAL[eighton](K); Whitchurch, Shropshire, 1872, WAL (K); Pulley, Salm, 1871, WAL (K); Brae Meole, W. Shrewsbury, 1870, W. A. Leighton (K); Cirencester, Gloucestershire, W. Joshua, Crombie, Lich. Brit. Exs. 190 (K); Leighton, Lichenes Britannici 409, paratype (K); H-Nyl 4400, holotype of O. longius (H).

14. Odontotrema majusculum Rehm, Hedwigia 21:115-116 (1882) (Fig. 1c, 7)
= Odontotrema minus f. salicella Kauffm., Pap. Mich. Acad. Sci., Art. Lett. 1:110 (1923)

Apothecia scattered on bleached decorticate wood, at first immersed, becoming strongly erumpent, black, shining, obscurely radially striate, 0.3 - 1.0 mm diam., opening by a broad non-dentate pore.

Margin in cross section ca. 10-20 µm thick below, up to 70 µm thick above, distinctly 2-layered, the outer layer ca. 20 µm thick, heavily carbonized, the inner layer consisting of branched periphysoids ca 2 µm diam. widely spaced in a gelatinous matrix. Subhymenium colorless, resting on a carbonaceous base. Asci cylindrical, nearly sessile, 55-60 x 6-8 µm, with a thin apical cap. Ascospores 8/ascus, biseriate, thin-walled, narrowly ellipsoid, 3-septate, not constricted at the septa, 10-15 x 3-4 µm. Paraphyses filiform, septate, 1 µm thick, not branched or enlarged apically. Hymenial gel faintly I+ blue.

On decorticated wood, chiefly of conifers, reported from the Alps and western North America. The type of O. minus f. salicella is in poor condition, but the characters present, host, and locality are consistent with O. majusculum rather than O. minus.

SPECIMENS EXAMINED: Europe: Austria: Auf Nadelholz-brettern eines Zaunes im Griesburg-Thal in Tyrol, Dr. Arnold 8/1865, type of O. majusculum (S). North America: USA: On decorticated Populus monilifera limbs, Sheridan, Montana, alt. 8000 ft., Mrs. Fitch, Herb. Rehm 7025 (S); On wood of Abies magnifica, Silver Lake, Lassen Co., California, L. Bonar 15.VIII.1965, California Fungi 1287 (H, UC); California, King's Canyon National Park, elev. 6500 ft., M. Sherwood & R. Clifford, 29. XII.1980 (OSC); Colorado, Tolland, Sept. 11, 1920, type of O. minus f. salicella (MICH).

15. Odontotrema minus Nyl., Herb. Mus. Fenn. 91 (1859)
≡ Patellaria minor (Nyl.) P. Karst., Myc. Fenn. 1: 233 (1871)
≡ Odontotrema hemisphaericum var. minus (Nyl.) Rehm, Ber. Bayr. bot. Ges. 13:165 (1912)
Fig. 1D; 8

Apothecia scattered to gregarious on bleached decorticated wood, at first immersed, becoming erumpent, 0.3-0.6 mm diam., orbicular, dark brown to black, opening by a dentate pore to expose the deeply sunken pale ochraceous disc, the margin rough, with coarse radial striations. Margin in cross section 35-50 µm thick, the outermost layer consisting of large dark brown or black granules, with little or no hyphal structure, lined on the inner face with ca. 25 µm of sparingly branched periphysoidal hyphae 1.5 µm diam. widely spaced in a gel which becomes pigmented above and near the junction with the carbonized layer. Subhymenium colorless, ca. 10 µm thick, resting on a thin continous black layer.

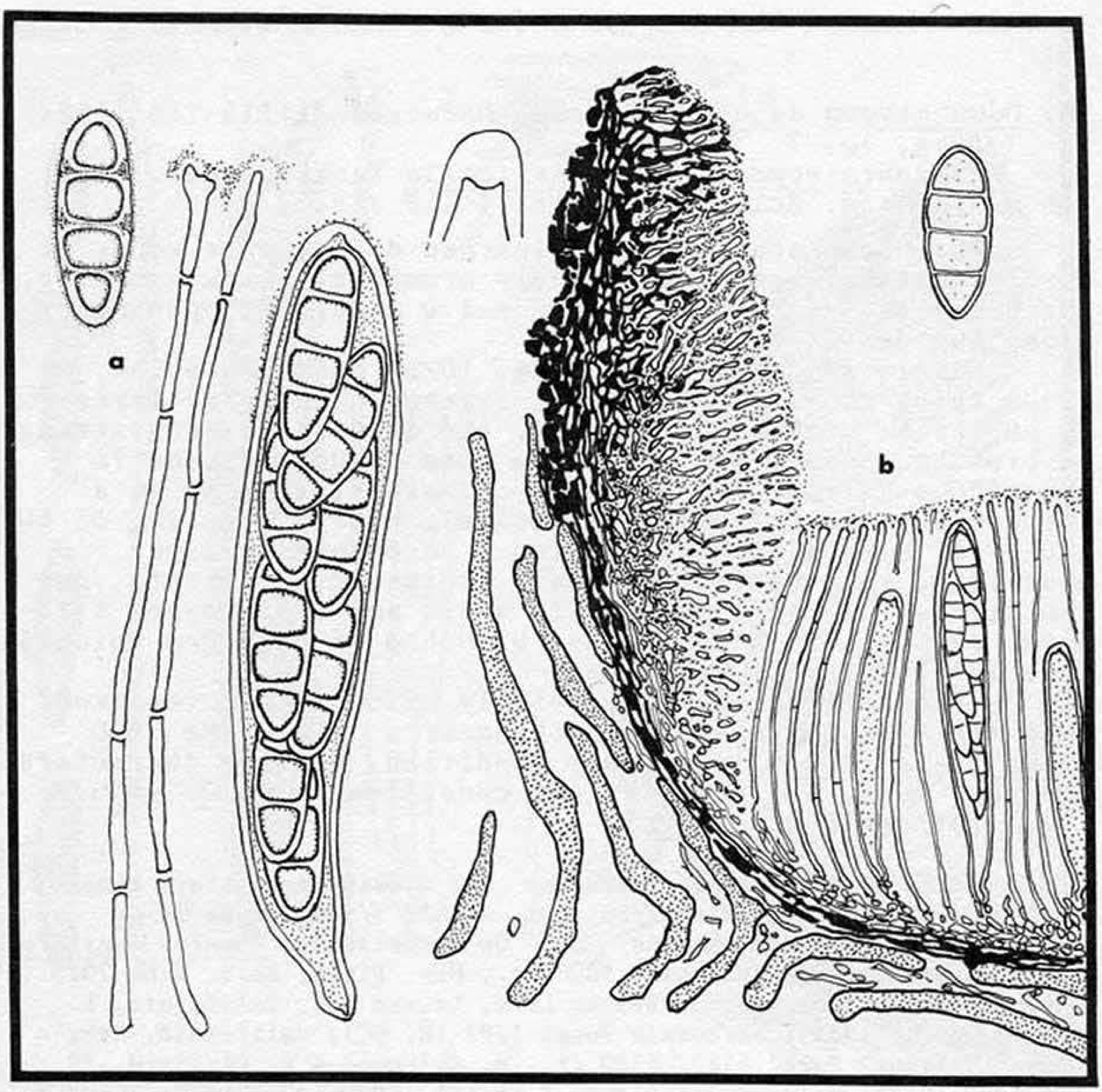

FIGURE 8: Odontotrema minus. a. Asci, paraphyses and spores, x1500. b. Cross section of ascocarp, x750. Drawn from Coppins & Tibell 6016.

Asci cylindrical, subsessile, with a distinct apical cap when young, becoming thin-walled and less markedly capitate when mature, 8-spored, 55-65 x 8-11 µm. Ascospores biseriate, colorless, ellipsoid or slightly obclavate, 3-septate, scarcely constricted at the septa, slightly thick-walled, 11-15 x 4.5 - 6 µm. Paraphyses filiform, mostly unbranched, septate, 1 - 1.5 µm diam., slightly enlarged above, firmly cemented in an I+ blue gel.

On hard weathered wood, chiefly of conifers, Scandinavia and the Alps, apparently common in Finland. Published reports of this species from Britain and North America are based on Xylopezia hemisphaerica. Some of the specimens examined (Coppins & Tibell 6016; Rehm Ascomyceten 368; Fellman, Kola, 1863; Roivainen 17.VII.1955, on Salix and Sorbus) have spores whose walls turn faintly blue in iodine following treatment with KOH; others, including the type, have I- spores. I am unable to determine any consistent correlation between I+ blue spores and morphological characters, distribution, or host range. It may be a function of the way the specimen was handled following collection.

Nylander gave spore sizes of 11-15 x 6-7 µm in his original description of *O. minus*. None of the material I examined had spores broader than 6 µm. It is possible that Nylander based his descriptions partly on other species, since there are examples of *Durella atrocyanea* and *Xylopezia hemisphaerica* labelled as *O. minus* in his herbarium. Both of these taxa have spores somewhat larger than *O. minus*.

The herbarium of the University of Helsinki includes numerous examples of this species determined by Nylander. Of the three specimens in Nylander's herbarium itself, one (4398) is correctly identified but was collected long after the species was published, and another (4399), also clearly not type material, is *Xylopezia inclusa*. The remaining specimen (4397) is undated, but comes from Nyland, the area mentioned in the original description, and is annotated in Nylander's handwriting. There is one additional specimen in the general collections which was collected by Nylander at Helsingfors (Helsinki, in Nyland) in 1858 and may also represent type material; it is not an obvious duplicate of 4397. Both specimens are in good condition and represent the same species. They are in agreement with the protologue and with the most common recent application of the species name. I here designate H-NYL 4397 as lectotype of *O. minus*, regarding the specimen in the general herbarium as a paratype.

SPECIMENS EXAMINED: Europe: Sweden: Norbotten, Luppio, J. P. Norrlin (H); Häsingland, Ängersjö, Coppins & Tibell 6016, 6.VIII.1977 (E). Austria: Rehm, Ascomyceten 368, on *Larix*, Rottenkogel bei Windisch-Matesi, Tyrol. Arnold 8.1874 (H;K). Finland: Tavastia, Tammela, Herb. Karsten 2154, 2155, 2156, 2158, 2159, 2160, 2161, 2162 (H); Herb. Lichenum Fenniae 147, Tavastia, Evo, on *Pinus*, J. P. Norrlin, 1874 (H); Tavastia, Evo, J. P. Norrlin 1874 (H); Tavastia, Evo, J. P. Norrlin 237, 314 (H); Tavastia, Tammela, Teurois, 1868 (H); Karsten, Fungi fenn. Exs. 261, Mustiala (K); Rabenh., Fungi Europaei 2647, Mustiala, Karsten X.1881 (K); Tavastia, Apikkala, J. Norrlin 1863 (H); Tavastia, Teurois, on *Pinus*, Blomquist & Norrlin, 1866 (H); Nylander & Norrlin, Herb. Lich. Fenn. 771, Savonia, Pieksämäki, on *Picea excelsa*, Norrlin 18.VIII.1880 (H); Kuusamo, on *Picea excelsa*, Matti Laurila 26.VI.1938 (H); Lichenes fenn. exs. 676, Kuusamo, Salla, on *Picea excelsa*, M. Laurila 30.VI.1937 (H); Abo, Merimasku, P. A. Karsten 1860 (H); Nyland, Helsinki, W. Nylander 1858, lectoparatype (H); Helsinki, n.d. (H); Porojärvet, on *Salix glauca*, L. & H. Roivainen, 17.VII.1955 (H); Porojärvet, on *Sorbus aucuparia*, L. Ollila & H. Roivainen, 21.VII.1955 (H); Inari, O. Ruoranan, 7.VIII.1920 (H); Lieksa, Halliovaara, E. Wainio, 1875 (H); Kuusamo, E. Wainio, 1877 (H); Repola, Koroppi, E. Wainio, 1875 (H);Kl. Kurkijaki, Tervu, lacus Laataka, V. Räsänen & M. Laurila, 20.VI. 1936 (H); Nyland, n.d., lectotype of *O. minus* (H-NYL 4397). USSR: Karelia, Petrosawolsk, A. Kullem, 1863 (H); Karelia, Muola, Pallila, A. Kihlman, 22.X.1893 (H); Karelia, Mjatusova, F. Elfving 22.X.1875 (H); Karelia, Pielisjärvi, M. Laurila, 11.VII.1936 (H).

16. *Odontotrema molle* Velen., Monogr. Disc. Bohem. 57 (1934)
= *Xylopezia inclusa* (Pers.) Sherw., Brittonia 38: 42 (1986)

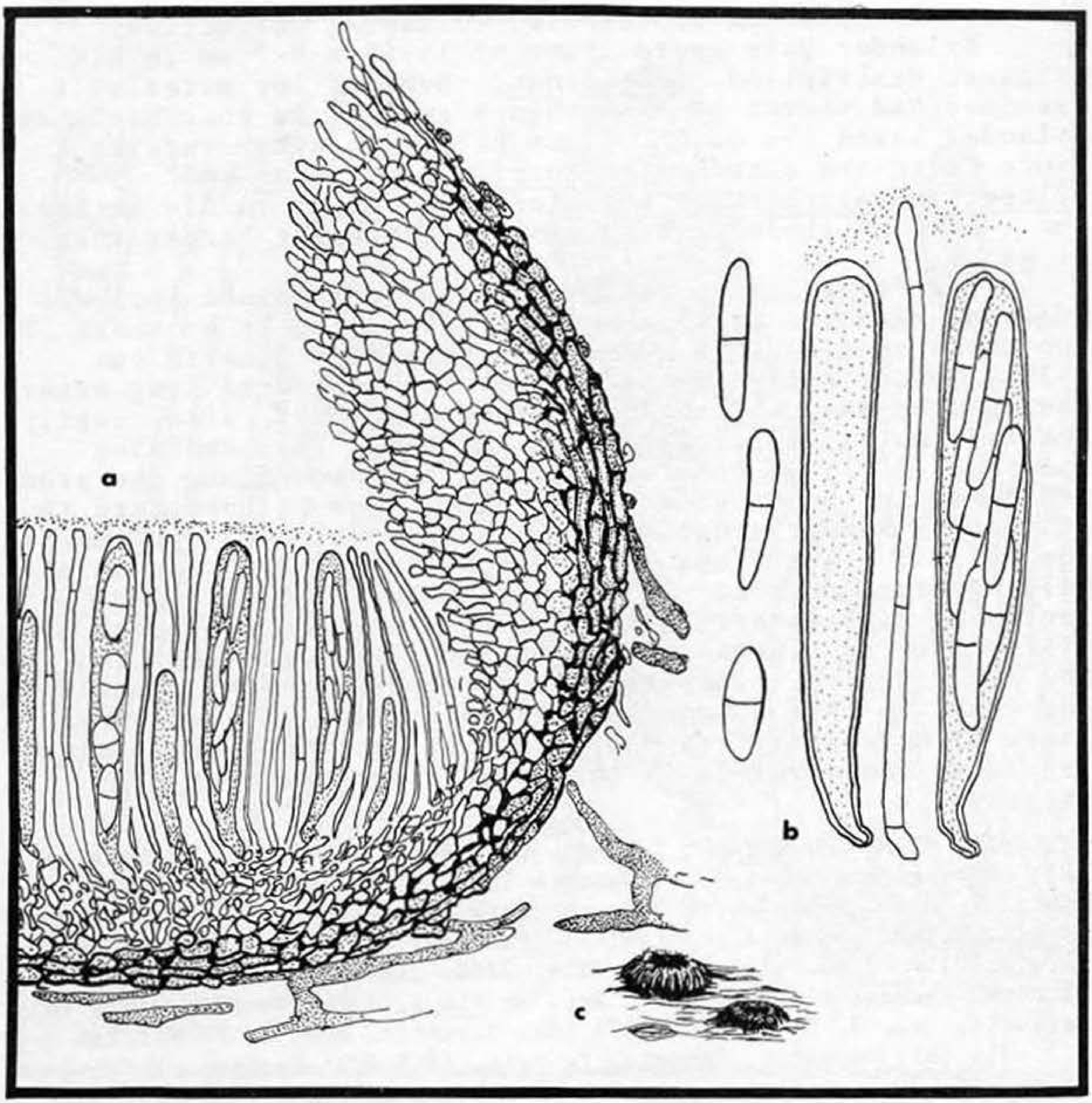

FIGURE 9. Odontotrema oregonense. a. Cross section of ascocarp, x750. b. Asci, paraphysis and spores, x1500. Drawn from the type.

17. Odontotrema oregonense Sherw., sp. nov. (Fig. 9)

Apothecia solitaria vel gregaria, primitus clausa et immersa, dein erumpentia, poro dentato dehiscentia, orbicularia, atra, latit .25 - .5 mm. Margo extus nigro, non carbonaceo, intus periphysoideus pseudoparenchymatis praedito. Asci unitunicati, primo cylindrici, apice haud incrassati, 40-45 x 5 (-7) m, in iodo non caerulescentes, 8-spori. Sporae cylindricae, hyalinae, 1-septatae, 10-13 x 1.5-2.5 m. Paraphyses filiformes, apice incrassatae, 1.5 m diam., in iodo caerulescentes. In ligno decorticato Pini, Purshii, et Artemisii, Oregon, USA.

HOLOTYPUS: Oregon, Klamath Co., on Purshia tridentata, MP 12 on Highway 31 S. of La Pine, elev. ca. 4500 ft. 9 June 1984, leg. M. Sherwood-Pike (BPI). Isotypus: IMI 288167.

ADDITIONAL SPECIMENS SEEN: North America: USA: Oregon, Lake Co., on Pinus ponderosa, Long Hollow, Paisley, elev. 5200 ft. M. Sherwood-Pike (BPI; IMI 288166); Oregon, Lake Co., on Artemisia tridentata, MP 17 on rd. 330 S. of Paisley, Elev. 5400 ft. M. Sherwood-Pike, 8.VI. 1984 (BPI; 288165).

Apothecia solitary or gregarious, at first immersed, becoming erumpent and at length nearly superficial, circular, .25-.5 mm broad, black, with fine radial striations, opening by a round pore with a pale grey and obscurely fimbriate rim to expose the deeply urceolate dark ochraceous disc. Margin in cross section ca 40 µm thick, the outer layer of thick-walled dark hyphae 2-3 µm diam, the cells with their long axes parallel to the surface, not carbonized, continuous over the base of the ascocarp, the inner layer composed of colorless pseudoparenchyma, the cells 2-3 µm diam., roughly isodiametric, with short colorless periphysoids on the inner face; periphysoidal hairs becoming longer towards the summit of the margin. Subhymenium of small colorless pseudoparenchyma, resting on dark marginal tissue. Asci cylindrical, 40-45 x 5(-7) µm, the apical cap not prominent, 8-spored. Ascospores cylindrical, 1-septate, 10-13 x 1.5-2.5 µm. Paraphyses filiform, septate, mostly unbranched, 1.5 µm diam., a little enlarged apically. Hymenial gel I+ blue.

On dry decorticate wood of conifers and desert shrubs at high elevations, Eastern Oregon, USA. The white rim surrounding the pore, visible with a hand lens, is a good field character for this species.

18. Odontotrema phacidiellum Nyl., Flora 57:316 (1874) (Figure 1e, 10)

Ascocarps scattered to gregarious, at first immersed in bleached decorticated wood, becoming partially erumpent, 0.2-0.6 mm diam., black, radially striate, opening by a dentate pore to expose the deeply urceolate pale ochraceous disc. Margin in cross section nearly 100 µm thick, the outer layer black and carbonaceous, the inner layer consisting of ca. 70 µm of intricately branched, almost moniliform periphysoidal hyphae 1.5 - 2 µm diam., widely spaced in a gel, the gel darkening at the interface between the two layers. Subhymenium ca. 20 µm thick, of colorless interwoven hyphae 1.5 - 2 µm diam., resting on a blackened basal crust ca. 15 µm thick. Asci cylindrical, capitate when young but not markedly so when mature, the membrane externally diffusely I+ blue, 55-60 x 5-7 µm, 8-spored. Ascospores biseriate, cylindrical, suballantoid, 1-septate, 11-13(-15) x 2.5 - 3.5 µm. Paraphyses numerous, filiform but sometimes swollen near the septa, septate, branched near the base, 1 µm diam. below, enlarged to 1.5- 2 µm above, firmly cemented in an I+ blue gelatinous matrix.

On decayed wood of an unidentified Angiosperm, Finland, known only from the type specimen, which seems to be slightly immature, since few of the asci contain spores. Odontotrema phacidiellum is similar morphologically to O. inculatum, but differs in having a well-developed black basal layer beneath the hymenium and in having more moniliform paraphyses.

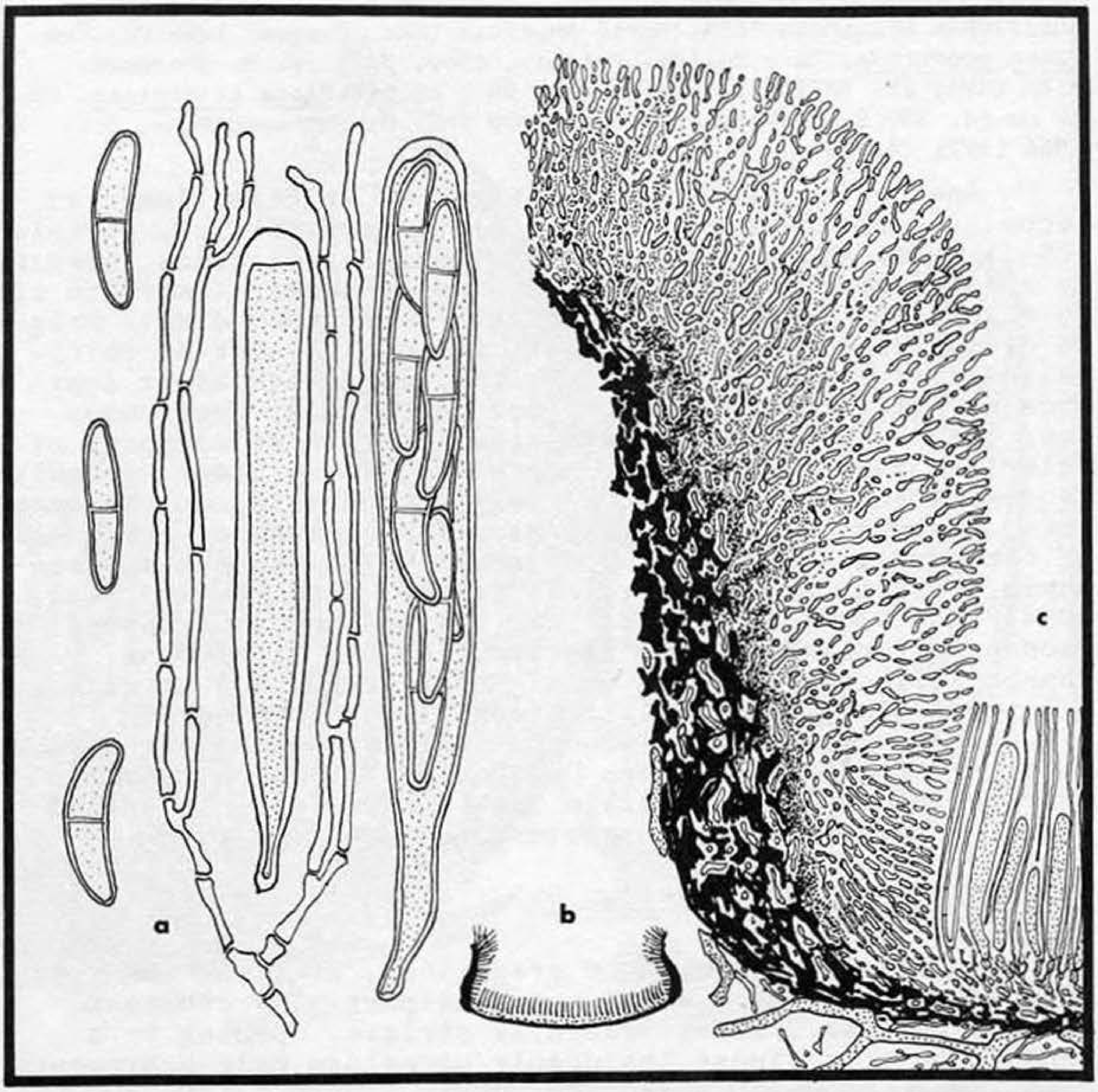

Figure 10. Odontotrema phacidiellum. a. Asci, paraphyses and spores, x1500. b. Cross section of ascocarp, x55. c. Cross section of ascocarp, x450. Drawn from the type.

The external appearance of the two species is also different. As the two species also inhabit rather different substrates (Angiosperm wood versus conifer bark) it seems likely that they are distinct.

SPECIMENS EXAMINED: Europe: Finland: Tavastia borealis, Pihlajavesi, E. Lang nr. 175, 1871 (H-NYL 4401, holotype; H, isotype)

19. Odontotrema phacidioides Nyl., Mém. Soc. Imp. Sci. Nat. Cherbourg 5: 143 (1858) (Figure 11)

Ascocarps scattered on bleached decorticate wood, at first immersed, then becoming erumpent, 0.8 - 1.0 mm diam., first closed, then opening by a central pore to expose the hymenium. Margin heavily carbonized, smooth or delicately radially striate, said by Nylander to become dentate, ca.

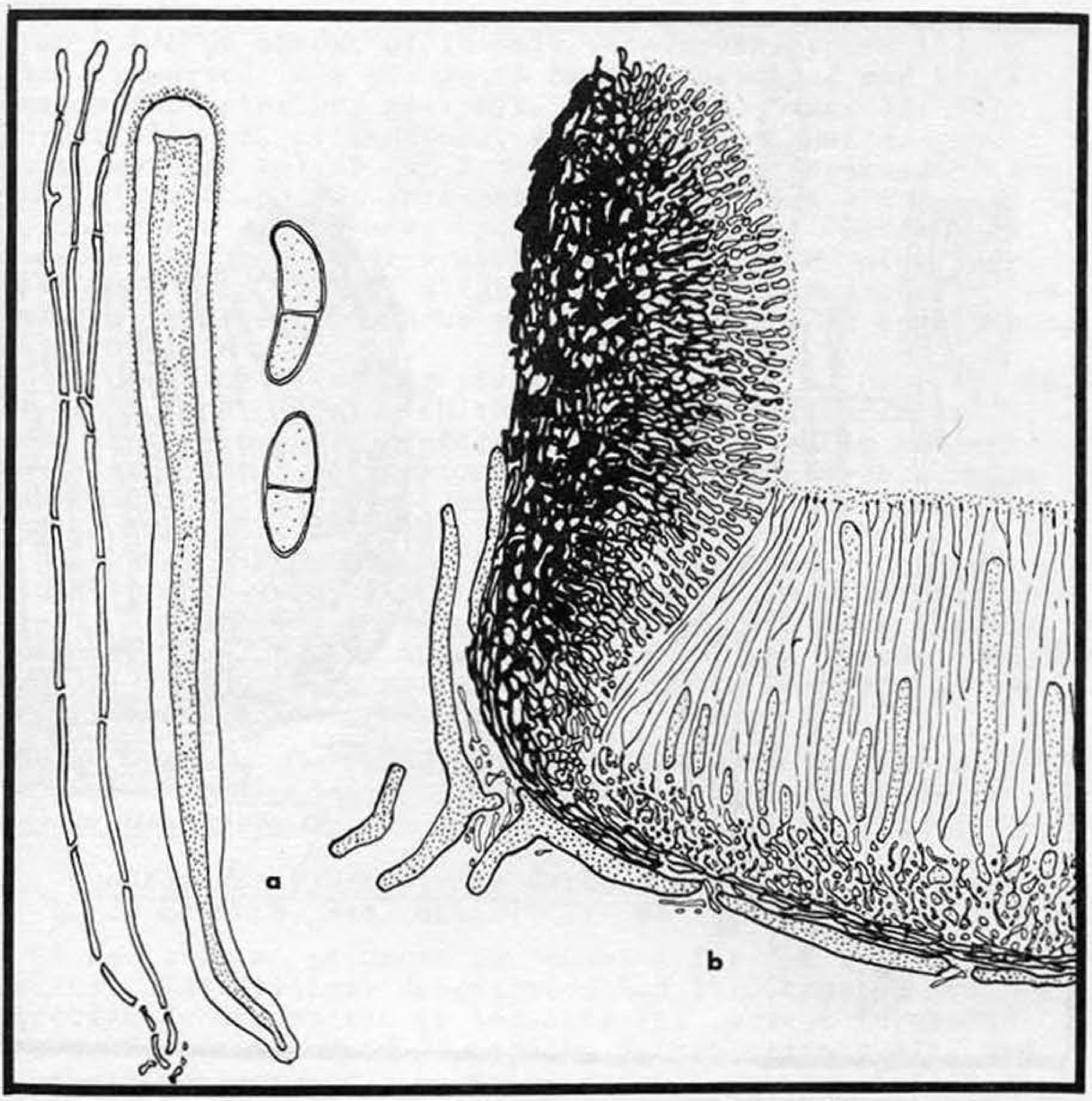

Figure 11. *Odontotrema phacidioides*. a. Ascus, paraphyses, and spores, x1500. b. Cross section of ascocarp, x450. Drawn from the holotype.

80 µm thick, with an inner layer of colorless hyphae 2 µm diam., oriented perpendicular to the surface and closely spaced in a gel, and a thick outer carbonized crust. Subhymenium ca. 20 µm thick, resting on a thin basal stroma of carbonized cells. Asci cylindrical, nearly sessile, at least 70 µm long and 6 µm wide, thick-walled with a thickened apex when young, the outer surface diffusely blue in KOH and iodine, 8-spored; ascospores 12-19 x 3.5-5.5 µm, thin-walled, inequilateral, 1-septate. Paraphyses numerous, filiform, 1 µm broad, septate, branched, slightly enlarged above, cemented in a gel.

On wood of *Ilex aquifolium*, Corsica. This species, the type of *Odontotrema*, is unfortunately known only from a single collection. This specimen is not fully mature. Although the species cannot be characterized completely, it is clearly congeneric with the more familiar *O. minus*, and seems to be a distinct species, distinguished by the broad 1-septate spores and perhaps also by its occurrence in a warm Mediterranean area, since most species of *Odontotrema* are boreal. It is also reminiscent of immature specimens of

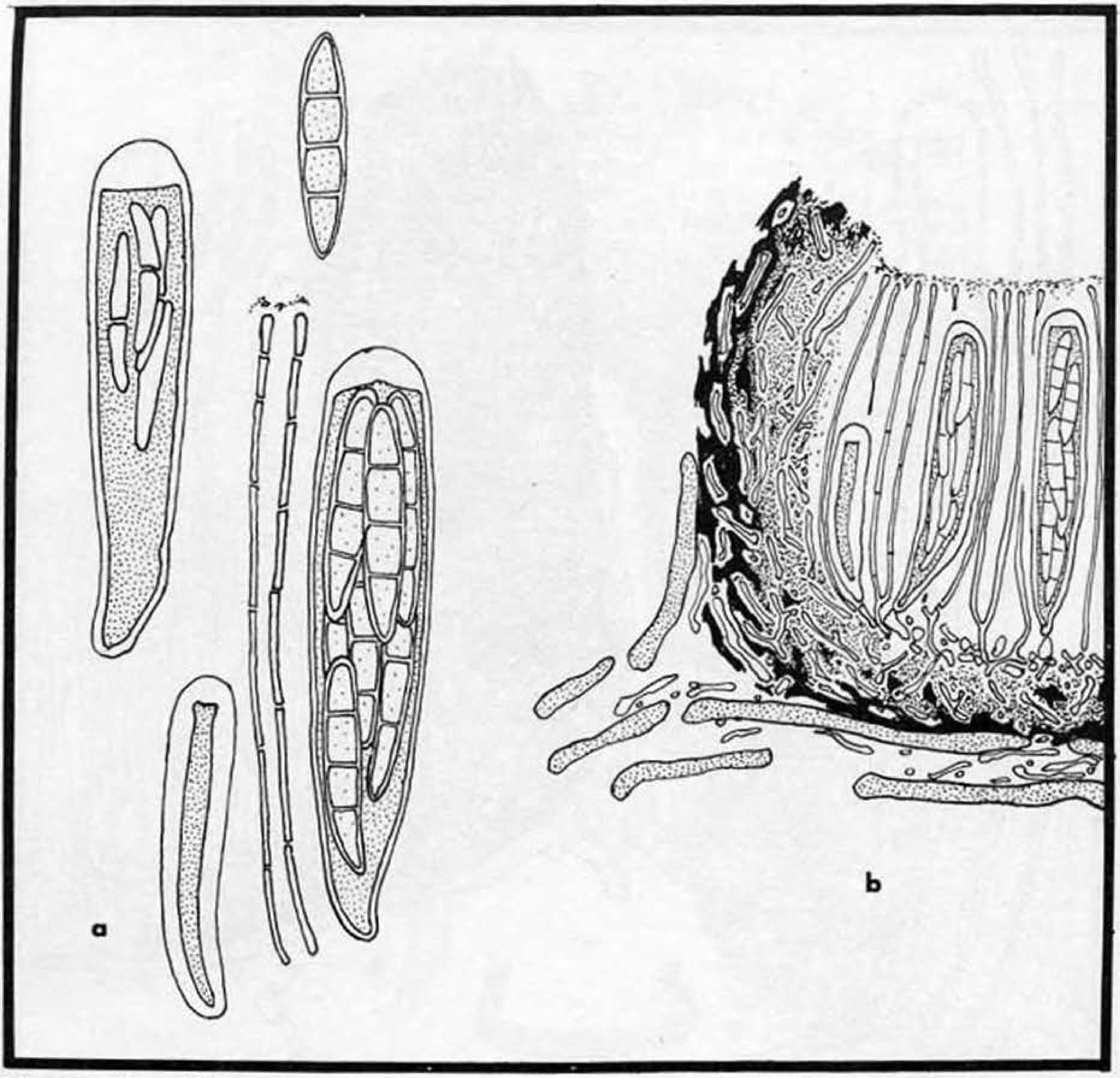

Figure 12. Odontotrema plantagineum. a. Asci, paraphyses, and spores, x1500. b. Cross section of margin, x750. Drawn from the holotype.

O. majusculum.

SPECIMENS EXAMINED: Europe: Corsica: Ad lignum vetustus ilicis, Léveillé (H-NYL 4403, lectotype, designated here, of O. phacidioides; H-NYL 4402, same collection data and appearing to be part of the same specimen, presumably an isotype).

20. Odontotrema pini Rommell
≡ Paschelkiella pini Sherw., q.v.

21. Odontotrema plantagineum (P. Karst.) P. Karst., Acta Soc. Fauna Flora Fenn. T2, 6:147 (1884)
≡ Trochila plantaginea P. Karst, Myc. Fenn. 1:247 (1871) (Fig. 12)

Ascocarps at first immersed in decaying peduncles, becoming erumpent, gregarious, at first closed, splitting open by means of radial fissures early in development and appearing discoid at maturity, the disc not covered by inrolled margin when dry. Margin and disc black when dry, disc dull greyish-brown when rehydrated. Margin and basal layer 15-20 µm thick, of loosely interwoven hyphae 1-2 µm diam., immersed in a gel which becomes hardened and black towards the exterior; periphysoids absent. Asci 40(-50) x 6-8 (?-16) µm, cylindrical, sessile, thick-walled when young, with an apical cap 2-3 µm thick not traversed by a pore, I-, 4-8 spored; ascospores 13-17 (-25) x 3-4 (-4.5) µm, colorless, 3-septate, cylindric-fusiform. Paraphyses numerous, unbranched or branched near the base only, septate, 1 µm diam. below, slightly enlarged above, the apices cemented in brown amorphous material, forming an epithecium; hymenial gel I-.

On decaying flowering stalks of Plantago major, Finland. Karsten's type, from which the above description is drawn, contains only a few apothecia, and it is possible that the sample sectioned was immature. Certainly the measurements I obtained for asci and spores are significantly smaller than Karsten's, which are given in parentheses.

Because of the lack of hymenial iodine reactions and discoid growth habit, this species is anomalous in Odontotrema. The ascus structure, however, is more like that of an Odontotrema than an immersed Dermateaceous fungus, and the marginal tissues seem to be a very reduced form of the type usual in the Odontotremataceae.

SPECIMEN EXAMINED: Europe: Finland, Tavastia australis, Tammela, Mustiala, ad Plantago major, 23.X.1870, leg P. Karsten, holotype of Trochila plantaginea (H-Karst 2164).

22. Odontotrema rauzabagense Sathe & Mogarkar, Marathwada U. J. Science, Nat. Sci. 16(9): 64 (1977)

I received no response to requests for the type of this species. The original description and illustration are not sufficiently diagnostic to indicate its correct taxonomic placement. It was said to open by a transverse cleft, and to have bitunicate asci, a thick epithecium, and 5-7 septate spores 25-35 x 6-10 µm. This description is reminiscent of O. ipomoeae (q.v.) and suggests that the taxon is a lichenized species of Graphidales.

23. Odontotrema rehmianum Höhnel, Sitzungsber. Kaiserl. Akad. Wien, Math.-Naturwiss. Kl. Abt. 1: 1207 (1906)
= Zignoella fagina Feltg., Pilzfl. Luxemb. Nachtr. 3: 292 (1903), fide Hohnel (1917).

24. Odontotrema rhopalospermum Kirschst.
≡ Phragmiticola rhopalospermum (Kirschst.) Sherw., q.v.

25. Odontotrema richardsonii Leighton
≡ Coccomycetella richardsonii (Leight.) Sherw., q.v.

26. Odontotrema subintegrum Nyl.
= Xylopezia inclusa (Pers.) Sherw. Brittonia 38:42 (1986)

27. Odontotrema xylophagum Massal., Atti Mem. Accad. d' Agricolt., Sci., Lett., Arti et Comercio di Verona ser. 4, 3: 66 (1902)
= Xylopezia inclusa (Pers.) Sherw., Brittonia 38:42 (1986)

6. *Odontura* Clem., Gen. Fungi 65 (1909)
≡ *Beloniella* (Sacc.) Boud., Bull. Soc. Mycol. France 1:119 non *Beloniella* Th. Fr. (1877)
≡ *Belonium* subgen. *Beloniella* Sacc., Consp. gen. discom. 219 (1884)
≡ *Odontotremella* Rehm, Ber. Bayr. Bot. Ges. 13:166 (1912)

Holotype species: *Odontotrema rhaphidosporum* (Rehm) Rehm

Ascocarps immersed, becoming partially erumpent, lignicolous, opening by a broad dentate pore. Margin black, externally carbonized, composed of small-celled textura intricata, lined internally with periphysoids. Asci cylindrical, becoming saccate, not prominently capitate when mature, I-, polysporous. Paraphyses filiform, septate, not branched. Ascospores long-cylindrical, curved, septate.

On dry decorticate wood, chiefly of conifers, alpine and boreal, Europe. There is a single species, *Odontura rhaphidospora*.

1. *Odontura rhaphidospora* (Rehm) Clem., Gen. Fungi 65, 174 (1909)
≡ *Pyrenopeziza rhaphidospora* Rehm, 26 Ber. Naturh. Ver. Augsburg 75 (1882)
≡ *Odontotrema rhaphidosporum* (Rehm) Rehm in Rabenh., Krypt.-Fl. ed. 2, 1(3): 207 (1888)
≡ *Belonium rhaphidosporum* (Rehm) Sacc., Syll. 8: 495 (1889)
≡ *Beloniella rhaphidospora* (Rehm) Boud., Bull. Soc. Mycol. France 1:119 (1885)
?= *Leptorhaphis pyrenopezizoides* Rehm, Ascom. no. 298 (nom. nud.)
= *Ramonia athallina* Sherw., Mycotaxon 6: 186 (1977)

This distinctive species, which is not uncommon in appropriate habitats, has been a source of confusion to mycologists, including the present author. Its characters are adequately illustrated in the description of *R. athallina*, cited above. The polysporous condition of the asci results from disarticulation of initially filiform spores to form (32?) 1-septate part-spores measuring 16-25 x 1.2-2.0 μm. The species is discussed briefly by Holm and Holm (1977), who found it on juniper in Norway.

SPECIMEN EXAMINED: Europe: Sweden: Hälsingland, Ängersjö par., Nature Reserve Bukolen, on *Picea* stump, B. J. Coppins & L. Tibell, 6.VIII.1977 (Coppins 6014).

7. *Paschelkiella* Sherw., *gen. nov.*

Holotype species: *Odontotrema pini* Rommell

> Ascocarpi primo immersi, minuti, orbiculari vel leniter elongati, non erumpescentes, primo clausi, per porum non dentatum aperientes. Margo non carbonacea, ex cellulis minutis in matrice gelatinosa composita. Periphysoidea nulla. Asci cylindrici, apice incrassati, 8-spori, in iode diffuse caerulescentes. Ascospori hyalini, transverse septati

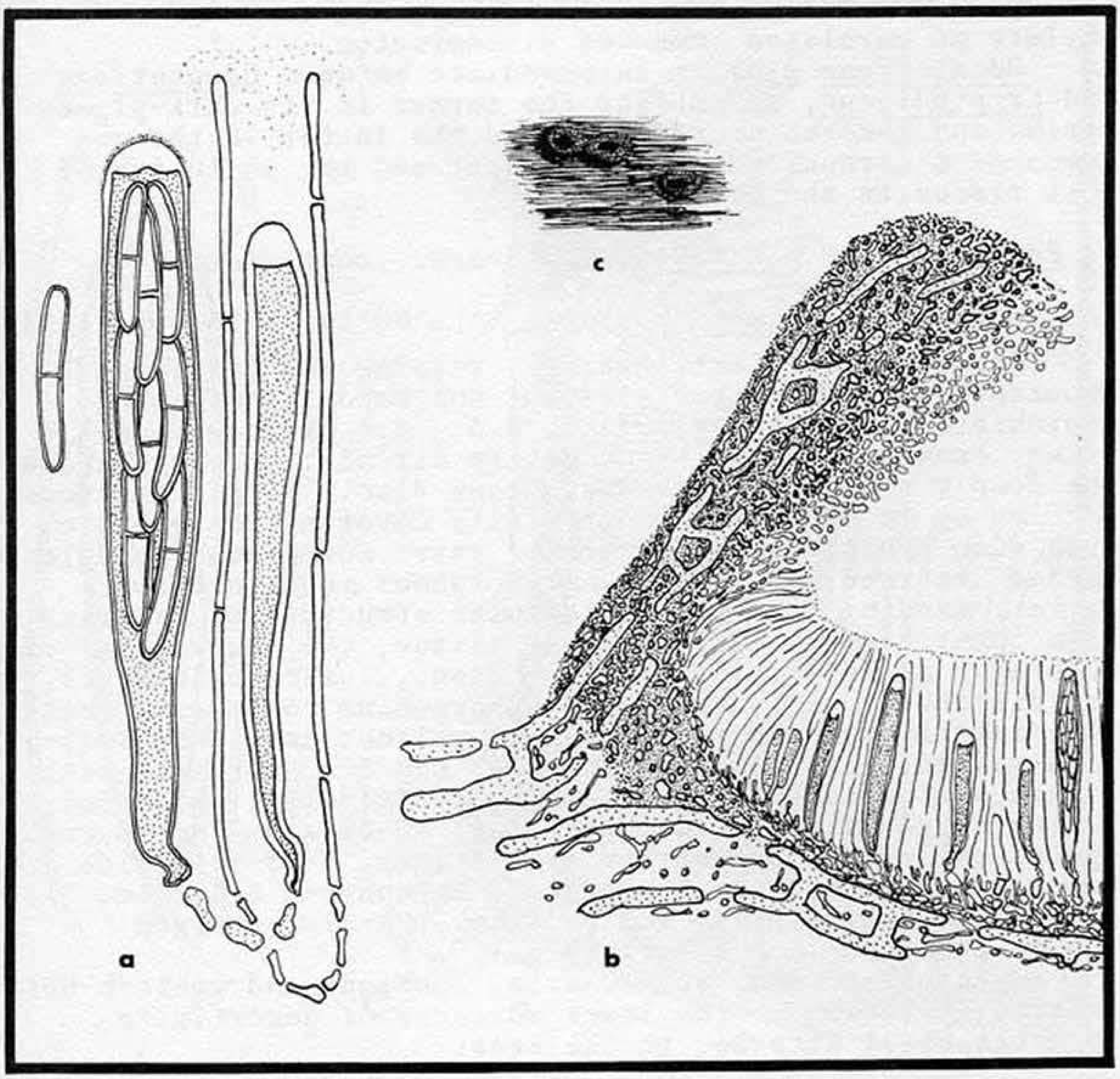

FIGURE 13. Paschelkiella pini. a. Asci, paraphyses and spores, x1500. b. Cross section of margin, x375. c. Habit sketch, x15. Drawn from IMI 246,165.

Etymology: A small Paschelke, after the author's godson, whose connection to botany is as yet unestablished.

Ascocarps immersed, raising the overlying substrate into small pustules but not becoming erumpent, minute, dark brown, smooth, at first closed, opening by a circular non-dentate pore to expose the deeply urceolate disc. Margin noncarbonized, of small-celled gelatinous pseudoparenchyma; periphysoids absent. Asci cylindrical, with thin lateral walls and a thickened apex, diffusely I+ blue following rehydration in KOH. Ascospores cylindrical, transversely septate. Paraphyses simple, filiform, septate.

On decorticated wood, saprophytic.

Von Höhnel (1917) recognized that P. pini was anomalous in Odontotrema because of its fleshy, noncarbonized margin and faint or absent hymenial iodine reaction, and proposed a transfer to Phragmonaevia. The application of the name Phragmonaevia is uncertain. The type species has never been adequately characterized, its type specimen cannot be located, and the genus has been used as an umbrella for a great variety of unrelated immersed discomycetes.

Odontotrema pini is intermediate between *Odontotrema* and *Cryptodiscus*, resembling the former in its dark pigmentation and general appearance, and the latter in the absence of a carbonized marginal layer and the inclusion of host tissue in the margin.

1. *Paschelkiella pini* (Rommell) Sherw., comb. nov.

(Figure 13)

≡ *Odontotrema pini* Rommell, Bot. Notis. 1895: 75 (1895)

Ascocarps at first immersed, raising the overlying substrate into small pustules but not becoming erumpent, orbicular or slightly elongate, 0.3 - 0.6 mm diam., dark brown, smooth, opening by an entire circular pore to expose the deeply urceolate dark ochraceous disc. Margin in cross section up to 60 μm thick, partially covering the hymenium even when hydrated, the outermost layer composed of nodulose hyphae immersed in a matrix of amorphous reddish-brown matter, tending to lose all cellular structure at maturity, with quantities of included host tissue, the inner layer of colorless globose cells ca. 2 μm diam., immersed in a gel, not distinctly periphysoidal. Subhymenium colorless, resting directly on host tissue. Asci cylindrical, subsessile, thin-walled, with a distinct apical cap 2-3 μm thick, without an obvious apical pore, diffusely faintly I+ blue following rehydration in KOH, 8-spored, 40-60 x 6-7 μm; ascospores colorless, cylindrical, biseriate, 9-13 (-15 fide Rommell) x 1.5 - 2 μm, 1-septate. Paraphyses filiform, septate, mostly simple, 1.0 μm diam., barely enlarged above, cemented in a colorless gel.

On conifer wood, Scandinavia, Scotland and western North America, fruiting on the lower surfaces of decorticate branches still attached to the tree.

SPECIMENS EXAMINED: Europe: Sweden: Rehm, Ascomyceten 1283, on *Pinus sylvestris*, Uppland, Skokloster, Dr. Starbäck (K, MICH); L. Rommell, Fungi Exs. Scand. 200, ad Drottingholm propr Stockholm et ad Femsjö (Småland) in ramis decorticatis *Pini sylv.* 18/5 et 7/9 1890 (K; S, labelled type of *Odontotrema pini*). Great Britain: Scotland, Black Wood of Rannoch, B. J. Coppins (E); Scotland, Abernethy Forest, on *Pinus sylvestris*, B. Coppins & M. Sherwood, V.1980 (E). North America: USA: Suttle Lake, Jefferson Co., Oregon, 15.VIII.1978, leg. M. Sherwood & L. Pike (FH; IMI 246,165); Oregon, Lane Co., Marcola, on *Libocedrus*, VIII.1983, leg. M. Sherwood-Pike (BPI).

8. *Phragmiticola* Sherw., gen. nov.

> Ascocarpi primo immersi, orbiculari vel elongati, nigri, per lacinias 3-4 irregulariter aperientes. Margo superior ex cellulis carbonaceis constata. Periphysoidea tenua, non ramosa, in matrice gelatinosa inclusa. Asci cylindrici, tenuiter tunicati, apice non incrassati, 8-spori; annulus apice in iodo caerulescens. Paraphyses filiformes, septatae, haud ramosae.

Holotype species: *Odontotrema rhopalospermum* Kirschst.

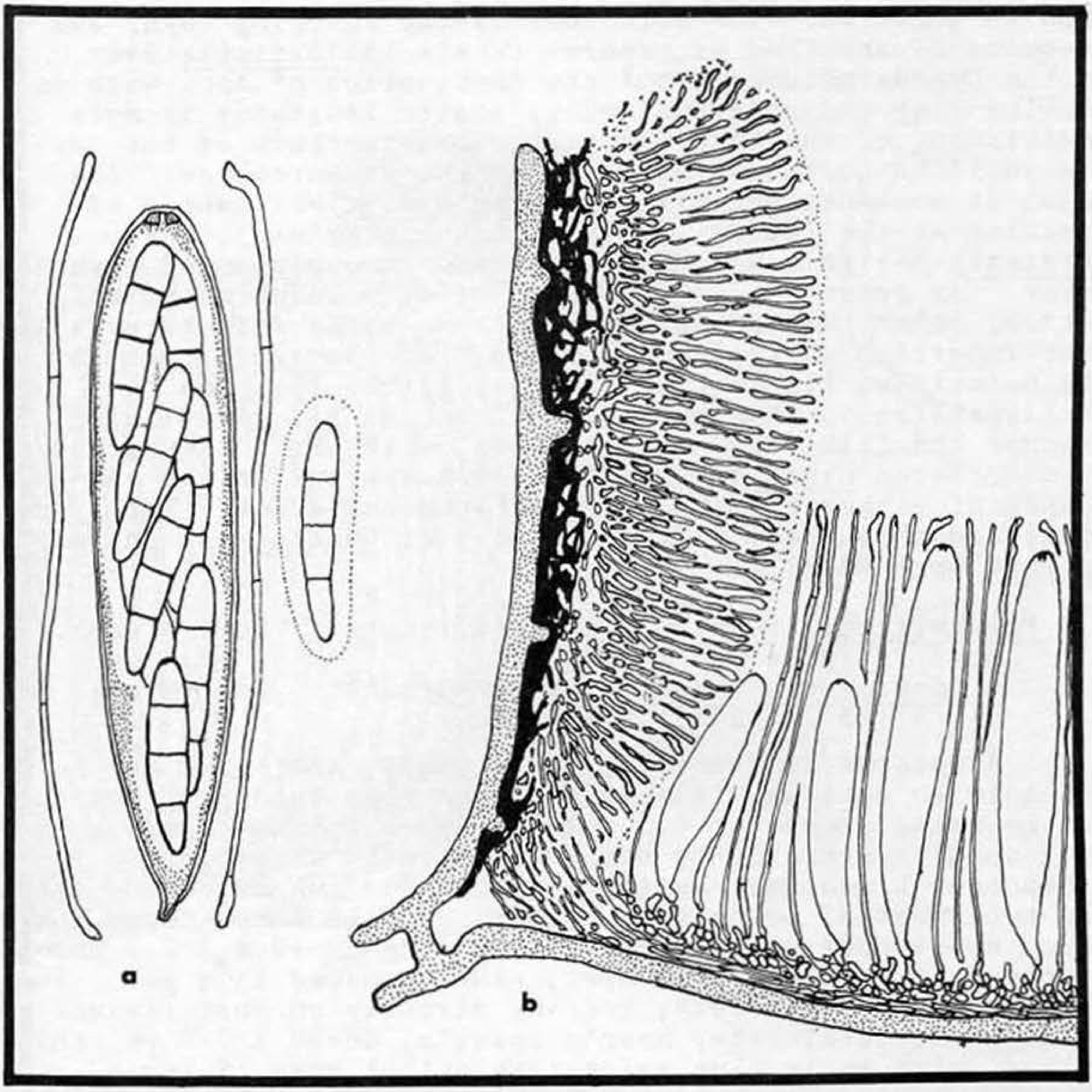

Figure 14. <u>Phragmiticola rhopalospermum</u> . a. Ascus, paraphyses and spores, x1500. b. Cross section of ascocarp, x750. Drawn from Petrak, Mycotheca generalis 191.

Ascocarps immersed, orbicular to elongate in outline, black, raising the overlying substrate into pustules but not becoming erumpent, opening by splitting the covering layer into irregular teeth. Margin in cross section composed of an outer layer of carbonized cells and an inner layer of vertically-oriented slender unbranched periphysoidal hyphae imbedded in a gelatinous matrix, with granular encrustations. Asci cylindric, becoming saccate, thin-walled, with a prominent I+ apical ring, 8-spored. Ascospores cylindrical, transversely septate, colorless, with a prominent gelatinous sheath. Paraphyses filiform, septate, sparingly branched. Hymenial gel I-.

This fungus, which occurs in Europe and is fairly conspicuous, may have an older name, but I have been unable to discover any. It is not among the immersed discomycetes discussed by Défago (1968) or Hein (1976).

The correct placement of <u>Phragmiticola</u> in a family is open to question. The structure of the covering layer and presence of sheathed ascospores recall Lasiostictis Sacc. in the Hypodermataceae, but the combination of asci with an I+ blue ring and a carbonized stromatic fruitbody is more reminiscent of the Phacidiaceae. The structure of the margin would be quite out of place in the Dermateaceae. The taxon is somewhat reminiscent of Karstenia Fr. (whose affinities at the family level are also uncertain), but Karstenia has thin-walled I- asci and an unpigmented covering layer. At present I am unable to offer a solution to this puzzle, other than to suggest that the ascus structure is the most important character and would place Phragmiticola in the Helotiales (incl. Phacidiaceae) rather than the Rhytismatales or Ostropales. Di Cosmo et al. (1984) also discuss and illustrate this species, with which they found an associated Libertiana Nag Raj anamorph unlike the anamorphs of either Phacidiaceae or Hypodermataceae. They also concluded that the family affinities of Odontotrema rhopalospermum were uncertain.

1. Phragmiticola rhopalospermum (Kirschst.) Sherw., comb. nov. (Figure 1G, 14)
   ≡ Odontotrema rhopalospermum Kirschst., Ann. Mycol. 36: 377 (1938)

Ascocarps immersed, brown to black, orbicular to elongate in outline, raising the substrate into pustules but not becoming erumpent, 0.3 - 1.0 x 0.3 - 0.6 mm diam., splitting open irregularly by means of teeth to expose the ochraceous hymenium. Margin in cross section ca. 50 µm thick, the outermost 20 µm heavily carbonized, the inner layer composed of slender unbranched periphysoids 30-40 x 2-2.5 µm, a little thickened near the apex, widely spaced in a gel. Subhymenium thin, colorless, resting directly on host tissue. Asci cylindric-clavate, nearly sessile, 40-60 x 7-9 µm, thin-walled, with an I+ blue refractive apical ring, 8-spored. Ascospores biseriate, cylindric-clavate with rounded ends, hyaline, 3-septate, 15-22 x 3-4 µm, with a prominent gelatinous sheath. Paraphyses filiform, 1.5 - 2 µm diam., distantly septate, sometimes branched near the apex, cemented in an I- gelatinous matrix.

On decaying stems of Phragmites communis, northern Europe. The specimen cited below is not type material, but agrees well with the original description.

SPECIMEN EXAMINED: Europe: Latvia: F. Petrak, Mycotheca generalis 191, on Phragmites vulgaris, Riga, Adazi, VI.1939, leg. J. Smarods (K).

9. Pleospilis Clem., Gen. Fungi 174 (1909)
   ≡ Melaspilea subgen. Spilomela Sacc., Syll. Fung. 18: 179 (1906)
   ≡ Spilomela (Sacc.) Keissler, Beih. Bot. Zbl. 37(2); 272 (1919)

Holotype species: Melaspilea vermifera Leighton

Ascocarps minute, immersed, becoming partially erumpent, at first closed, opening by a broad nondentate pore to expose the deeply sunken hymenium. Margin dark brown, non-

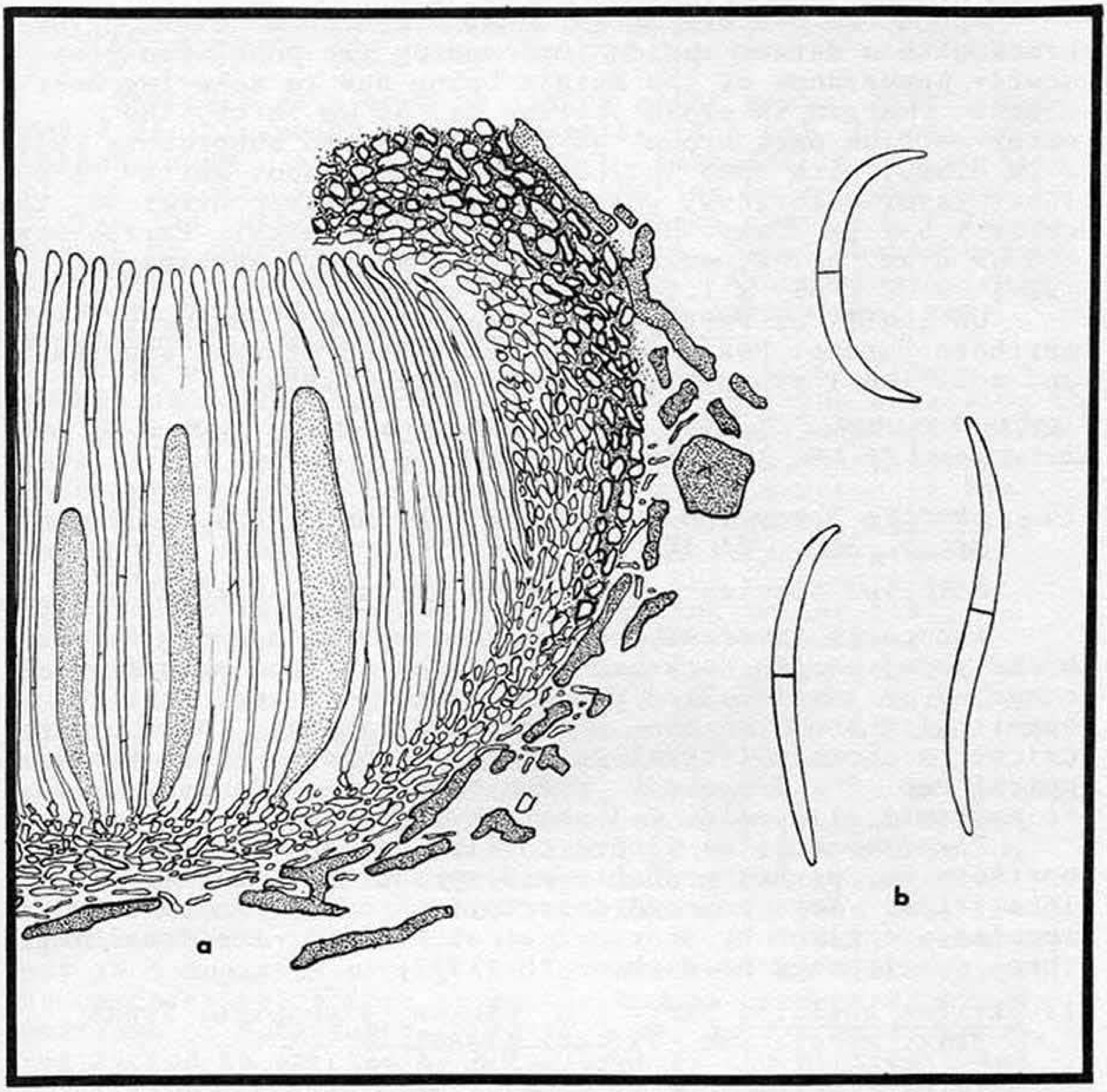

FIGURE 15. *Pleospilis ascaridiella*. a. Cross section of ascocarp, x750. b. Ascospores, x1500. Drawn from IMI 233298.

carbonized, of small-celled pseudoparenchyma, without a well-defined internal periphysoidal layer. Asci cylindrical, thin-walled, without a well-defined apical cap, 8-spored. Ascospores acicular, sigmoid, transversely septate. Paraphyses numerous, simple, septate. Hymenial gel I-.

On thalli of lichens, northern Europe. The generic name *Spilomela* was proposed for conservation by Hawksworth and Sherwood (1981), but this proposal was rejected. There is one species, *P. ascardiella*.

1. *Pleospilis ascaridiella* (Nyl.) D. Hawksw., Lichenologist 15: 22 (1983)
    ≡ *Lecidea ascaridiella* Nyl., Flora 53: 471 (1870)
    ≡ *Spilomela ascaridiella* (Nyl.) D. Hawksw., Notes R. Bot. Garden Edinburgh 38: 175 (1980)
    = *Melaspilea vermiformis* Leighton, Grevillea 3:114 (1875)
    ≡ *Spilomela vermiformis* (Leight.) Keissler ('*vermifera*'), Beih. Bot. Zbl. 37(2): 272 (1919)

Apothecia densely gregarious, 0.1-0.25 mm diam., grey-black with a darker region surrounding the pore, the grey scurfy appearance of the margin being due to adhering host tissue. Margin in cross section ca. 40 µm thick, the outer portion dark brown, of tightly-packed subglobose cells 2 µm diam., with some included brown amorphous matter, the inner layer colorless, gelatinous, pseudoparenchymatous, the cells 1.5-2 µm diam. Hymenium ca. 75 µm thick. Paraphyses 1.5 µm diam. below, enlarged to 2 µm above. Ascospores (22-) 25-32 (-35) x 1.5-2.0 µm, 1-septate.

On thalli of Pertusaria hymenaea (Ach.) Schaerer, northern Europe. For a further discussion of this species and additional synonyms, see Hawksworth (1980)

SPECIMEN EXAMINED: Europe: Denmark: Jutland, Dollerup, M. S. Christiansen 76-234, 24.V.1976 (IMI 233298).

10. Skyttea Sherw., D. Hawksw. & Coppins, Trans. Brit. Mycol. Soc. 75: 482 (1980)

Holotype species : Beloniella nitschkei Körber

Ascocarps immersed, becoming erumpent, opening by a broad pore; margin dark brown or greenish, noncarbonized, composed of small-celled pseudoparenchyma, lined near the summit with short hairs. Periphysoids absent. Asci cylindrical, with thin lateral walls and a more-or-less thickened apical cap, I-, 8-spored. Hymenial gel I-. Ascospores oval to narrowly ellipsoid, 0-3 septate.

Parasymbiotic on lichen thalli, documented only from northern Europe but probably widespread in temperate localities. Keys to, and descriptions of the seven original species are given by Sherwood et al. (1980); the remaining three are treated by Hawksworth (1982).

1. Skyttea buelliae Sherw., D. Hawksw. & Coppins, Trans. Brit. Mycol. Soc. 75: 483 (1980)
2. Skyttea cruciata Sherw. et al., ibid. 484 (1980)
3. Skyttea elachistophora (Nyl.) Sherw. et al., ibid. 484 (1980)
4. Skyttea fusispora Sherw. et al., ibid. 484 (1980)
5. Skyttea gregaria Sherw. et al., ibid. 486 (1980)
6. Skyttea lettaui (Grumm.) D. Hawksw., Notes R. B. G. Edinburgh 40: 396 (1982)
7. Skyttea nitschkei (Körber) Sherw. et al., Trans. Brit. Mycol. Soc. 75: 488 (1980)
8. Skyttea spinosa D. Hawksw. & Coppins, Notes R. Bot. Garden Edinburgh 40: 392 (1982)
9. Skyttea thallophila (Karst.) Sherw. & D. Hawksw., Trans. Brit. Mycol. Soc. 75: 489 (1980)
10. Skyttea viridis D. Hawksw. & Coppins, Notes R. Bot. Garden Edinburgh 40: 394 (1982)

11. *Stromatothecia* D. Shaw & D. Hawksw., Papua and New Guinea Sci. Soc. Proc. 22: 24 (1971)

Stromata developed on living plant parts, black, composed of interwoven hyphae immersed in a gel, becoming carbonaceous. Ascocarps numerous, imbedded in the surface of the stroma, at first closed, opening by a broad pore to expose the sunken hymenium. Paraphyses numerous, filiform, simple or sparingly branched, septate. Asci odontotremoid, cylindric, capitate, I-, polysporous. Ascospores acicular, sigmoid, septate. Ascus and ascocarp development non-synchronous. Anamorph unknown.

There is one species, *S. nothofagi*, known from a number of collections on species on *Nothofagus* belonging to the *N. brassi* group from New Guinea. Details of the structure of the ascocarp margin are lacking in the original description, but a photograph of a cross section at low magnification (Plate IIB, Shaw and Hawksworth, 1971) suggests that some sort of periphysoidal layer is present.

Stromatothecia was assigned to the Pleosporales by Shaw and Hawksworth (1971); Von Arx and Muller (1975) referred it to the Cyttariales. Neither placement is satisfactory. The asci of *Stromatothecia* are not functionally bitunicate, and the unbranched paraphyses, with distinct free apices, are not at all reminiscent of the pseudoparaphyses of loculoascomycetes. Moreover, the sequence of ascocarp development, beginning with an initially closed perithecioid body which opens by a symmetrical pore to expose a sunken but clearly discoid hymenium, is not characteristic of discocarpous loculoascomycetes,

A relationship to the Cyttariaceae is even less likely. The Cyttariaceae is a distinctive family (usually put in a separate order, the Cyttariales) of discocarpous ascomycetes which form stromatic bodies on hypertrophied portions of *Nothofagus*. *Cyttaria* is, as far as is known, restricted to species of *Nothofagus* of the *menziesii* and *fusca* types, which occur in Australia, New Zealand, and South America, but not in New Guinea. It is characterized by synchronous development of both ascocarps within a stroma and asci within an ascocarp, and by thin-walled asci with a prominent I+ apical ring, apparently a modification of the operculate type. On the basis of development and morphology it has been concluded (Korf, 1983) that its relationships lie with the Sarcoscyphaceae (Pezizales).

If currently accepted ascomycete systematics, with its emphasis on ascus morphology and ascocarp development, has any validity, then one must conclude that *Stromatothecia* and *Cyttaria* are not closely related but represent a striking example of convergent evolution in the ascomycetes.

The *brassii* - group of *Nothofagus* is believed, on the basis of pollen studies, to be the most ancient of the three types of *Nothofagus*. It is possible that *Stromatothecia* is a more ancient fungus than *Cyttaria*. There is undoubtedly a great deal of biogeographic and evolutionary information which could be obtained from a systematic comparison of the fungi which parasitize *Nothofagus* and the mycoflora of northern hemisphere Fagaceae. The distribution of these two conspicuous genera is certainly tantalizing.

1. *Stromatothecia nothofagi* D. Shaw & D. Hawksw., *Ibid.* 25 (1971)

Stromata developing laterally on twigs of narrow (3-6 [-11]) mm diameter, spherical, black, 1-2 cm. diameter, at first smooth, becoming covered with coarse hemispherical protuberances ca. .5 mm diam. The matrix of the stroma consists of dark brown lossely woven prosenchyma with a firm gelatinous texture, becoming brittle and carbonaceous when old.

Ascocarps numerous, developing near the surface of the wartlike protuberances, at first immersed and perithecioid, opening at maturity by a broad pore to expose the deeply urceolate disc, .1 - .2 mm diam. Paraphyses numerous, filiform, sparingly septate, 0.5 - 1.7 µm diam., swollen apically to 2.0 µm. Asci cylindrical, becoming slightly saccate at maturity, 50-67.5 (-85) x 9.5-12.5 µm, with thin lateral walls and a slightly thickened apex, 32 (?) spored, I-; ascospores acicular, sigmoid, 1-septate, (20-) 25-35 x 0.8-1.2 µm.

On living twigs of species of *Nothofagus* of the *N. brassi* group, New Guinea, associated with canker-like swellings and apparently parasitic. Shaw and Hawksworth (1971) cite a number of specimens. Immature stromata bear, either exclusively or in addition to black protuberances of the type in which the ascocarps eventually develop, pink hornlike processes which may represent early stages in the differentiation of the fertile portion of the stroma.

12. *Winteria* (Rehm) Sacc., Syll. Fung. 2: 225 (1883)

≡ *Trematosphaeria* subgen. *Winteria* Rehm, Ber. Naturh. Ver. Augsburg 26: 72 (1881)
≡ *Mycowinteria* Sherw., Brittonia 38: 36 (1986)

Mycowinteria is a monotypic genus producing small greenish ascocarps on decorticate wood; these remain for a long time closed, eventually opening by a broad pore. Muriform spores, asci with a broad I+ blue apical annulus, and lack of periphysoids will immediately distinguish *Mycowinteria* from *Odontotrema*, which it superficially resembles. The characters and affinities of *Mycowinteria* are discussed in greater detail by Sherwood-Pike and Boise (1986).

13. *Xerotrema* Sherw. & Coppins, Notes R. Bot. Garden Edinbugh 38: 368 (1980)

Holotype species: *Xerotrema megalosporum* Sherw. & Coppins, l.c.

Ascocarps immersed, tiny, black, becoming partially erumpent, opening by a broad dentate pore. Margin black, carbonized, of small-celled textura intricata, lined internally with periphysoids. Asci cylindrical, becoming saccate, uniformly thin-walled when mature, I-, 1 (?-8) spored. Ascospores muriform. Paraphyses septate, branched apically. Hymenial gel I-.

The one described species occurs on dry decorticate wood in cool-temperate exposed localities in Europe and North

America. The most important diagnostic characteristic of Xerotrema is the large muriform spores borne in unisporous asci; the other generic characters are those of Odontotrema.

SPECIMENS EXAMINED (in addition to those cited by Sherwood & Coppins, 1980): USA: Oregon, Linn Co., Belknap lava flow, on Pseudotsuga menziesii, 12.VI.1983, elev. 4500 ft., leg. M. Sherwood-Pike & L. Pike (BPI); Oregon, Klamath Co., Odell Creek, on Pinus contorta, elev. 4800'. 10.VI.1984, leg. M. Sherwood-Pike (OSC).

13. Xylopezia Höhnel, Ann. Mycol. 15: 308 (1917)

Holotype species: Stictis hemisphaerica Fr., Syst. Mycol. 2: 196 (1822)

The genus Xylopezia, which is treated in detail elsewhere (Sherwood-Pike and Boise, 1986) includes several species of lignicolous ascomycetes with small to minute ascocarps which open by a broad nondentate pore and have transversely septate spores. Superficially Xylopezia resembles Odontotrema, but it lacks periphysoidal hyphae, has interthecial filaments which anastomose apically, and lacks hymenial iodine reactions. The asci are not functionally bitunicate, but otherwise the aspect of Xylopezia is that of a loculoascomycete. Xylopezia hemisphaerica (Fr.) Sherw. is both commoner (at least in North America) and more conspicuous than any species of Odontotrema; of all the taxa discussed in this paper it is the one most likely to be encountered by the casual collector.

Acknowledgements

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ENDOPHYTE-HOST ASSOCIATIONS IN FORAGE GRASSES. VII. *ACREMONIUM CHISOSUM*, A NEW SPECIES ISOLATED FROM *STIPA EMINENS* IN TEXAS*

James F. White, Jr.,

Department of Botany, University of Texas,
Austin, Texas 78713-7640

and

Gareth Morgan-Jones

Department of Plant Pathology, College of Agriculture,
Auburn University, Auburn, Alabama 36849-4210

ABSTRACT

Acremonium chisosum White and Morgan-Jones, a new endophytic species isolated from culms, leaf sheaths and seeds of *Stipa eminens* Cav., in Texas, is described and illustrated. It is compared with other endophytes classified in section *Albo-lanosa* Morgan-Jones and Gams of the genus *Acremonium* Link. Fungal endophytes are also reported from *Stipa lobata* Swallen, *S. robusta* (Vasey) Scribn., and *S. viridula* Trin.

INTRODUCTION

The common occurrence of endophytic fungi within certain pasture grasses, particularly species of the genera *Festuca* L., and *Lolium* L., has been documented in the literature for many years (McLennan, 1920; Sampson, 1933; Neill, 1941). Several species of ryegrass (e.g. *Lolium perenne* L., *L. temulentum* L., and *L. remotum* Schranck) and two species of fescue (tall fescue, *Festuca arundinacea* Schreb., and red fescue, *F. rubra* L.) have long been known to harbor such entities. It is only in recent years, however, that some of these have been isolated *in vitro* and their morphological and cultural characteristics described (Morgan-Jones and Gams, 1982; Latch *et al.*, 1984; White and Cole, 1985b, 1986a; White *et al.*, 1987). A number of clavicipitaceous endophytic anamorphs have been implicated in toxicity syndromes of grazing animals (Hoveland *et al.*, 1980; Siegel *et al.*, 1985) and this has intensified interest in the group. Fungal endophytes appear to be involved in the ryegrass staggers disorder of cattle and sheep in New Zealand and in the fescue toxicity syndrome of cattle in the southeastern United States. Preliminary surveys of grass genera have led to the dicovery of endophytes in the following, in addition to *Festuca* and *Lolium*; *Agrostis* L., *Bromus* L., *Cinna* L., *Dactylis* L., *Elymus* L., *Holcus* L., *Hordeum* L., *Poa* L., *Sitanion* Raf., *Sphenopholis* Scribn., and *Stipa* L. (Morgan-Jones and Gams, 1982; White and Cole, 1985a, 1986b; White and Morgan-Jones, unpublished

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data).

These fungi occur as vegetative hyphae in symptomless grasses and occupy intercellular spaces in leaf sheaths, stem pith and seeds. Invasion of the embryo within seed occurs when hyphae penetrate between the epidermal cells of the scutellum. The hyphae eventually extend into primary leaf tissue. The endophytes are apparently seed-borne but there is never any necrosis of seedling tissue as a result of colonization. As more becomes known of the biology of these endophytes it is evident that they have coexisted with their grass hosts for a long period of time and have become very well adapted to their singularly unique ecological niche. There is some indication that their presence affords host grasses protection against insects and pathogenic fungi (Funk *et al.*, 1983; White and Cole, 1985c).

In 1982, Morgan-Jones and Gams established, on the basis of cultural peculiarities *in vitro* and overall morphology, the section *Albo-lanosa* Morgan-Jones and Gams in the genus *Acremonium* Link to accommodate two endophytic anamorphs occurring in pasture grasses in Alabama; namely *Acremonium coenophialum* Morgan-Jones and Gams, which they made the type of the section, and *Acremonium typhinum* Morgan-Jones and Gams, the anamorph of *Epichloe typhina* (Fr.) Tulasne. In 1984, Latch and coworkers named a third endophyte, *Acremonium lolii* [as *A. loliae*] Latch, Christensen and Samuels, isolated in New Zealand. Since that time a sterile endophyte has been described from *Festuca versuta* Beal (White and Cole, 1986a) and *Acremonium huerfanum* White, Cole and Morgan-Jones from *Festuca arizonica* Vasey (White *et. al.*, 1987) in the United States. These fungal taxa are distinguished on the morphology of their conidiogenous cells, shape and size of conidia, as well as colony characteristics and growth rates *in vitro*. Although at present classified in *Acremonium* because of a closely similar morphology, these anamorphs are not thought to be related to other species of the genus, which, even before their introduction, was recognized as a somewhat heterogeneous entity. In general these endophytes are slow-growing *in vitro* and are unique in several respects. Their conidiogenous cells arise as solitary, attenuated, lateral outgrowths from hyphae and are frequently not delimited by a basal septum. There is no periclinal thickening at the apex of the conidiogenous cells and only one or, at most, two conidia are formed at each conidiogenous locus. Individual conidia often assume a perpendicular orientation in relation to conidiogenous cell apex soon after detachment. Where only one conidium is produced, conidiogenesis appears to be holoblastic.

Although fungal endophytes are apparently widespread and ubiquitous in pasture grasses they do not occur in all species. White and Cole (1985a) reported that they are absent or infrequent in occurrence in *Festuca ovina* L., and *Festuca idahoensis* Elmer.

Certain grass species belonging to the genus *Stipa* L., have been reported as having intoxicating effects upon cattle and horses when consumed in substantial quantities (Bews, 1929). Among these are *S. inebrians* Hance and *S. viridula* Trin., from Europe, *S. robusta* (Vasey) Scribn., from North America, and *S. sibirica* Munro from northern Asia. The specific epithet *inebrians* and the common name for *S. robusta*, sleepygrass, are indicative of their propensity to induce intoxication. *Stipa viridula*, which also occurs in North America, has not been reported to cause any toxicosis on this continent, although it is known to do so in Europe (Bews, 1929). Species of *Stipa* have been observed to have severe narcotic effect on horses, even causing unconsciousness (Hance, 1876, 1877; Havard, 1891; Bailey, 1903; Farwell, 1911; Lescohier, 1911; Bews, 1929; Marsh and Clawson, 1929; Kingsbury, 1964). Horses have been reported to remain unconcious for as long as forty eight hours, but to subsequently recover completely.

In order to investigate the possibility that fungal endophytes may be responsible for the historically unexplaines toxicity of *Stipa* species, a survey of some of those growing in North America has been undertaken by us. The results are reported herein.

MATERIALS AND METHODS

Collections of North American *Stipa* species housed in the following herbaria were examined for the presence of endophytic mycelium using the pith-scraping technique of Clark *et al.* (1983): University of Texas Herbarium [TEX]; Tracy Herbarium, Texas A & M University [TAES]; and the Sol Ross University Herbarium [SR]. Species examined were; *S. arida* Jones, *S. columbiana* Macoun, *S. comata* Trin., *S. eminens* Cav., *S. leucotricha* Trin., *S. lobata* Swall., *S. neomexicana* (Thurb.) Scribn., *S. pringlei* Scribn., *S. robusta* (Vasey) Scribn., *S. scribneri* Vasey, *S. tenuissima* Trin., *S. thurberiana* Piper, and *S. viridula* Trin.

Stem pieces approximately 2cm long were removed from dried specimens and split longitudinally. Aqueous aniline-blue stain (0.1%) was applied to the exposed pith and the pith scraped into a glass slide. A drop of water was added and a coverslip placed on the pith sample before microscopic examination. Collections of species found to harbor endophytic hyphae are listed in Table 1.

Stipa eminens, a species abundant from west Texas to Arizona and central Mexico, was chosen for further study because of the presence of a fungal endophyte in all the herbarium specimens examined. A number of fresh collections of this species were made in the Chisos mountains of west Texas. Seeds were germinated and squash preparations of young seedlings made. Isolations of the endophyte were made on potato dextrose agar [Difco] from leaf sheaths, stems and seed, using previously published methodology (Clark *et al.*, 1983; White and Cole, 1986a).

For determination of growth rates *in vitro*, ten 2mm plugs of agar bearing mycelium were cut from the margins of 30-day old colonies growing on PDA and each placed on a fresh Petri dish plate. The plates were incubated at 20C in the dark for forty days, following which individual colony diameters were measured and the average of the ten calculated.

Examination of the endophyte in leaf sheaths, stems and seeds were made according to the method of Clark *et al.* (1983). For study of the endophyte in embryos, seeds were deglumed, cut in half, and fixed in FAA for twenty four hours. Following washing and gradual dehydration through a series into absolute ethanol, halves were embedded in LR White acrylic medium. Sections were cut and stained as desribed previously (White and Cole, 1986a).

RESULTS AND DISCUSSION

TABLE 1. Occurrence of fungal endophytes in herbarium specimens of *Stipa* species collected in North America (+ indicates presence; - indicates absence).

HOST	COLLECTION SITE	ACCESSION DATA		FUNGUS
Stipa eminens	Bofecillos Mts., Tex.	Butterwick	1825	+
	N. Quitman Mts., Tex.	"	2327	+
	S. Hueco Mts., Tex.	"	3171	+
	Hudspeth Co., Tex.	Hinckley	311	+
	Ft. Stockton, Tex.	McVaugh	10689	+
	Alpine, Tex.	Warnock	T-533	+
	Chisos Mts., Tex.	"	6985, 9202	+
	Elpaso Co., Tex.	"	7362	+
	Kent, Tex.	"	9252	+
	Diablo Mts., Tex	"	16712	+
	Marathon, Tex.	"	20250	+
	Coahiula, Mex.	Johnston	663, 1026	+
	Jalisco, Mex.	McVaugh	16728	+
	Puebla, Mex.	Hitchcock	814	+
	Tamaulipas, Mex.	Valdez	VR-1475	+
	Zacatecas, Mex.	Henrickson	13483	+
Stipa lobata	Grand Canyon, Ariz.	Silveus	1924, 1925	-
	Chisos Mts., Tex.	Campsey	445	+
	Guadalupe Mts., Tex.	Turner	143	-
	Alpine, Tex.	Hinckley	187	+
	Brewster Co., Tex.	Warnock	W-537	+
	Glass Mts., Tex.	"	6929	+
	Chihuahua, Mex.	Henrickson	12857	+
	Chihuahua, Mex.	"	12960	-
	Coahuila, Mex.	Cowan	3656	-
	Coahuila, Mex.	Gould	10510	-
	Coahuila, Mex.	Wendt	2026, 2071	-
	Neuvo Leon, Mex.	Mueller	523, 878	-
Stipa robusta	Woodland Park, Colo.	Dayhoff	63-53	+
	Buena Vista, Colo.	Silveus	1608	+
	Colorado Springs, Colo.	"	1910A, 1910B	+
	Pikes Peak, Colo.	Tracy		+
	Cloudcroft, New Mex.	Gould	9983	+
	San Miguel Co., New Mex.	Hill	12034	+
	Folsom, New Mex.	York	145	+
	Coahuila, Mex.	Villarreal		+
Stipa viridula	Lincoln Co., Colo.	Lonard	1179	-
	Colorado Springs, Colo.	Silveus	1214, 7659	-
	Buena Vista, Colo.	"	1608	+
	Manitau Springs, Colo.	"	7650A	-
	Manitau Springs, Colo.	"	7650B	+
	Starkville, Miss.	Tracy	5125	-
	Knox Co., Neb.	Clements	2680	-
	Sherdun, South Dak.	Griffiths		-
	Sheridan, Wyo.	Nelson	315	-

Occurrence and Distribution

It is perhaps noteworthy that of the thirteen species of *Stipa* examined, fungal endophytes were encountered in only four; namely *S. eminens, S. lobata, S. robusta* and *S. viridula.* This again indicates that not all grasses are colonized by such fungi. In addition to *S. eminens,* all collections of *S. lobata* examined contained endophytic mycelium. In contrast, *S. lobata* was colonized irregularly in parts of west Texas and the adjoining Mexican states of Chihuahua and Coahuila. Many collections of this species from other areas were found to be free of any endophyte (Table 1). *Stipa viridula* contained an endophyte only in central Colorado, where it occurs sympatrically with *S. robusta.* The absence of an endophyte in *S. viridula* in other areas may explain why this species is not considered toxic on this continent (Havard, 1891; Sampson, 1924; Hitchcock, 1950).

The consistent presence of an endophyte in *S. robusta* suggests that the narcotic effects attributed to this species may be caused by a substance or substances produced by the fungus. Although similar appearing mycelium occurs in *S. lobata* and *S. eminens,* these grasses have not, however, been recognized as having toxic properties.

Histological Studies

Endophytic hyphae found in *Stipa* were mostly unbranched, hyaline, thick-walled, and 3-9µm in diameter, occurring irregularly in leaf sheaths, stem pith, seeds (Plate 1, A-D), and seedlings of *S. eminens* (Plate 1, E). In developing seeds, hyphae were sparsely evident beneath the seed coat in proximity of the embryonic scutellum, but were observed to penetrate the latter intercellularly (Plate 1, C: indicated by arrows) and were present in the embryonic shoot within seeds (Plate 1, D: indicated by arrow). On seed germination, squash preparations revealed numerous hyphae in elongating mesocotyls (Plate 1, E).

Taxonomy

Although the endophytic mycelia encountered in the four species of *Stipa* bear morphological similarity, we are unable to determine if they represent the same taxonomic entity until isolations *in vivo* are made from each grass. Detailed study of the endophyte of *S. eminens* reveals that it belongs in section *Albo-lanosa* of *Acremonium* but is distinct from any taxon hitherto described.

Acremonium chisosum White et Morgan-Jones, sp. nov. (Figure 1, Plate 2).

Coloniae in agaro decocto tuberorum post 40 dies ad 20C, 11mm diametro, lente crescentes, albae, lanosae, pulvinatae; reverso pallide brunneo. Hyphae vegetativae hyalinae, septatae, crasso-tunicatae, 3-9µm latae. Cellae conidiogenae holoblasticae, discretae, laterales, ex hyphis aeriis oriundae, orthotropicae, aculeatae, hyalinae, plerumque percurrenter prolificantes, asetatae vel uniseptatae, 10-30µm longae, 2.5µm crassae ad basim, 1-2µm crassae ad apicem. Conidia solitaria, hyalina, laevia, aseptata, ellipsoidea vel obovata, interdum obpyriformia, ad apices obtusa et ad bases subtruncata, 5-9 X 2.5-4µm. Chlamydosporae nullae. Teleomorphosis ignota.

In culturis culmis Stipae eminens, Chisos Mountains, Brewster Co.,

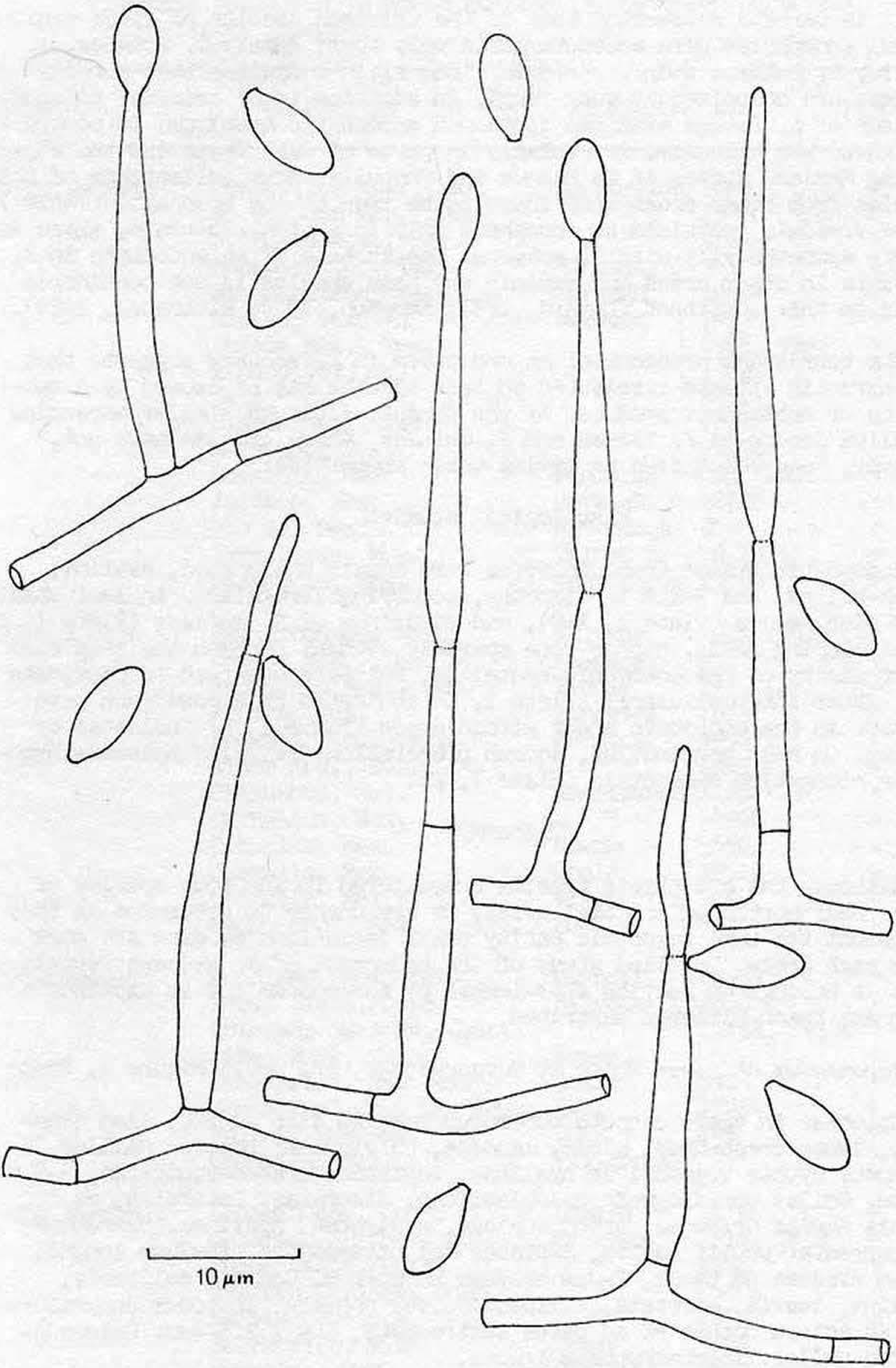

FIGURE 1. *Acremonium chisosum*. Conidiogenous cells and conidia.

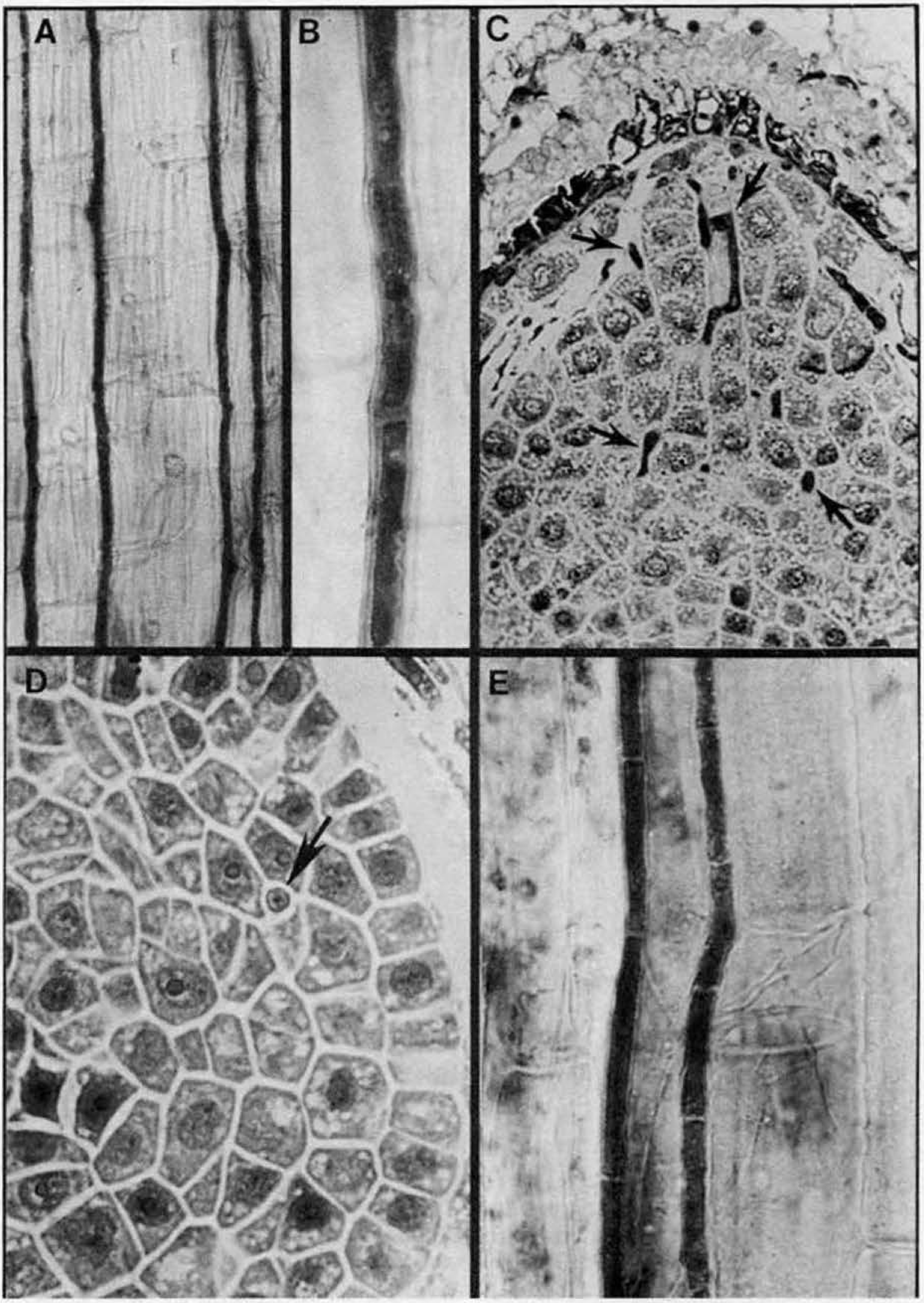

PLATE 1. A, Endophytic mycelium in *Stipa eminens* (X375); B, thick-walled, septate hypha (X1800); C, V.S. of young seed showing hyphae [arrows] penetrating the embryonic scutellum intercellulary (X375); D, T.S. of embryonic shoot within seed showing intercellular hypha [arrow] (X1200); E, squash preparation of 10-day old seedling bearing two intercellular, septate, unbranched hyphae (X1200).

Texas, November 1, 1985, J.F. White Jr., AUA, holotypus.

Colonies on potato dextrose agar extremely slow-growing, reaching a diameter of 11mm after 40 days at 20C, white, cottony, pulvinate; reverse tan to pale brown. Vegetative hyphae hyaline, septate, thick-walled, 3-9 µm wide. Conidiogenous cells holoblastic, discrete, arising as lateral extensions of the aerial hyphae, orthotropic, aculeate, frequently proliferating percurrently, asepate or, rarely 1-septate, sometimes, but not always, delimited from the subtending hyphae by a transverse septum, 10-30µm long, 2-5µm wide at the base, gradually tapering to 1-2µm wide at the apex, producing but one conidium at each conidiogenous locus, frequently doubling in length following proliferation. Conidia solitary, hyaline, smooth, aseptate, ellipsoid to obovate, sometimes pyriform, obtuse at the apex, 5-9 X 2.5-4µm, subtruncate with a minute, barely discernible circumscissile frill at the base. Chlamydospores absent. Teleomorph unknown.

Isolated from culms, leaf sheaths and seeds of *Stipa eminens* Cav.; North America.

Collections examined: from *S. eminens*, Chisos Mountains, Brewster Co., Texas, November 1, 1985, J.F. White, Jr., AUA, TEX, type.

This species resembles other anamorphic endophytes presently classified in *Acremonium* in colony characteristics *in vitro*, particularly in color and texture . All endophytes isolated thus far are slow growing, *A. chisosum* especially so. The only grass endophyte described that has a somewhat different colony type is the sterile fungus occurring in *Festuca versuta*. The colonies of that entity are similar in being slow-growing but have a fleshy-tan, heavily wrinkled appearance (White and Cole, 1986a).

Conidium detachment and displacement in *A. chisosum* is often achieved by the percurrent proliferation of a hypha-like extension from below. This eventually assumes the aculeate morphology of the primary conidiogenous cell and produces a second conidium at a higher level. The process of proliferation and final morphological expression is not unlike that in some species of *Fusarium* Link, such as *F. poae* (Peck) Wollenweber and *F. sambucinum* Fuckel, although in that genus a plurality of conidia are produced at each phialidic conidiogenous locus. Interestingly, Gams (1971) illustrates a similar appearing conidiogenous cell in *Acremonium egyptiacum* (van Beyma) W. Gams, a member of section *Simplex* W. Gams, with two percurrent proliferations. Apical proliferation was said to occur often in the conidiogenous cells of that species. In *A. chisosum*, a detached conidium can usually be seen lying to one side of the original conidiogenous locus (Plate 2, D & E) and is usually orientated at a more or less right angle in relation to the parent conidiogenous cell. The site of initial conidiation is frequently discernible by the slightly flared apex of the primary conidiogenous element surrounding the base of the proliferated portion (indicated by an arrow in Plate 2, I). Among anamorphic endophytes placed in section *Albo-lanosa*, *A. chisosum* is unique in its ability to produce a plurality of conidiogenous loci from a single cell by percurrent proliferation.

Conidiogenesis in *A. chisosum* is described as being holoblastic advisedly. Within the limits of resolution of the light microscope it is by no means easy to be certain of the details of cells wall relationships

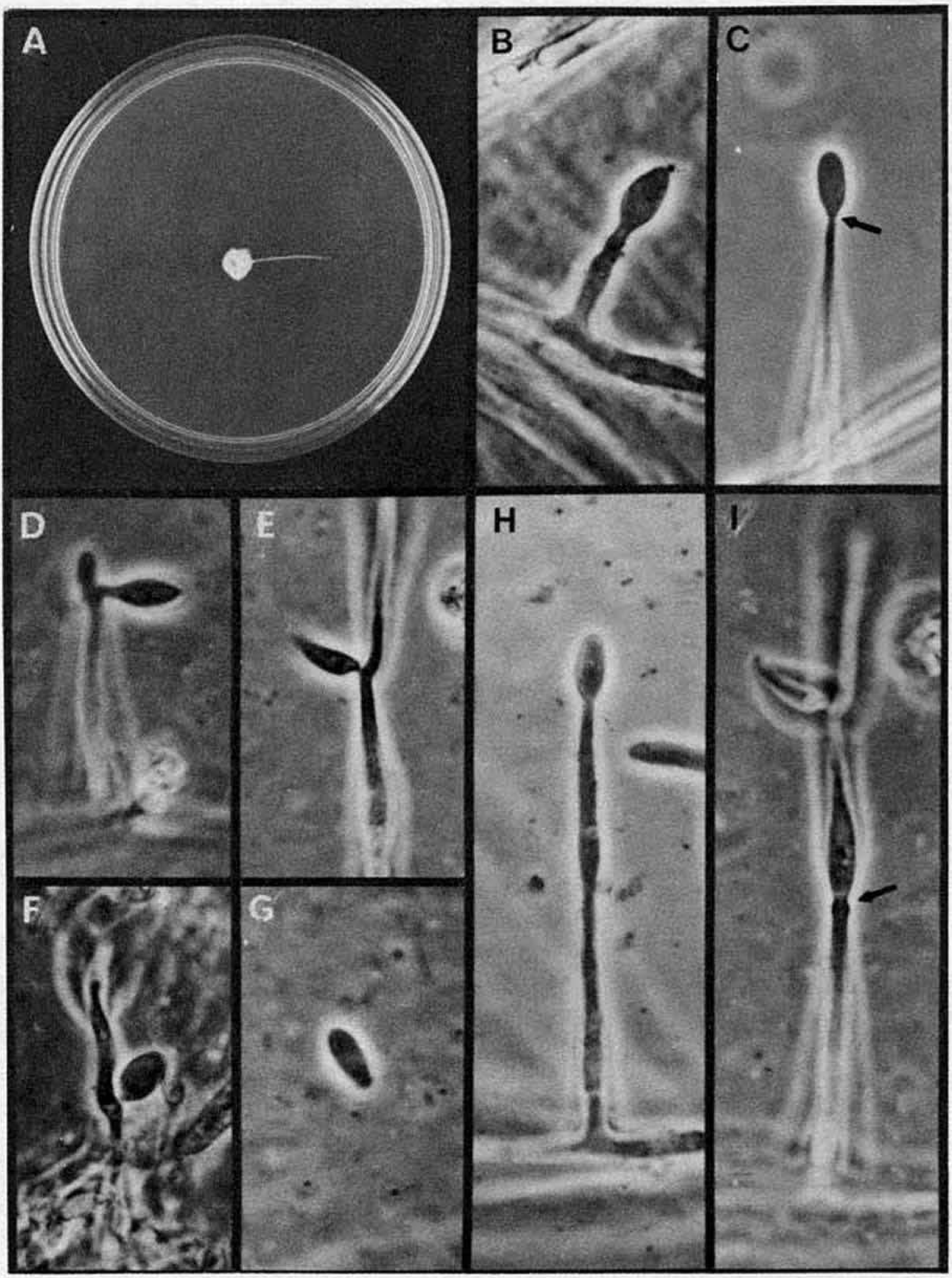

PLATE 2. *Acremonium chisosum*. A, 40-day old colony growing from *S. eminens* seedling onto PDA; B, conidiogenous cell with conidium initial at the apex; C, conidiogenous cell bearing mature conidium [arrow indicating basal septum]; D–F, proliferating conidiogenous cells with displaced primary conidia; G, mature conidium; H, maturing conidium at apex of proliferated portion; I, proliferated conidiogenous cell showing site of first conidiogenous locus [arrow]; (all X1400).

between parent and daughter cells in a fungus as small. From the presence of a minute circuscissile frill around the subtruncate base of the conidium it is reasonable to deduce that detachment is rhexolytic, brought about by a break in the periclinal wall of the conidiogenous cell immediately below the delimiting septum. In this connection it is interesting to note that Latch *et al.* (1984) considered that it is possible that conidiogenesis in *Acremonium coenophialum, A. lolii* and *A. typhinum* is holoblastic. They based this judgement on the fact that periclinal thickening typical of a phialide is not seen in conidiogenous cells of this species and that only one conidium is formed in most instances. It certainly appears that the primary conidia of these anamorphs develop holoblastically. If and when a second conidium is formed at the same locus this could originate enteroblastically. Conidium detachment in *A. typhinum* leaves behind a rather blunt conidiogenous cell apex that appears to be closed. This would lead one to believe that a schizolytic process is involed in secession, but here again it is difficult to be certain. Questions relating to conidiogenesis and conidium detachment in these anamorphs can only be satisfactorily answered by transmission electron microscopy of thin sections of the conidiogenous cells.

Apart from the presence of percurrent proliferation, *A chisosum* can be easily distinguished from other species by its wide hyphae and the shape and size of its conidia. It is now clear that there exist in pasture grasses a number of anamorphs having sufficiently distinctive and stable morphological discontinuities to warrant their classification as separate form-species.

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MATERIALS FOR A LICHEN FLORA OF THE ANDAMAN ISLANDS-III

P.K. SETHY, M.B. NAGARKAR & P.G. PATWARDHAN

Department of Mycology, M.A.C.S. Research Institute, Pune-411 004,India.

ABSTRACT

Twelve species of Thelotremataceae from the Andaman Islands, India are described and illustrated. Leptotrema tarmuguliense, Thelotrema kalarense and T. polythecium are new species. Ocellularia concolor, O. dolichotata and Thelotrema leucophthalmum are new records to the lichen flora of India and rest are being first time reported from the Andaman Islands.

This paper, third in the series of on-going studies of the lichens from the Andaman Islands, gives an account of twelve species of Thelotremataceae. Distribution records outside the Islands are taken from Hale (1974,1978, 1981), from our own identified materials in AMH and from examination of types.

Leptotrema compunctum (Ach.) Müll. Arg., Flora Jena 71: 527(1888). Urceolaria compuncta Ach., Meth. Lich., P.143(1803). (Fig. 1)

Thallus pale olivaceous gray, smooth, partly hypophloeodal, with indistinct cortex, medulla 100-130 µm thick; ascocarps numerous, closely disposed, immersed, 0.2-0.3 mm diam, ecolumellate; pore round to irregular, open, 150-180 µm across, partially filled with excipular materials, white to ashy white pruinose; exciple ± free, ashy brown in the ostiolar region, disc pulling away from the apothecial wall; hymenium 120-160 µm high; ascospores 8 per ascus, brown, muriform, 10-15 X 20-30 µm, 6-8 X 1-3 loculate, I-.

Chemistry: Thallus K + deep yellow, P + orange; norstictic and trace of stictic acids.

Specimens examined: North Andaman, Diglipur Range, Sitapur- 86.53, 97, 108, 154, 184A, 210, 215, 223.

Distribution: United States, West Indies, Central and South America, Angola, Mozambique, India, Sri Lanka, Java, Philippines, Indonesia.

Norstictic acid is of rare occurrence in the genus Leptotrema. Leptotrema compunctum, a pantropical species, is virtually indistinguishable morphologically from the norstictic acid containing L. occultum (Eschw.) Hale, a New World species, but the latter has consistently smaller (16-21 µm long) ascospores. Furthermore, L. compunctum has stictic acid in addition to norstictic acid.

Leptotrema desquamans (Müll.Arg.) Patw. & Makh., Bryologist 83: 368 (1980). (Fig. 2)

Anthracothecium desquamans Müll.Arg., Flora Jena 71: 48 (1888).

Thallus greenish gray to olivaceous buff, shiny, continuous, smooth, partly hypophloeodal, cortex 15-25 µm thick, medulla 100-120 µm thick; ascocarps many, solitary, partially immersed in periderm to semi-emergent, 0.3-0.45 mm diam, ecolumellate; pore very tiny, inconspicuous, 20-30 µm across, ± white rimmed; exciple fused, pale yellow to brown; hymenium 100-140 µm high; ascospores 8 per ascus, brown, muriform, 12-15 X 25-33 µm, 6-8 X 2-4 loculate, I-.

Chemistry: Thallus K + yellow, P + orange; stictic and constictic acids.

Specimens examined: South Andaman, near Wandoor, Tarmuguli Island-85.1897, 1938, 1944, 1947, Baratang Island, Bishnu Nala-85.700, North Andaman, Diglipur Range, Kalara- 86.463b.

Additional specimens examined: South India, Kerala State, Cardamom Hills, Kumily- 76.829, Wynad Forest, Gudalur to Nilambur Road- 76.65, Sabarimalai Hills- 83.465, 536.

Distribution: India, Sri Lanka, Philippines, Sabah, Australia.

This species, characterized by the semi-emergent ascocarps, tiny pore and small (25-33 µm long) ascospores, is closely related to Leptotrema phaeosporum (Nyl.) Müll.Arg. which, however, has completely immersed ascocarps and a brown rimmed pore.

Leptotrema tarmuguliense, sp.nov. (Fig. 3)

Thallus corticola, pallide fulvo-cinereus vel olivaceo-bubalinus, laevis, pro parte hypophloeodes; ascocarpia numerosa, solitaria vel 2 confluentia, emergentia, ± basin constricta, 0.4-0.6 mm diametro, ecolumellata; ostiolum rotundatum, parvum vel sat apertum, 60-250 µm across, ± annulo leviter fusco; excipulum connatum, non-carbonaceum; hymenium 160-200 µm altum; ascosporae 2:nae, fuscae, murales, 15-23 X 70-93 µm, loculis numerosis, I-.

Thallus pale yellowish gray to olivaceous buff, smooth, minutely fissured with age, partly hypophloeodal, cortex 8-10 µm thick, medulla 50-70 µm thick; ascocarps numerous, solitary to two in a group, emergent, ± constricted at the base, 0.4-0.6 mm diam, ecolumellate; pore round, minute to moderately open, 60-250 µm across, (old ascocarps have wider pore, more than 300 µm, lacking hymenial contents), ± thin pale brown rim; exciple fused, non-carbonized; hymenium 160-200 µm high; ascospores 2 per ascus, brown, muriform, 15-23 X 70-93 µm, I-.

Chemistry: Thallus K + deep yellow, P + orange; stictic and constictic acids.

Typus: India, Andaman Islands, South Andaman, near Wandoor, Tarmuguli Island, 19th December 1985, M.B. NAGARKAR & P.G. PATWARDHAN 85.1862, Holotype-AMH, Isotype-US.

Other specimens examined: South Andaman, near Wandoor, Tarmuguli Island- 85.1860, 1861.

This species is distinguished by the strongly emergent, though small ascocarps, fused exciple and large (70-93 µm long) ascospores. It does not have any close relatives in the genus.

L. elachistoteron (Leighton) Patw. & Kulk. has medium sized (60-85 µm long) ascospores and stictic acid in the thallus, but differs from the present species in semi-emergent ascocarps and dark-rimmed pore.

Ocellularia concolor Meyen & Flotow, *Nova Acta Acad. Lepoldin-Carolin,* **19:** 230 (1843). (Fig. 4)

Thallus olivaceous buff, dull, cracked, mostly hypophloeodal, cortex 4-6 µm thick, medulla 40-60 µm thick; ascocarps many, solitary, semi-emergent to emergent, 0.6-1.2 mm diam, columellate; pore open, 150-300 µm, ± black rimmed; exciple carbonized; columella simple to becoming divided in the later stage, 200-400 µm thick, carbonized, with tip white pruinose, filling the pore; hymenium 100-130 µm high; ascospores 8 per ascus, hyaline, trans-septate, 4-7 X 20-25 µm, 6-8 loculate, I + deep violet.

Chemistry: Thallus K-, P-; lacking lichen substances.

Specimens examined: South Andaman, near Wandoor, Tarmuguli Island- 85.1866, 1867, 1940a; Middle Andaman, Betapur Range, Pitcher Nala- 85.2459.

Distribution: Panama, Dominica, Philippines, India.

The specimens from Tarmuguli Island listed above conform well with the characters of *Ocellularia concolor* except that, the columella is fissurred in the later stages, which however, is not uncommon in the species having broader columella.

Ocellularia dolichotata (Nyl.) A.Zahlbr., *Cat. Lich. Univ.*, **2:** 589 (1923). (Fig. 5)
Thelotrema dolichotatum Nyl., *Ser. Lich. Trop. Labuan et Singapore*, p.19 (1891).

Thallus off-white to buff, verruculose to finely rugulose, with numerous depressed notch-like spots formed by eroded cortex over the surface, mostly hypophloeodal, cortex 10-18 µm thick, medulla 80-140 µm; ascocarps many, solitary, emergent, more or less constricted at the base, 0.8-1.5 mm diam, columellate; pore often verruculose; exciple carbonized; columella simple, 250-400 µm thick, broader (450-600 µm) towards base, carbonized, tip white pruinose, filling the pore; hymenium 200-300 µm high; ascospores 2-4 per ascus, 12-16 X 150-220 µm, 20-30 loculate, I + violet.

Chemistry: Thallus K-, P-; lacking lichen substances.

Specimens examined: North Andaman, Mayabandar Range, Kaichi Nala- 85.2763, 2777, 2780, 2787, 2838, 2841.

Distribution: India, Sri Lanka, Thailand, Peninsular, Malaysia, Philippines, Sabah, Sarawak, Solomon Islands.

The specimen no. 85.2838 has a strongly verruculose thallus, distinctly emergent ascocarps with constricted base, depressed pore and less opened (less than 300 µm across) without dark area and columella not visible through the pore, whereas other specimens have a finely rugulose thallus, less emergent ascocarps, a ± brown to dark-brown area around the pore and columella distinctly visible through the pore.

Ocellularia allosporoides (Nyl.) Patw. & Kulk., a common species in South India and the Andaman Islands also, has columellate ascocarps and no lichen substances in the thallus but differs in having smooth thallus, thinner (less than 200 µm diam.) columella and smaller (less than 140 µm long) ascospores.

Ocellularia perforata (Leighton) Müll.Arg., *Hedwigia*, **31:** 284 (1892). (Fig. 6)
Thelotrema perforatum Leighton, *Trans.Linn.Soc.London.* **25:**447 (1866).

Thallus greenish gray to olivaceous buff, smooth to uneven, partly hypophloeodal, cortex 12-15 µm thick, medulla 150-180 µm thick; ascocarps numerous, solitary, immersed to slightly raised, 0.2-0.4 mm diam,columellate; pore moderately open, 100-150 µm across, slightly depressed, ± off-white annulate rim; exciple becoming dark brown; columella simple, 60-80 µm thick, dark brown; hymenium 80-100 µm high; ascospores 8 per ascus, hyaline, trans-septate, 3-6 X 15-20 µm, 5-7 loculate, I + deep violet.

Chemistry: Thallus K + yellow, P + deep yellow; protocetraric acid.

Specimens examined: Middle Andaman, Long Island, on the way to Lalaji- 85.2066, North Andaman, Diglipur Range, Milangram- 86.254, 278, 359, 360.

Distribution: West Indies, Central and South America, India, Sri Lanka, Java, Australia, Solomon Islands, Hawaii Islands.

Ocellularia perforata is most closely related to *O. diacida* Hale and *O. papillata* (Leighton)A.Zahlbr.in having weakly developed to well-developed, thin (60-100 µm diam.) columella, carbonization restricted at the apices of the exciple and columella, and small (20-35 µm long)ascospores. *Ocellularia papillata* has a distinctly white-rimmed pore and no lichen substances in the thallus. *O. diacida* Hale, a species of very common occurrence in the Andaman Islands, has frequently semi-emergent ascocarps and the 'diacida' unknowns. All these species occur in low elevation rain forest.

Ocellularia terebratula (Nyl.) Müll.Arg., *Mém. Soc. Phys. Hist. nat. Genève*, **29** (8): 12 (1887). (Fig. 7)
Thelotrema terebratulum Nyl., *Ann. Sci. nat.* (*Bot.*) V, **7**: 315 (1867).

Thallus ashy greenish gray to greenish glaucous, smooth, nitid, epiphloeodal, cortex 15-25 µm thick, medulla 100-160 µm thick; ascocarps numerous, immersed in medulla, 0.2-0.3 mm diam, ecolumellate; pore moderately open, 80-100 µm across, with white to off-white annulate rim; exciple free, pale yellow; hymenium 50-70 µm high; ascospores 8 per ascus, hyaline, trans-septate, 3-4 X 10-13 µm, 4 loculate, I + deep violet.

Chemistry: Thallus K + pale yellow, P + yellow; psoromic acid.

Specimen examined: North Andaman, Diglipur Range, Milangram- 86.236.

Distribution: United States, West Indies, Central and South America, South Africa, India, Sri Lanka, Taiwan, Sabah, New Caledonia, Solomon Islands.

Ocellularia micropora (Mont.) Müll.Arg. is closely related to *Ocellularia terebratula* in most of the characters but has a thinner (up to 5 µm thick) cortex and much fissured thallus.

Thelotrema kalarense, sp. nov. (Fig. 8)

Thallus corticola, cinero-glaucescence vel griseo-sepiaceus, laevis, hypophloeodes; ascocarpia numerosa, solitaria, semi-emergentia, 0.6-0.8(1.0) mm diametro, ecolumellata; ostiolum rotundatum vel irregularum, apertum, 300-450 µm diametro, disco albo vel albo-cinereo pruinoso; margin thallino suberecto vel erecto; excipulum liberum, non-carbonaceum, periphysoidibus instructis; hymenium 100-180 µm altum; ascosporae 8:nae, incolores, murales, 4-6 X 10-15 µm, 5-6 X 2-3 loculatae, I-.

Thallus glaucous gray to greyish sepia, smooth, hypophloeodal,ecorticate, medulla 60-80 µm thick; ascocarps numerous, solitary, semi-emergent, 0.6-0.8(1.0) mm diam, ecolumellate; ostiole round to irregular, open, 300-450 µm across,disc white to ashy white pruinose,pulling away from the apothecial wall in later stage; thalline margin suberect to erect; exciple free, with periphysoids, non-carbonized; hymenium 100-180 µm high; ascospores 8 per ascus, hyaline, muriform, 4-6 X 10-15 µm, 5-6 X 2-3 loculate, I-.

Chemistry: Thallus K-, P-; lacking lichen substances.

Typus: India, Andaman Islands, North Andaman, Diglipur Range, Kalara, in Evergreen Forest,4th January 1986, P.G.PATWARDHAN & M.B.NAGARKAR 86.460, Holotype-AMH, Isotype-US.

Other specimens examined; North Andaman, Diglipur Range, Kalara-86.437, 459, Sitapur- 86.275.

This species closely resembles _Phaeotrema lacteum_ Krempelh. in respect of gross morphology, anatomy and chemistry, but _P. lacteum_ has brown, trans-septate and large (30-60 µm long) ascospores. There are no close relatives of this species in the genus.

Thelotrema leucophthalmum Nyl., _Bull. Soc. Linn. Normand._ II, 2: 39 (1868). (Fig. 9)

Thallus greenish gray to honey-brown, verrucose, partly hypophloeodal, cortex 70-100 (125) µm thick, pale yellow, medulla 80-150 µm thick, with crystals; ascocarps many, solitary or 2 to 3 aggregated in a common thalline wall, emergent, 0.8-2.5 mm diam, ecolumellate; disc 400-1500 µm across, heavily white pruinose; thalline margin thick, distinct greenish yellow, suberect to erect to barely recurved, 380-550 µm high, pruinose at apex, non-carbonized, with periphysoids; hymenium deeply situated, (60) 100-200 µm high; ascospores 4-8 per ascus, hyaline, muriform, 10-15 X 25-35(40) µm, 8-10 X 3-4 loculate, I-.

Chemistry: Thallus K + yellow, P + orange; stictic and constictic acids.

Specimens examined: North Andaman, Diglipur Range, Sitapur- 85.1402, 1403, 1418, 1433, 1435.

Distribution: South-east Asia, New Caledonia.

This species is very conspicuous in the field by its ascocarps with white pruinose disc and exciple on a honey-brown coloured thallus. The frequent occurrence of 2-3 aggregated ascocarps in a common thalline margin, small (25-40 µm long) ascospores and stictic acid in the thallus are distinctive characters of this species.

The present species is closely allied to _Thelotrema dissulatum_ Hale in respect of large ascocarps, white pruinose disc, erect to barely recurved thalline margin and stictic acid in the thallus but the latter species has smooth thallus, solitary ascocarps, coarsely split and subgranular white thalline rim, and consistently smaller (14-16 µm long) ascospores.

Thelotrema polythecium, sp. nov. (Fig 10)

Thallus corticola, albidus vel fumosus, laevis, hypophloeodes, albo-maculato; ascocarpia numerosa, solitaria vel 2-4 confluentia, immersa vel leviter emergentia, 0.3-0.45 mm diametro, ecolumellata; ostiolum rotundatum vel irregularum, apertum, 150-200 µm diametro, disco albo-pruinoso; margine thallino integro vel lacerato indistincto, eroso-albido;

excipulum liberum, albo-pruinosum, non-carbonaceum; periphysoidibus indistinctis; hymenium 80-100 µm altum; ascosporae 8:nae, incolores, murales, 5-8 X 20-25 µm, 7-8 X 2-3 loculatae, I-.

Thallus off-white to smoke gray, smooth, with white circular to irregular patches over the thallus, marked positions of undeveloped ascocarps, hypophloeodal, ecorticate, medulla 80-140 µm thick; ascocarps numerous, solitary to groups of 2-4, immersed to slightly raised, 0.3-0.45 mm diam, ecolumellate; pore round to irregular, open, 150-200 µm across, gaping, disc white to ashy white pruinose; thalline margin entire to indistinctly lacerate, eroded in pore area; exciple free, forming double pore configuration, white pruinose, non-carbonized, periphysoids indistinct; hymenium 80-100 µm high; ascospores 8 per ascus, hyaline, muriform, 5-8 X 20-25 µm, 7-8 X 2-3 loculate, I-.

Chemistry: Thallus K-, P-; lacking lichen substances.

Typus: India, Andaman Islands, North Andaman, Mayabandar Range, Kaichi Nala, 30th December 1985, M.B. NAGARKAR & P.G. PATWARDHAN 85.2793, Holotype-AMH, Isotype-US.

Other specimens examined: North Andaman, Mayabandar Range, Kaichi Nala- 85.2728, 2767.

Externally this species is identical with *Ocellularia kamatii* Patw. & Kulk. especially with regards to immersed, frequently grouped ascocarps, distinct inner exciple forming a kind of double pore with the main apothecial rim. The ascospores in *O. kamatii*, however, are trans-septate and larger (up to 140 µm long).

Thelotrema expallescens Nyl. with ± immersed ascocarps, periphysoids-bearing exciple differs from the present species in having minute pore (up to 100 µm across), smaller ascospores (up to 16 µm long) and stictic acid in the thallus.

Thelotrema subhiatum Patw. & Nagarkar, *Biovigyanam* **6**: 9 (1980). (Fig.11)

Thallus straw coloured to buff, shiny, smooth, hypophloeodal, ecorticate, medulla 40-60 µm thick; ascocarps numerous, in densely crowded patches, 2-6 in a group, semi-emergent, subchroodiscoid, 0.4-0.8 mm diam; pore irregular, open, 300-450 µm across; thalline margin cracked, suberect to erect, sometimes barely recurved, rarely deciduous; exciple free, with periphysoids, pale yellow, cracked; hymenium layer deeply situated, 80-100 µm high; ascospores 4-6 per ascus, hyaline, muriform, 8-10 X 25-37 µm, 8-11 X 2-4 loculate, I-.

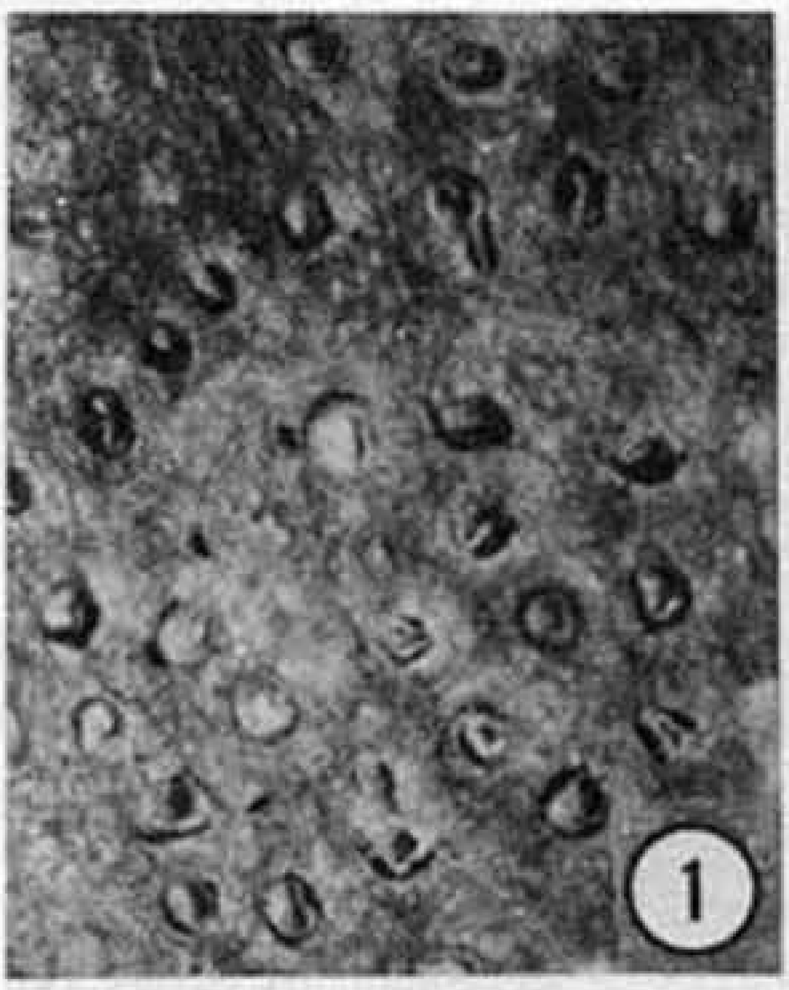
Chemistry: Thallus K-, P-; lacking lichen substances.

Specimen examined: South Andaman, Baratang Island, Wrafter's Crick-85.538.

Distribution: India.

The present specimen bears a close resemblance with *Thelotrema confertum* Nagarkar *et al.* a South Indian species, in all respects, but the latter has very small (12-16 µm long) ascospores.

Explanation of figures 1-12:1. *Leptotrema compunctum* (86.184A); 2. *L. desquamans* (85.1944); 3. *L. tarmuguliense* (85.1862, Holotype-AMH); 4. *Ocellularia concolor* (85.2459); 5. *O. dolichotata* (85.2838); 6. *O. perforata* (85.2066); 7. *O. terebratula* (86.236); 8. *Thelotrema kalarense* (86.460, Holotype-AMH); 9. *T. leucophthalmum* (85.1403); 10. *T. polythecium* (85.2793, Holotype-AMH); 11. *T. subhiatum* (85.538); 12. *T. velatum* (85.2344). Scale in mm.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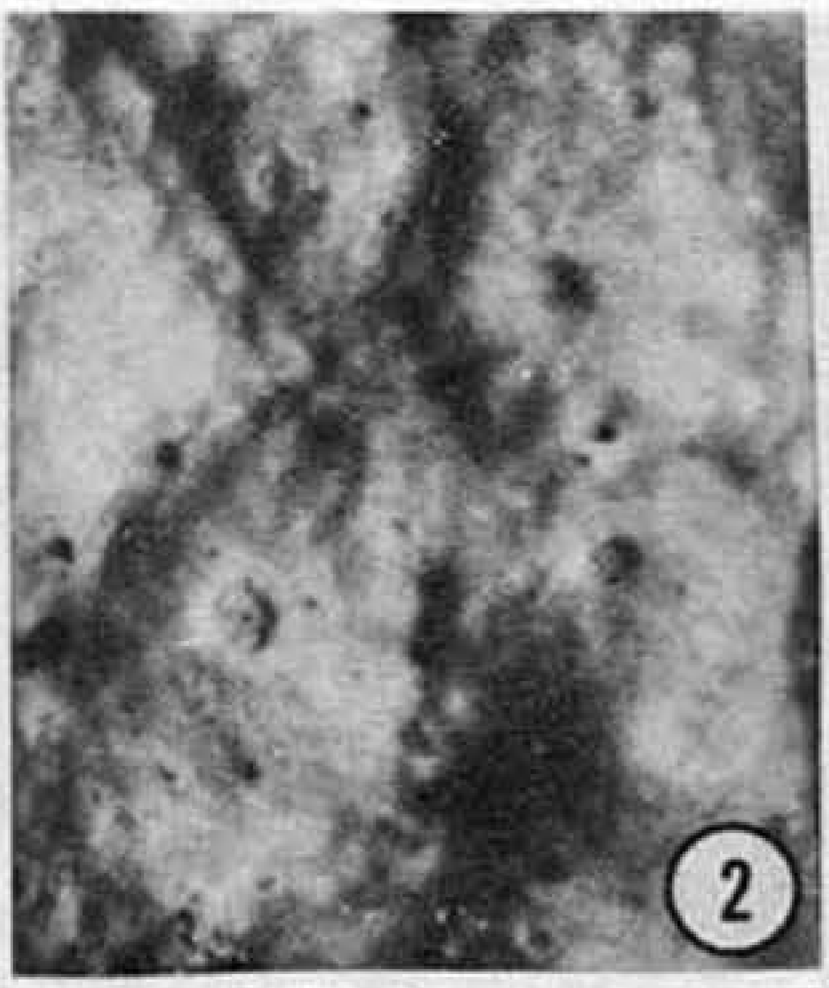
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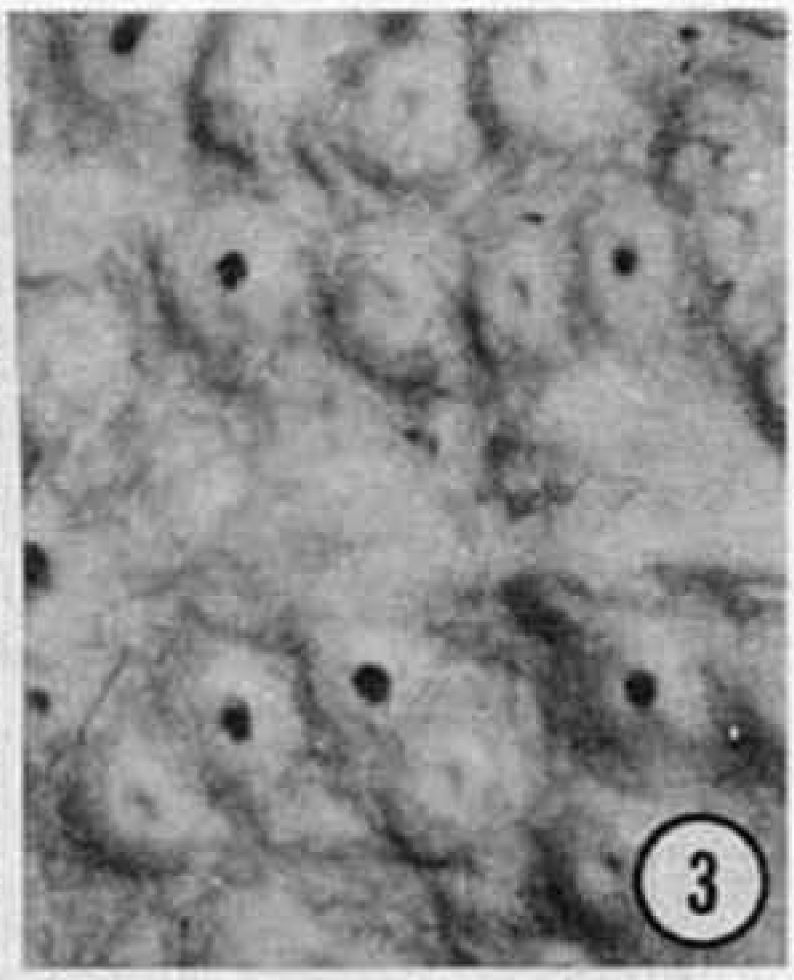
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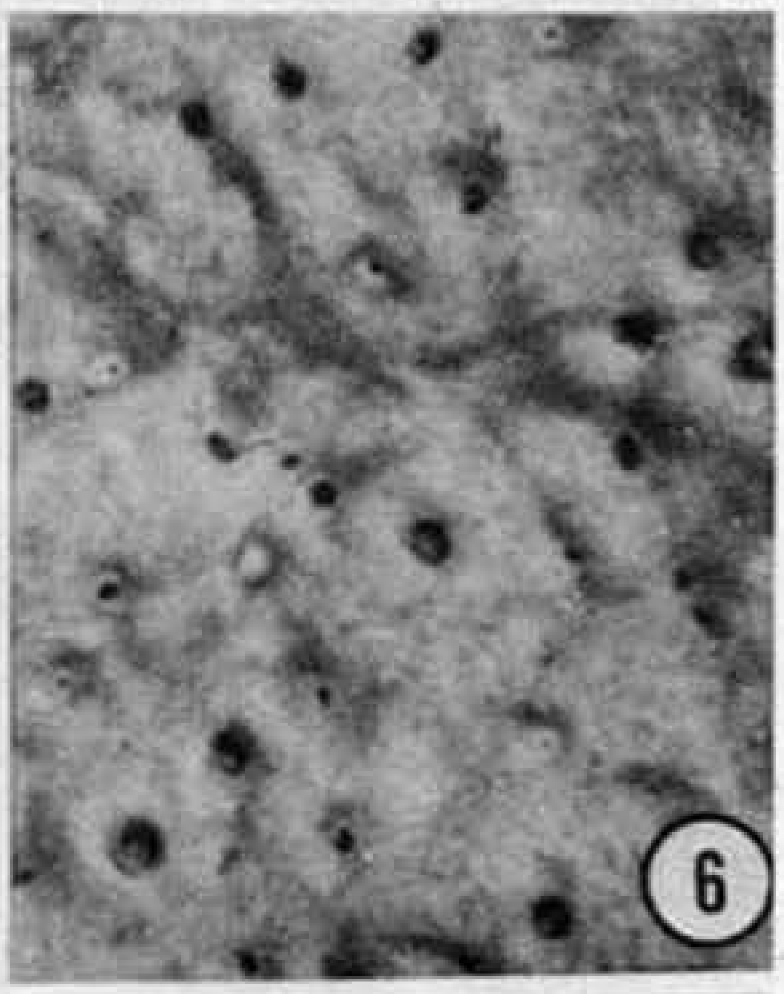
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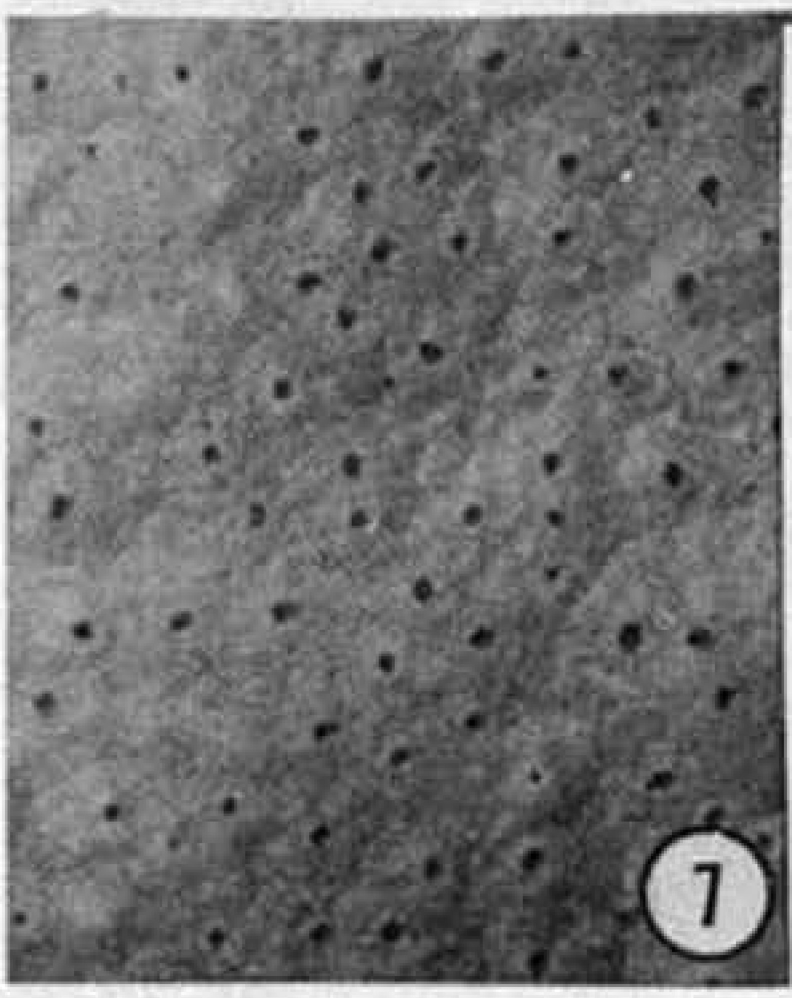
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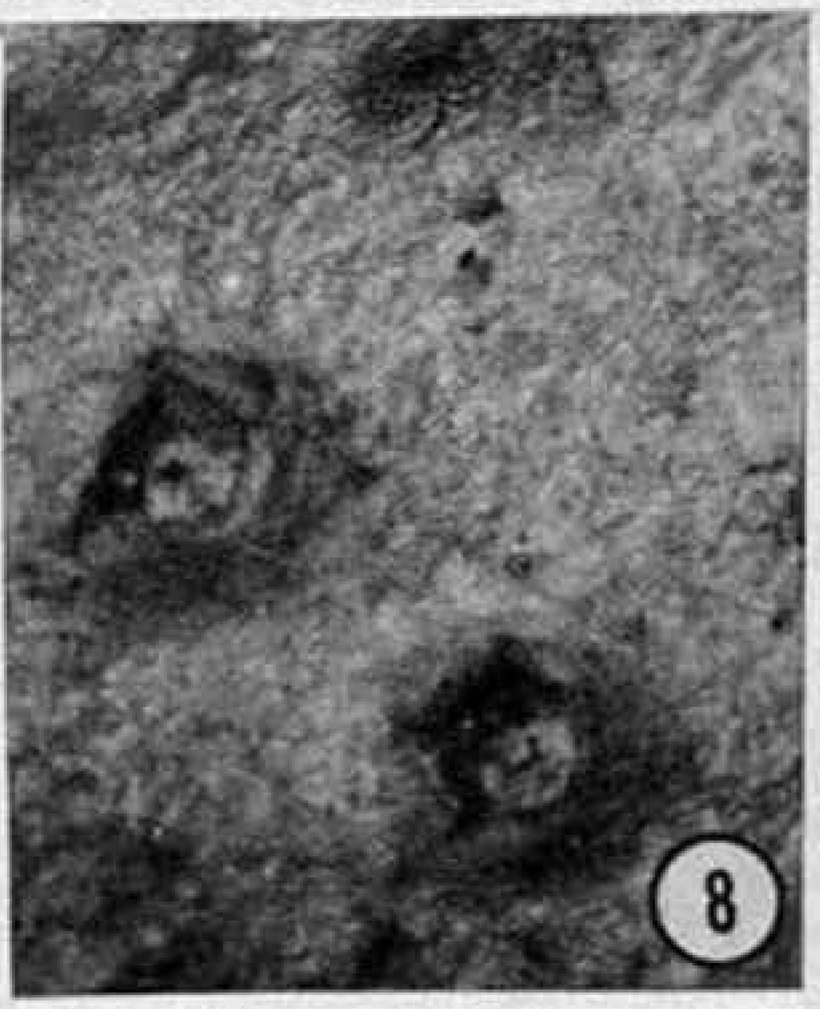
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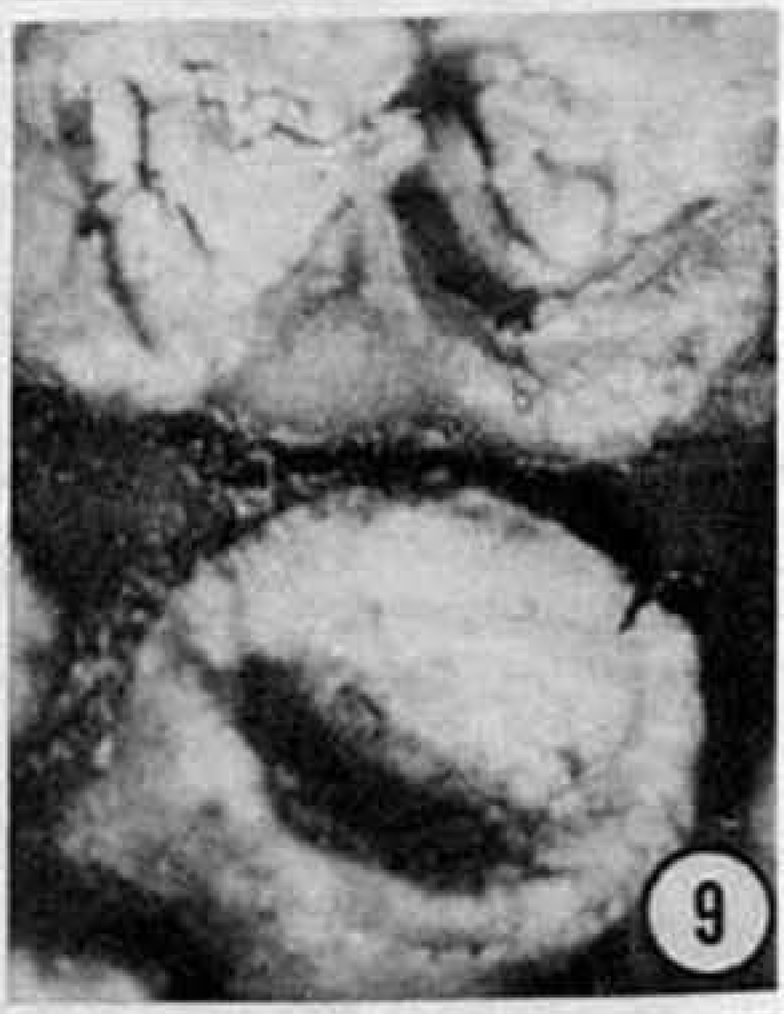
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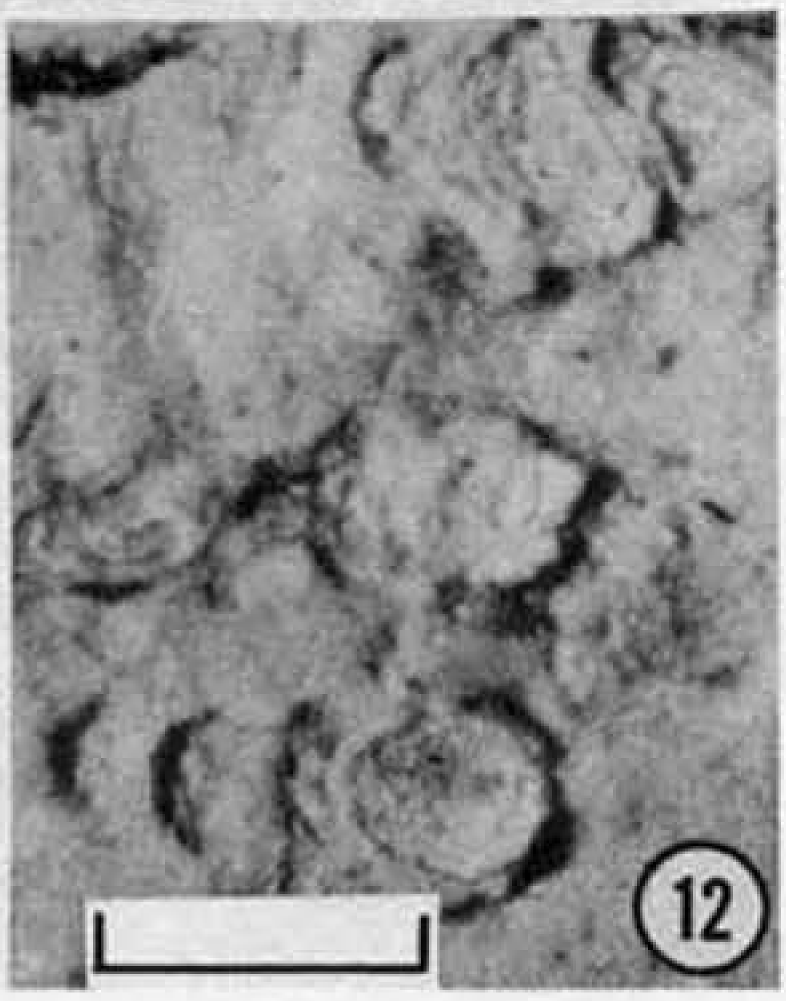
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Thelotrema velatum Müll.Arg., Bull. Soc. Bot. Belgique **32:** 147 (1893). (Fig. 12)

Thallus olivaceous buff, smooth, partly hypophloeodal, ecorticate, medulla 120-140 µm thick; ascocarps many, rounded, semi-emergent to emergent, chroodiscoid, 0.6-0.8 (1.2) mm diam; disc 400-600 µm across, densely white to ashy white pruinose; thalline exciple erect to becoming recurved; exciple free, with indistinct periphysoids, non-carbonized;hymenium 50-80 µm high; ascospores 4-8 per ascus, hyaline, muriform, 6-8 X 20-33 µm, 8-10(12) X 3-4 loculate, I-.

Chemistry: Thallus K-, P-; lacking lichen substances.

Specimen examined: Middle Andaman, Betapur Range, Pitcher Nala-85.2344.

Distribution: Central America, India.

Thelotrema leprocarpum (Nyl.) Tuck. and T. colobicum Nyl. belonging to 'T. platycarpum' group are comparable with T. velatum in morphology of ascocarps and in chemistry but have larger (more than 50 µm long) ascospores. T. leprocarpoides Hale has smaller (0.4-0.6 mm diam.) ascocarps, suberect to erect thalline margin and somewhat larger (36-40 µm long) ascospores.

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STUDIES ON CONIDIOGENESIS IN *RHINOCLADIELLA AQUASPERSA*

T. IWATSU, K. NISHIMURA & M. MIYAJI

Department of Pathogenic Fungi
Research Institute for Chemobiodynamics
Chiba University
1-8-1 Inohana, Chiba City, Chiba 280, Japan

ABSTRACT

An investigation of conidiogenesis in a subculture of the original isolate of *Rhinocladiella aquaspersa* by light and scanning electron microscopy is reported. Both sympodial and annellidic conidiogenous cells were found to occur, the latter infrequently. Reduced forms of sympodial conidiogenous cells and intermediate forms between them were also encountered. Phialides without collarettes were not observed. A developmental continuum from sympodial to annellidic ontogeny is apparent in this fungus.

INTRODUCTION

In 1972, Borelli (1) described a new taxon, *Acrotheca aquaspersa*, for an etiological agent of human chromomycosis. According to him, one of the characteristics of this taxon is possession of erect, dematiaceous, sympodial conidiophores bearing one-celled acropleurogenous conidia. In 1983, Schell *et al.* (10) noted that the generic name *Acrotheca* Fuckel, being a synonym of *Ramularia* Unger, was unacceptable for this fungus and transferred it to *Rhinocladiella* Nannf.. According to them, the fungus produces not only sympodial conidiogenous cells but also annellides and phialides without collarettes. They regarded the sympodial conidiogenous cells as the most stable and distinct anamorph among them. Their description of the fungus was based on light microscopy. The conidiogenous structures in this fungus are, however, so minute as to make it difficult to identify its modes of conidium ontogeny by only light microscopy. The present authors reexamine conidium ontogeny in the fungus by light (LM) and scanning electron microscopy (SEM).

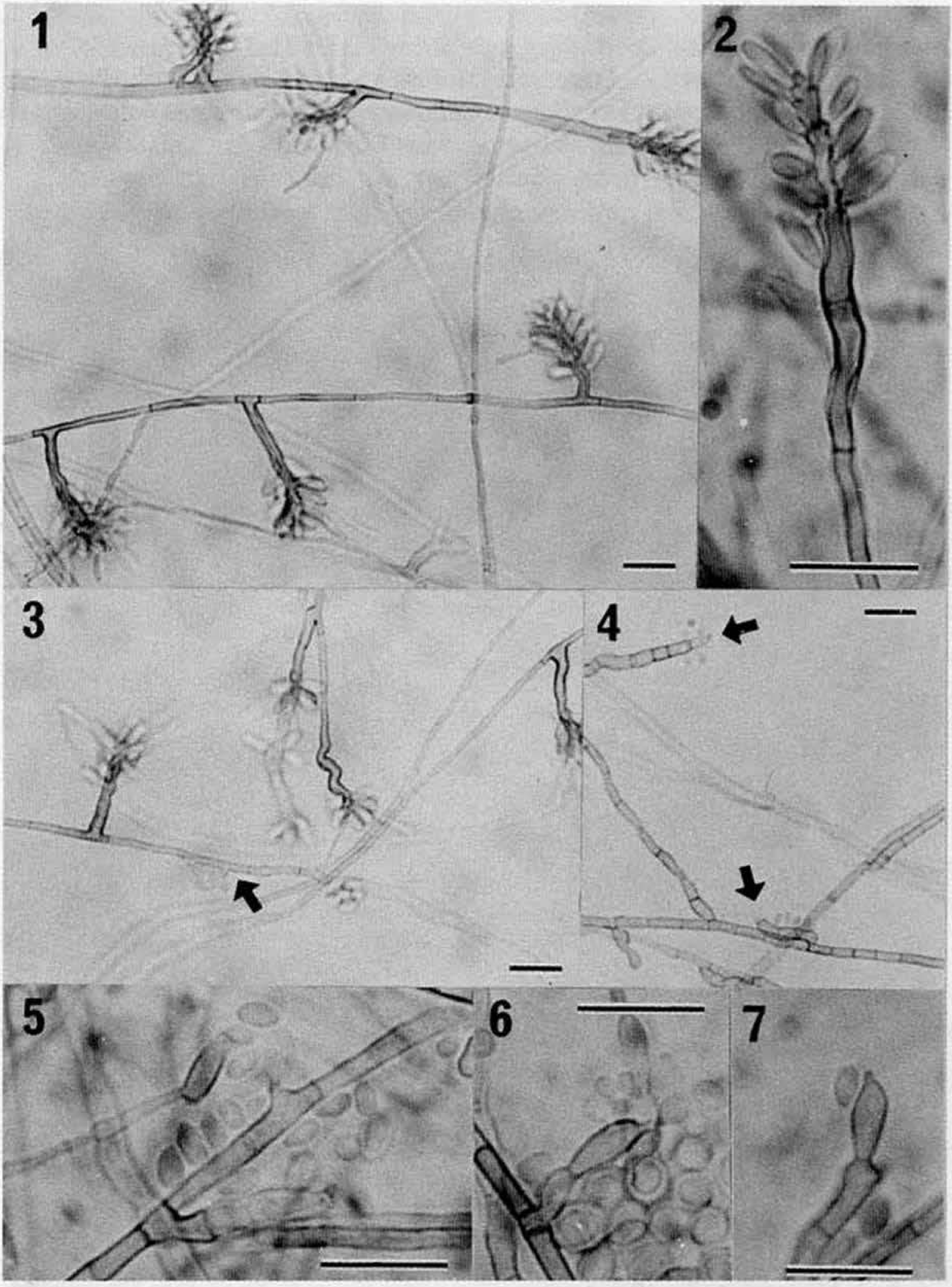
MATERIALS AND METHODS

A subculture of the original isolate of *Rhinocladiella aquaspersa* (Borelli) Schell, McGinnis et Borelli (DCU 612 = FMC 241 = ATCC 24410 = CBS 313.73 = CDC B-1918 = NCMH 76) was used. For LM and SEM, slide cultures were prepared using corn meal agar (Difco) or oat meal agar (Difco). These were incubated at 27°C for 14 to 21 days in the dark. Cover glasses bearing the fungus were examined directly with a light microscope or were prepared for SEM by the following process. Following fixation with 2 % glutaraldehyde at 3°C for 24 hours and 1 % osmium tetroxide at 3°C overnight, the specimens were dehydrated by a series of gradient alcohols, acetones, and isoamyl acetate, then dried with a Critical Point Drier HCP-1 (Hitachi), coated with gold palladium using an Ion Coater IB-3 (Eiko Engineering Ltd.) and observed with a scanning electron microscope HFS-2 (Hitachi).

RESULTS

LM photographs are shown in Figs. 1-7. In the culture, erect sympodial conidiogenous cells were predominantly produced on the conidiophores (Fig. 1). They were smooth, cylindrical, geniculate and 5-35 X 2-3 (average 17.2 X 2.5) µm in size. Conidial scars occurred sympodially on the surface of the upper portion of the conidiogenous cells (Fig. 2). Conidia were smooth, ellipsoidal to short-cylindrical, with truncate scars, one-celled, 4-9.5 X 1.5-2 (average 6.0 X 1.9) µm in size and were arranged in an acropleurogenous manner (Fig. 2). This sympodial anamorph resembles *Rhinocladiella atrovirens* Nannf., the type species of the genus.

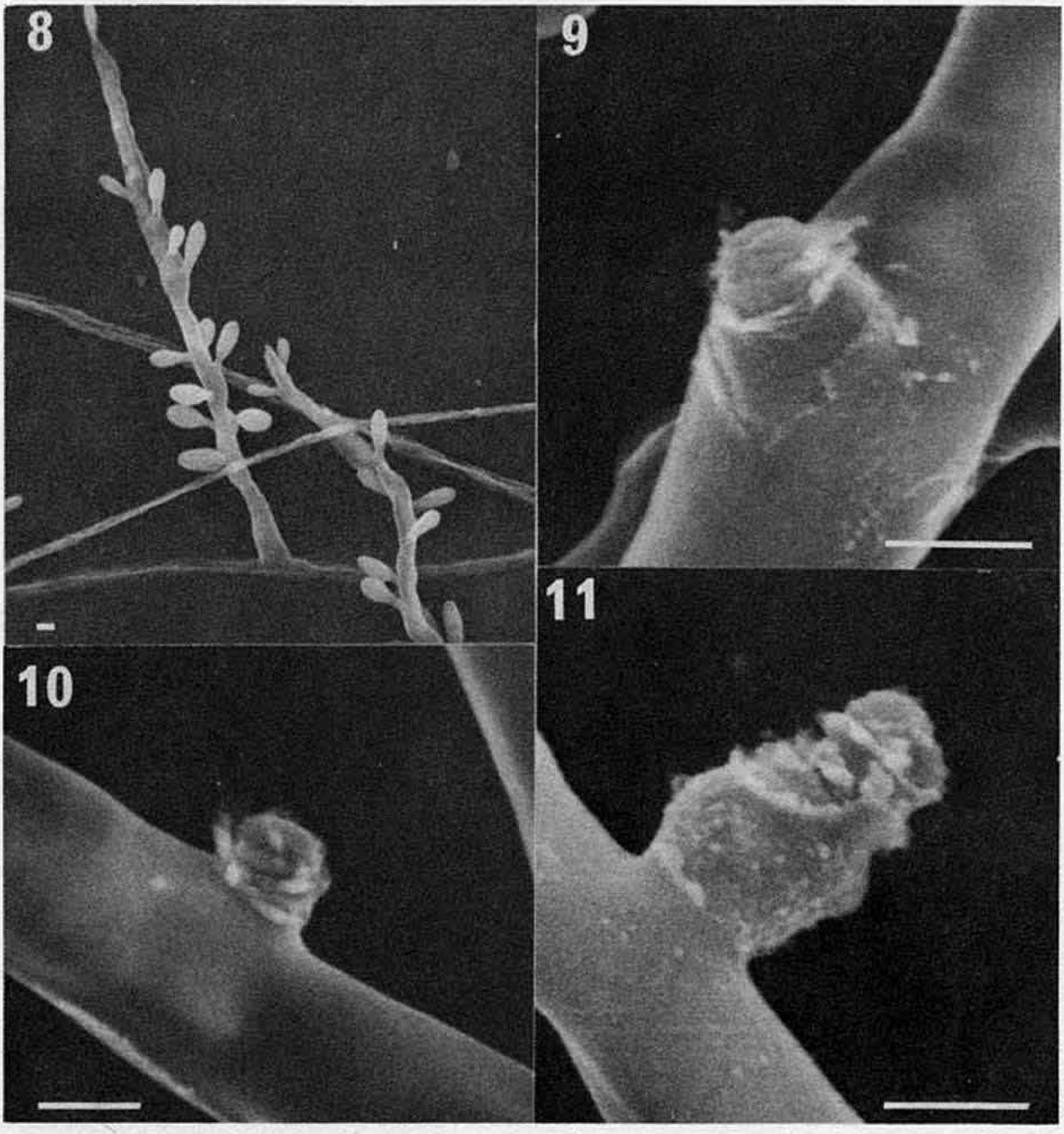
Other forms of conidiogenous cells were also observed in the culture (Figs. 3-7). These forms were produced intercalarily, terminally or laterally on the hyphae, and were smooth, cylindrical, obclavate to lageniform, about 4-14 X 1.5-3 µm in size. These conidiogenous cells resemble annellides or phialides. However, it is difficult to identify them by LM because their conidiogenous structures were so minute. Conidia developed from these conidiogenous cells were smooth, more or less thin-walled, subglobose to



Figs. 1-7. Light microscopic photographs of *Rhinocladiella aquaspersa*. 1, 2. Erect sympodial conidiogenous cells bearing one-celled acropleurogenous conidia (*Rhinocladiella* morph). 3(arrow), 4 (arrows), 5-7. Conidiogenous cells resembling annellides or phialides. Bar=10 μm.

ellipsoidal and about 2-5 X 1.5-3 µm in size (Figs. 5-7).

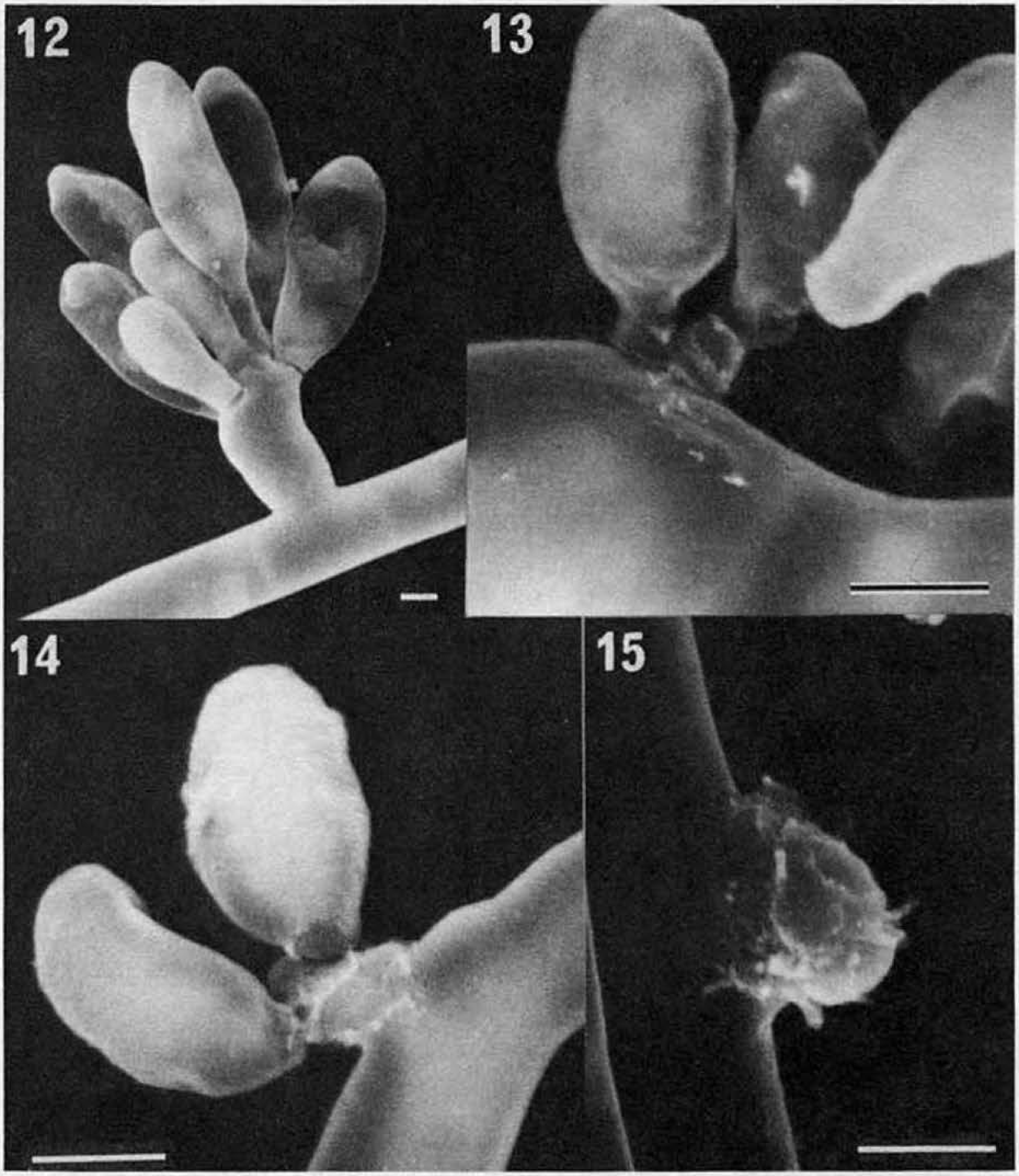
SEM photographs are shown in Figs. 8-17. In addition to the erect sympodial conidiogenous cells (Fig. 8), annellides were also observed, even though few in number. Conidiiferous pegs of the annellides were more or less cylindrical or slightly tapered, and measured less than 2 µm in thickness and less than 3 µm in length. Circumscissle scars on the pegs were relatively thin and fragile (Figs. 9, 11) or irregularly arranged (Figs. 10, 11).



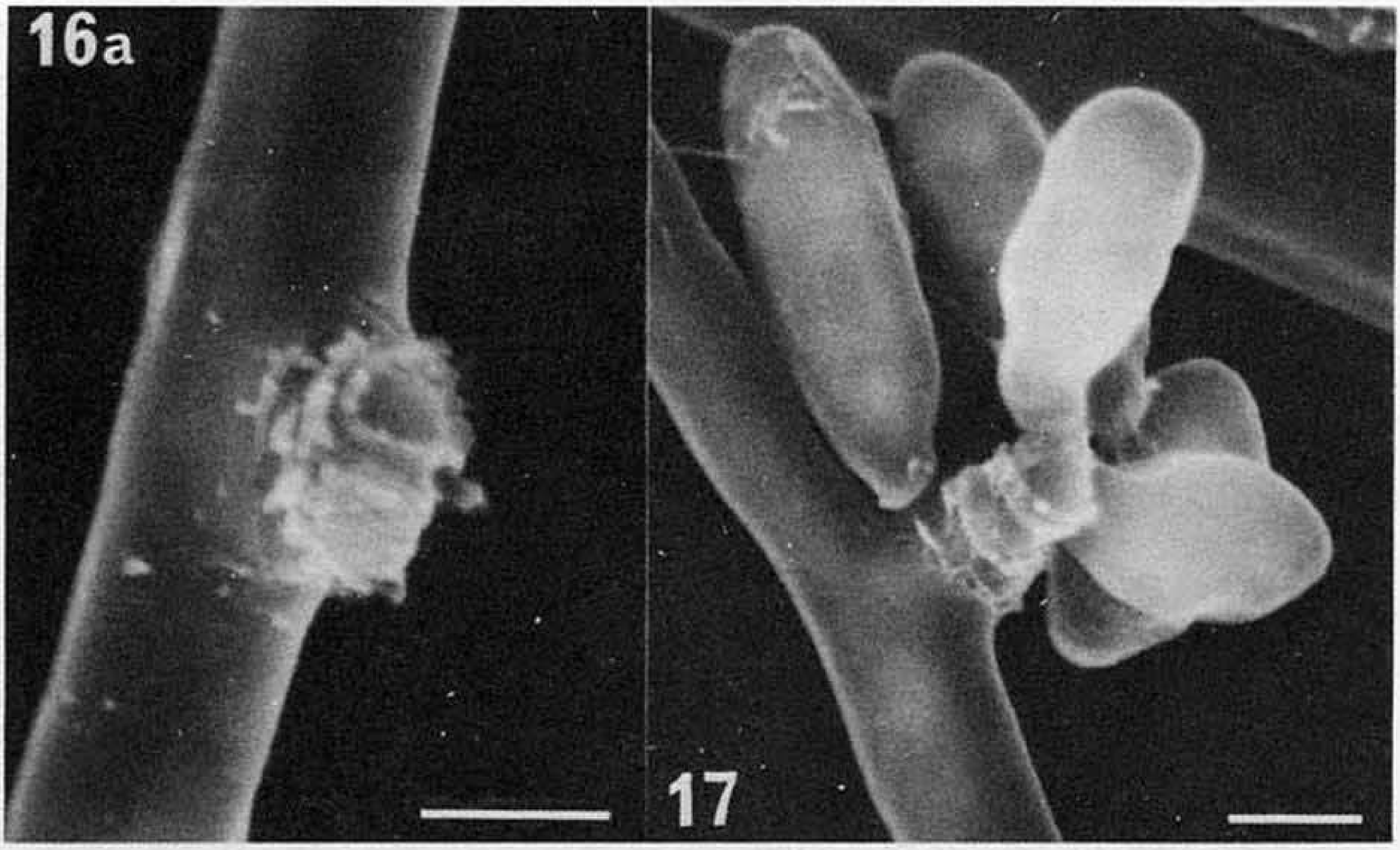
Figs. 8-11. Scanning electron microscopic photographs of *Rhinocladiella aquaspersa*. 8. Erect sympodial conidiogenous cell. 9-11. Annellides. Bar=1 µm.

Reduced conidiophores with sympodial conidiogenous cells were occasionally observed (Fig. 12). Some of them were extremely short (Fig. 13). In these reduced forms, bud scars sometimes overlapped each other (Figs. 14, 15).

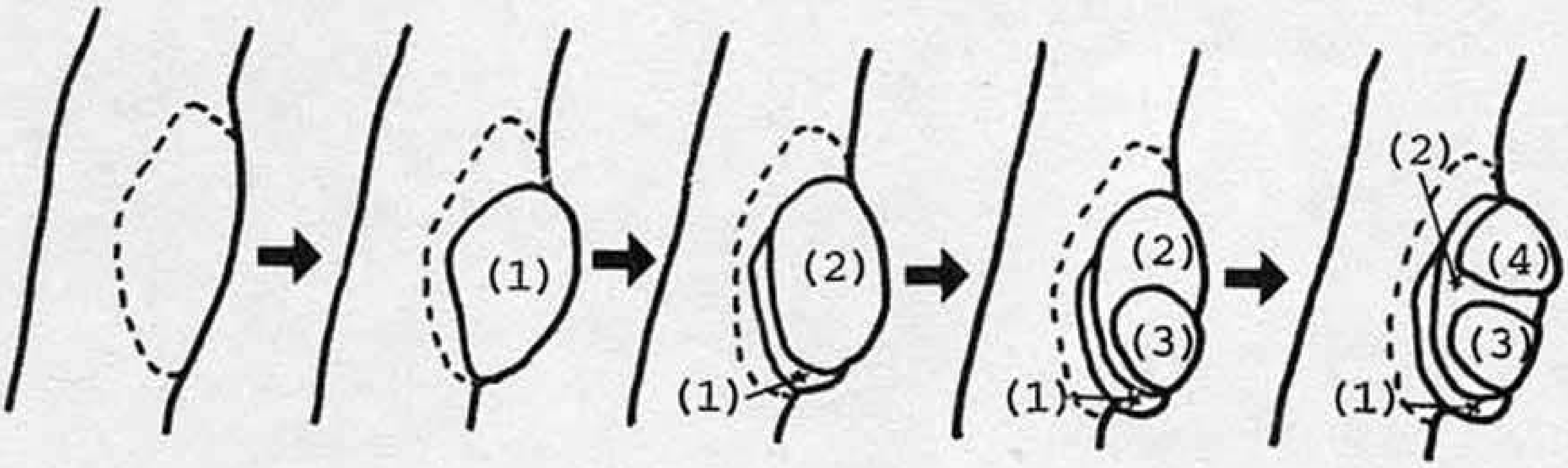
Intermediate forms between sympodial and annellidic



Figs. 12-15. Scanning electron microscopic photographs of *Rhinocladiella aquaspersa*. 12. Sympodial conidiogenous cell arising from reduced conidiophore. 13-15. Reduced sympodial conidiogenous cells. Bar=1 µm.



Figs. 16a, 17. Scanning electron microscopic photographs of *Rhinocladiella aquaspersa*. Intermediate forms between sympodial and annellidic conidiogenous cells. Bar=1 µm.



* Bud scars are labelled (1)-(4) to indicate their order of formation.

Fig. 16b. Schematic presentation of Fig. 16a.

conidiogenous cells sometimes occurred. In some of them, conidia were initially produced in an annellidic fashion, but subsequently by sympodial growth (Figs. 16a, 16b). Fig. 17 shows another example of the intermediate form. In this form, the conidiogenous cells bear annellations but the conidiogenous pegs grew in a zigzag manner, giving the conidiogenous cells a morphology reminiscent of both a sympodula and an annellide.

DISCUSSION

Schell *et al.* (10) examined a culture derived from the original isolate of *R. aquaspersa* by LM, and described three anamorphs in the culture; erect sympodial conidiogenous cells with acropleurogenously arranged one-celled conidia (*Rhinocladiella* morph), annellides (*Exophiala* Carmichael morph) and phialides without collarettes (*Wangiella* McGinnis morph). Their description of the latter two was very brief, and neither was illustrated. In the present investigation using LM and SEM, the culture derived from the same isolate produced the erect sympodial conidiogenous cells, annellides , various reduced forms of sympodial conidiogenous cells and intermediate forms between sympodial and annellidic conidiogenous cells. Phialides without collarettes were not observed.

It is interesting to note that intermediate forms between sympodial and annellidic conidiogenous cells sometimes occurred in the fungus. Intermediate forms between the two types of conidiogenous cells have also been observed in several other fungi (9, 12, 16). Nishimura and Miyaji (9) observed both sympodial and annellidic conidiogenous cells with various intermediate forms in *Hortaea werneckii* (Horta) Nishimura et Miyaji. They analyzed the mechanisms of their formation and concluded that the sympodial and annellidic anamorphs in *H. werneckii* are a homology. Recently, Tsuneda *et al.* (13) have reported that interconversion of sympodial and annellidic anamorphs readily occur in isolates of *R. atrovirens*.

It has been suggested that conidia produced by sympodial conidiogenous cells are holoblastic while those arising from annellides are enteroblastic or holoblastic (2, 7). It is of interest to determine whether conidia developed from intermediate forms between sympodial and annellidic conidiogenous cells in this fungus are holoblastic or enteroblastic. Whether the process of conidiation is holoblastic or enteroblastic may simply be a matter of juvenility or maturity of the wall at the conidiogenous locus (6). Conidium ontogeny has been used as one of important criteria in the generic separation of the conidial fungi (4, 14). However, it is now recognized that conidium ontogeny is much more plastic than anticipated (5). A developmental continuum occurs between different modes of conidiogenesis such as between phialidic and annellidic proliferation (8, 11, 15), between sympodial and phialidic development (2, 3) and between sympodial and annellidic proliferation (9, 12, 13, 16). *Rhinocladiella aquaspersa* must be included among fungi in which the third type of continuum is observed.

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ENTROPHOSPORA SCHENCKII: A NEW SPECIES IN THE ENDOGONACEAE FROM COLOMBIA

Ewald Sieverding[1]
and
Silvia Toro T.

Centro Internacional de Agricultura Tropical (CIAT)
Apartado Aéreo 6713, Cali, Colombia

SUMMARY

Entrophospora schenckii forms small (less than 100 µm in diam.) hyaline spores singly in soil and in roots. Except for spores no other fungal structures stain with trypan blue or other common dyes. For positive identification of *E. schenckii* spores lacking intact hyphal attachments we recommend that single spore pot cultures be set up to produce spores of different development stages.

RESUMEN

Entrophospora schenckii forma esporas hialinas pequeñas (menor de 100 µm en diam.) solas en el suelo y en la corteza de las raices. Excepto para esporas ninguna otra estructura del hongo se tiñe con azul de trípano u otros colorantes. Para determinar el género de esporas carentes de conexiones hifales, se recomienda de establecer cultivos puros en potes a partir de una sola espora. Así, observando esporas en diferentes estados de desarrollo se puede clasificarlo.

INTRODUCTION

Species of vesicular arbuscular mycorrhizal fungi from different edapho-climatic conditions of Colombia are maintained in pot cultures on the tropical pasture legume *Pueraria phaseoloides* (Roxb.) Benth., at CIAT Palmira, Valle, Colombia. From pots inoculated with soil from a rose nursery, hyaline, small sized spores were recovered lacking a hyphal attachment. Subsequent pot cultures with these spores were observed and

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[1] Present address: Inst. Trop. Pflanzenbau, Grisebachstrasse 6,
D-3400 Göttingen, West Germany

and the development stages of the fungus showed that the spores were an undescribed species in the genus Entrophospora Ames & Schneider. In this description the spore wall terminology follows that of Walker (1983). For the use of the term "sporiferous saccule" we refer to Walker et al. (1984).

ENTROPHOSPORA SCHENCKII Sieverding & Toro sp. nov. (Figs. 1, 2 and 3)

Sporocarpia ignota. Sporae singillatim in solo vel radicibus efformatae; spora intra collum, diam. 8-10 µm, sacculi sporangiferi, diam. (37) 50-60 (-68) µm, crescet; paries sacculi sporangiferi 0.5 µm crassus; sacculus primo hyalinus deinde perlucidus festur simulatque materia interna in adulescentem sporam exhausta; hypha sporam et sacculum 6-26 µm longa. Sporae adultae globosae vel subglobosae, (37-) 50-65 (-77) µm, vel ellipsioidae, 48-97 x 25-60 µm diam. Crassitudo plenus parietis sporarum 1.5-2.5 µm; sporae paries e stratis tribus: exteriorum idem paries hyphae in quam spora cresceto, hyalinum, evanidum, 0.5 µm crassum adhaerentum strato secundo; secundum hyalinum solidum, 0.5-1.0 µm crassum; tertium separabilis e strato secundo, membrana hyalina, 0.5-1.0 µm crassa. Hyphae extra radicium nonsepta vel septa.

Sporocarps unknown. spores hyaline, globose to subglobose, (37-) 50-60 (-77) µm diam. or ellipsoid to ovoid, 48-97 x 25-60 µm, formed singly in soil and in the cortical cells of roots, within the 8-10 µm diam. neck of a globose to subglobose sporiferous saccule, (37-) 50-60 (-68) µm diam.

Spore wall structure consists of three walls (walls 1-3) in two groups (groups A&B). Wall group A of two walls (walls 1&2). Wall 1 approx. 0.5 µm thick, formed by the wall of the sporiferous saccule neck, usually adherent to wall 2, a unit wall 0.5-1.0 µm thick. Wall group B is a single, membranous wall (wall 3) 0.5-1.0 µm thick. Spores found occasionally with the collapsed sporiferous saccule still attached, but usually broken away from it near the spore.

Extra-radical mycelium dimorphic, coenocytic in youth with septae sometimes forming with age; consisting of broad (1.5-5.0 µm diam.) hyphae from which emanate narrow hyphae (1-2 µm diam.).

TYPE: Colombia, Valle, Palmira, Centro Internacional de Agricultura Tropical. From culture no. C-133-8 on Pueraria phaseoloides (Holotype OSC, isotypes FLAS, COL).

ETYMOLOGY: Named in honor of N.C. Schenck, University of Florida, Gainesville, for his taxonomic work with the Endogonaceae.

DISTRIBUTION: To date, E. schenckii is only known from Colombia, South America. The type was isolated from a pot culture of tropical kudzu established with soil from a former rose nursery of Melecio Ospina, 2 km from Cajica towards Tabio, Cundinamarca. Entrophospora schenckii was also isolated from a sugarcane field, Ingenio Manuelita, Palmira, Valle del Cauca (CIAT culture no. C-117-6). In both cases the soils were fertile, with pH 7.4 and 6.8, 5.4 and 3.5% organic matter, 274 and 20 μg P/g soil (Bray II extr.), 22 and 20 meq. Ca, 2.2 and 11 meq. Mg, 0.3 and 1.3 meq. K/100 g soil for M. Ospina and Manuelita, respectively.

DISCISSION: Entrophospora schenckii is easily separated from the other two species in this genus, E. infrequens (Hall) Ames & Schneider and E. colombiana Spain & Schenck by its hyaline and thinner walls and smaller spore diameter. Spores of E. schenckii are often devoid of the subtending hypha and remain of the collapsed sporiferous saccule, making the genus determination impossible. For total confidence in distinguishing E. schenckii from other hyaline, small-spored species of the Endogonaceae we recommend the establishment of single spore pot cultures as proposed by Yu-Cheng Fang et al. (1983). In this way a positive determination can be made with spores at all development stages.

Wall characteristics of E. schenckii may be difficult to observe. Wall 1 (Fig. 2) usually is present on spores and may be detected by observing the point where the neck of the sporiferous saccule is connected to the spore (Fig. 3). On some specimens, wall 1 is absent, having been lost as the saccule collapses. This is not precisely the same phenomenon as the evanescent wall described by Walker (1983), but because the wall is present at an early developmental stage of the spore and can be lost later, we have chosen to extend the concept to include this type of wall. On broken spores, wall 1 may wrinkle and because of this, may more easily observed. Wall 2 is always distinct. Wall 3 (wall group B, Fig. 2) is distinct in specimens mounted in polyvinyl alcohol lactophenol (Walker 1979); this wall encloses the plasmalemma with the spore content. On most specimens wall 3 is flexible and thus is characterized as a membranous wall after Walker (1983), though on some specimens, it may be more rigid and thus may appear as an unit wall.

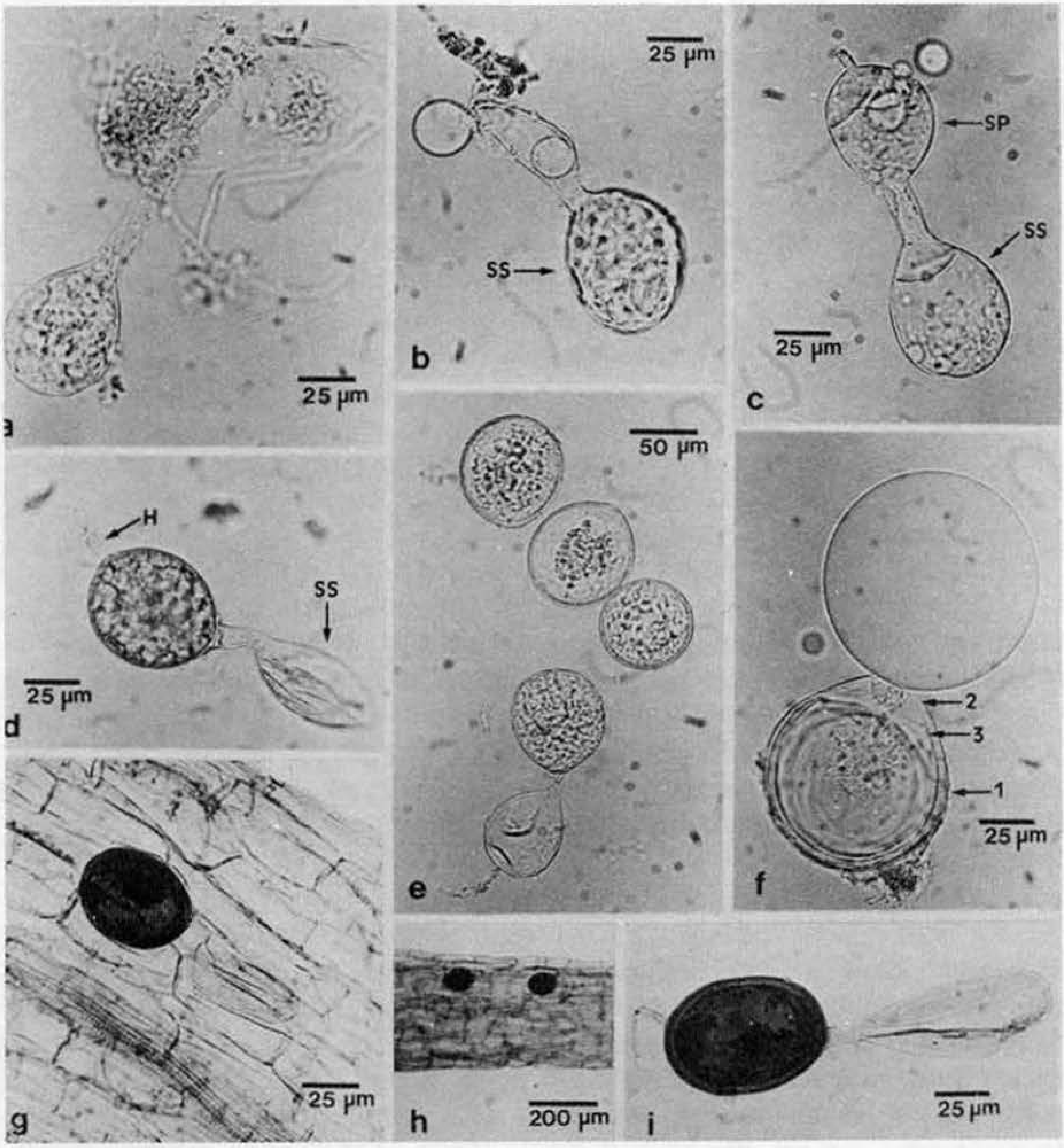

FIG. 1: Light photomicrographs of Entrophospora schenckii. a) Young and b) mature sporiferous saccule (SS = Sporiferous saccule). c) Initial stage of spore formation (SS = Sporiferous saccule; SP = Young spore). d) Mature spore with collapsed sporiferous saccule (SS) and subtending hypha (H). e) Group of spores. f) Broken spore with three walls (1,2,3), wall 1 partly sloughed off. g)h) Spores in the cortex of roots stained with trypan blue. i) Spore stained with trypan blue and wall swollen by lactophenol. a)b)c)e)i) Material mounted in lactophenol; d) mounted in water; f) mounted in Melzer's reagent.

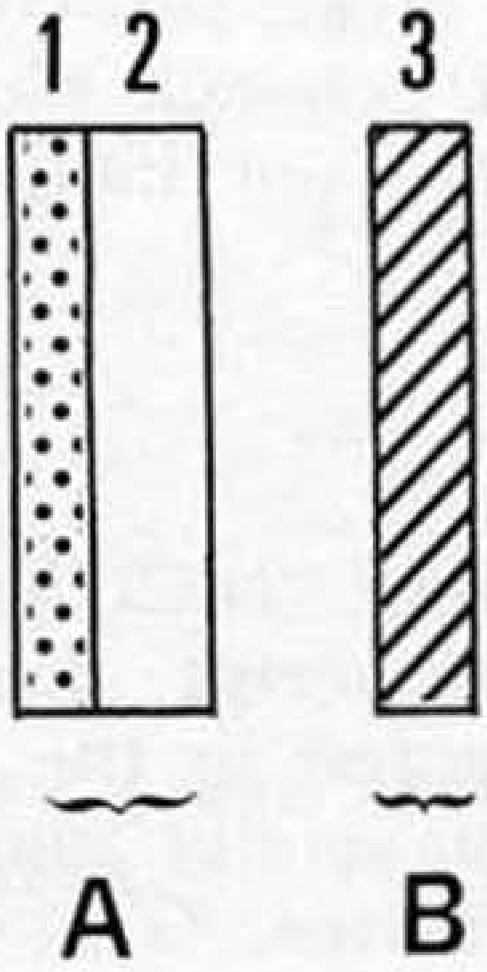

FIG. 2. Murograph of the wall structure of Entrophospora schenckii. Diagram after Walker (1983).

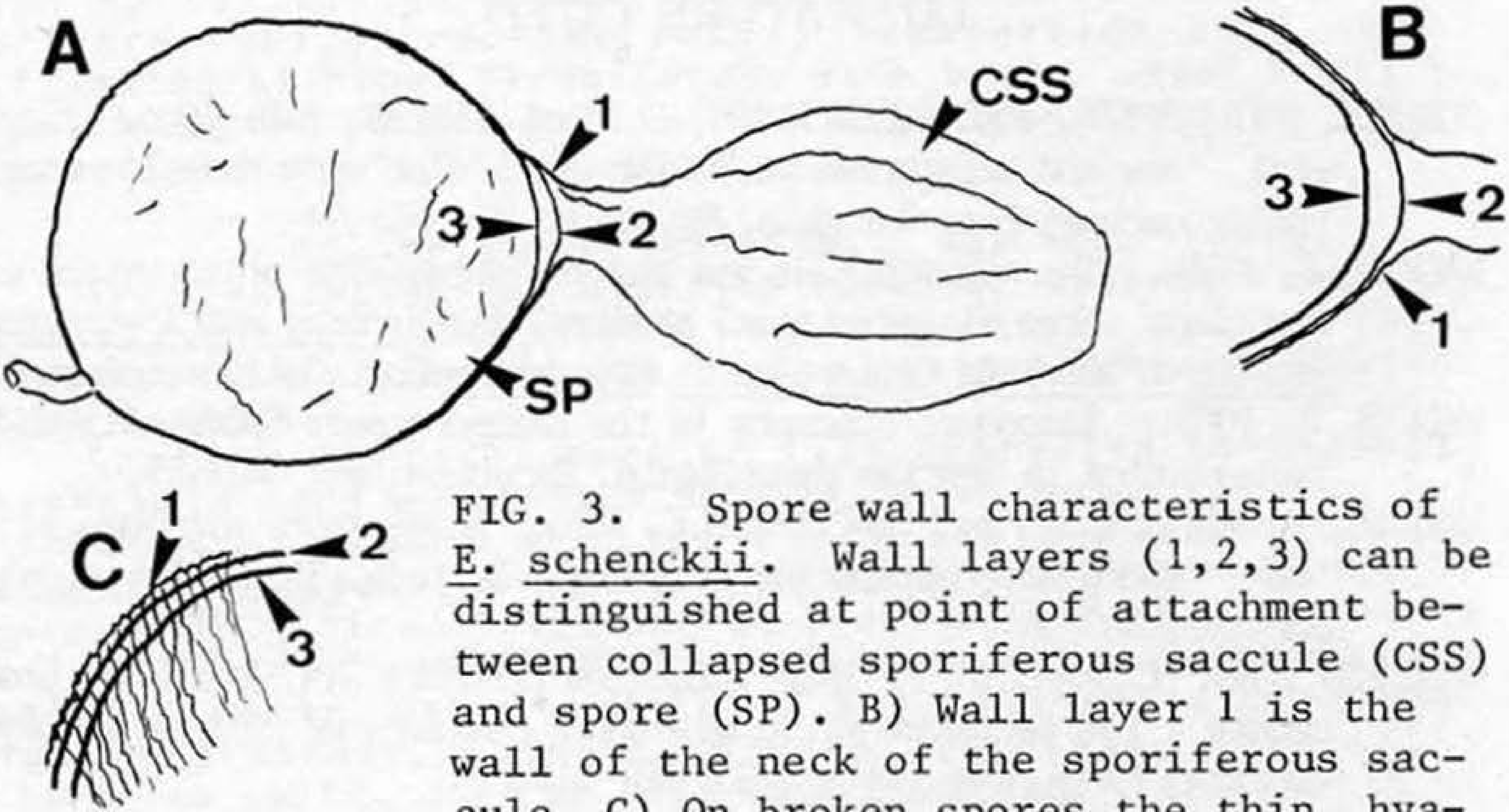

FIG. 3. Spore wall characteristics of E. schenckii. Wall layers (1,2,3) can be distinguished at point of attachment between collapsed sporiferous saccule (CSS) and spore (SP). B) Wall layer 1 is the wall of the neck of the sporiferous saccule. C) On broken spores the thin, hyaline wall 1 often wrinkles.

Except for spores, the fungal structures of E. schenckii were resistant to staining by any of the common methods. Thus, we could not confirm whether this species forms vesicular-arbuscular mycorrhizae. We conclude from the presence of spores in the cortical cells of the roots that E. schenckii forms endomycorrhizae.

In some specimens of E. schenckii we found globose to subglobose, 25-35 μm diam., hyaline, thin walled structures formed terminally on the narrow hyphae of the external mycelium. These often collapsed in lactophenol.We did not determine whether these were developing sporiferous saccules or vesicle-like structures similar to, but smaller than, those reported for *Acaulospora appendicula* Spain, Sieverding & Schenck (Schenck *et al.* 1984). Therefore these structures were not included in the description.

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A NEW SPECIES OF MELANELIA FROM NEPAL

Theodore L. Esslinger

Department of Botany
North Dakota State University
Fargo, North Dakota 58102

Since the time of my original monograph and description of Melanelia (Esslinger, 1977 & 1978), no new species of that genus have been described. There is little doubt that a number of species remain to be discovered and described, particularly from lichenologically poorly explored regions such as the southern hemisphere and remote areas of the northern hemisphere. Recently, examination of a small collection of brown Parmeliaceae made by Dr. Josef Poelt in Nepal has yielded the following undescribed species. I am pleased to name it in his honor:

Melanelia poeltii Essl., sp. nov. Fig. 1

Thallus appressus, moderate adnatus, superne isidiatus et pseudocyphellatus, isidiis plus minusve cylindricis, pseudocyphellis sparse et obscuris, acidum fumarprotocetraricum continens.

Thallus foliose, more or less appressed throughout, moderately adnate, up to 6 or 7 cm in diameter. Lobes 1-3 (-5) mm broad, more or less flat, short and rounded to slightly elongate, more or less contiguous to imbricate. Upper surface olive-brown to red-brown or dark brown; smooth to irregularly and slightly pitted or wrinkled; dull to somewhat shiny, especially near the lobe-ends, sometimes lightly pruinose; without soredia; isidiate, the isidia arising as small, more or less spherical papillae, mostly on the older parts of the thallus, cylindrical to rather irregular, becoming short branched, mostly ca. 0.10 up to .25 mm long and 0.06 to 0.09 mm in diameter; pseudocyphellate, but the pseudocyphellae sparse (absent on some lobes), nearly concolorous with the upper surface and therefore inconspicuous and easily overlooked. Lower surface dark brown to black; more or less flat and smooth, rather shiny; moderately rhizinate. Apothecia and pycnidia not seen.

Thallus reactions: cortex all spot tests negative; medulla PD+ yellow-orange to red-orange (PD- only in some older thallus parts), K-, C-, KC-, CK-. Constituent: fumarprotocetraric acid.

This species is similar, both in habit and habitat to Melanelia elegantula (Zahlbr.) Essl., and is most likely to be mistaken for that species. The two are easily distinguished by the difference in chemistry and spot tests: M. elegantula lacks detectable lichen substances and has a

Fig. 1. Part of the holotype of Melanelia poeltii Essl., 5X. (Poelt L207, M).

PD- medulla. The PD+ medullary reaction of M. poeltii is sometimes weak or restricted to the upper portion of the medulla and may apparently be lacking in older thallus parts. Only fumarprotocetraric acid could be detected on the TLC plates (using the standardized techniques outlined by Culberson, 1972), but protocetraric acid often occurs as a trace substance with fumarprotocetraric acid in other species of this group [e.g. M. olivacea (L.) Essl., and M. olivaceoides (Krog) Essl.], and it may well be present in very small amounts in this species as well.

In Melanelia, true isidia appear to have two basic patterns of development. In one of these, characterized by M. elegantula, the isidia originate on younger thallus parts as small, more or less conical to hemispherical (i.e., broad, not constricted at the base) papillae which have very obscure pseudocyphellae present on their tips. Development into simple to sparsely (and usually unequally) branched isidia is often rather distinctly centripetal on the thallus. In the other type of isidial ontogeny, the isidia originate as small more or less spherical (i.e., constricted at the base) papillae without pseudocyphellae and with only a weak (if any) tendency for centripetal development on the thallus. Despite the superficial resemblance of M. poeltii and M. elegantula, the two are not likely very closely related (certainly not "chemotypes") since isidial ontogeny in M. poeltii is of the second type.

One other species that might be confused with M. poeltii is M. olivaceoides, since the latter species also often has a PD+ medulla and isidia-like propagules. These propagules are actually isidoid soredia instead of true isidia, however, and originate for the most part as granular soredia in soralia. Also, M. olivaceoides lacks detectable pseudocyphellae.

Melanelia poeltii may actually be most closely related to the nonisidiate species M. olivacea, with which it shares a similar chemistry, pseudocyphellae, and habit. The two are almost similar enough to fit Poelt's (1970) concept of a primary and secondary species pair, but that judgment will require study of further material of M. poeltii, hopefully including fertile material.

Specimens Examined: Nepal, Mahalangur Himal, Khumbu, Bibre, 45-4600 m, Poelt L207 (M, holotype); Pheriche, 4250 m, Poelt L203, L206 (M).

I wish to thank Dr. Hannes Hertel for arranging the loan of these specimens.

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BENIOWSKIA AND ITS SYNONYM CLATHROTRICHUM

Richard T. Hanlin

Department of Plant Pathology
University of Georgia
Athens, Georgia 30602

ABSTRACT

An examination of numerous collections of *Beniowskia* on grasses from tropical and warm temperate regions of the world indicates that all belong to a single species, *B. sphaeroidea* (Kalchbr. & Cke.) Mason. It was first collected in the United States in Kansas in 1909 and has since been reported from Georgia, Nebraska, and Texas. A comparison of type and authentic material of *Beniowski* Raciborski and *Clathrotrichum* Patouillard shows the two genera to be congeneric; *Clathrotrichum* thus becomes a synonym of *Beniowskia*. The septum in *B. sphaeroidea* has a single central pore and associated woronin bodies.

INTRODUCTION

Beniowskia is a genus of sporodochial hyphomycetes that parasitizes grasses in the tropics and warm temperate areas. The genus is characterized by formation of sporodochia on the surface of host (grass) leaves from internal mycelium. The sporodochium is attached to the leaf by a bundle of parallel hyphae that emerges through the epidermis and expands to form an open network of extensively-branched, many-septate, hyaline hyphae that comprise the sporodochium (Fig. 14). Sporodochia vary in size (ca 0.5-3.0 mm) and shape, from pulvinate to elongate. Globose, hyaline, one-celled conidia are produced on short pegs formed laterally on the sporodochial hyphae (Barron, 1968). In recent years the fungus has been reported from Texas (Taber, et al., 1978) and Georgia (Brown and Hanlin, 1982), presumably the first known occurrences of this species in the United States.

During the literature review on this fungus the following comment was encountered in an article by Mason (1928): "Miss Wakefield points out that *Clathrotrichum subcarneum* Pat. gen. nov., spec. nov., ..., is, from the figures and description, a *Beniowskia* . . .". Carmichael, et al. (1980), on the other hand, list *Clathrotrichum* as a possible synonym of *Martindalia* and *Heydenia*. A study was undertaken to compare *Beniowskia* and *Clathrotrichum* and to investigate other aspects of *Beniowskia*; the results are reported below.

MATERIALS AND METHODS

Dried specimens borrowed from herbaria were mounted in water for examination and measurements. Fresh material for electron microscopy was fixed in buffered 2% glutaraldehyde, postfixed in OsO_4, and infiltrated with and embedded in Spurr's medium, following procedures described previously (Glover and Hanlin, 1981). Thin sections were cut and stained with 2% uranyl acetate, mounted on grids, and examined on a Zeiss 10A transmission electron microscope. Electron micrographs were made with Kodak electron microscope image film and photomicrographs were made with Kodak technical pan 2415 film on a Nikon Optiphot microscope equipped with Nomarski phase interference optics. Data taken from the host index card file at National Fungus Collections, U.S.D.A., Beltsville, MD, are referenced as BPI. Herbarium acronyms conform to Index Herbariorum (Holmgren, et al., 1981).

OBSERVATIONS

Beniowskia graminis Raciborski - Type material of this species (PAD) on *Panicum nepalense* Spreng. bore only a few flat, brittle structures that yielded hyphal fragments and conidia when mounted. Both hyphae and conidia are hyaline and the hyphae have short pegs to which the conidia were attached. Conidia are globose, one-celled, and average 9.2 µm diam (Fig. 1). A second collection (BPI) bearing the same data as the type was dated April, 1900. This specimen did not have any sporodochia. A third collection (FH) from the type locality was identified by Raciborski and must be regarded as authentic. This specimen bears round to elongate sporodochia up to 400 µm wide. They are buff in color and are attached to the host leaf by a central bundle of parallel hyphae. The sporodochium is composed of a much-branched network of septate, hyaline hyphae. Globose, hyaline, one-celled conidia that average 8.2 µm diam are borne on short pegs on the sporodochial hyphae (Fig. 3). This material agrees well with the original description by Raciborski (1900). Additional material of *B. graminis* from the type locality is contained in collections by von Höhnel. These specimens are identical to the Raciborski material (Fig. 2, 4-5).

Material examined. *Beniowskia graminis* - JAVA: Raciborski, Nr. 100, *Panicum nepalense*, undated, PAD, TYPE; Raciborski, Nr. 100, April, 1900, BPI; Raciborski, 3070 SS*16* 1091, *Panicum nepalense*, undated, FH; v. Höhnel, No. 698, 1908, BPI, FH, IMI; v. Höhnel, 1908, FH.

Beniowskia penniseti - TRINIDAD: F. L. Stevens, No. 896, *Chaetochloa poiretiana*, 8-15-22, FH, NY, IMI; UGANDA: Hansford, No. 737, *Pennisetum purpureum*, 11-7-26, IMI; Small, No. 251, *Pennisetum purpureum*, undated, IMI, TYPE; ZIMBABWE [as RHODESIA]: E. A. Robinson, *Setaria verticillata*, 1-3-53, IMI; F. Eyles, No. 14002, *Setaria verticillata*, 2-20, IMI.

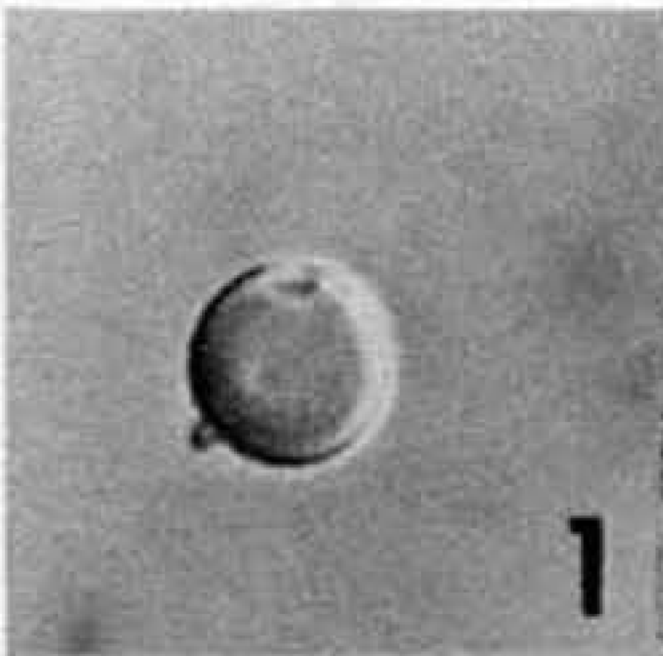
Beniowskia sphaeroidea - ECUADOR: H. Sydow, *Pennisetum* sp., 11-2-37, IMI; H. Sydow, *Pennisetum bambusiformis*, 11-2-37, NY; H. Sydow, *Pennisetum tristachys*, 1-12-38, IMI, NY; MALAWI [as NYASALAND]: P. O. Wiehe, *Sorghum vulgare*, 4-28-50, NY; SIERRA LEONE: F. C. Deighton, *Andropogon tectorum*, 3-30-51, BPI, IMI; No collector, *Andropogon tectorum*, undated, IMI; TRINIDAD: W. Norwell, *Chaetochloa sulcata*, 2-15-21, IMI; UNITED STATES:

Kansas, C. L. Kramer & P. C. Duffield, *Panicum virgatum*, 8-14-58, NY; Georgia, L. Newsome, *Setaria geniculata*, 9-1-77, GAM; J. Williams, *Setaria* sp., 9-82, GAM; Texas, R. Taber, *Setaria geniculata*, 6-77, NY; VENEZUELA: H. Sydow, No. 177, *Lasiacis sorghoidea*, 1-7-28, BPI; H. Sydow, No. 260, *Lasiacis sorghoidea*, 1-16-28, BPI, FH; ZIMBABWE: L. E. Claflin, *Pennisetum americanum*, 3-86, BPI.

Ceratium sphaeroideum - SOUTH AFRICA: MacOwen, No. 1284, *Andropogon marginatum*, IMI; TYPE. Identical in appearance to the above, but with conidia averaging 10.9 µm diam (Fig. 9-10).

Clathrotrichum subcarneum Patouillard - The type of this species (ECUADOR, Lagerheim, 6-1892, FH) has globose to cushion-shaped, buff colored sporodochia that are attached to the host (*Setaria* sp.) by a central column of parallel hyphae. The sporodochium consists of a much-branched network of hyaline hyphae. Many hyphal tips at the periphery of the sporodochium were spirally coiled (Fig. 6). Globose, one-celled, hyaline conidia that average 9 µm diam were borne on short pegs on the sporodochial hyphae (Fig. 6-8).

Figs. 1-8. *Beniowskia sphaeroidea*. 1. Conidium of *Beniowskia graminis* from type. The attachment pedicel is visible on the lower left of conidium. X1187. 2. Conidia of *B. graminis* from von Höhnel collection in type locality. X1267. 3. Conidia and sporodochial hyphae from authentic material (Raciborski 3070). X1292. 4. Sporodochial hyphae from von Höhnel collection. X1214. 5. Lower portion of sporodochium of *B. graminis* from von Höhnel collection. X156. 6. Hyphae on periphery of sporodochium from type of *Clathrotrichum subcarneum*. X591. 7. Sporodochium from type of *C. subcarneum*. X77. 8. Conidia and sporodochial hyphae from type of *C. subcarneum*. X1083.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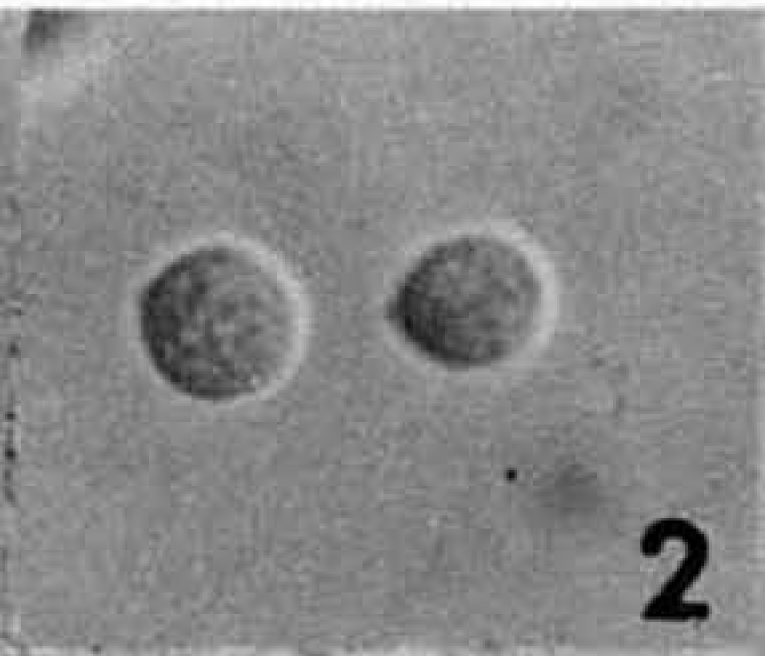
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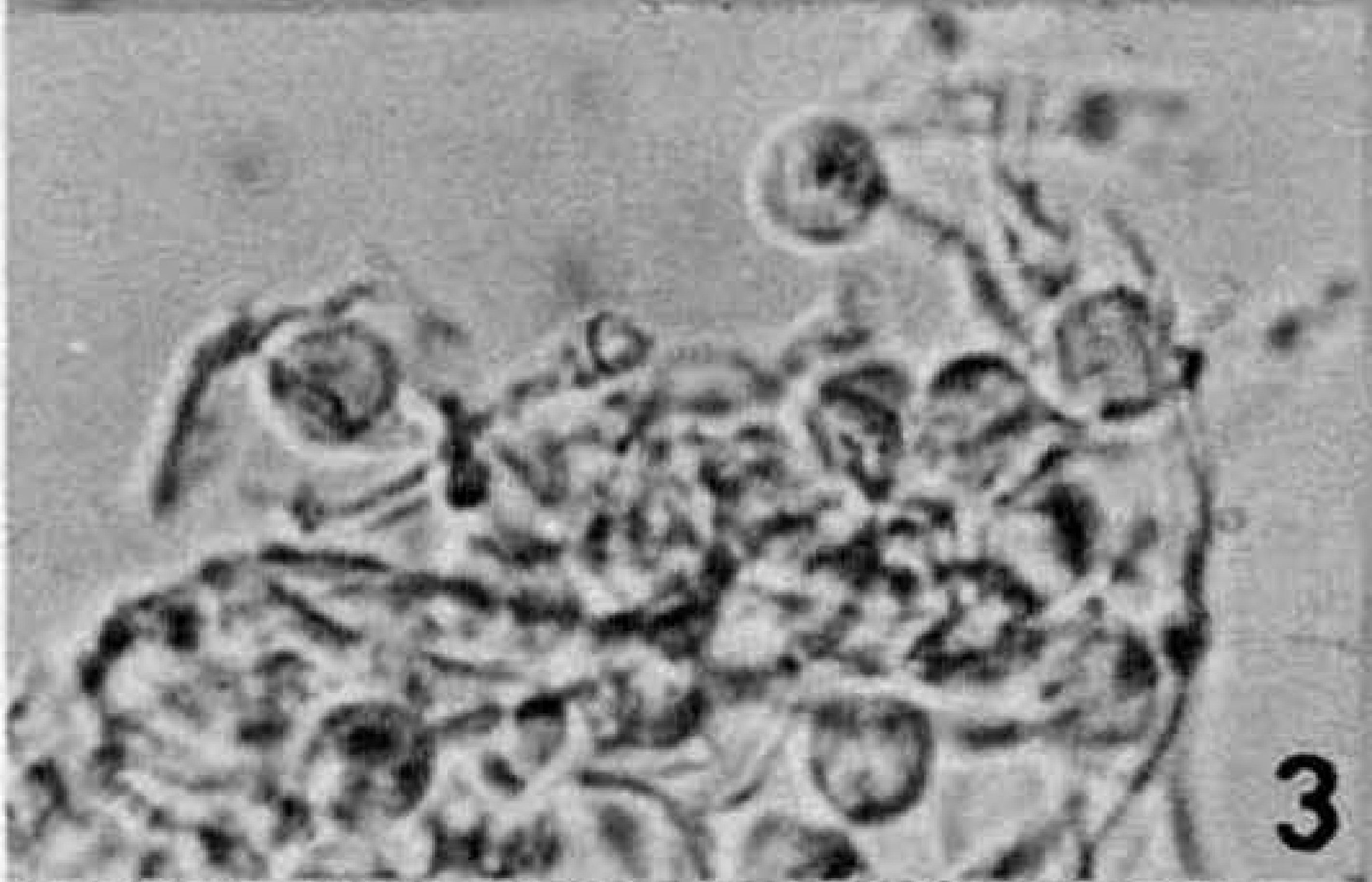
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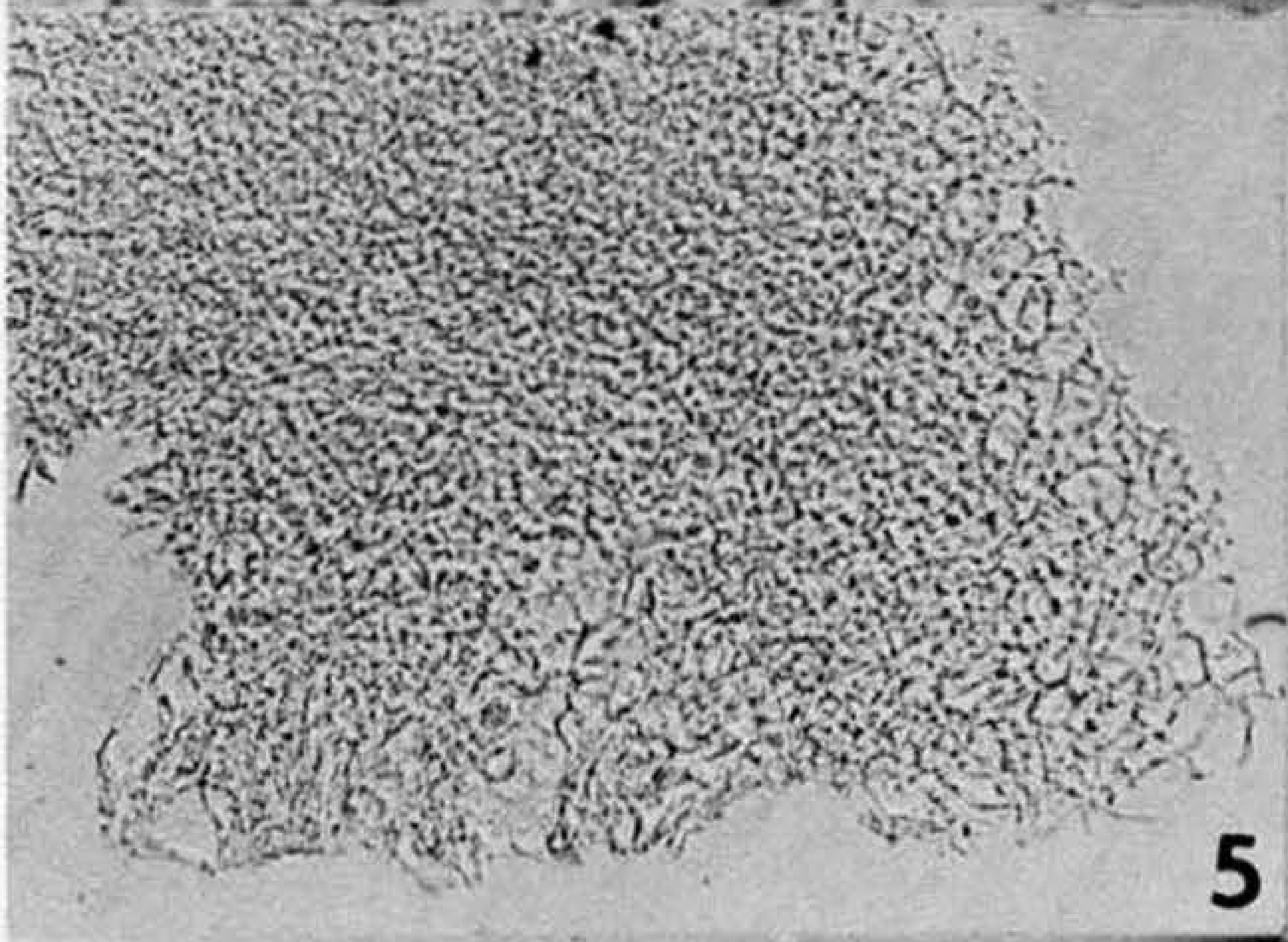
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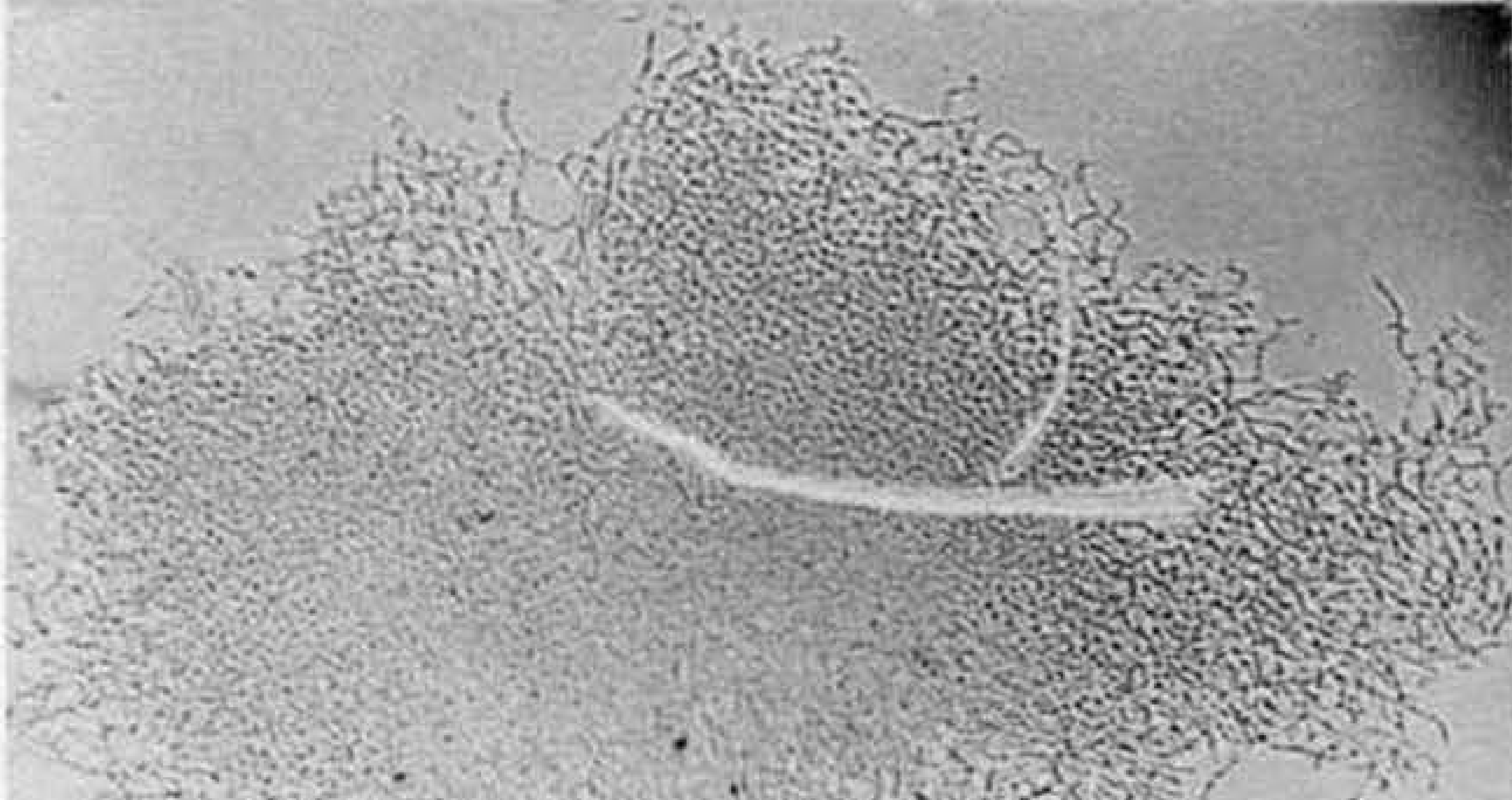
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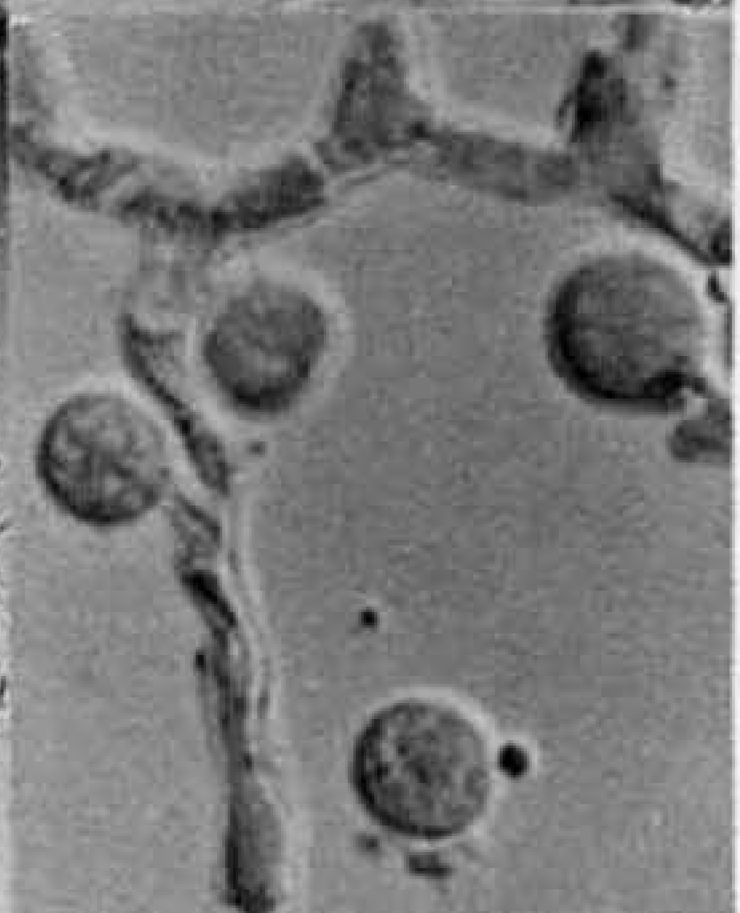
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Botrytis uredinicola Peck - The type material bore sporodochia identical to those described in the above two species (Fig. 11-12). Conidia averaged 8.6 µm diam. JAPAN: P. N. Dorsett & W. J. Morse, Gramineae, 7-8-29, BPI; UNITED STATES: Kansas, E. Bartholomew, No. 3809, *Panicum virgatum*, 7-22-08, NYS (TYPE), BPI; C. T. Rogerson, *Panicum virgatum*, 8-8-53; Nebraska, J. M. Bates, *Panicum virgatum*, 8-21-14, BPI.
Sporotrichum peribebuyense Spegazzini - The type material bore sporodochia identical to those described above (Fig. 13). Conidia averaged 9.8 µm diam. PARAGUAY: Spegazzini, No. 382, *Setaria* sp., March, 1881, PAD, TYPE.

The septum in *B. sphaeroidea* is narrow and is composed of a thin, central electron transparent region bordered on either side by slightly denser regions (Fig. 15). It has a single central pore with closely associated, dark staining, woronin bodies. The central area of the septum tapers to a sharp point at the edge of the pore, which was occluded by a dark-staining plug in the sections observed (Fig. 17).

Conidia are attached to the hypha by a short, cylindrical peg (Fig. 16). When the conidium dehisces a portion of the stalk sometimes remains attached to it; these stalks can often be observed on detached conidia (Fig. 1). The basal portion of the stalk remains attached to the conidiogenous hypha (Fig. 15, 17).

Figs. 9-14. *Beniowskia sphaeroidea*. 9. Conidia and sporodochial hyphae from type of *Ceratium sphaeroideum*. X667. 10. Sporodochium from type of *C. sphaeroideum*. X78. 11. Conidia and sporodochial hyphae from type of *Botrytis uredinicola*. X1350. 12. Sporodochium from type of *B. uredinicola*. X 74. 13. Conidia and sporodochial hyphae from type of *Sporotrichum peribebuyense*. X1037. 14. Sporodochium of *Beniowskia sphaeroidea* collected in Georgia, showing basal column of hyphae that attaches to host leaf. X50.


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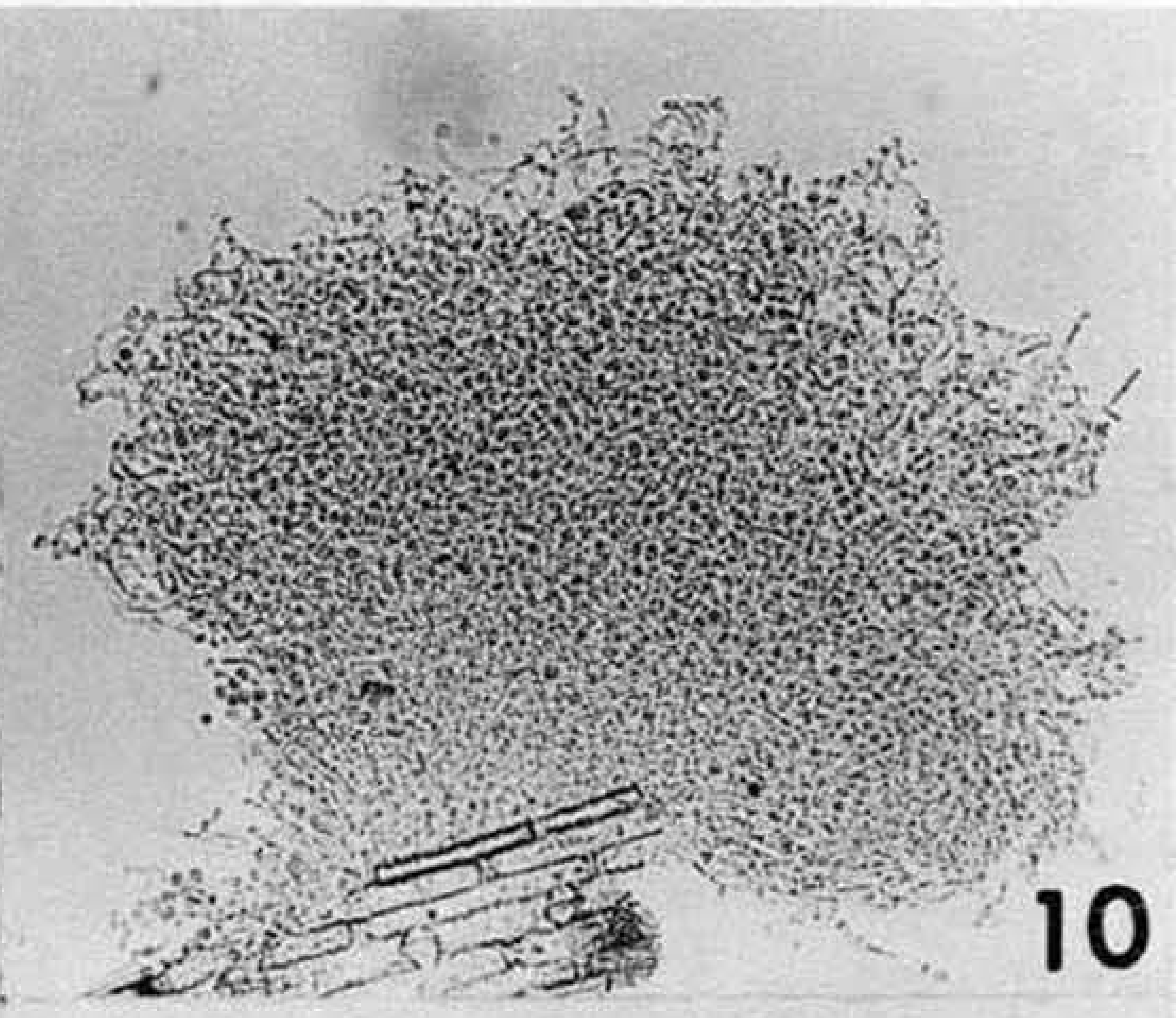
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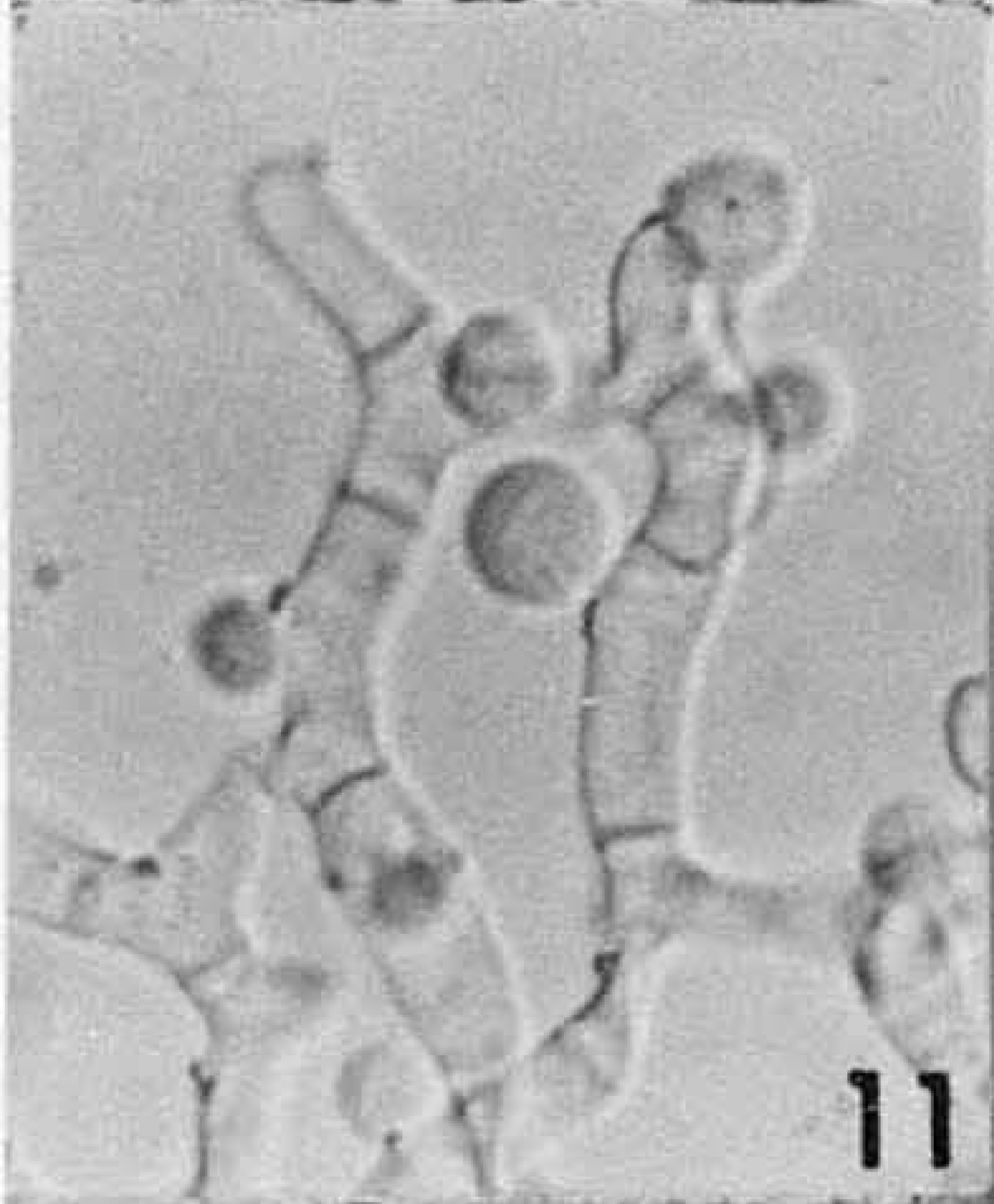
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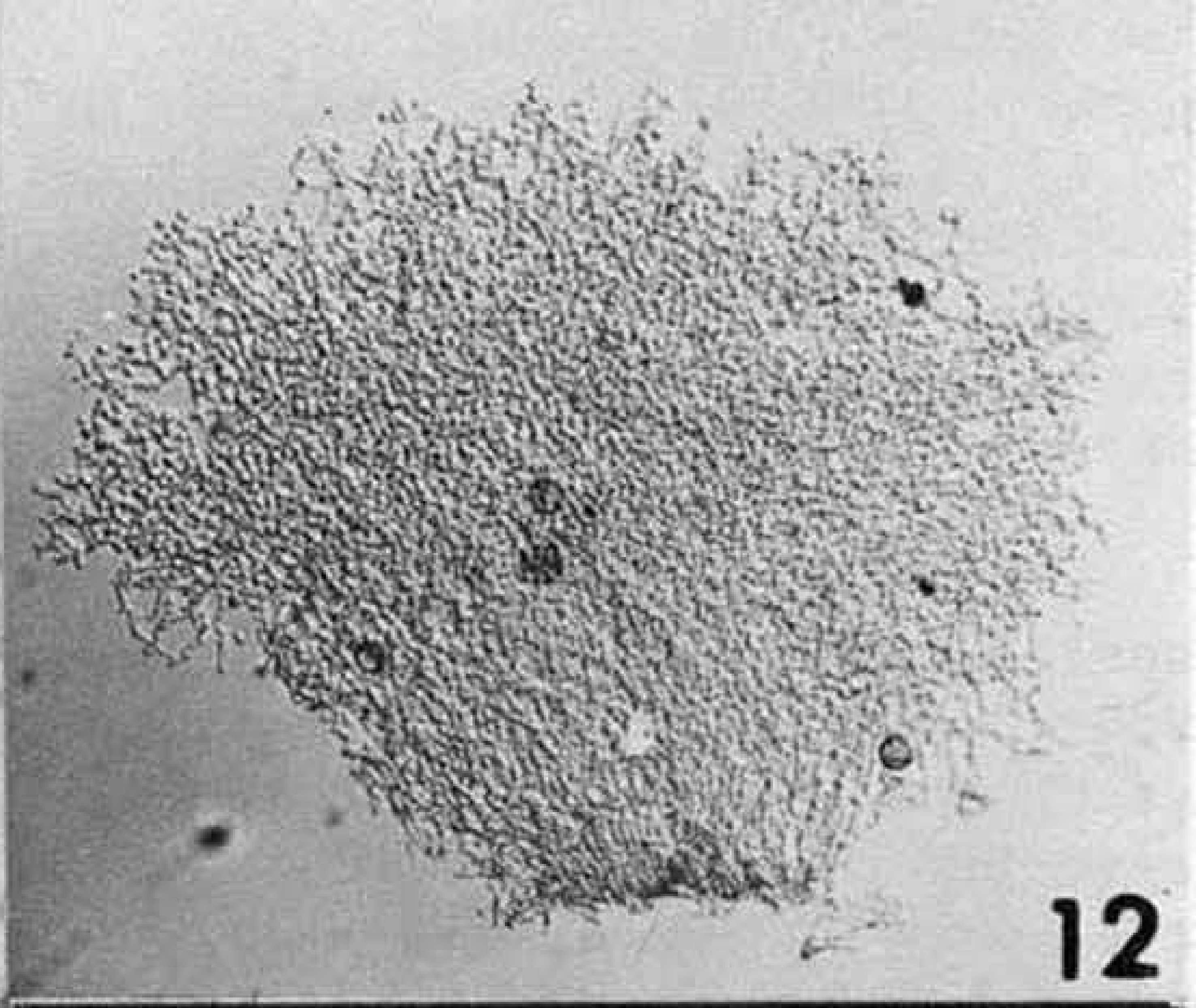
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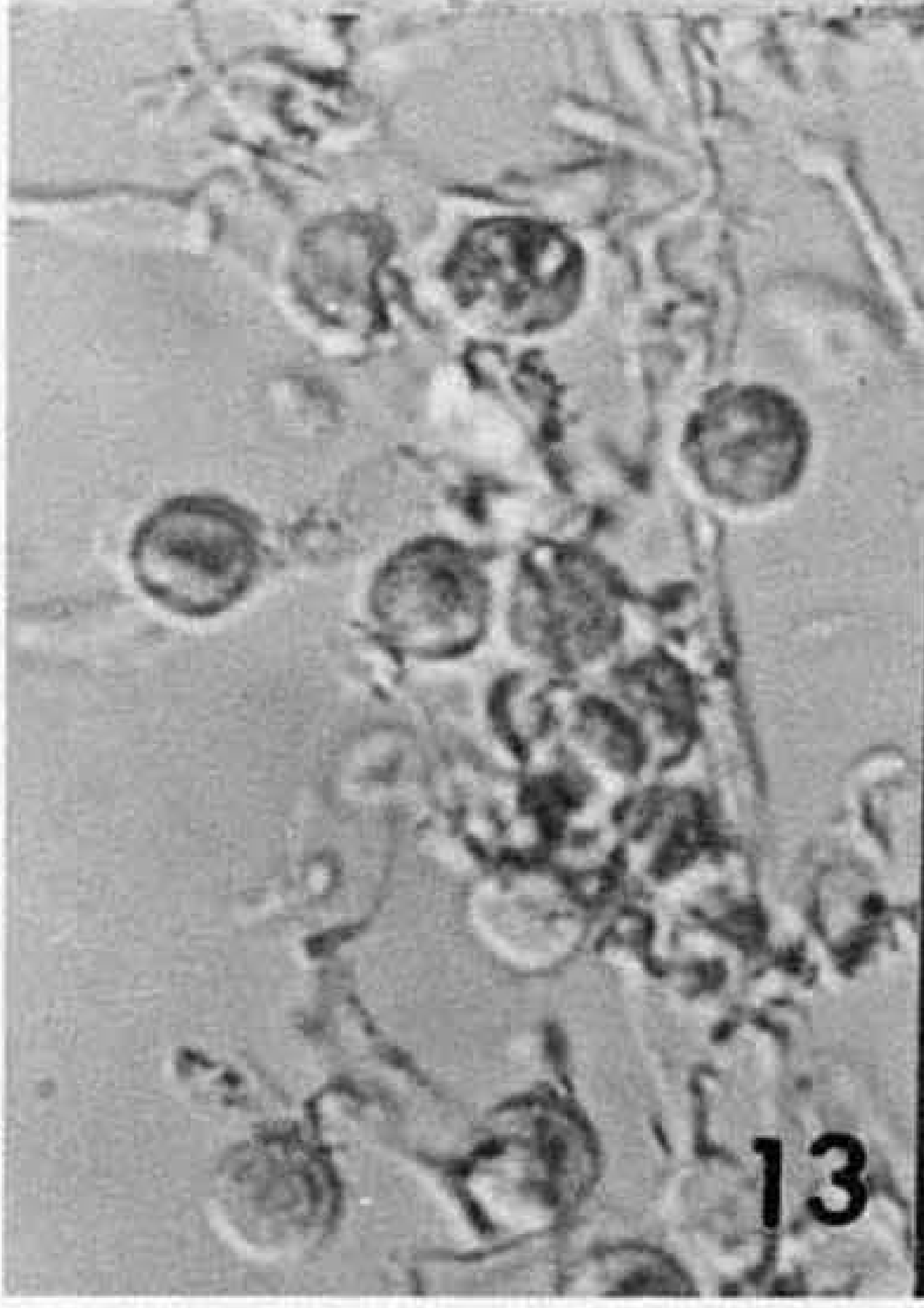
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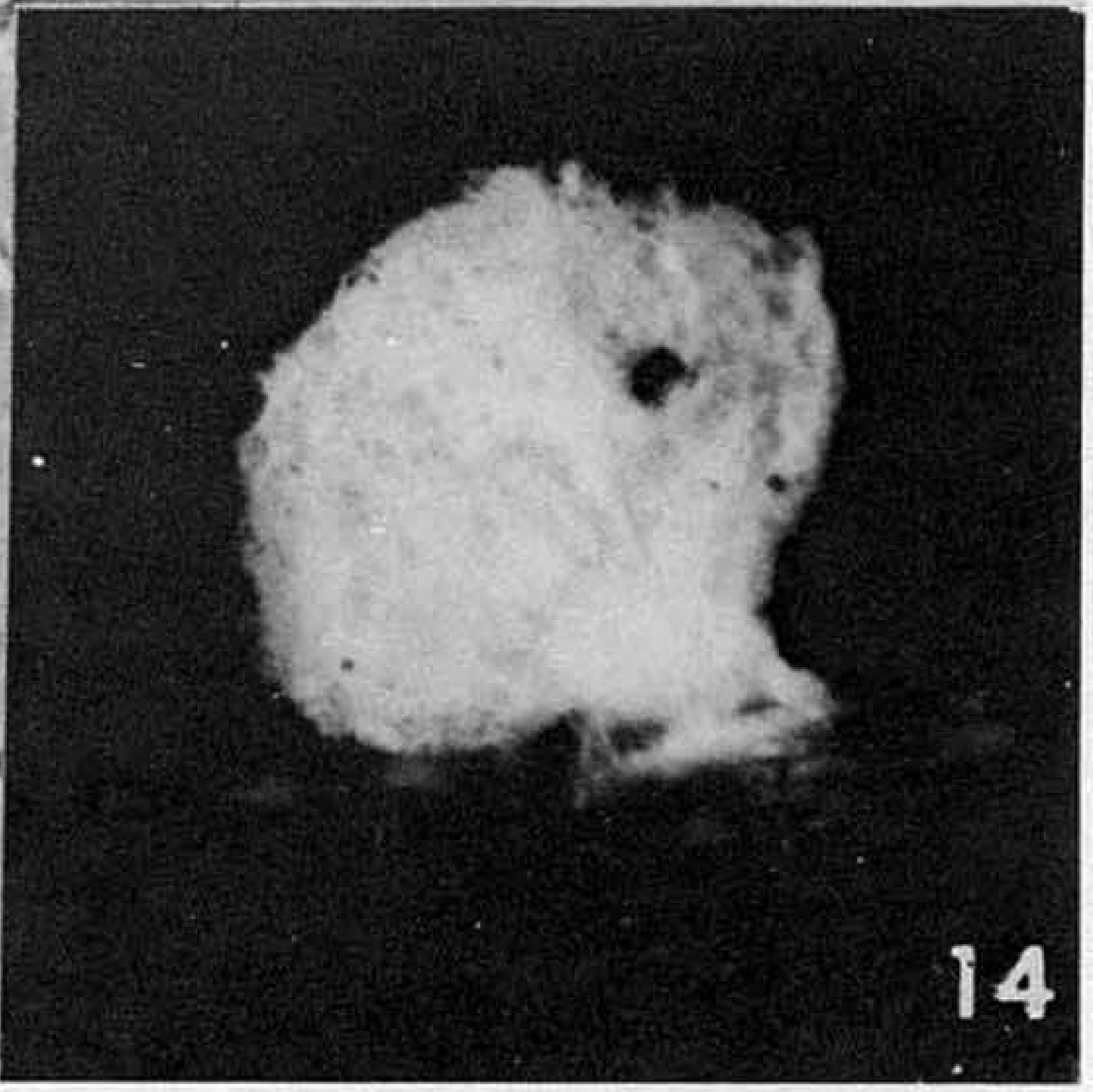
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CONCLUSIONS

Comparison of type and authentic material of *Beniowskia* and *Clathrotrichum* shows that the two genera are congeneric. Although Patouillard (1921) described *Clathrotrichum* as having a synnema, his illustrations show a very short stalk, which is the bundle of parallel hyphae that emerge from the host tissues and branch to form the sporodochium. It is not a synnema in the accepted sense of the term.

Carmichael, et al. (1980) list *Clathrotrichum* as a possible synonym of *Martindalia*, a genus that Barr and Bigelow (1968) demonstrated is synonymous with the basidiomycete *Phleogena faginea* (Fr.) Link. *Beniowskia* is listed by Carmichael et al. (1980) as having a possible basidiospore state in *Galzinia* or *Hapalopilus*, based on the statement by Stalpers (1978) that conidia found in *Hapalopilus* are "*Beniowskia*-like". Sections through septa of *B. sphaeroidea*, however, show that the septum is simple and has associated woronin bodies. If *Beniowskia* has a teleomorph it is likely ascomycetous.

All of the material examined comprises a single species. The small differences that are present in spore size and size and shape of the sporodochium can be attributed to natural variation of the fungus. The spirally coiled hyphae that occur on the periphery of the sporodochium are lacking in some collections. Most dried specimens are buff to brownish in color, but all fresh material examined was pure white. Under reflected light, however, living sporodochia often have a pinkish cast. Most conidia are borne singly but short chains are sometimes formed (Taber et al., 1978; Cole and Samson, 1979). The conidia appear smooth under the microscope, but close examination reveals barely discernible roughenings on some conidia. The fungus has been well illustrated by Taber, et al. (1978).

Mehrotra (1963) described *B. macrospora* from an unidentified grass in India. He distinguished it from *B. sphaeroidea* because of its smooth, larger conidia. The conidia were up to 30 µm diam, with most being 12.5-20 µm, compared to an average of 9-10 µm for *B. sphaeroidea*. Material of *B. macrospora* has not been examined.

Figs. 15-17. *Beniowskia sphaeroidea*. 15. Section of sporodochial hypha with septum and conidium attachment peg. X5,417. 16. Section showing attachment of conidium (top) to hypha. X11,875. 17. Close-up of septum showing woronin bodies and dark plug in septal pore. Conidial attachment peg is visible at upper left. X11,956.

Attempts to culture *B. sphaeroidea* (Rogerson, 1956; Taber, et al., 1978; Brown and Hanlin, 1982) have been unsuccessful, but inoculations of host plants with field-collected material have been made (Taber, et al., 1978; Claflin, pers. comm.). Mehrotra (1963), however, reported that *B. macrospora* grew well on potato dextrose agar. Peck (1909) described *Botrytis uredinicola* as parasitic on a uredinous fungus, and it does sometimes occur in uredinial pustules, but it seems likely that it is merely erupting through the same leaf areas as the rust and is not hyperparasitic.

Current synonyms for *Beniowskia* are given below, including earlier listings by Mason (1928) and Hughes (1958).

Beniowskia sphaeroidea (Kalchbr, & Cke.) Mason (1928)

≡ *Ceratium sphaeroideum* Kalchbrenner & Cooke (1880)
= *Beniowskia graminis* Raciborski (1900)
= *Beniowskia penniseti* Wakefield (1916)
= *Albugo* sp. (Eyles, 1926)
= *Clathrotrichum subcarneum* Patouillard (1921)
= *Botrytis uredinicola* Peck (1909)
= *Sporotrichum peribebuyense* Spegazzini (1886)

Hosts: *Andropogon marginatum* Steud. (So. Africa) (Kalchbrenner and Cooke, 1880), *Brachieria* sp. (Uganda) (BPI), *Cenchrus ciliarus* L. [=*Pennisetum ciliare* (L.) Link], (So. Africa) (BPI), *Chaetochloa poiretiana* Hitchc. [=*Setaria poiretiana* (Schult.) Kunth.] (Trinidad) (Mason, 1928), *C. sulcata* Hitchc. (Trinidad), Gramineae (Japan), *Lasiacis sorghoidea* Hitchc. (Venezuela), *Panicum palmifolium* Willd. [=*S. palmifolia* (Willd.) Stapf.] [Malawi (as Nyasaland)] (Mason, 1928) (Kenya) (BPI), *P. virgatum* L. (United States), *Pennisetum bambusiformis* (Tourn.) Hemsl. (Ecuador), *P. clandestinum* Hochst. ex Chiov. (Kenya) (BPI), *P. americanum* (L.) K. Schum. (Zimbabwe) (BPI), *P. hohenackeri* Hochst. ex Steud. [=*P. alopecuros* Steud.] (India) (BPI), *P. japonicum* Trin. (Japan) (Hennings, 1904). *P. nepalense* Spreng. (Java) (Raciborski, 1900), *P. polystachyum* Schult. [=*P. setosa* Rich.] (Kenya) (Nattrass, 1920), *P. purpureum* Schumach. (Kenya) (Nattrass, 1941; McDonald, 1937) (Mauritania)

(Anonymous, 1971) (Uganda) (Wakefield, 1916; King, 1959), *P. tristachyum* Spreng. (Ecuador), *P. salifex* Stapf & C. E. Hubbard (Kenya) (BPI), *Setaria aurea* Hochst. (Uganda) (Mason, 1928), *S. barbata* (Lam.) Kunth [Ethiopia, Guinea, Nigeria, Malawi (as Nyasaland) and Somalia (as Somaliland)] (BPI), *S. chevaliori* Stapf (Kenya) (BPI), *S. geniculata* (L.) Beauv. (United States) (Taber, et al., 1978; Brown and Hanlin, 1982), *S. nigrirostris* (Nees) Dur. & Schinz (So. Africa) (BPI), *S. sphacelata* (Schum.) Stapf & C. E. Hubbard (Kenya, So. Africa) (BPI), *S. verticillata* (L.) Beauv. [Zimbabwe (as So. Rhodesia)] (Eyles, 1926), and *Sorghum vulgare* Pers. (Uganda) (Wakefield, 1920) [So. Africa, Sudan and Zimbabwe (as So. Rhodesia)] (Tarr, 1962).

The only non-graminicolous host recorded for *Beniowskia* is the report by Tarr (1963) who ascribed whitish flecks on leaves of *Commelina* sp. in the Sudan to *Beniowskia* sp.

Several reports (Taber, et al, 1978; Tarr, 1962; Brown and Hanlin, 1982) indicates that *B. sphaeroidea* can be a serious pathogen on the hosts it attacks. The only economically important crop plant it has been reported on is sorghum [*Sorghum bicolor* (L.) Moench] (Tarr, 1962), but recently it has been found to infect pearl millet (*Pennisetum americanum*) in Zimbabwe (L. E. Claflin, pers. comm.). Infection levels of up to 60% occurred in certain breeding lines, although infected plants did not appear to be adversely affected. Plant breeders of graminicolous plants in the tropics may need to consider this disease in future breeding programs.

It now appears that the first report of *B. sphaeroidea* from the United States is that by Peck (1909) when he described it as *Botrytis uredinicola* from material collected in Kansas. The fungus has also been reported from Georgia, Nebraska, and Texas.

ACKNOWLEDGMENTS

I thank the curators of the herbaria listed herein for loan of specimens, and especially Amy Y. Rossman for furnishing information from the host index card file at BPI. I thank Nancy Jones for assistance with electron microscopy. The manuscript was reviewed by E. A. Brown, L. E. Claflin, and A. Y. Rossman.

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MYCOTAXON

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A NEW SPECIES OF OIDIODENDRON

Shun-ichi UDAGAWA[1] and Noritsuna TOYAZAKI[2]

[1] *National Institute of Hygienic Sciences, Kamiyoga 1-chome, Setagaya-ku, Tokyo 158, Japan*
[2] *Public Health Research Institute of Kobe City, Minatojimanaka-machi 4-chome, Chuo-ku, Kobe 650, Japan*

SUMMARY

Oidiodendron setiferum Udagawa et Toyazaki, a new species, is described and illustrated from an isolate from house dust collected in Kobe, Japan. It is characterized by having a whorl of 2-4 sterile, setiform hairs subtending a penicillate head of fertile hyphae on a dark conidiophore and catenate arthroconidia formed by fragmentation of the fertile hyphae.

During a study of saprophytic fungi in indoor environments and their potential hazards to human health, we found a hyphomycete with a whorl of sterile hairs subtending a penicillate fertile head. A single isolate of the fungus was obtained following the dilution plate treatment of a house dust sample from Kobe city, Japan, in 1986. Superficially this fungus resembles some members of the genus *Gliocephalotrichum*; however, the penicillate heads bear a dry mass of profuse arthroconidia. The colony aspect of this fungus shows a marked resemblance to that of *Oidiodendron* Robak (Barron, 1962). Members of the genus *Oidiodendron* are characterized by slow-growing colonies, darkly pigmented conidiophores with a head of tree-like branches of fertile hyphae and catenate conidia formed by fragmentation of hyphal branches. This fungus differs from the generic concept of *Oidiodendron* in that the conidiophore stipe has two to four sterile setiform hairs below the apex, and the penicillate fertile head is surrounded by the hairs. These differences are considered significant only at the species level and the generic description would have to be emended to include this fungus.

Oidiodendron Robak (1932) emend. Udagawa et Toyazaki

Lectotype species: *Oidiodendron tenuissimum* (Peck) Hughes (1958)

Deuteromycotina, Hyphomycetes.

Colonies slow-growing, effuse, varying in color. Mycelium partly superficial, partly immersed in the substratum; hyphae hyaline or pigmented, branched, septate, detached or aggregated into funiculose strands. Conidiophores macronematous, mononematous, erect, arising from submerged or aerial hyphae and often from hyphal strands, composed of a straight, simple, slender, pigmented, smooth or roughened, septate stipe and a terminal head of verticilloid or rather irregular tree-like branches of hyaline or pale fertile hyphae; in one species (*O. setiferum*) bearing just below the head sterile seta-like hairs. Fertile hyphae (conidiogenous cells) borne as repeated branches from the terminal part of stipe, interlacing or verticilloid in whole appearance, integrated, determinate, cylindrical, forming numerous short segments by basipetal septation, maturing from the tip back towards the main conidiophore axis into branching chains of arthroconidia. Arthroconidia dry, catenate, separating from each other by gelatinous connectives, one-celled, cylindrical, doliiform, ellipsoidal, ovoid, globose or subglobose, hyaline or pigmented (grayish green, brown or olivaceous brown), smooth or ornamented. Pigmented chlamydospores present in two species. Teleomorphic genera, where known, *Byssoascus* von Arx, *Myxotrichum* Kunze (Sigler and Carmichael, 1976; Currah, 1985).

Oidiodendron setiferum Udagawa et Toyazaki, sp.nov.

(Figs. 1-5)

Coloniae in agaro farina avenae mixto restrictae, post 14 dies sub 23°C 13-15 mm diametro, planae, tenues, ex mycelio vegetativo submerso compositae, brunneo-griseae vel murinae, plus minusve pulveraceae; reversum purpureo-griseum vel fusco-nigrum.

Mycelium immersum ex hyphis ramosis, septatis, delicatis, sinuatis vel rectis, levibus, hyalinis, 1.0-3.0(-4.0) μm latis compositum. Conidiophora macronemata, plerumque ex hyphis immersis oriunda, ex stipite simplici et capitulo penicillato fertili composita, superne circa capitulum fertile pilis sterilibus setiformibus instructa; stipites erecti, stricti, olivaceo-brunnei vel atrobrunnei, 50-200 × 2.5-3.5 μm, septati, leves vel subtiliter asperati; capitula

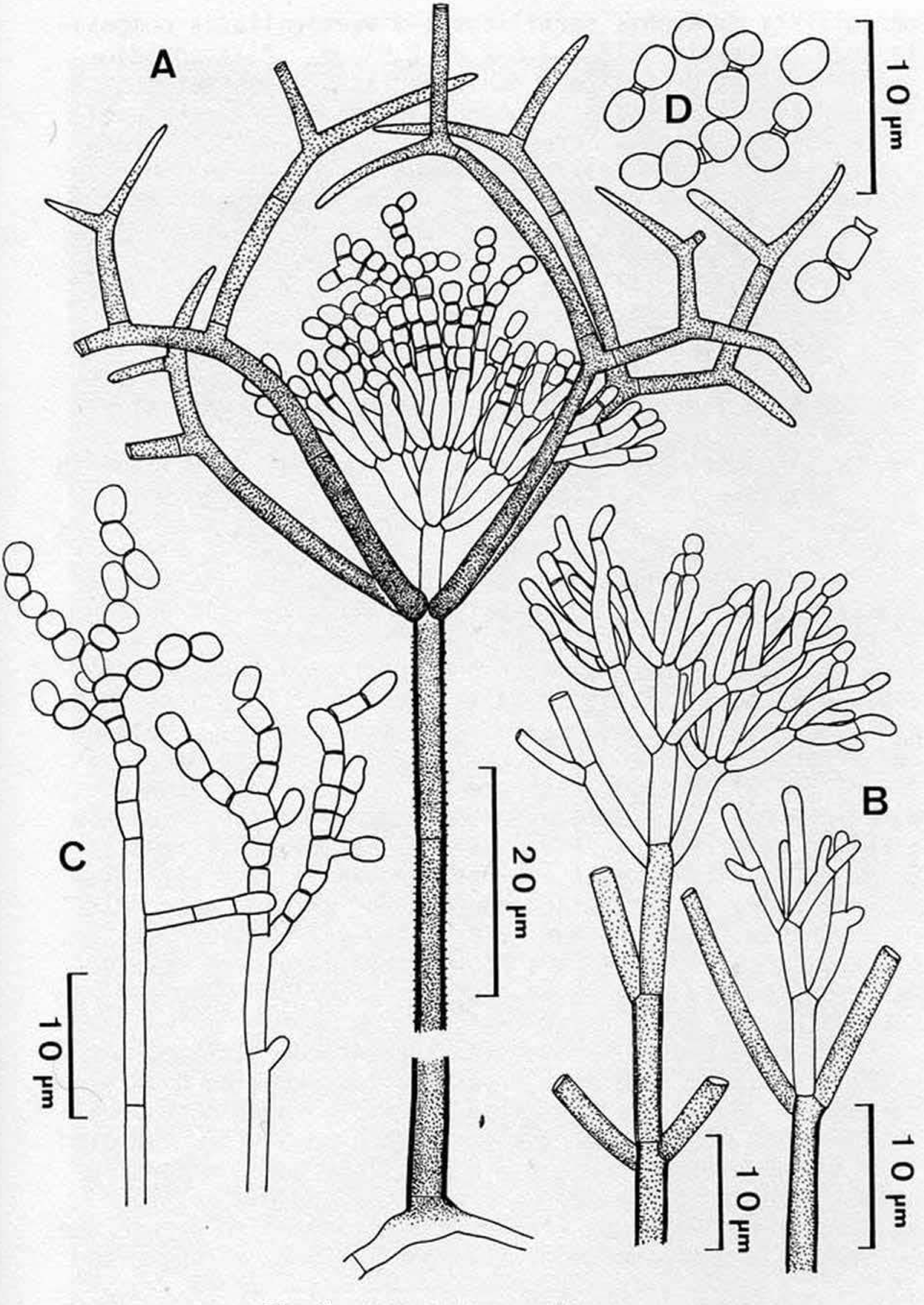

Fig. 1. *Oidiodendron setiferum*.
A-C. Conidiophores, fertile hyphae and conidia. D. Conidia.

penicillata ex hyphis fertilibus 1-3 verticillatis composita; rami primarii 5-12 × 1.5-2.0(-2.5) µm. Pili conidiophori steriles 2-4, atrobrunnei, septati, leves vel subtiliter asperati, saepe in monopodium ramosi et recurvati, usque 80-100 µm longi, prope basim 2.0-2.5 µm lati, gradatim angustati et pallescentes versus apicem acutum. Hyphae fertiles (cellulae conidiogenae) in conidiophoris incorporatae, terminales, determinatae, anguste cylindricae, 1.0-1.5 µm latae, rectae vel leviter undulatae, per fissiones in septis basipetaliter ad arthroconidia disarticulantes. Conidia catenata, sicca, schizogena, simplicia, dilute brunnea, ovoidea vel ellipsoidea vel subglobosa, 1.5-3.0 (-4.0) × 1.0-2.0 µm, levia, uno vel ambobus apicibus aliquantum truncata, ad connectivum interdum crassiora et fuscatiora.

Holotypus: cultura, NHL 2967, ex materia pulveratus in domo, Higashinada-ku, Kobe, in Japonia, 16.i.1986, a Toyazaki, isolata. In collectione fungorum 'National Institute of Hygienic Sciences (NHL), Tokyo, Japan.'

Etymology: Latin, *setifer*=bristle-bearing, referring to the setiform hairs which arise from the conidiophore stipe.

Colonies on oatmeal agar growing restrictedly, attaining a diameter of 13-15 mm in 14 days at 23°C, plain, thin, with vegetative mycelium submerged, brownish gray (Methuen 6E2 after Kornerup and Wanscher, 1978) or 'Mouse Grey' (Rayner,1970), more or less powdery due to conidial masses, with thin and broad margin; exudate and odor none; reverse purplish gray (Methuen 14E2) or 'Fuscous Black' (Rayner). Colonies on malt extract agar growing as on oatmeal, velvety or appearing granular, composed of a thin basal felt, more or less zonate, brown to brownish gray(Methuen 7E4-2), or 'Greyish Sepia' to 'Pale Mouse Grey' (Rayner); reverse dark ruby (Methuen 12F4) or 'Fuscous Black' to 'Brown Vinaceous' (Rayner).

Immersed mycelium composed of branched, septate, delicate, sinuous or straight, smooth-walled, hyaline hyphae measuring 1.0-3.0(-4.0) µm wide. Conidiophores macronematous, arising mostly from the immersed hyphae, each composed of a mononematous stipe and a penicillate head of fertile hyphae becoming a powdery mass of arthroconidia in age, bearing at the upper part sterile setiform hairs around the fertile head; stipes erect, straight, olivaceous brown to

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Figs. 2-5. *Oidiodendron setiferum*. Conidiophores, fertile hyphae and conidia. Figs. 2 and 5, ×500; 3 and 4, ×1250.


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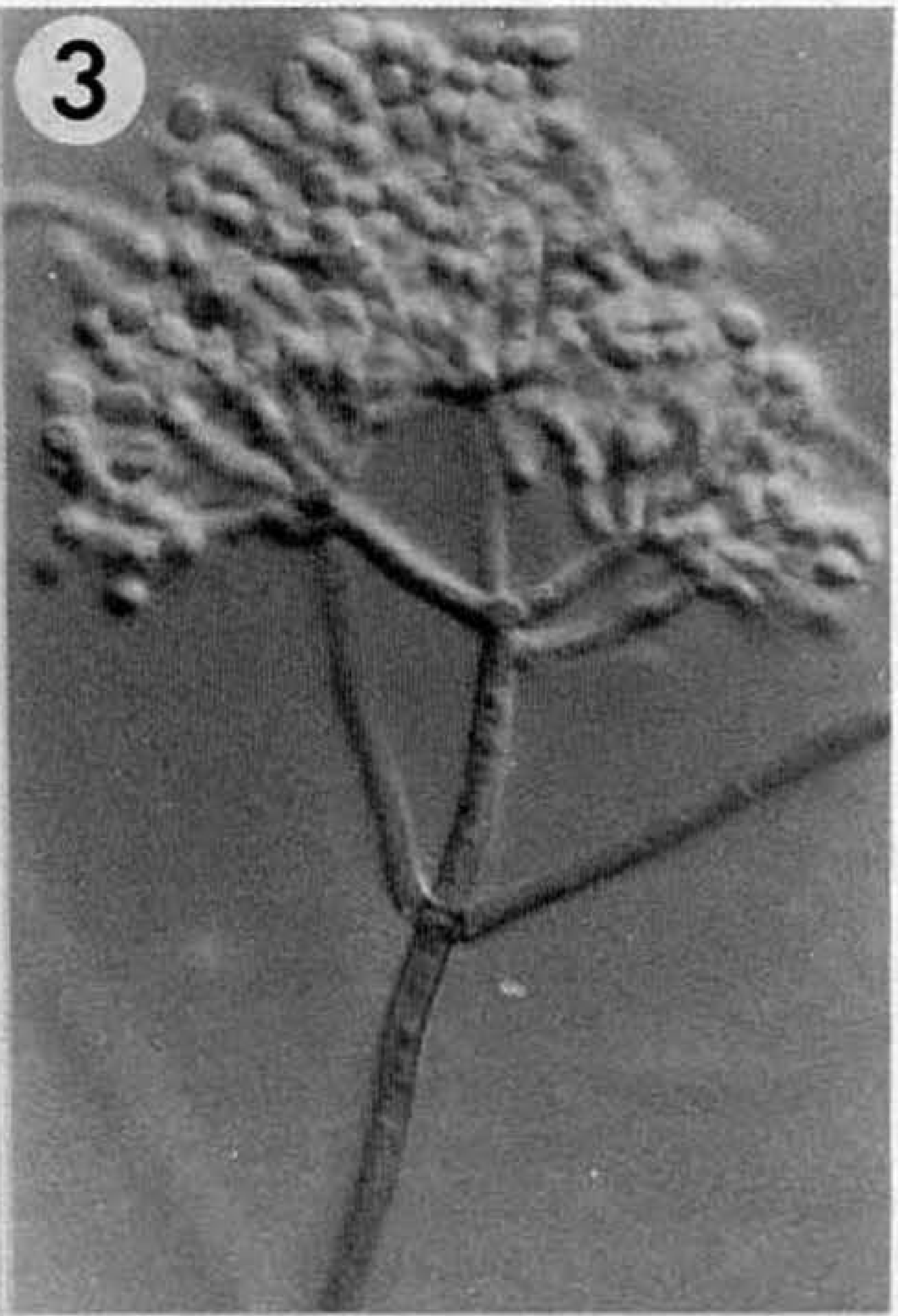
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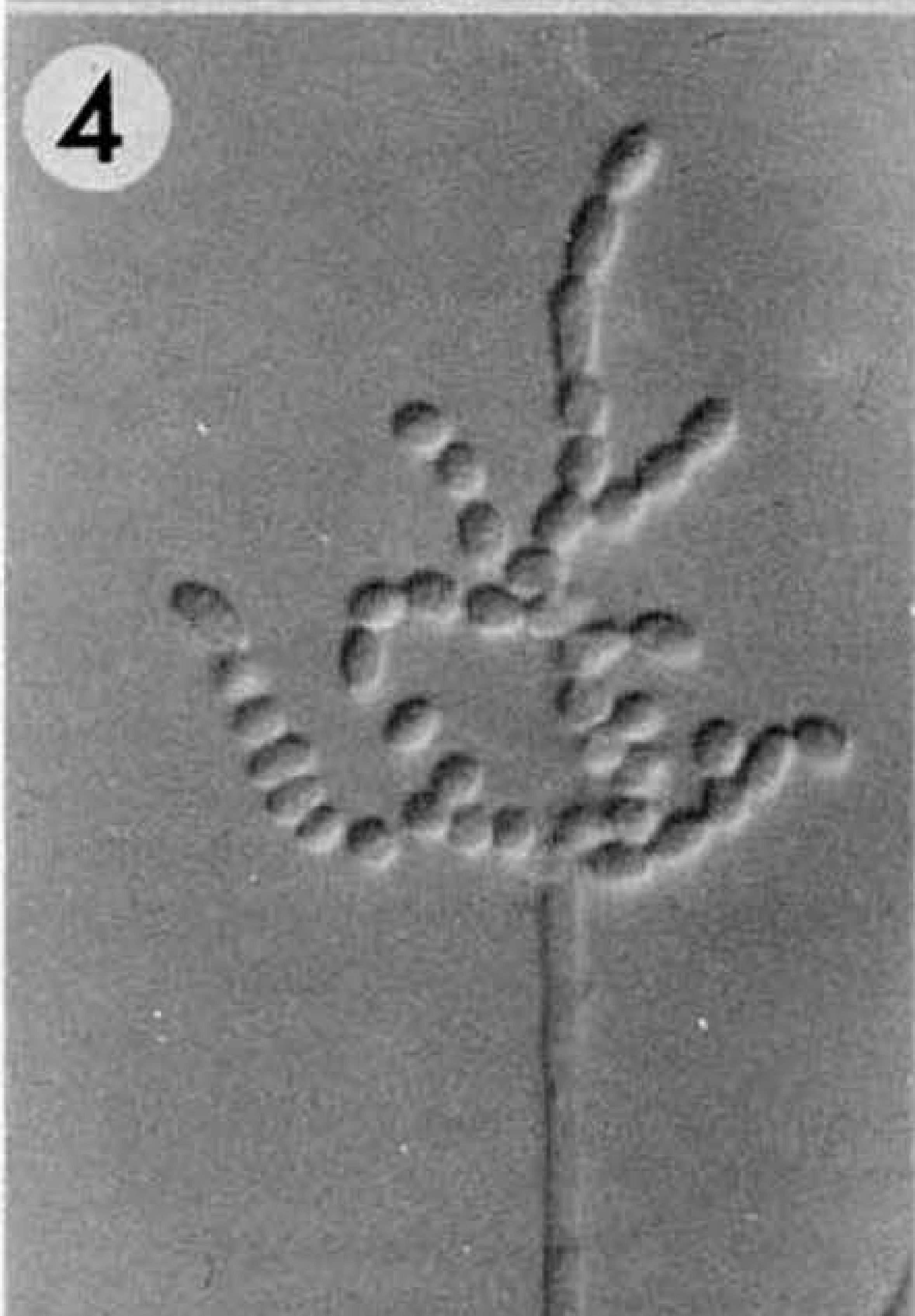
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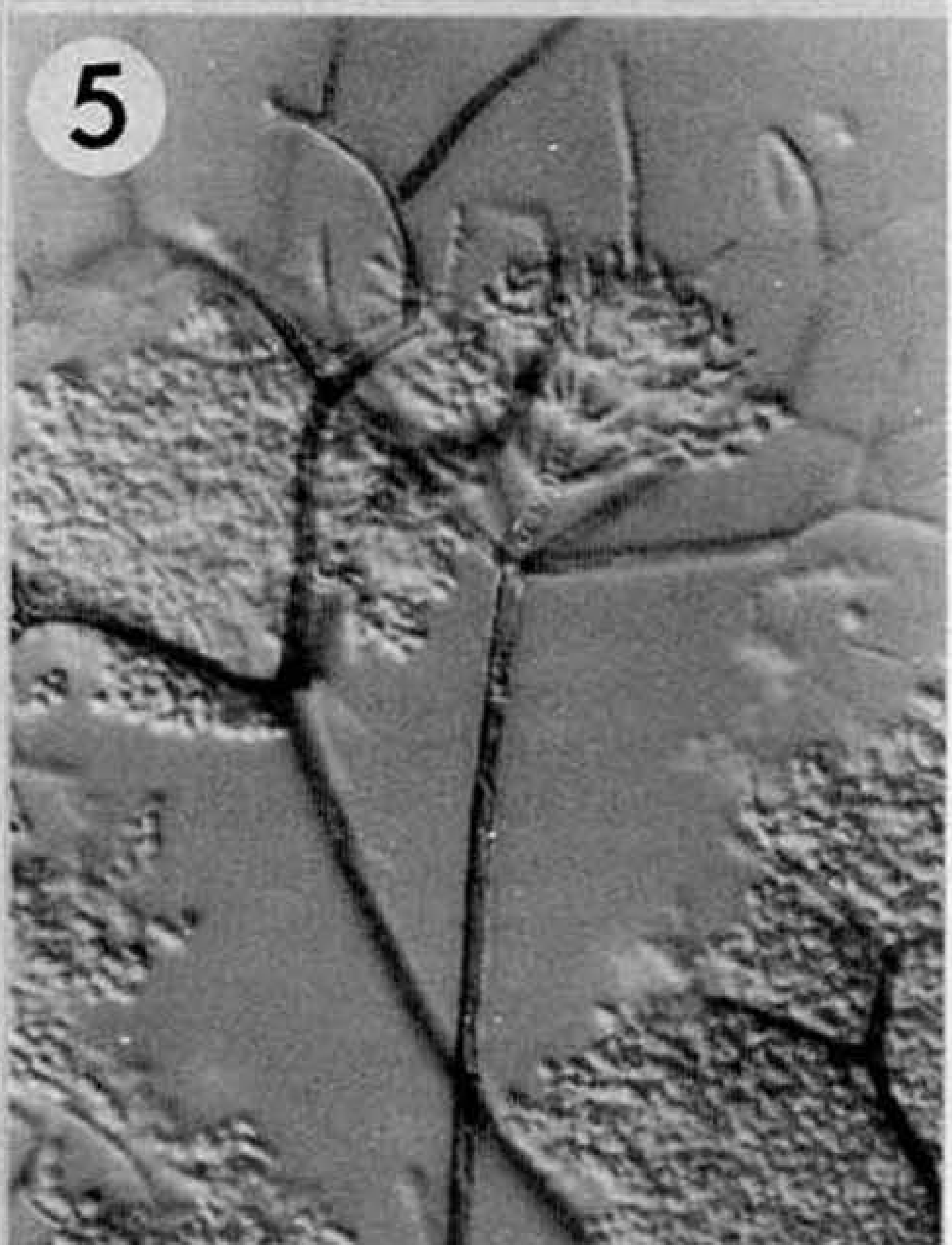
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dark brown, 50-200 × 2.5-3.5 µm, septate, with walls smooth or finely roughened; penicillate heads composed of verticilloid whorls, one to three series of fertile hyphae with primary branches 5-12 × 1.5-2.0(-2.5) µm. Sterile hairs 2-4 per conidiophore (sometimes biseriate), dark brown, septate, smooth or finely roughened, often monopodially rebranched and recurved, up to 80-100 µm long, 2.0-2.5 µm wide near the base, tapering and fading gradually to a pointed tip. Fertile hyphae (conidiogenous cells) integrated, terminal on the branches, determinate, narrow-cylindric, 1.0-1.5 µm wide, straight or slightly undulate, fragmenting to form arthroconidia by basipetal septation. Conidia catenate, dry, schizogenous, simple, pale brown, ovoid to ellipsoidal, or subglobose (more or less polygonal), 1.5-3.0(-4.0) × 1.0-2.0 µm, smooth-walled, with one or both ends somewhat truncated, sometimes thicker and darker at the connective point.

Conidiogenous apparatus is occasionally suppressed and arthroconidia form directly on undifferentiated fertile hyphae (Figs. 1-C, 4).

At 37°C, growth is nil.

Specimen examined: an isolate from house dust, Uozaki-naka-machi, Higashinada-ku, Kobe-city, Hyogo-pref., Japan, coll. N. Toyazaki; Developed on potato-dextrose agar in Mycology Laboratory of Public Health Research Institute of Kobe City, 16.i.1986, NHL 2967, holotype.

Living cultures of NHL 2967 have been deposited in the National Institute of Hygienic Sciences, Tokyo, and the Microfungus Collection and Herbarium, University of Alberta, Edmonton, Canada.

The genus *Oidiodendron* was erected in 1932 by Robak for three species, *O. fuscum* (=*O. tenuissimum*), *O. rhodogenum* and *O. nigrum* (=*O. cereale* (Thüm.) Barron), isolated from ground wood pulp in Norway. Excluding *Oidiodendron* anamorphs of members of the Myxotrichaceae (Currah, 1985), 17 species have been described to date: *O. cereale*, *O. echinulatum* Barron, *O. griseum* Robak, *O. tenuissimum* and *O. truncatum* Barron are representatives of the most abundant and widely distributed species as inhabitants in both cultivated and virgin soils (Barron, 1962; Morrall, 1968; Tokumasu, 1973, 1976; Domsch et al., 1980; Gams and Söderström, 1983; Mercado and Castaneda, 1985). According to Domsch et al. (1980), *Oidiodendron* species also occur on decaying wood and bark where they can often form macroscopically visible patches. In our investigations with air conditioning problems, *O. griseum* was isolated from filtrated particles in dwelling house (unpublished data). So far there has been no record of any species of *Oidiodendron* being pathogenic to humans, but in monitoring hygienic conditions in modern homes, it is worth noting that *O. cereale* has been isolated from wooden boards of a bath-house in Finland (Salonen and Ruokola, 1969).

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We would like to thank Professor Roger D. Goos of the University of Rhode Island for his helpful review of the manuscript, and Dr. Yoshio Otani for correction of the Latin diagnosis.

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STUDIES IN THE GENUS *PHOMA*. VI. CONCERNING *PHOMA MEDICAGINIS* VAR. *PINODELLA*.

James F. White, Jr.,

Department of Botany, University of Texas,
Austin, Texas 78713-7640

and

Gareth Morgan-Jones

Department of Plant Pathology, College of Agriculture,
Auburn University, Auburn, Alabama 36849-4210

ABSTRACT

Phoma medicaginis Malbr. and Roum. var. *pinodella* (L.K. Jones) Boerema, the causal organism of black stem disease of red clover, and footrot and leaf spot disorders of pea, is described and illustrated. Details of its cultural characteristics *in vitro* and the anatomy of its pycnidial wall are documented.

INTRODUCTION

Over the years, some confusion has existed concerning the identity of pycnidial fungi implicated in black stem and footrot diseases of members of the Fabaceae. Because of this, as has often been the case with fungi belonging to the Coelomycetes, a number of binomials, based at least in part on host associations, have been applied to what are, essentially, the same organisms. In the case of pycnidial fungi associated with clover, lucern and pea, six binomials exist, namely; *Ascochyta imperfecta* Peck, *A. pisi* Lib., *A. pinodella* L.K. Jones, *Diplodina medicaginis* Oud., *Phoma medicaginis* Malbr. and Roum., *P. trifolii* E.M. Johnson and Valleau. In addition, the names *Phoma herbarum* West. forma *medicaginum* West. [often cited as *P. herbarum* var. *medicaginis*], and *Ascochyta pisi* Lib. var. *medicaginis* Sacc., have also been proposed for fungi occurring on these legumes. *Ascochyta pisi* and *A. pisi* var. *medicaginis* are distinct and separate entities but the others belong to the same species complex.

Research by plant pathologists in Europe and North America has resulted in the recognition of two biotypes, as reflected by cultural characteristics, associated with black stem of lucern and black stem of red clover, respectively (Johnson and Valleau, 1933; Schenck and Gerdemann, 1956; Edmunds and Hanson, 1960; and Boerema *et al.*, 1965). Ellingboe and Kernkamp (1957) and Ellingboe (1959), however, found no correlation between cultural characteristics and host origin and Edmunds and Hanson

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(1960) believed that only one fungus was involved. Although the two distinguishable types appear to be relatively constant in their *in vitro* expression, variability in pathogenicity exists between isolates and individual strains from one host are able to attack other legume species (Toovey *et al.*, 1936; Mead and Cormack, 1961; Boerema *et al.*, 1965) Isolates were found, however, to be more pathogenic on their original hosts.

Following detailed study of numerous isolates from the three hosts, Boerema *et al.* (1965) concluded that they were all conspecific but that the two cultural types encountered merited recognition at varietal rank. On the basis of morphology, they determined *Phoma* Sacc. to be the most appropriate genus in which to classify the fungus. Although *Phoma herbarum* forma *medicaginum* is the oldest validly published name for it, it cannot be adopted for two reasons. Firstly, *Phoma herbarum* is a different species and, secondly, elevation of the epithet *medicaginum* to specific rank would create a later homonym of *Phoma medicaginis*, the next oldest name validly applied to the fungus. The latter binomial, therefore, becomes the acceptable name for it.

Boerema *et al.* (1965) transferred *Ascochyta pinodella* to *Phoma medicaginis* as variety *pinodella* and recognized *Phoma trifolii* to be a synonym of it. In so doing *P. medicaginis* var. *medicaginis* was created and *Diplodina medicaginis* and *Ascochyta imperfecta*, in addition to *P. herbarum* forma *medicaginum*, were considered to be synonyms. Dorenbosch (1970), Punithalingam and Gibson (1976), and Sutton (1980) have accepted all, or part, of this synonymy, as we do here, but Domsch *et al.* (1980) list *A. imperfecta* as a synonym of *P. medicaginis* var. *pinodella*.

In our continuing attempt to provide comprehensive, standardized accounts of the characteristics of taxa within the genus *Phoma* we have had opportunity to study an isolate of *P. medicaginis* var. *pinodella*. A number of useful diagnostic criteria by which it can be accurately identified have been recognized and are documented herein.

TAXONOMIC PART

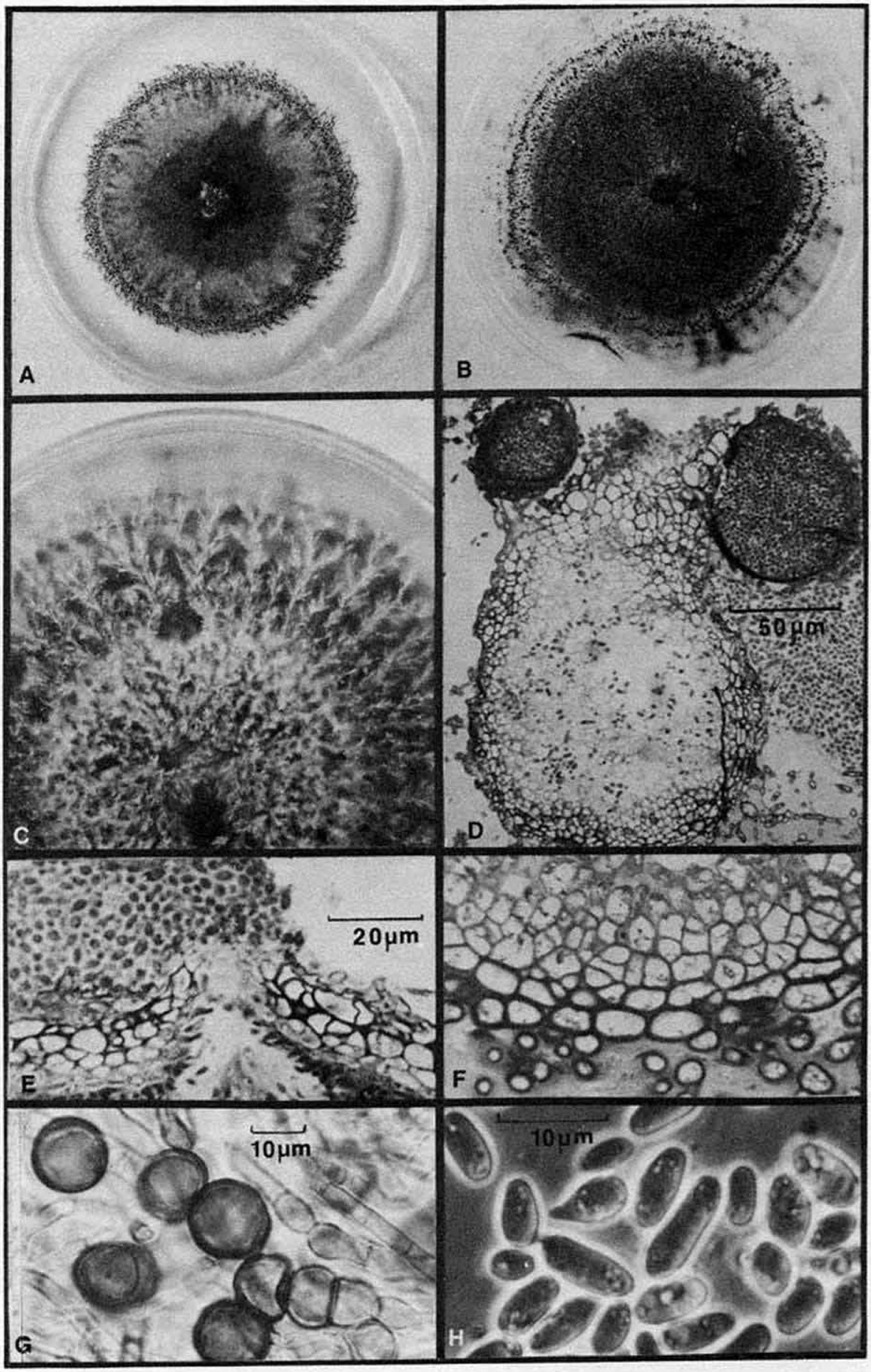
Phoma medicaginis Malbr. et Roum. var. *pinodella* (L.K. Jones) Boerema apud Boerema, Dorenbosch, and Leffring, Neth. J. Pl. Path. 71: 88, 1965 (Plate 1, figure 1).

≡ *Ascochyta pinodella* L.K. Jones, Bull. N.Y. St. Agric. Exp. St. 547: 10, 1927.

= *Phoma trifolii* E.M. Johnson et Valleau, Bull. Ky Agric. Exp. St. 339: 73, 1933.

Colonies on potato dextrose agar [Difco] (Plate 1, A) frequently somewhat variable in appearance, dense and usually felty or, in places, sparse, light grayish-green at the center when young, becoming dark

PLATE 1. *Phoma medicaginis* var. *pinodella*. A, three-week old colony on PDA; B, three-week old colony on MEA; C, reverse of three-week old colony on MEA showing numerous, fan-shaped or feather-like crystal aggregations; D, V.S. primary and two secondary pycnidia; E, V.S. apex of primary pycnidium showing ostiole; F, section of primary pycnidium wall; G, chlamydospores; H, conidia.


A
B
C
50 µm
D
20µm
E
F
10µm
G
10µm
H

gray-olivaceous or blackish at the center with age, with a peripheral, broad, pale to mid-gray concentric zone punctated towards its outer limits by numerous dark, radial patches or small sectors, with a broad, pale cream to whitish margin, after ten days producing abundant fertile pycnidia arranged in a broad, dense concentric ring towards the periphery and sometimes extending into the darker sectors, attaining a diameter of 50mm at 20C after 6 days, 55mm at 25C and 30mm at 30C; reverse brownish in the center, progressively lighter towards the margin, darker underneath the radial sectors [sectors usually extending to about one-third the colony diameter]. Colonies on malt extract agar [Difco] (Plate 1, B) with sparse aerial mycelium, olivaceous, with a whitish marginal zone, frequently with variously sized darker radial sectors, producing abundant pycnidia arranged in several marginal, narrow concentric rings or scattered more or less evenly over the central part, attaining a diameter of 50mm at 20C after 6 days, 55mm at 25C and 30mm at 30C; reverse olivaceous, becoming brownish centrally with age and showing dense, feather-like or fan-shaped clusters of whitish crystals formed in the medium (Plate 1, C). Colonies on cellulose agar with very little aerial mycelium, producing pycnidia sparsely, in scattered patches after three weeks. Mycelium on all three culture media composed of hyphae of two types: hyaline, smooth, moderately branched, infrequently septate, 1-2µm wide; and pale brown, smooth, frequently branched, abundantly septate, 2-6µwide, often aggregated into closely appressed, interconnecting strands. Pycnidia of two types. Primary pycnidia solitary, usually gregarious, globose, without a pronounced neck, uniostiolate, ostiole 20-25µm in diameter, superficial or partly immersed in the agar medium, blackish-brown to black, glabrous, pseudoparenchymatous, 150-250µm in diameter. Pycnidial wall (Plate 1, F) at first 10-30 µm thick, composed of four to six layers of irregularly ellipsoid, thick-walled primary cells, cells in the apical region somewhat larger than elsewhere, becoming progressively thicker following sequential division of the inner wall cells, sometimes eventually completely occluding the venter and assuming as a result a sclerotium-like anatomy. Internal cells thin-walled, more or less isodiametric, angular to somewhat globose, 2-15µm in diameter, becoming 2-6µ following cell division. The outer wall layer often partially sloughs off, exposing the non-pigmented mass of wall cells within. Sclerotium-like structures, bearing very few, if any, conidia, are formed readily in cellulose agar. Secondary pycnidia (Plate 1, D) produced atop primary pycnidia following meristematic activity of the outer wall cells in the vicinity of the apex, one or two to each primary pycnidium, with 5-10µm thick walls, at first having a prosenchymatous texture made up of closely appressed interwoven hyphae, becoming pseudoparenchymatous when mature, composed of three to six layers, with individual cells 1.5-2.5µm wide, pale brown, globose to somewhat flask-shaped, uniostiolate, 60-100µm in diameter, bearing adundant conidia, formed regularly on PDA and MEA but sparsely on cellulose agar. Conidiogenous cells phialidic, hyaline, simple, smooth-walled, subglobose to obpyriform or broadly flask-shaped, borne on the innermost cells of the pycnidial walls, 2.5-3.5µm in diameter. Conidia (Plate 1, H) enteroblastic, hyaline, smooth, ovate to ellipsoid or oblong to short-cylindrical, obtuse at each end, continuous or sometimes one-septate, usually containing several small guttules at each end, 6-10 X 2.5-4µm. Exuding conidial mass whitish to pale buff in color. Chlamydospores (Plate 1, G) produced abundantly on all media even in young colonies, terminal or intercalary, solitary or in chains of various lengths, globose, mostly unicellular, occasionally bi- or tricellular, thick-walled, smooth, pale brown to brown, 10-20µm in diameter.

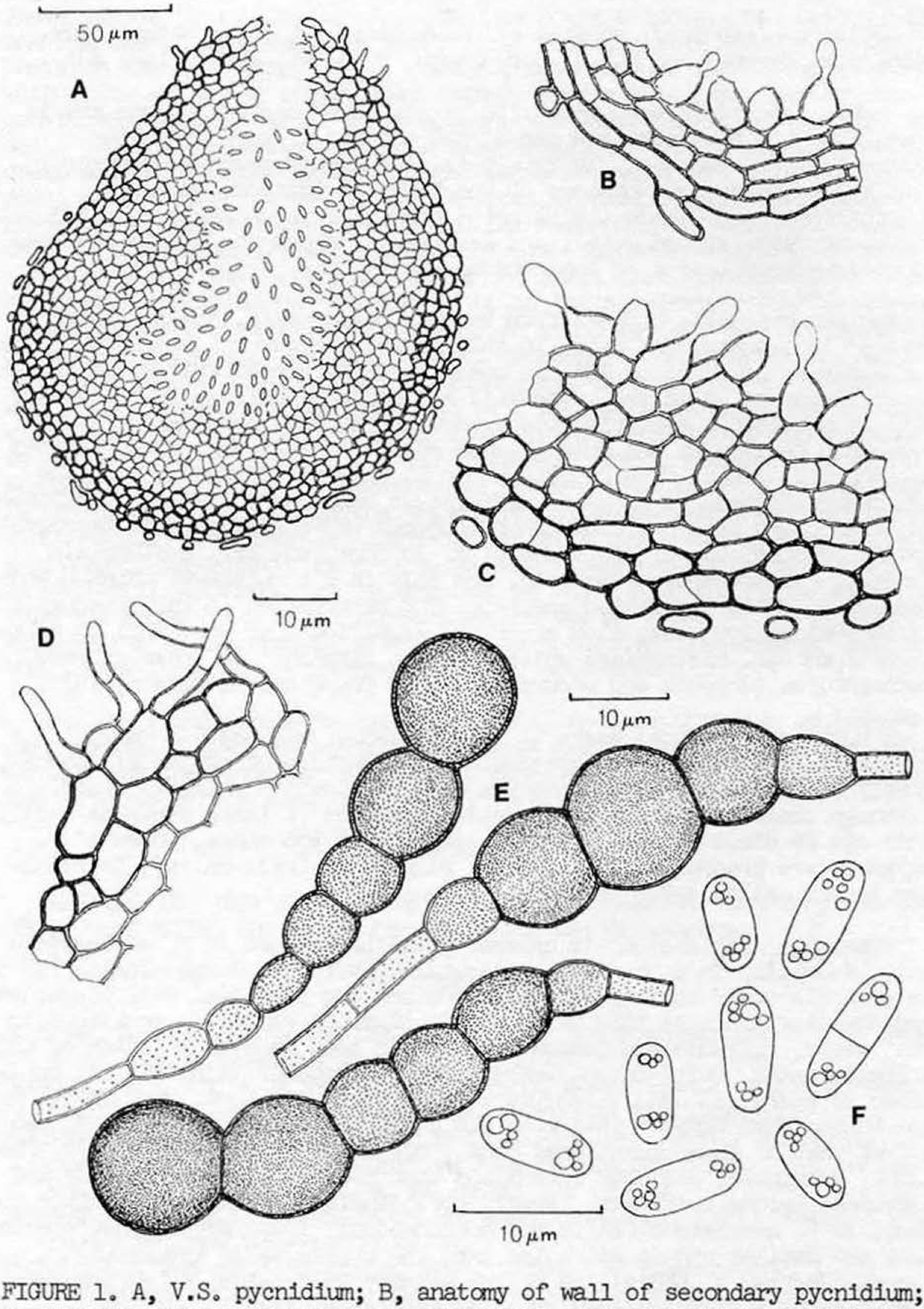


FIGURE 1. A, V.S. pycnidium; B, anatomy of wall of secondary pycnidium; C, anatomy of wall of primary pycnidium; D, Apical portion of wall of primary pycnidium showing hyphal elements which give rise to secondary pycnidia; E, chlamydospores; F, conidia.

Ubiquitous in arable soils and on a variety of hosts, especially genera of the Fabaceae; Africa, Europe, New Zealand, North America.

Collection examined: on stem of *Pisum sativum* L., The Netherlands, 1965, G.H. Boerema and M.M.J. Dorenbosch, PD74/396, ATCC 32162, AUA.

Phoma medicaginis var. *pinodella* is both seed and soil-borne and is considered to be a weak pathogen of pea and red clover [*Trifolium pratense* L.] (Dorenbosch, 1970). It is also known to occur on several host genera other than members of the Fabaceae (Sutton, 1980). Punithalingam and Gibson (1976) noted that black stem lesions, which seldom extend below ground level, and leaf spots on pea and clover can lead to serious crop losses in some instances.

Variety *pinodella* differs from variety *medicaginis*, which will be treated in a subsequent paper in this series, in several respects. In var. *medicaginis*, colonies on PDA are peach to buff-colored when young rather than olivaceous as in var. *pinodella* and are more uniform in appearance with no noticeable sectoring occurring. At 25C var. *medicaginis* grows much more rapidly on MEA than it does on PDA whereas var. *pinodella* has an identical growth rate on both media at this temperature and at the two others tested. On MEA var. *medicaginis* has also a distinctly striated appearance and does not produce the copious fan-shaped crystal aggregations characteristic of var. *pinodella*. In addition, var. *medicaginis* produces chlamydospores sparsely, and only in old cultures. Schenck and Gerdemann (1956) determined that conidium germination in var. *pinodella* is optimal at 20C, very slow at 5C and significant at 35C. This is different from var. *medicaginis* which fails to germinate at these extreme temperatures (Schenck and Gerdemann, 1956; Chung and Wilcoxson, 1971).

A number of features serve to distinguish *P. medicaginis* var. *pinodella* from other *Phoma* species. The production of chains of globose, mostly single-celled chlamydospores is a distinctive characteristic. Although somewhat similar to the chlamydospores of *Phoma eupyrena* Sacc., they can be dintinguished by their larger size and shape. Those of *P. eupyrena* are predominantly inflated, pigmented, thick-walled, intercalary hyphal cells, 4-7µm in diameter.

Pycnidial wall anatomy is another peculiar feature in *P. medicaginis* var. *pinodella*. In a previous publication (White and Morgan-Jones, 1984), we have discussed the importance of documenting pycnidial wall structure and the usefulness of this criterion in classification. As mentioned in that paper, sporadic and tentative note has been made in the past of this characteristic. Quite often, where there are graphic illustrations published of pycnidial wall structure in the literature these lack detail or are inaccurate. Variety *pinodella* has a pycnidial wall anatomy reminiscent of that of *Phoma macrostoma* Mont., but is much better developed. The large, pulvinate, cellular extensions that protrude into the venter and sometimes become confluent, largely occluding the cavity, are similar to those of *P. macrostoma* (White and Morgan-Jones, 1964) but in that species they are smaller and do not bulge into the venter to an identical degree. Continued subdivision of the primary wall cells, as occurs in var. *pinodella*, particularly those of the inner, largely hyaline layer, appears to occur infrequently within the genus *Phoma*. In fully mature pycnidia,the rupture of the outer pycnidial wall layer is another feature which appears to be unique. We have examined the pycnidial wall anatomy of over twenty species (White and Morgan-Jones, unpublished data) and in none have we found the continued pycnidial wall merstematic activity characteristic of *P. medicaginis* var. *pinodella*. Species such as *Phoma lingam* (Tode) Desm., classified by Boerema and van Kesteren (1981) and Boerema *et al.* (1981) in *Phoma* sect. *Plenodomus* (Preuss) Boerema, Kesteren and Loerakker, often, however, have similar appearing pycnidia with thick-walls and irregularly shaped venters resulting from uneven growth and cell division. In *P. lingam*, the inner layer of pycnidial wall cells varies considerably in thickness and frequently columnar mounds of cells extend into the cavity, occasionally becoming confluent and partially subdividing the venter into several locules (Cunningham, 1927; Boerema and van Kesteren, 1964). Species belonging to section *Plenodomus* produce a thick wall layer composed of hyaline, sclerenchymatous cells between large, pigmented outer cells and small meristematic cells lining the venter. This tissue is referred to as "scleroplectenchyma" by Boerema *et al.* (1981) and is present not only in pycnidia, but in the ascomata of the *Leptosphaeria* Ces. and de Not. teleomorphs of members of this section. Such tissue is absent in *P. medicaginis* var. *pinodella*. Boerema *et al.* (1965) noted that the pycnidial wall of var. *medicaginis* differs somewhat from that of var. *pinodella*. That of var. *medicaginis* was described as being "textura globulosa" sense Starbäck (1895), whereas that of var. *pinodella* was said to be intermediate between this and "textura prismatica". In our opinion it is difficult to generalize about pycnidial wall anatomy since usually more than one layer of cells is involved and each layer has a different appearance not only in terms of shape of individual cells but in cell wall thickness and coloration. We shall make further comment on this and present our views concerning the use of these terms, originally descriptive of discomycete apothecia, in reference to pycnidial wall anatomy, in a forthcoming treatment of var. *medicaginis*.

Two additional features that are useful in identifying *P. medicaginis* var. *pinodella* are possession of minutely guttulate, sometimes one-septate conidia and the presence of numerous large cells in the pycnidial wall in the vicinity of the apex.

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PUNCTELIA PERRETICULATA, A DISTINCT LICHEN SPECIES

GEROULD WILHELM and DOUGLAS LADD
The Morton Arboretum
Lisle, Illinois 60532, USA

ABSTRACT -- **Parmelia perreticulata** (Räs) Hale is recognized as a distinct species in **Punctelia** Krog, not as conspecific with **P. subrudecta** as it recently has been rendered. Information is provided on morphology and habitat differences between the two species in the Interior Highlands of the United States.

Punctelia perreticulata *(Räs) Wilhelm & Ladd, comb. nov. Basionym: Parmelia dubosquii Abb. var. perreticulata Räs, Ann. Bot. Soc. Zool. Fenn. 20:3, 1944. Parmelia perreticulata (Räs) Hale, Southw. Nat. 3:212, 1958.*

Krog (1983) created the genus **Punctelia** around those Parmeliae which have a pored or incipiently pored upper cortex. In view of the recent trend toward the recognition of numerous genera (Hale, 1974 and Esslinger, 1978), particularly among the old **Parmelia** species [**Bulbothrix** Hale, **Hypotrachyna** (Vain.) Hale, **Parmelina** Hale, **Parmotrema** Mass., **Pseudoparmelia** Lynge, **Relicina** (Hale & Kurok.) Hale, **Xanthoparmelia** (Vain.) Hale, and others], this treatment of the pored parmeliae seemed inevitable. Recently, Hale (1984) segregated **Flavopunctelia** from **Punctelia** based upon cortical chemistry and conidial characters. We agree with these treatments, but question Krog's placement of **Parmelia perreticulata** into synonymy with **Punctelia subrudecta** (Nyl.) Krog. Though it is not explained, one assumes that the lightly colored lower cortex and the presence of lecanoric acid and soredia, combined with the evident rareness of the perreticulate morphology and inadequate habitat data, lead Krog to this decision.

Punctelia subrudecta has an even to somewhat ridged upper cortex, and it has usually granular or even pustular soralia, and occasionally lobules, associated with the pseudocyphellae. **P. perreticulata** has a strongly foveolate-reticulate upper cortex, and always has finer soredia in more linear soralia associated with the ridges and as well as with the pores. Wetmore (1976) recognizes **Parmelia perretic-**

ulata and says it is characterized by a scrobiculate upper cortex and fewer pseudocyphellae. Hale (1979) characterizes it as having a foveolate upper surface, narrower lobes, and laminal soralia.

Our experience with these two lichens in the Interior Highlands of the United States has convinced us that **P. subrudecta** and **P. perreticulata** are quite distinct, both from a morphological standpoint and from the fact that each morphology has a very different habitat. **P. subrudecta** is a very common lichen on open-grown trees along roadsides and in areas where the ambient lands are in agricultural or rural residential use. Frequently it occurs on deciduous trees in dry upland oak forests and savannas; it occurs occasionally on exposed siliceous rocks in similar habitats. **P. perreticulata** occurs rarely, is restricted to natural areas, and is almost always found on old-growth conifers, mostly on **Juniperus virginiana, J. ashei**, and **Pinus echinata** which grow on bluffs or in glades where the fuel loading is too sparse to sustain substantial or regular fire. Wetmore (1976), for Big Bend, Texas, cited three specimens of **P. perreticulata** from pine and juniper; six specimens of **P. subrudecta** were cited and listed from pine, juniper, and oak.

Punctelia perreticulata has a distinct morphology with a narrowly defined habitat and should be recognized as a discrete taxonomic entity.

The authors are grateful to Mason E. Hale, Jr. for his encouragement and for having read critically this note.

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A NEW SPECIES OF THE GENUS CANOPARMELIA FROM ARGENTINA

Mónica T. Adler[1]

Departamento de Ciencias Biológicas,
Facultad de Ciencias Exactas y Naturales,
Universidad de Buenos Aires,
1428 Buenos Aires, Argentina.

Resumé

Canoparmelia austroamericana Adler is described as new. This species was collected in two distant localities 1200 km apart in the Provinces of Buenos Aires and Santiago del Estero, Argentina.

Introduction

Very recently, the genus *Pseudoparmelia* Lynge, monographed by HALE (1976), has been split into five segregates, viz. *Pseudoparmelia* sensu stricto and *Flavoparmelia* (HALE, 1986) and *Canoparmelia*, *Paraparmelia* and *Relicinopsis* (ELIX, JOHNSTON & VERDON, 1986).

The new species belongs to the genus *Canoparmelia* Elix & Hale on the basis of the following characteristics: 1) grey foliose thallus with narrow eciliate lobes which have a narrow erhizinate marginal zone at the underside; 2) the presence of laminal apothecia with entire disc, 8 ellisoid spores per ascus, their dimensions falling well in the range of the species of *Canoparmelia*; 3) laminal pycnidia with fusiform and bifusiform conidia, and 4) presence of atranorine and chloratranorine in the cortex.

Methods

The thalline chemistry was determined using standardized TLC methods (CULBERSON, 1972; CULBERSON & AMMAN, 1979 and CULBERSON *et.al.*, 1981), but the results were not wholly successful. Reverse phase HPLC (LUMSBCH & ELIX, 1985) gave better separation and enabled the unambiguous identification of the characteristic substances.

CANOPARMELIA AUSTROAMERICANA Adler sp. nov.

Thallus adnatus, lignicola vel corticola, viridi-cinereus, 5-10 cm latus. Superne albo-maculatus reticulatus cristatus ad lobis, mox corrugatus, ad centrum verrucosus ubi apothecia formant. Isidiis et sorediis destitutus. Lobi subrotundatis 1-5 mm latis, margine interdum irregulariter crenati, ciliis destituti. Subtus obscure vel pallidus castaneus sparse rhizinosus. Rhizinis simplicibus, saepe coalescentes. Cortex superior 14-35 µm crassus, stratum gonidiale 38-76 µm crassus, medulla alba 200-250 µm crassa, cortex inferior

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[1] Fellow of the Argentine Nat'l Research Council (CONICET).

11-17 µm crassus. Apothecia numerosa, adnata, disci castanei, 2-8 mm diam. Sporae octonae, 6-8 x 10-12 µm. Pycnidia numerosa, conidia fusiformia vel bifusiformia, 5-7 µm longa. Acidum stenosporicum, acidum perlatolicum, acidum glomelliferïcum, atranorinum et chloratranorinum continens.

Holotypus: Argentina: Prov. de Buenos Aires, Ranchos (35° 20' S, 58° 10' W), leg. Protomastro & Adler, II.1985 in Herb. **BAFC** conservatus est; isotypus **ANUC** et **US**.

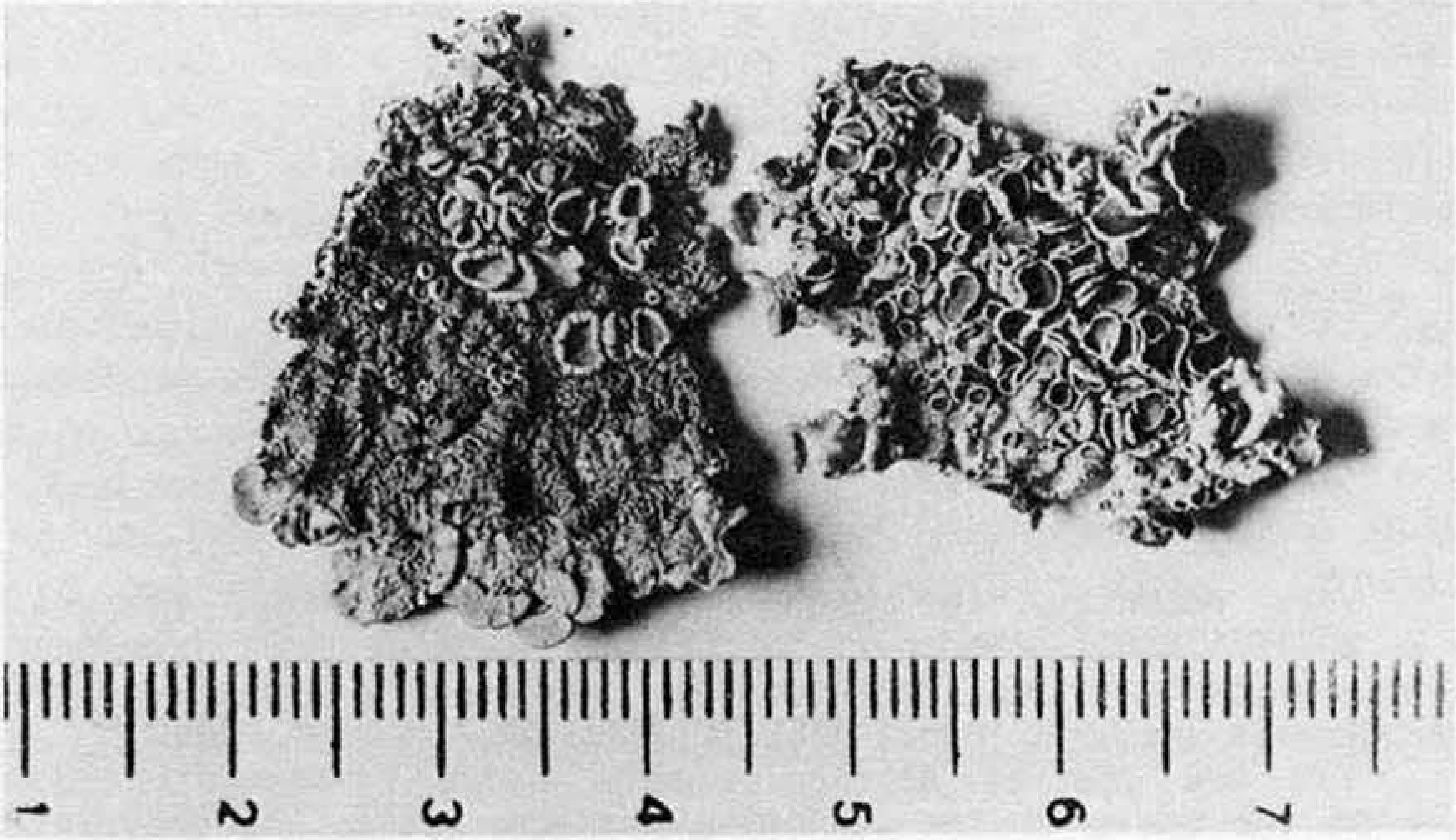

Fig. 1. Aspect of the holotype of Canoparmelia austroamericana Adler.

Thallus adnate, greenish grey, corticolous or lignicolous, 5-10 cm broad. Lobes apically subrotund, 1-5 mm wide, the margins sometimes irregularly crenate, eciliate (Fig. 1). Upper surface reticulately ridged and maculate at the apices of the lobes, soon becoming wrinkled; the center commonly verrucose, caused by the formation of abundant apothecia, lacking isidia and soredia. Lower surface dark to light brown, sparsely rhiziniate with an erhiziniate or weakly papillate marginal zone; rhizines simple, often coalescing. Medulla white. Apothecia lecanorine, abundant to very crowded, disc brown, 2-8 mm diam. Spores 8 per ascus, simple, hyaline, 6-8 x 10-12 µm. Pycnidia very common, immersed, with blackish ostioles, conidia bifusiform to fusiform (or bifusiform in the sense of KROG, 1982).

Chemistry: reactions: upper cortex, K+ yellow, medulla K-, C-, KC+, faint purple, P-.
chemical contents: upper cortex containing atranorine and chloratranorine; medulla containing stenosporic, perlatoric and glomelliferic acids.

Representative specimens: Prov. of Buenos Aires: 10 km N of Ranchos on route 29, leg. Protomastro & Adler, XII.1985 (**BAFC** 36.618, 35.619 and 35.620). Prov. of Santiago del Estero: Los Pirpintos, Dept° Copo (26° 10' S, 62° 05' W), 172 m alt. On Prosopis nigra, leg. Protomastro & Adler, V.1985 (**BAFC** 35.621).

Habitat, Climate and Pytogeography

The type locality, 10 km N of Ranchos, at an altitude of 30 m in the Prov. of Buenos Aires, is situated in the Pampean phytogeographical Province (CABRERA & WILLINK, 1973). The climate is warm-temperate, with a mean annual temperature of 15-16°C, and 1000 mm of mean annual rainfall, mostly concentrated in fall and spring (CABRERA, 1976). The vegetation is typically a grassland which develops on more or less flat terrain with some depressions where water accumulates seasonally. Fence posts and cultivated trees are the main substrates for lichens. The sample from the Prov. of Santiago del Estero was collected at an altitude of 172 m in a subtropical semiarid area of the Chaco phytogeographical Province (CABRERA & WILLINK, 1973). The mean annual temperature is abt 18°C and the mean annual precipitation is abt 800 mm, concentrated in summer (MORELLO & ADAMOLI, 1974). The natural forest of this plain is characterized by *Schinopsis lorentzii* ("quebracho colorado", *Aspidosperma quebracho-blanco* and *Zizyphus mistol*, but *Prosopis nigra* invades the disturbed forest areas after logging.

Discussion

Canoparmelia austroamericana Adler appears to be closely related to the isidiate species *Canoparmelia caroliniana* (Nyl.) Elix & Hale, since both have similar reticulate-maculate upper surfaces and identical medullary chemistry. However, *Canoparmelia caroliniana* is clearly distinguished by the presence of isidia (absent in the former), and the color of the underside, being mainly black, rarely brown, in the latter but dark to light brown in *C. austroamericana*. This species could possibly be considered the non-isidiate morph of *C.caroliniana* as suggested by Dr. J. A. Elix (personal communication).

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NOTES ON THE MAYAPPLE AND THE LIFE HISTORY OF THE FUNGUS SEPTOTINIA PODOPHYLLINA

DR. J. GREMMEN

Zetten, The Netherlands

ABSTRACT

The life-history of the fungus *Septotinia podophyllina* occurring on the Mayapple, *Podophyllum peltatum,* in eastern North America and the fungus's dissemination to a number of new host plants on the European continent is discussed. The early medical applications of the host as an anti-tumor agent are noted. The case shows how introduction of plants carrying pathogenic organisms may sometimes lead to unexpected, serious damage to the native flora or to economically important crops.

Podophyllum peltatum L. (Berberidaceae) is a native plant of eastern North America inhabiting deciduous forests. Its common name is Mayapple or American Mandrake, though it has neither affinity to, nor similarity with, the European Mandrake, *Mandragora officinarum* L. (Solanaceae). The Mayapple has 20-30 cm long stems developing from a firm rootstock, with 5-9-lobed or deeply cut, toothed leaves. Under these leaves occur 3-4 cm diam, white, saucer-shaped, waxy flowers with 6-9 petals, 12-18 stamens, and a single pistil (FIG. 1). After pollination by bumble-bees (*Bombus* spp.) 5-6 cm diam, light yellow, globular, edible fruits, resembling small prunes, are produced (FIG. 2).

Centuries ago the Penobscot Indians of the northeastern United States used to apply decoctions of the leaves of *P. peltatum* for the treatment of skin-cancer, polyps, and warts. Chemical research later proved that the rootstocks as well as the immature fruits and leaves contain an active substance called podophylline. Because of pharmaceutical and medical interest in the action of podophylline as a tumor-inhibiting substance (Ormsbee & al., *1949*), *P. peltatum* was early introduced into various botanical gardens in Europe, among them the so-called "Artsenijhof" of the University of Amsterdam. In this medical herb garden investigations were executed on growth and large-scale propagation (van Laren, *1919*). From the rootstock as well as the side roots a drug called "Resina podophylli" has been obtained for the treatment of warts, in particular against a phenomenon known as Condyloma acuminata. As a result of its caustic and toxic effects, this drug is no longer in use and is omitted today from the Dutch pharmacopoeias.

Due to the introduction of *P. peltatum,* a fungus called *Septotinia podophyllina* Whetzel (Ascomycetes) arrived on the European continent. This organism causes a leaf blotch of the Mayapple in North America, scarcely of any economic significance, but demonstrated serious pathogenicity to young poplars in the Old World. On the Mayapple as well as on a number of poplar species rapidly increasing, large leaf-spots occur, causing dieback of leaves and premature leaf-fall. On these spots pustules (sporodochia) with hyaline conidia appear (FIG. 3), allowing spread of the fungus to neighboring leaves and plants.

In one special cultivar, *Populus euramericana* 'Serotina,' leaves, leaf-petioles, and tops of young shoots were killed by the fungus (Gremmen, *1962*). An attack of leaves and young shoots was also observed on *Salix fragilis* L. (van den Ende, *1960*), and once on leaves of *Prunus serotina* Ehrenb. (de Kam, *1973*).

Septotinia podophyllina infects only 1-4-year old nursery stock by virtue of certain factors such as (i) short-distance ascospore infection on low-hanging leaves from apothecia produced on overwintering sclerotia in the soil in early summer, and (ii) feeding on the leaves by the profusely developing willow-beetles (*Phyllodecta* spp.), since small wounds are needed for successful infection. Since an increasing number of nurseries raising poplars

FIGS. 1-2. *Podophyllum peltatum*. 1. Flowering state, Natural Bridge Nature Park, Sauk County, Wisconsin, May 1980 (Gremmen 5112). 2. In mature fruit, Eloise Butler Gardens, Minneapolis, Minnesota, Sept. 1977 (Gremmen 2744). FIG. 3. Sporodochia of *Septotinia podophyllina* on leaf of *P. peltatum*, Lloyd-Cornell Preserve, McLean, New York, June 1932 (CUP 20334a).

have also been established in North America in recent decades, the *Septotinia*-disease has recently been found there, too.

In consequence of the introduction of the Mayapple onto the European continent, the fungus *Septotinia podophyllina* has spread to *Populus* spp., to *Salix* spp., and to *Prunus serotina*. Further research may show that more susceptible host plants exist, demonstrating the fungus's dynamic life-cycle and polyphagous nature when arriving in a new environment and with other host plants.

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Through the courtesy of Professor R. P. Korf, Plant Pathology, Cornell University, an original photograph prepared for the late Professor H. H. Whetzel has been reproduced here. I also thank Mr. K. Loeffler, their photographer, for adapting my original color slides of *Podophyllum* for black and white reproduction.

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