MYCOTAXON

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

Volume X January-March 1980 No. 2

CONTENTS

[MYCOTAXON for October-December 1979 (10: 1-264) was issued October 19, 1979]

ISSN 0093-4666 *MYXNAE 10(2) 265-524 (1980)*

Library of Congress Catalogue Card Number 74-7903

Published quarterly by MYCOTAXON, Ltd., P.O. Box 264, Ithaca NY 14850
For subscription details and availability in microform, see back cover

MYCOTAXON

VOLUME X, 1979-1980

COMPLETE IN TWO QUARTERLY ISSUES

CONSISTING OF iv + 524 PAGES

INCLUDING FIGURES

C O - E D I T O R S

G. L. HENNEBERT

French Language Editor & Book Review Editor

RICHARD P. KORF

English Language Editor & Managing Editor

Published by

MYCOTAXON, LTD., P.O. BOX 264, ITHACA, NY 14850, USA

Printed in the United States of America

TABLE OF CONTENTS, VOLUME TEN

No. 1 October-December 1979

No. 2 January-March 1980

MYCOTAXON

Vol. X, No. 2, pp. 265-268 January-March 1980

NOTES ON CORTICIACEAE (BASIDIOMYCETES) VI

Rogersella eburnea nov. spec.

KURT HJORTSTAM

Målaregatan 12
S- 441 00 Alingsås, Sweden

and

EVEN HØGHOLEN

N- 2340 Løten, Norway

S U M M A R Y

A new species, Rogersella eburnea is described and illustrated from material collected in Canada by K. H. Harrison. Additional collections are known from U.S.A. (Tennessee), Norway, and Sweden.

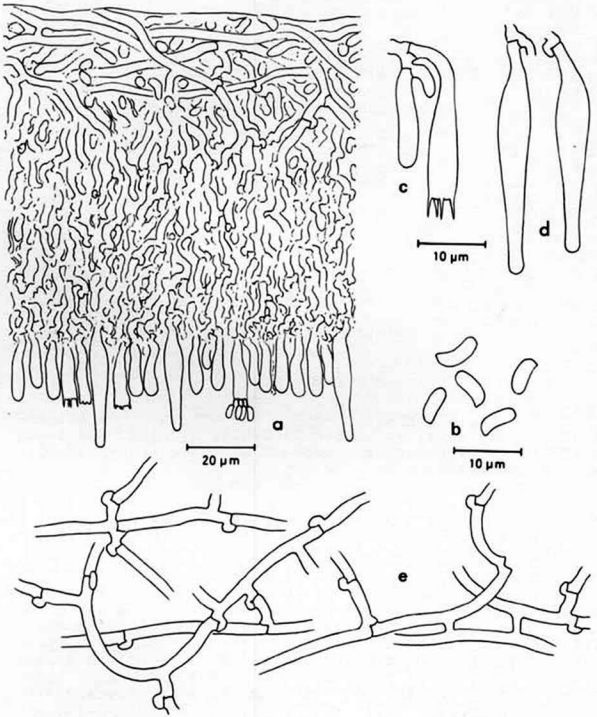
ROGERSELLA EBURNEA Hjortst. & Høgholen nov. spec.

Fructificatio resupinata, effusa, adnata, confluens, membranacea, subceracea, durescens, circiter 100-150 um crassa, incrassata; hymenio leve; colore candido vel eburneo. Systemate hyphali monomitico; hyphis basalibus plus minusve crassitunicatis, facile observatis, rectis vel aliquantum flexuosis, uniformibus, 2.5(3) um latis, fibulatis; hyphis subhymenialibus plus minusve indistinctis, tenuitunicatis, fibulatis. Cystidiis fere ampulliformibus, plerumque capitatis, tenuitunicatis, 30-40 x 5 um. Basidiis terminalibus, subclavatis, constrictis, 20-25 x 5 um, 4- sterigmatibus. Sporis suballantoideis vel reniformibus, 6 x 2.5 um, non amyloideis.

Holotypus: Canada. Ravine, Kentville, N.S., on rotten Tsuga sp. 1934-09-01 K. A. Harrison DAOM 5488.

Isotypus: a portion of the holotype in GB.

Paratypi: Canada. Beren´s River, on Juniperus sp., 1935-08-



Rogersella eburnea a) section through the fruitbody b) spores c) basidia d) cystidia e) subicular hyphae - Coll. K. A. Harrison 1934.09.01 DAOM 5488. Holotypus. Drawing by John Eriksson.

02 G. R. Bisby DAOM 5804. U.S.A. Tennessee. Great Smokey Mts. Nat. Park. Gatlinburg, Cherokee Orchard, on coniferous wood, L. Ryvarden 14218 O. Ontario, Brant Co, N of Scotland, on conifer, 1937-06-27 R. F. Cain. Norway. Hedmark, Ringsaker, Havik NN87.63, on decidous wood, 1977-10-08 Even Høgholen 770/77 O. Oppland PN 11, Østre Toten, Fuglejern north of Hersjøen, on Picea abies, 1971-08-03 L. Ryvarden 7625 O. Sweden. Västergötland, Hålanda par., NE of the farmstead Grandalen, on coniferous wood, 1970-09-03 K. Hjortstam 3430/b GB.

Fruitbody resupinate, effuse, adnate, confluent, more or less membranaceous, about 100-150 um thick, subceraceous, thickening and becoming firm with age, hymenium smooth, white to ivory white. Hyphal system monomitic. Basal hyphae somewhat thick-walled, generally easily observed, straight or somewhat flexuose, uniform, 2.5(3) um wide. Subhymenial hyphae more indistinct, slightly gelatinized, irregular, thin-walled. All hyphae with clamps. Cystidia rather well differentiated, arising from the subhymenial layer, usually more or less flaskshaped, in most cases capitate, subcapitate or obtuse, thin-walled, 30(-40 x 5 um. Basidia terminal, subclavate, slightly constricted, with walls at first thin then slightly thickened, about 20-25 x 5 um, with 4 sterigmata. Spores suballantoid or reniform (Snell & Dick 1971 pl. 13), rarely ellipsoid, thin-walled, cyanophilous reaction not observed, usually 6 x 2.5 um, not amyloid.

Habitat and distribution. Growing on trunks and branches, preferably of coniferous trees, only once recorded on deciduous wood. Its ecology seems to be quite different from R. sambuci which is more frequent in mixed wood-lands, with predominating deciduous trees, while R. eburnea as far as known, prefer humid coniferous forest, in more or less continental areas.
In aspect of its known distribution the species is widespread in the north temperate region but obviously a rare species.

Remarks. The genus Rogersella was described by Liberta and Navas (1978) and comprises two species, R. asperula, which is the type species and R. sambuci, and is evidently a satellite genus to Hyphoderma. At least R. sambuci has also similarity of some species in Hyphodontia, see Eriksson and Ryvarden (1976 p. 577).

The new species R. eburnea resembles both R. asperula and R. sambuci, preferably in its white fructification and in having the same kind of cystidia, which in most cases are capitate. Furthermore, the hyphal texture and the appearance of the individual hyphae is no doubt very similar. The basal hyphae are for example distinctly observed and slightly thickened, while the subhymenial ones are more or less indistinct and usually slightly conglutinated. The spore-walls are, however, thin-walled in R. eburnea and no cyanophilous reaction is observed. In R. asperula as well as in sambuci the spore-walls may be weakly thickened and

a slight reaction in Cotton blue is usually observed. To the naked eye the new species reminds very much of Phlebia romellii (Litsch.) Parm. but this species has narrower spores and a dense hyphal texture.

Key to the species of Rogersella.

1 Hymenium farinose, reticulate, verruculose to odontioid, spores asperulate ..... R. asperula
1 Hymenium usually completely smooth, seldom tuberculate, spores smooth 2

2 Spores suballantoid to reniform .....R. eburnea
2 Spores ellipsoid, in some collections variable and becoming cylindrical .....R. sambuci

References

Eriksson, J. & Ryvarden, L. 1976: The Corticiaceae of North Europe Vol. IV: 547-886.

Liberta, A. E. & Navas, A. J. 1978: Notes on Venezuelan Corticiaceae (Basidiomycetes). Can. Journ. Bot. Vol. 56: 1777-1781.

Snell, W. H. & Dick, E. A. 1971: A glossary of mycology. 1-181. Harward Univ. Press.

MYCOTAXON

Vol. X, No. 2, pp. 269-287 January-March 1980

STUDIES IN TROPICAL CORTICIACEAE (BASIDIOMYCETES) I

KURT HJORTSTAM

Målaregatan 12
S- 44100 Alingsås, Sweden

and

LEIF RYVARDEN

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

S U M M A R Y

The types of 13 tropical Corticiums have been studied and their generic affinities are discussed. The genus Dendrodontia is described based on Grandinia bicolor Talbot. New combinations are proposed in Brevicellicium, Dendrodontia, Hyphoderma, Intextomyces, Mycoaciella, Phlebiopsis, Phlebia, Radulodon and Scytinostromella.

One of us (Ryvarden) has made three excursions in Africa and besides polypores also numerous corticoid fungi were collected. We have now started to study these collections. Many tropical fungi are cosmopolitan in their distribution, and thus it is necessary to consider descriptions from all parts of the world. The results from some type studies are reported here in the first, of what we hope will be a long series of papers concerning tropical corticoid fungi.

BREVICELLICIUM MELLINUM (Bres.) Hjortst. & Ryv. Fig. 1.
nov. comb. Basionym: Corticium mellinum Bres., Ann. mycol. 18: 47, 1920.

Nomenclatural type: Brazil. Rick 434. (S).!

Fruitbody resupinate, effuse, loosely adnate, pellicular to membranaceous (athelioid), cream to ochraceous (probably only with age), subiculum byssoid, paler than the hymenium,

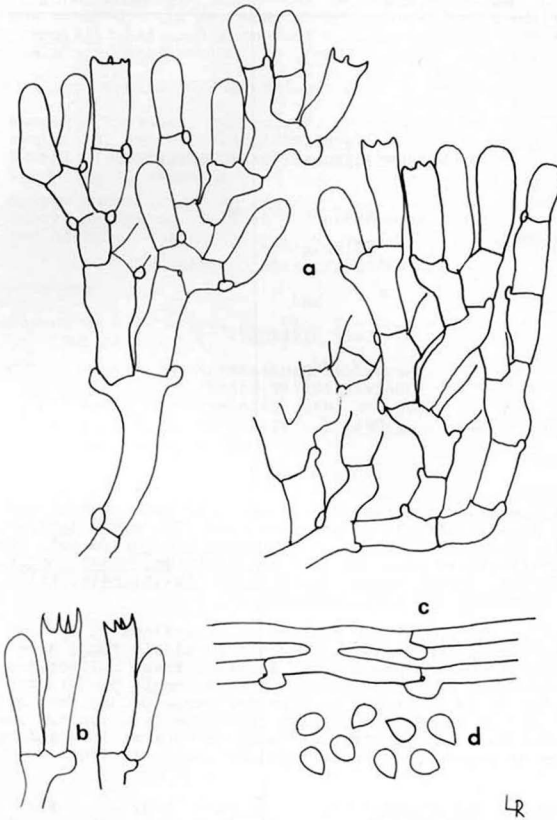


Fig. 1. Brevicellicium mellinum a) sections through the fruitbody b) basidia c) hyphae from the subiculum d) spores. From the type.

margin not determinable.
Hyphal system monomitic. Basal hyphae straight and uniform, anastomosing, thin-walled, 2.5-3(-4) um wide, with clamps. Subhymenial hyphae widened, somewhat isodiametric, 4-6(-8) um wide and with relatively small clamps. Cystidia lacking. Basidia terminal, clavate to subcylindrical, slightly constricted, with four sterigmata, 15-20 x 4-4.5(-5) um. Spores thin or with somewhat thickened walls, in phase-contrast microscope metachroic (red in Cotton-blue) but with walls non or weakly cyanophilous, usually more or less oblique, 3(-4) x 2.5(-3) um, non-amyloid.

Remarks. This may be a somewhat difficult species to recognize as it is rather similar to other species in Corticiaceae e.g. Leptosporomyces ovoideus and Trechispora byssinella which both are more or less pellicular, non cystidiate, and have narrow and straight basal hyphae and small spores. Chiefly, B. mellinum is rather well-marked by the isodiametric subhymenial hyphae and the small oblique spores.

Brevicellicium exile has about the same spore morphology but the spores are larger, in most cases 5-6 x 3.5-4 um. The hymenium is also less pellicular and without distinct subiculum.

Fig. 2.

CORTICIUM SUBOCHRACEUM Bres., Hedwigia 35: 290, 1896.

Nomenclatural type: Brazil, Blumenau. Möller 274. (S).!

Fruitbody resupinate, effuse, adnate, smooth, not separable from the substrate, somewhat membranaceous, ceraceous, in colour light brown, margin indeterminable.

Hyphal system monomitic, Hyphae of the subiculum mostly thick-walled, encrusted and somewhat gelatinized, about 3-4 um wide, with clamps. Subhymenial hyphae similar, but more short-celled, encrusted, the incrustations are especially marked in KOH. Cystidia apparently lacking. Basidia terminal, clavate, 12-15 x 4-5 um, with four sterigmata. Spores ellipsoid to sybcylindrical, thin-walled, smooth, 5-6.5 x 2.5-3 um, non-amyloid.

Remarks. We believe that the species is related to species in Ceraceomyces or other related genera, but until additional specimens have been examined we retain it in Corticium. At present we have no other suggestions about relationship than in the vicinity of the above-mentioned genus.

CORTICIUM SULPHUROSUM Bres., Ann. mycol. 18: 47, 1920.

Nomenclatural type: Brazil, Bahia. Torrend 59. (S).!

The type specimen is fragmentary and no essential features can be studied. Neither basidia nor spores appear, only hyphae occurring. These are of small demension, encrusted, and apparently without clamps. In macromorphology the species is well distinguished by its sulphury colour and rhizomorphic margin. Corticium sulphurosum maybe corresponds with species in Phanerochaete.

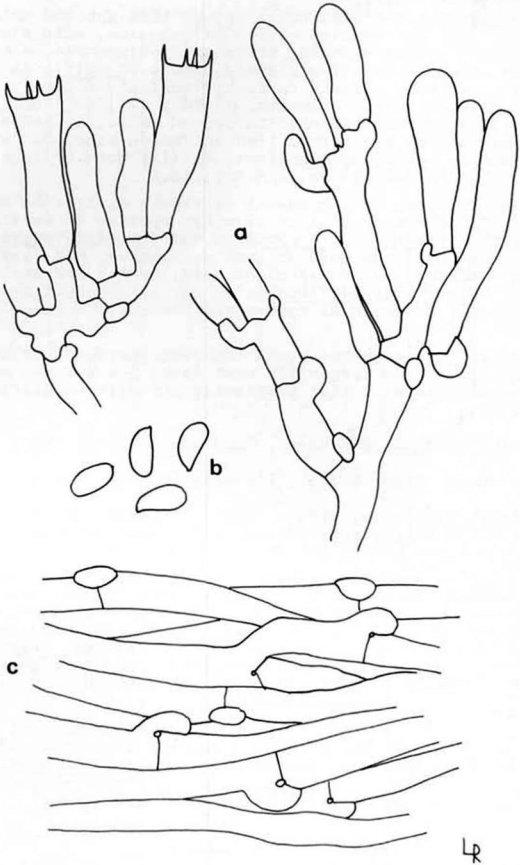


Fig. 2. Corticium subochraceum a) sections through the fruitbody b) spores c) hyphae from the subiculum. From the type.

DENDRODONTIA nov. gen. Hjortst. & Ryv.

Fructificatio resupinata, effusa, laxe adnata, hymenio tuberculato vel odontioideo, cinerascenti; subiculo distincto, infuscato; systemate hyphali dimitico; hyphis skeleticis crassitunicatis, flavidis vel modice brunneis, interdum ramosis, non fibulatis, hyphis subhymenialibus plus minusve hyalinis, tenuitunicatis vel incrassatis, fibulatis,; cystidiis nullis; hymenium dendrohyphidiis numerosis instructum; basidiis clavatis, terminalibus, basibus fibulatis; sporis tenuitunicatis, incoloribus, non amyloideis, in typo plus minusve ellipsoideo vel suballantoideo.

Type species: Grandinia bicolor Talbot, in Wakef. & Talbot.

Fruitbody resupinate, effuse, loosely adnate, hymenium tuberculate or odontoid, more or less greyish. Subiculum well-differentiated, brownish.
Hyphal system dimitic. Skeletal hyphae yellowish or light brown, thick-walled, slightly ramificate, without clamps. Subhymenial hyphae more or less hyaline, thin-walled or becoming thickened, with clamps. Cystidia lacking. Dendrohyphidia numerous, projecting above the basidia. Basidia clavate, terminal, with clamped base. Spores thin-walled, in the type specimen ellipsoid to suballantoid, non-amyloid.

Remarks. The main features of this genus are the dimitic hyphal system, with ramified brownish skeletal hyphae and the occurrence of hyaline dendrohyphidia. The fruitbody is in vertical section well-marked by a brownish basal zone below the subhymenium. The spores are thin-walled and non-amyloid as well as the hyphae. We are of the opinion that these characters should justify a new genus.

Dendrodontia is related to Scytinostroma, but rather well distinguished by the non-dextrinoid skeletal hyphae. The skeletal hyphae in Dendrodontia are brown, and no noticeable change in colour is seen in Melzer's reagent. The dendrohyphidia could remind one of those in Laeticorticium but species of that genus have usually basidia with basal bladder and all known species are also monomitic, and the hyphae are hyaline.

Fig. 3.

DENDRODONTIA BICOLOR (Talbot) Hjortst. & Ryv. nov. comb.

Basionym: Grandinia bicolor Talbot in Wakef. & Talbot, Bothalia IV: 947, 1948. (Type specimen: W. R. Rump 100, 27756, South Africa, Town Bush, Pietermaritzburg).

Fruitbody resupinate, effuse, loosely adnate, somewhat tough, orbicular to confluent, with the hymenium tuberculate or slightly odontioid, subiculum brownish and well-differentiated, margin distinct, consisting of brown subicular hyphae.
Hyphal system dimitic. Skeletal hyphae brownish, thick-walled, slightly branched, non-fibulate, about 3 um wide. Subhymenial hyphae hyaline, thin-walled and easily separa-

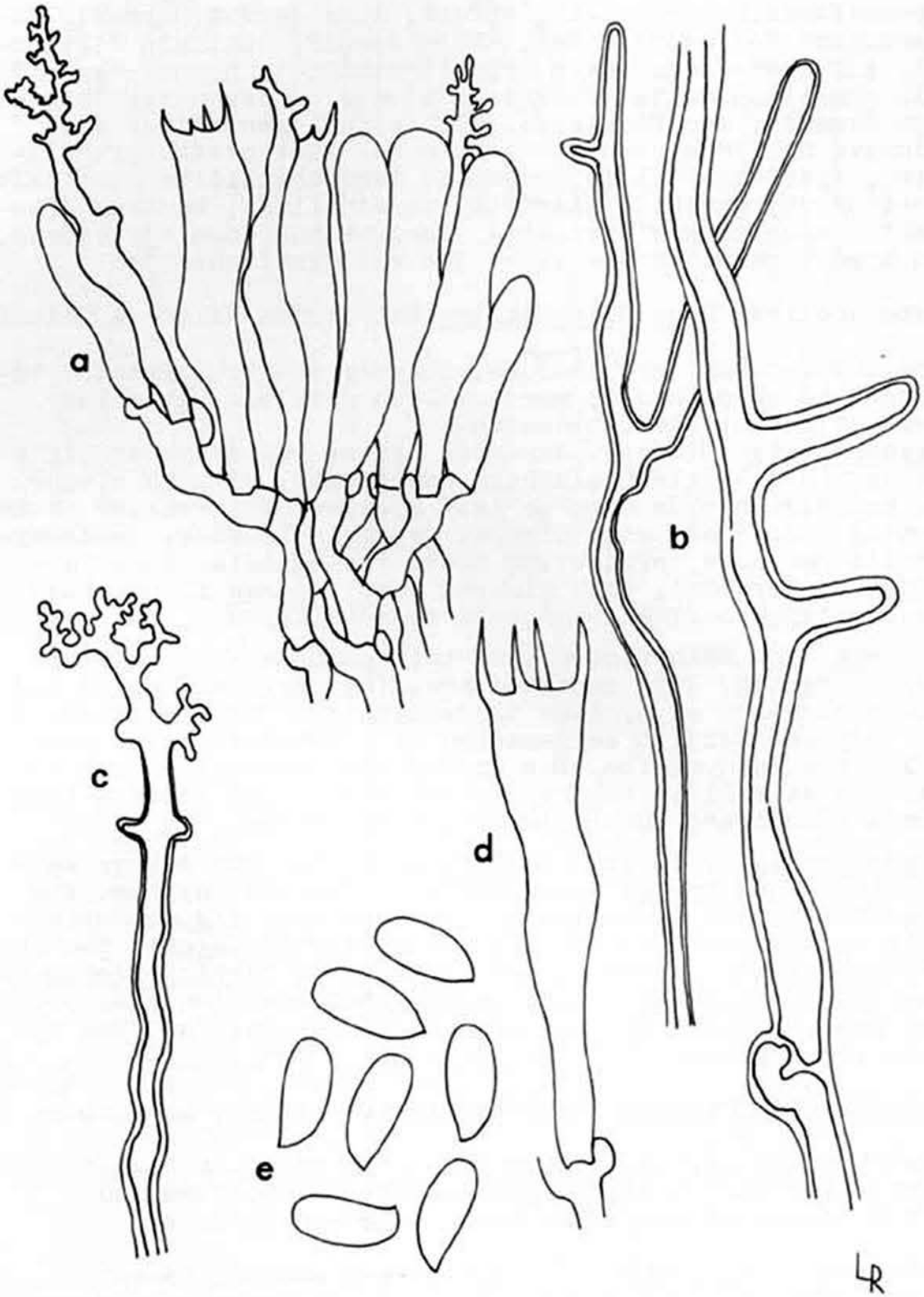


Fig. 3. Dendrodontia bicolor a) section through the fruit-body b) skeletal hyphae c) dendrohyphidium d) basidium e) spores. Coll. Ryvarden 10182(O).

ted from the skeletal ones, with clamps. Cystidia lacking but with dendrohyphidia between the basidia, arising from the subhymenial hyphae, thin-walled, non-dextrinoid and non-amyloid. Basidia clavate, somewhat constricted, 30-35 x 6-7 um, with four sterigmata. Spores ellipsoid to subcylindrical, thin-walled, usually 8-10 x 3.5-4 um, non-amyloid.

Remarks. Easily recognized species because of its brown skeletal hyphae and distinct margin with the hymenium tuberculate or odontioid. Also well delimited from other dimitic species through its hyaline, thin-walled dendrohyphidia and rather large, more or less ellipsoid spores which are non-amyloid.

Specimens studied: Africa, from the type locality Rump 217 (K). Tanzania. Kilimanjaro Prov. Mt. Kilimanjaro W slope, W Kilimanjaro Forest Sta. alt. c. 1800 m. 1973-02-10/11 Ryvarden 10182.

HYDNUM EICHELBAUMII P. Henn.

Englers bot. Jahrb. Vol. 38: 108, 1907.

Nomenclatural type: Africa, Ost-Usambara, Aman. Sept. 1903, F. Eichelbaum No. 40. (S).!

The type specimen consists of a small fragment and cannot be adequately described. It is probably closely related to genera in Coniophoraceae.

Fruitbody resupinate, effuse, adnate, hydnoid and few aculei present in the collection, margin not determinable, rhizomorphs absent, aculei subulate, brownish, 0.5-1 mm long with smooth hymenium between the aculei, subiculum whitish, easily distinguished.
Hyphal system monomitic, individual hyphae thin-walled, smooth, non-amyloid and non-dextrinoid, more or less collapsed, clamps not observed. Cystidia or gloeocystidia thin-walled, obtuse, smooth, about 50-80 x 5-7 um. Basidia mostly collapsed. Spores brownish, with germpore, thick-walled, smooth, broadly ellipsoid or subglobose, 7-9 x 5 um, non-amyid.

Fig. 4.

HYPHODERMA RUDE (Bres.) Hjortst. & Ryv. nov. comb.

Basionym: Odontia rudis Bres., Ann. Mycol. Vol.: 18: 42, 1920.

Nomenclatural type: Brazil, S. Leopoldo. Rick 51. (S).!

Additional specimen seen: Brazil, S. Leopoldo. Theissen (S).

Fruitbody resupinate, effuse, adnate, hymenium distinctly odontioid, with small slightly fimbriate, conical aculei, usually less than 0.5 mm long, creamish, margin not determinable in type specimen.
Hyphal system monomitic. Basal hyphae thick-walled, smooth, ramified, long-celled. Subhymenial hyphae more thin-walled,

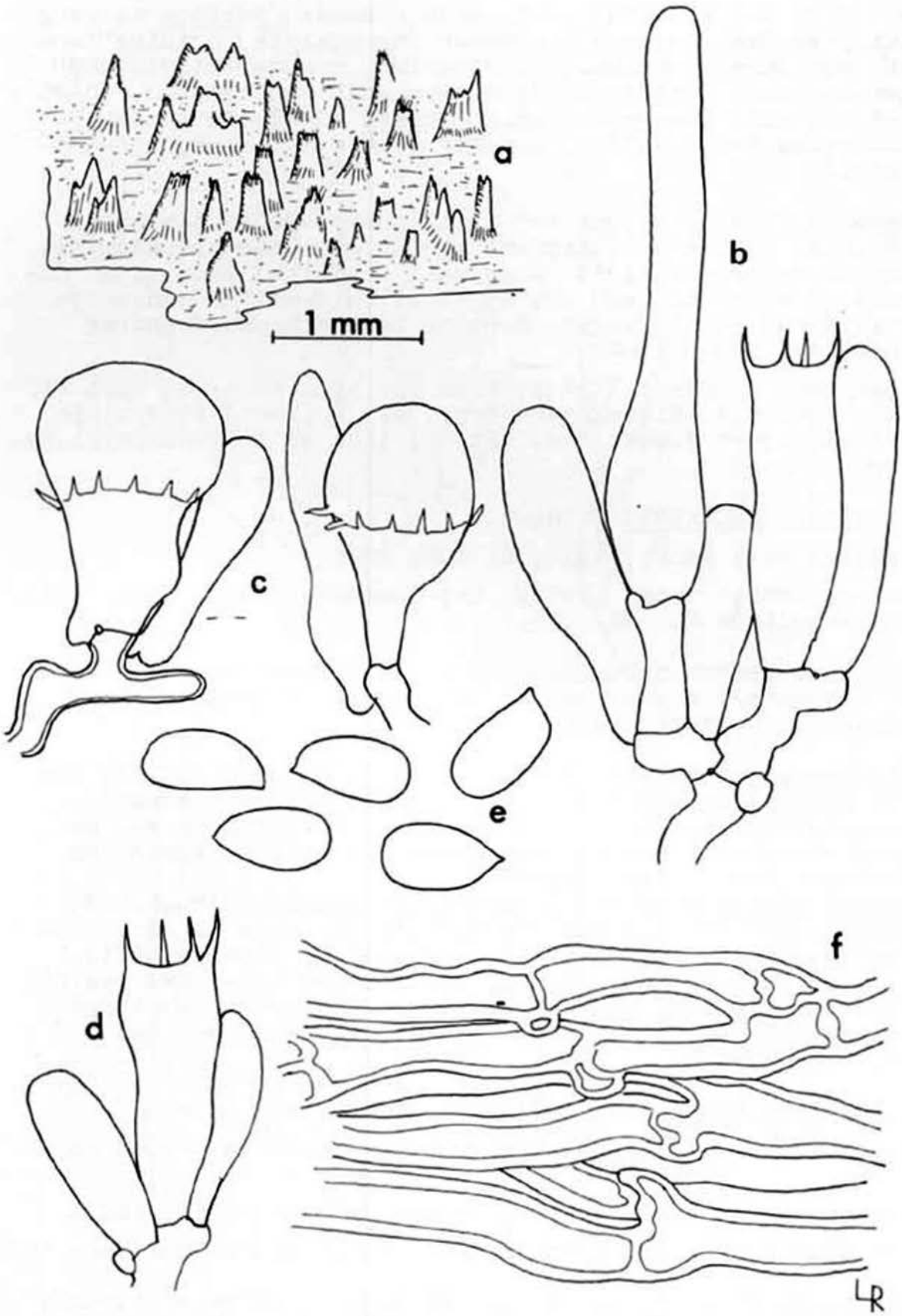


Fig. 4. Hyphoderma rude a) part of fruitbody b) cystidium and basidia c) stephanocysts d) basidium e) spores f) hyphae from the subiculum. From the type.

with shorter cells. All hyphae with clamps and about 3-4 um wide, non-amyloid or dextrinoid. Cystidia of two kinds: 1) tubular gloeocystidia, terminal, obtuse, mostly enclosed in the texture and somewhat difficult to find, about 40-70 x 8-12 um, 2) stephanocystidia, numerous and easily observed, globose and in the middle with a dentated collar, clamped at the base, about 15 x 10 um. Basidia terminal, more or less clavate, slightly constricted, with four sterigmata, 25-30 x 5-6 um. Spores thin-walled, smooth, ellipsoid, with oil-droplets in the protoplasm, usually 9-10 x 6 um, non-amyloid.

Remarks. The species is well recognized by occurrence of stephanocysts and having a odontioid hymenium. It belongs in vicinity of Hyphoderma praetermissum (Karst.) Erikss. & Strid.

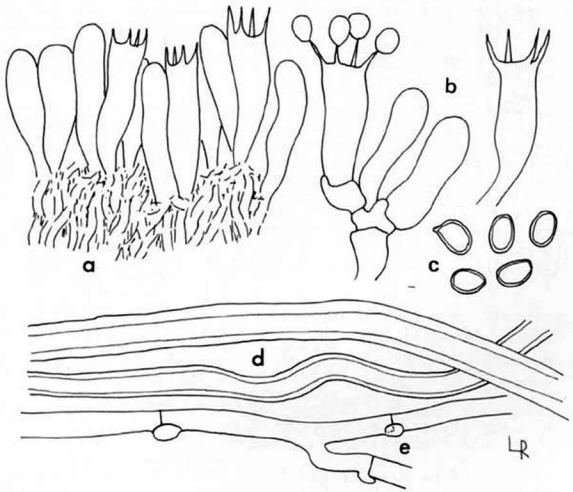


Fig. 5. Intextomyces umbrinus a) section through the fruitbody b) basidia c) spores d) skeletal hyphae e) generative hyphae. From the type.

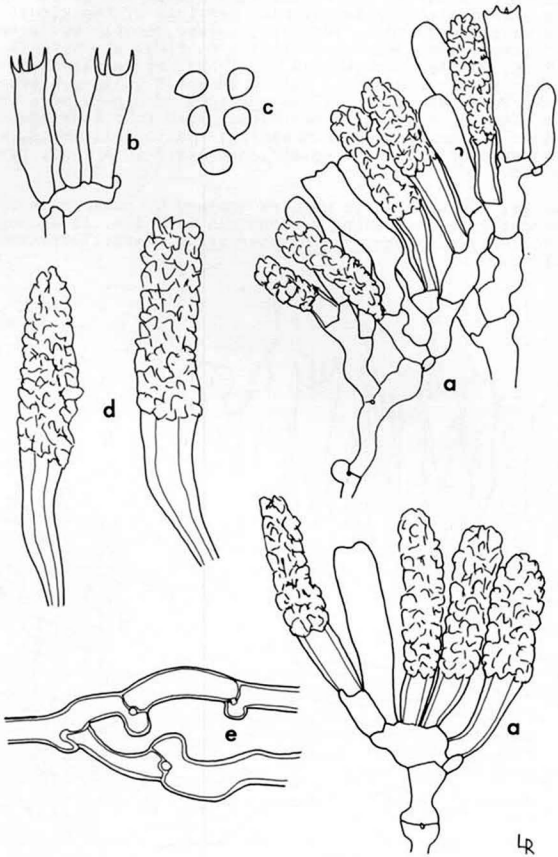


Fig. 6. Kneiffia brasiliensis a) section through the fruitbody b) basidia c) spores d) cystidia e) hyphae. Coll. Brazil, Bahia, Torrend 1912(S).

Hyphoderma odontiaeforme Boid. & Berth. which has been described from Africa (Berthel & Boidin 1966) is probably the same but no authentic material has been studied by us of that species. The description and the figure correspond with H. rude.

Fig. 5.

INTEXTOMYCES UMBRINUS (Bres.) Hjortst. & Ryv. nov. comb.

Basionym: Radulum umbrinum Bres., Hedwigia 35: 287, 1896.

Nomenclatural type: Brazil, Blumenau. Möller 262.(S).!

Fruitbody resupinate, effuse, adnate, hymenium hydnoid with scattered aculei, ceraceous, light brown.
Hyphal system apparently dimitic or subdimitic. Hyphae of three types 1) basal hyphae thick-walled and simple septate, but some with clamped septa, hyaline and about 4-5 um wide, mostly straight and uniform. 2) Some broad hyphae observed, mostly in the subiculum, up to 7 um wide, usually with clamps. 3) Subhymnenial hyphae thin-walled and with clamps, 3.5-4 um wide. Cystidia lacking. Basidia terminal, more or less cylindrical or clavate, no clamps seen at the base, but as in I. contiguus the bearing hyphae with clamps, 20-30 x 5-6 um, with 4 sterigmata. Spores subglobose or rarely globose, smooth, thick-walled and strongly cyanophilous, 3.5-4 x 3-3.5 um or 3.5-3 um across, non-amyloid.

Remarks. The species is easily recognized by its odontioid appearance and in having small, thick-walled spores. It is questionable whether this species belongs to Intextomyces, and additional material is needed for further studies. However, we have incorporated the species in this genus because of its basidial similarities to I. contiguus.
We have not been able to exactly confirm the occurrence of clamps at all septa because most of the hyphae are conglutinated and difficult to separate. Besides, as in many old collections of fungi, the hyphae are shrunk and difficult to study.

KNEIFFIA BRASILIENSIS Berk., Fungi Brasiliensis, Vidensk. Meddel. Naturhist. Fören. Kjöbenhavn, p. 31, 1879. Fig. 6.

Material studied: Brazil, Bahia. 19(12) Torrend. ex herb. Bresadola, det. Bres., typica! (S).!

Fruitbody resupinate, effuse, adnate; hymenium somewhat ochraceous, destinctly odontioid, aculei usually more or less conical, seldom flattened, slightly fimbriate, margin similar, thinning out.
Hyphal system monomitic. Basal hyphae with walls thin to thickened, smooth, slightly gelatinized, about 2-3 um wide, subhymenial hyphae similar, usually thin-walled. All hyphae with clamps, easily observed. Cystidia numerous, terminal, strongly encrusted, (metuloids), conical, 30-40 x 8-10 um. Basidia terminal, clavate, generally 15 x 4-4.5 um, with four sterigmata. Spores subglobose, thin-walled, smooth, 4 x 2-2.5 um, non-amyloid.

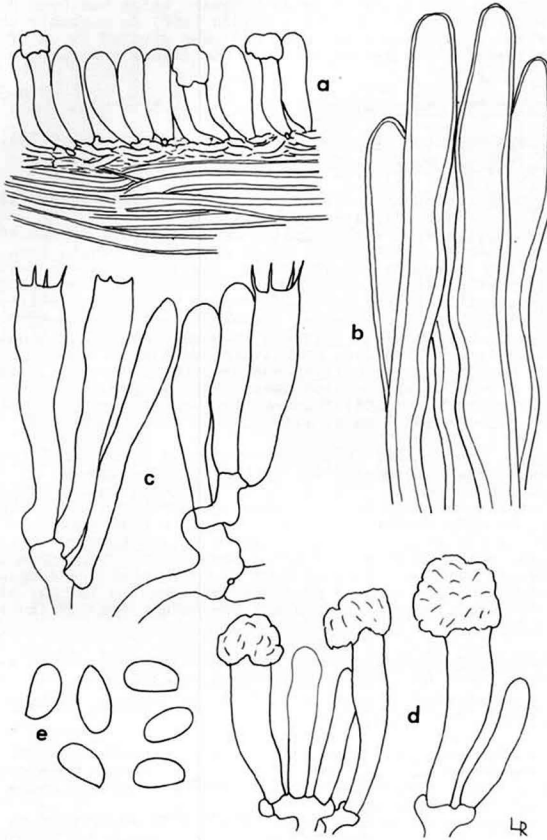


Fig. 7. Mycoaciella hinnulea a) section through the hymenium b) skeletal hyphae c) basidia d) cystidia e) spores. From the type.

Remarks. This species is quite similar to Phlebia queletii (Bourd. & Galz.) M. P. Christ. and the only distinguishing character seems to be the spores which are larger in P. queletii (about 5 x 3 um). We have not seen any authentic material and therefore we do not propose a new combination. If Bresadola's concept is correct, the species belongs in Phlebia sens. lat.

Fig. 7.

MYCOACIELLA HINNULEA (Bres.) Hjortst. & Ryv. nov. comb.

Basionym: Odontia hinnulea Bres., Ann. mycol. Vol. 18: 42, 1920.

Nomenclatural type: Brazil, S. Leopoldo. Rick 15. (S).!

Additional specimen: Brazil, S. Leopoldo, ad lignum frondosum. Rick 20 (S)

Fruitbody resupinate, effuse, adnate, ceraceous, hymenium distinctly odontioid to hydnoid with large, subulate aculei, about 1.5-2 mm long, light to reddish brown, subiculum rather thin but easily distinguished.
Hyphal system dimitic. Skeletal hyphae present in central part of the aculei, thick-walled, in some cases slightly encrusted with small granules, intertwined, without clamps, but with several adventitious septa, about (2.5)-3.5-5 um wide, non dextrinoid and non-amyloid. Generative hyphae thin-walled, generally smooth, with clamps, 2.5-3 um wide. Cystidia clavate and covered with a resinous, yellowish globule up to 20 um long. They are easily observed because its light-refractivity in phase-contrast microscope. Basidia terminal, more or less clavate, with four sterigmata, ca. 20 x 4-5 um. Spores thin-walled, smooth, ellipsoid, variable in size but generally 6-7 x 3.5 um, non amyloid.

Remarks. Easily recognized species by its dimitic hyphal system and cystidia. It is closely related to M. bispora (Stalpers) Erikss. & Ryv. but may be separated by larger spores, which measure 4-5.5 x 2.5-3 um in M. bispora. M. hinnulea clearly belongs in Mycoaciella and in several respects is distinguishable from e.g. Mycoacia by its dimitic hyphal system and from Steccherinum in lacking the large encrusted cystidia arising from skeletal hyphae.

PHLEBIA ROSEA (P. Henn.) Hjortst. & Ryv. nov. comb. Fig. 8.

Basionym: Grandinia rosea P. Henn. Vergl. Eng. Bot. Jahrb. Vol. 38: 108, 1907.

Nomenclatural type: Tanzania: Ost-Usambara, Eichelbaum, no 72C. Aug. 1903 (S!).

Additional specimens seen: Tanzania, Arusha prov. Arusha nat. park. Lake Kusare, 1500 m. 9 Feb. 1973. Ryvarden 9912 (O). Kenya. Eastern Prov. Aberdare Mountains, Kimakia Forest sta. 2200 m. 16 January 1973. Ryvarden 8951 (O).

Fruitbody resupinate, effuse, adnate, about 0.5 mm, distinctly grandinioid with small aculei, more or less ceraceous, rosy-pinkish, with age more or less membranaceous and somewhat dull, margin similar or slightly fibrillose. Hyphal system monomitic. Basal hyphae thin-walled, straight and uniform, 5 um wide, sometimes encrusted, subhymenial hyphae narrower and about 2.5-3 um wide, all hyphae without clamps. Cystidia lacking. Basidia narrowly clavate to tubular, 25-30 x 5 um, with four sterigmata. Spores ellipsoid or subglobose, smooth, 4-5 x 3 um, with distinct apiculus, non-amyloid.

Remarks. The rosy colour and the grandinioid, more or less ceraceous fruitbody together with non-clamped hyphae are the striking characters of this species. The fungus seems to be easily recognized in the genus Phlebia sens. lat.

Additional specimen studied: Africa, Kenya, Eastern prov., Aberdare Mounts. Kimakia Forest sta., alt. c. 2200-2400 m. 1973-01-16/18. Ryvarden 8951 (O).

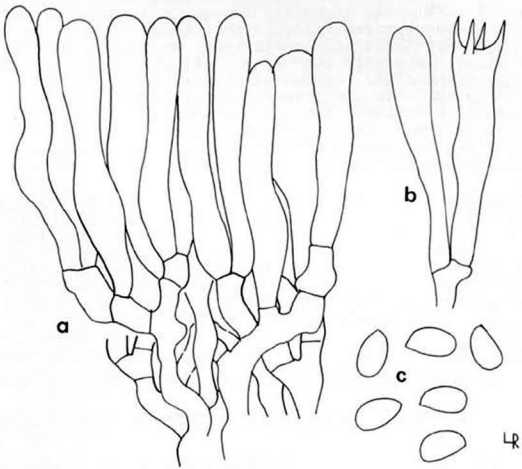


Fig. 8. Phlebia rosea a) section through the hymenium b) basidium c) spores. Coll. Ryvarden 8951(O).

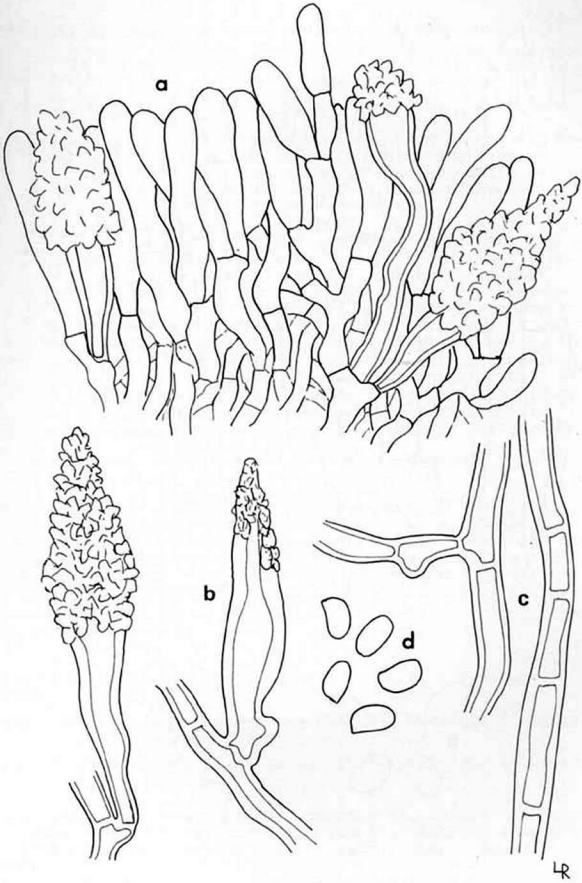


Fig. 9. Phlebiopsis galochroa a) section through the hymenium b) cystidia c) hyphae d) spores. From the type.

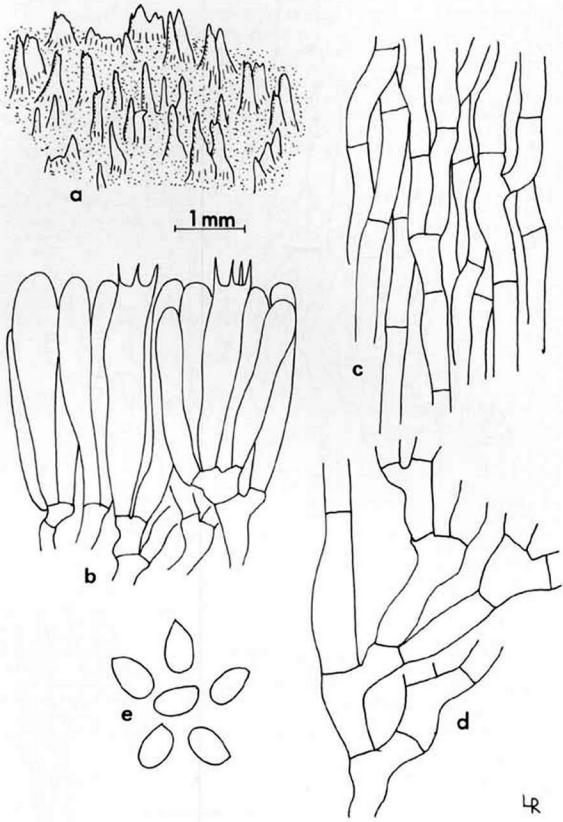


Fig. 10. Radulodon subquercinus a) part of fruitbody b) section through the fruitbody c) hyphae from the core of the teeth d) hyphae from the subiculum e) spores. From the type.

Fig. 9.

PHLEBIOPSIS GALOCHROA (Bres.) Hjortst. & Ryv. nov. comb.

Basionym: Peniophora galochroa Bres. Hedwigia 35: 290, 1896.

Nomenclatural type: Brazil, Blumenau. Möller s.n. (S).!

Fruitbody resupinate, effuse, adnate, hymenium smooth, under a lens (50 x) with indistinctly projecting cystidia, light ochraceous, subiculum creamish and and easily observed, tough, consisting of thick-walled, less branched hyphae, margin not especially differentiated.
Hyphal system monomitic or subdimitic (?). Hyphae of the subiculum thick-walled, in KOH and Melzer's reagent light-refracting, in Cotton blue with the walls easily distinguishable but not cyanophilous. The hyphae are in most cases smooth but slightly encrusted ones occur, about 3-3.5 um wide, not amyloid or dextrinoid. Subhymenial hyphae branched, less light-refracting, usually thin-walled or thickened, all hyphae without clamps. Cystidia more or less imbedded, only few projecting above the basidia, terminal, thick-walled and strongly encrusted (Metuloids), 50-60 x 7-10 um. Basidia terminal, clavate or subcylindrical, 15-20 x 3.5-4.5 um, with four sterigmata. Spores thin-walled, ellipsoid, usually 5-6 x 4 um, non-amyloid or dextrinoid.

Additional specimen: Brazil, S. Catharina, Blumenau. Möller s.n.

Recently Jülich (1978) described the genus Phlebiopsis with P. gigantea as type species. Peniophora galochroa lacks the dense resinous zone so prominent between the subiculum and the subhymenium in P. gigantea, besides the cystidia are smaller and the texture softer in general. However, as the hyphae, spores and basidia are very similar in the two species we felt it natural that they were placed in the same genus.

Fig. 10.

RADULODON SUBQUERCINUS (P. Henn.) Hjortst. & Ryv. nov. comb.

Basionym: Radulum subquercinum P. Henn. Monsunia I, Fungi II, p. 46 (in reprint) 1899.

Nomenclatural type: Java, Salek. 1897-09-11 leg. E. Nyman (S).!

Fruitbody resupinate, adnate, ochraceous, margin not determinable, hymenium odontioid to hydnoid, hard and somewhat brittle, aculei conical, smooth, rather large, about 0.5-1 mm long.
Hyphal system monomitic. Basal hyphae thin-walled, smooth, some arranged in a parallel manner, slightly conglutinated, some irregular, 3-5 um wide, without clamps but a few clamps have been observed on hyphae next to the substrate. Subhymenial hyphae similar in width, irregular, no clamps

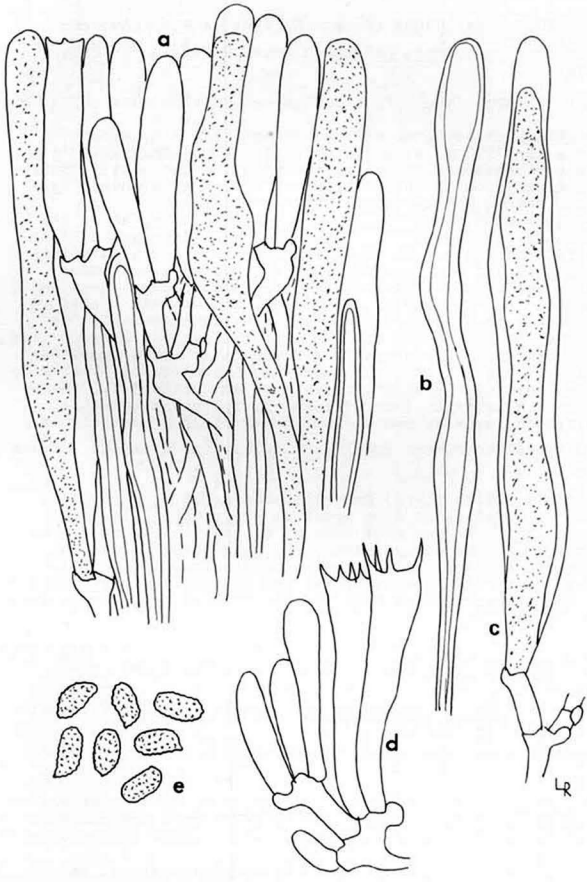


Fig. 11. Scytinostromella cerina a) section through the hymenium b) skeletal hyphae c) gloeocystidium d) basidia e) spores. From the type.

observed. Cystidia not seen. Basidia terminal, clavate, 20-30 x 4.5(6) um, with four sterigmata. Spores ellipsoid or subglobose, thin-walled, smooth, 4.5-5(-6) x 3-3.5(-4) um, non-amyloid.

Remarks. The species seems to be related to the other species in Radulodon by its hydnoid, hard and brittle fruitbody. R. subquercinus differs from other species in Radulodon in its spore morphology. Known species in the genus have spores which are nearly globose and also with somewhat thickened walls, while spores of R. subquercinus remind one of those of Phanerochaete. As for many other species of Corticiaceae we are of the opinion that additional materials are needed to confirm the relationship.

Fig. 11.

SCYTINOSTROMELLA CERINA (Bres.) Hjortst. & Ryv. nov. comb.

Basionym: Corticium cerinum Bres. Ann. mycol. 18: 47, 1920.

Nomenclatural type: Brazil, ad corticem arborum. Torrend 302. (S).!

Fruitbody resupinate, effuse, adnate, soft membranaceous, light yellowish to brownish, hymenium smooth, margin not especially differentiated or becoming slightly fibrillose. Hyphal system dimitic. Skeletal hyphae thick-walled, straight and uniform, not or rarely ramified, indistinctly pigmented, 2-2.5 um wide, without clamps, non-dextrinoid but the walls apparently with weak cyanophilous reaction, generative hyphae ramified, thin-walled, 2.5-3.5(-4) um wide, with clamps. Gloeocystidia present, mostly cylindrical or tubular, terminal, sometimes widened at the apex, in KOH with light-refracting contents, no aldehyde reaction, generally 90-120 x 10 um. Basidia terminal, somewhat extended clavate, normally with four sterigmata, in some cases two-sterigmated basidia observed, about 40-50(60) x 5 um. Spores thick-walled, ornamented (easily observed in Melzer's reagent), ellipsoid, 4.5-5 x 2.75-3 um, distinctly amyloid.

Remarks. Easily recognized species owing to its gloeocystidia and dimitic hyphal system. The location to the genus Scytinostromella seems to be well established. For further information of this genus see Freeman and Petersen (1979). Scytinostromella humifaciens (Burt.) Freem. & Pet. seems to come close to S. cerina but has subulate and shorter cystidia, besides smaller spores.

References

Berthet, P. & Boidin, J. 1966: Observations sur quelques Hymenomycetes ewcoltes en Republique Camerounaise. Cahiers Mabokè 4: 27-54.

Freeman, G. W. & Petersen, R. H. 1979: Studies in the genus Scytinostromella. Mycologia 71: 85-91.

Jülich, W. 1978: Studies in resupinate basidiomycetes V. Persoonia 10: 137-140.

MYCOTAXON

Vol. X, No. 2, pp. 288-292 January-March 1980

POCILLOPYCNIS, AN EMENDATION

FRANK DICOSMO

Department of Biology, University of Waterloo, Waterloo, Ontario, Canada, N2L-3G1

ABSTRACT

Pocillopycnis nomen anamorphosis, typified by *P. umensis*, is redescribed and illustrated from type material. Conidia are holoblastic on sympodially proliferating conidiogenous cells.

INTRODUCTION

Dyko & Sutton (1979) presented a well illustrated revision of *Linodochium* Höhnel (1909), *Pseudocenangium* Karsten (1886), *Septopatella* Petrak (1925), *Sirosyphella* Höhnel (1910), and introduced the anamorph genus, *Pocillopycnis* Dyko & Sutton. The brief protologue for *Pocillopycnis* stated: "Conidiomata pycnidial becoming cupulate, superficial, separate, composed of textura angularis. Ostiole absent. Conidiophores absent. Conidiogenous cells phialidic, hyaline, discrete, arising directly from the inner wall on the lower half of the conidiomata. Conidia enteroblastic, hyaline, lunate, euseptate." *Pocillopycnis umensis* (Bubák & Vleugel) Dyko & Sutton was compared to other similar but distinct anamorph taxa. *P. umensis* was excluded from *Pseudocenangium* because of differences in the morphology of the conidioma and conidiogenesis. The mode of "...conidium ontogeny excludes it from *Septopatella*,..." and the lack of "...conidiophores and of textura porrecta and textura oblita in the conidiomata exclude it from *Gelatinopycnis*" (Dyko & Sutton 1979). *Foveostroma drupacearum* (Lév.) DiCosmo, the type species of *Foveostroma* DiCosmo (1978) differs from *P. umensis* in morphology of conidioma and conidiophores.

Although *P. umensis* was excluded from a number of similar anamorph genera, the striking similarity between it and species of *Gelatinosporium* Peck char. emend. DiCosmo (DiCosmo 1978, Funk 1977, 1978), was not mentioned. This similarity prompted a reexamination of *P. umensis* which has brought to light several anomalies regarding *P. umensis* as delimited by Dyko & Sutton (1979). The mode of conidiogenesis was found not to be "enteroblastic" as originally described. Furthermore, the morphology of conidioma differs considerably from that apparent in the original description and illustrations. An emended description of *P. umensis* is presented.

TAXONOMIC PART

Pocillopycnis Dyko & Sutton char. emend. DiCosmo.

Conidiomata pycnidial, scattered to gregarious, discrete, initially immersed, ultimately becoming erumpent, subglobose to depressed globose, without a definite ostiole; wall composed of roughened pseudoparenchymatous cells forming a *textura globulosa* above, which differentiates to form *textura oblita* below. Conidiogenous cells proliferating sympodially, producing conidia on conspicuous pegs. Conidia holoblastic, straight or curved, lunate to irregularly sigmoid, septate, hyaline, smooth-walled.

Type species: *Pocillopycnis umensis* (Bubák & Vleugel) Dyko & Sutton.

Pocillopycnis umensis (Bubák & Vleugel) Dyko & Sutton char. emend. DiCosmo.

Conidiomata pycnidial, caulicolous, scattered to gregarious, initially immersed in outer cortical layers of the host (Fig. 1), ultimately erumpent, without a definite ostiole, dehiscent by irregular rupture of the apical tissue of *textura globulosa*, subglobose to depressed globose, glabrous, dark brown above, subhyaline below; up to 160 µ diam.; upper portion of the conidioma composed of dark brown to brown, minutely rouhgened pseudoparenchymatous cells forming a *textura globulosa* up to 25 µ thick, which differentiates to form a *textura oblita* (Fig. 8) up

to 10 μ thick at the base. Conidiophores (Figs. 2-5) arising from the innermost hyphae of the locule and extending half way up the wall, simple or branched, septate, 10-20 X 3-4 μ, often reduced to simple conidiogenous cells 5-10 X 2.5-3.5 μ invested in a copious mucilaginous matrix. Conidiogenous cells proliferating sympodially 1-4 times, producing conidia on conspicuous pegs which are usually terminal but occasionally lateral. Conidia holoblastic, straight or curved, lunate to irregularlly sigmoid, hyaline, smooth-walled, 72-90 X 3-4 ($\bar{x}$=80 X 3.5) μ mean length/width ratio=23:1.

Host: On twigs of *Picea excelsa*.

Specimen examined: Holotype in BPI, J. Vleugel, Holmon, Umea Province, Sweden, July 1907.

DISCUSSION

As originally delimited (Dyko & Sutton 1979), *P. umensis* could well have been placed in *Gelatinosporium*; but this study has established that conidia of *P. umensis* are produced holoblastically on sympodially proliferating conidiogenous cells. This excludes it from *Gelatinosporium* which exhibits phialidic conidiogenesis.

The mature conidiomata of *P. umensis* were originally described as being superficial and composed of *textura angularis*. This could not be confirmed. In vertical section the conidiomata are immersed in the cortical layers of the host and ultimately become erumpent. Only when the host covering layer and the upper pseudoparenchymatous half of the conidiomata are lost do the structures become cupulate and appear superficial.

Figs. 1-8. *Pocillopycnis umensis*. 1. conidioma (vertical section) arrows indicate outer cortical layer. X200. 2. conidiogenous cell. X2000. 3. conidiogenous cell, note the septum (arrow). X2000. 4-5. conidiogenous cells with proliferation in mucilaginous matrix. X2000. 6. conidium. X1000.

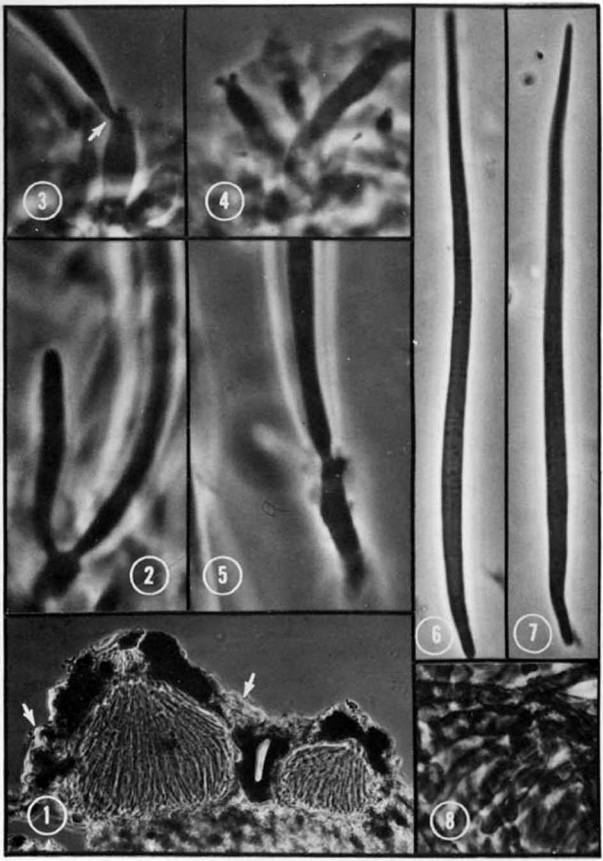


Fig. 7. conidium. X1000. 8. surface view of tissue type at base of conidioma. X2000.

ACKNOWLEDGEMENTS

I thank Dr. K.A. Pirozynski of the National Museums of Canada, Ottawa and Drs. W.B. Kendrick and T.R. NagRaj for reading a preliminary manuscript and making helpful criticisms. This research was supported in part by a grant made by the Natural Sciences and Engineering Research Council of Canada to Prof. W.B. Kendrick and by a Natural Sciences and Engineering Research Council of Canada Postgraduate Scholarship made to Frank DiCosmo.

LITERATURE CITED

DiCosmo, F. 1978. A revision of *Corniculariella*. Can. J. Bot. 56:1665-1690.

Dyko, B.J. and B.C. Sutton 1979. A revision of *Linodochium*, *Pseudocenangium*, *Septopatella*, and *Siroscyphella*. Can. J. Bot. 57:370-385.

Funk, A. 1977. The genus *Dermea* and related conidial states on Douglas fir. Can. J. Bot. 54:2852-2856.

Funk, A. 1978. New species of *Gelatinosporium* on western conifers. Can. J. Bot. 57:765-767.

Höhnel, F., von. 1909. Fragmente zur Mykologie. (VIII. Mitteilung, Nr. 354 bis 406.) Sitzungsber. Akad. Wiss. Wien Math. Naturwiss. Kl. Abt. 1, 118:1157-1246.

Höhnel, F., von. 1909. Fragmente zur Mykologie. (XI. Mitteilung, Nr. 527 bis 573.) Sitzungsber. Akad. Wiss. Wien Math. Naturwiss. Kl. Abt. 1, 127:617-679.

Karsten, P.A. 1886. Symbolae ad Mycologiam Fennicam. Part 17. Medd. Soc. Fauna Fl. Fenn. 13:159-165.

Petrak, F. 1925. Mykologische Notizen VIII. Ann. Mycol. 23:1-143.

MYCOTAXON

Vol. X. No. 2, pp. 293-295 January-March 1980

A NEW GENUS AND A NEW SPECIES OF CLATHRACEAE

LIU BO

Department of Biology, Shansi University, China

AND

BAU YUN-SUN

Department of Biology, Chinese University of Hong Kong

ABSTRACT
(AUSZUG)

Eine neue Gattung und eine neue Spezies sind in China gefunden worden. Wir schlage diesen Pilz als neu zu Mykologie zusammen mit Beischreibung in Latein vor. Abbildung und Photographie sind auch versorgt.

During the course of studies on a mycological field trip, a fungus specimen with certain interesting features was collected. A scrutiny of the available literature revealed it to be a new species of the Clathraceae and it is named and described here as Pseudoclathrus cylindrosporus.

Pseudoclathrus new genus

Pseudoclathrus Liu et Bau gen. nov.
Fructificatio stipitata; receptaculum e brachio recto isodiametro constatum; brachium exterior lato unilongitudinaliter sulcatum, apice connectum; sporae cylindracae.
Type species: Pseudoclathrus cylindrosporus

Sporocarps are stipitate. The receptacle is formed by erect ramifications (arms or laciniae) of equal diameter. Each ramification has a longitudinal sulcus (furrow) on its abaxial side. Ramifications are united at their apices. Spores are cylindrical.
Type species: Pseudoclathrus cylindrosporus Liu et Bau

The new genus is a taxon between Clathrus and Lysurus. It is especially close to Clathrus columnatus Bosc. and Lysurus mokusin (L. ex Pers.) Fr. In common with Clathrus are the vertical branches united at apex and never separated, but

Clathrus has neither a longitudinal sulcus on its abaxial side nor any kind of stipe. A longitudinal sulcus on abaxial side of ramification and a stipe are found in both Lysurus and the new genus, but the stipe of this new genus is amphi-complanate.

Pseudoclathrus cylindrosporus new species

Pseudoclathrus cylindrosporus Liu et Bau sp. nov.
Fructificatio 6cm. alto; receptaculum e sex brachio recto isodiametro constatum, 2.5cm. longum; brachium exterior lato unilongitudinaliter sulcatum, apice connectum, aurantiacum; gleba foetida brunnescenti-olivacea; stipes occultus, spongiosus albidus, compressus, hexagonus, 3.5cm. longus, 1-1.2cm. crassus; volva vaginiformis, alba, 3cm. alta; sporae cylindricae, dilute olivaceae, 2.8-4 x 1.2-1.5μm.
Hab. ad terram. Peking Municipality: Western Hill. 30 September 1948. Liu Bo (3471, Typus).

Sporocarps are 6cm. high. The receptacle consists of 6 erect arms (laciniae) in equal diameter and 2.5cm. high. A longitudinal furrow appears on outside part of each arm. Upper terminals of arms are united and never separated, and the arms are orange yellow in color. The gleba is on two sides of the arms, olive brown in color and foetid. The stipe is hidden in the volva. It is 3.5cm. long, 1-1.2cm. thick, spongy in texture, white colored, flat on both sides and with 6 longitudinal ridges (corresponding to the arms). The volva is scabbard-like, white, and 3cm. high. Spores are cylindrical, pale olive color, and 2.8-4 x 1.2-1.5μm. in size.

Fig. 1. Pseudoclathrus cylindrosporus Liu et Bau, showing sporocarp (about 3/4 natural size)

The type specimen was collected on the ground by Liu Bo on 30 September 1948 in Western Hill of Peking. It was then numbered 3471 and deposited in Biology Herbarium of the Shansi University in Taiyuan City of the Shansi Province, China.

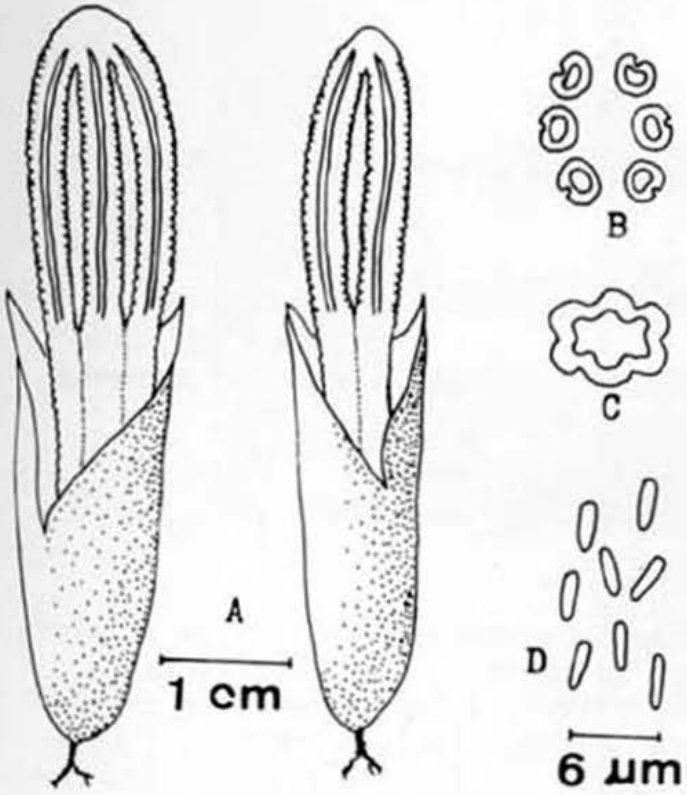


Fig. 2. Pseudoclathrus cylindrosporus Liu et Bau; A. sporocarp, front side view (left) and lateral side view (right); B. cross section of arms, showing furrows; C. cross section of stipe, showing ridges; and D. spores

Bibliography

Bessey, E.A. 1965. Morphology and taxonomy of fungi. New York : Hafner Publishing Co.

Clements, F.E. and C.L. Shear. 1964. The genera of fungi. New York : Hafner Publishing Co.

Dring, D.M. 1973. Gasteromycetes. In Ainsworth, G.C., F.K. Sparrow and A.S. Sussman (eds.). Fungi : An advanced treatise. Vol. 4B, pp. 451-478. New York : Academic Press.

Dring, D.M., J. Meeker and R. Goos. 1971. Clathrus oahuensis, a new species from Hawaii. Mycologia 63(4): 893-897.

Kawamura, S. 1954. Icones of Japanese fungi. Vol. 6. Tokyo : Kazamashobo.

Kluzak, Z. 1974. Lysurus gardneri Berk : a new species for Czechoslovakia. Česká Mykol. 28(3): 181-184.

Kozelnicky, G.M. and W.N. Garrett. 1966. The unusual occurrence of a stinkhorn fungus (Clathrus ruber) on golf turf. Plant Dis. Reporter 50(11): 840.

Semmens, E.J. 1967. Notes on the development and structure of the "Basket Fungus", Clathrus gracilis (Berk.) Schlechtendal. Muelleria 1(3): 219-221.

MYCOTAXON

Vol. X, No. 2, pp. 296-298 January-March 1980

A NEW SPECIES OF AMANITA

DAVID T. JENKINS

Department of Biology, University of Alabama in Birmingham
Birmingham, AL 35294

ABSTRACT

Amanita pallidoflavescens (fig.1) is described and illustrated from Alabama. It is placed into the stirps *Cinereoconia* and compared with the other taxa therein.

Amanita pallidoflavescens Jenkins, sp. nov.
Holotype: Homewood Park, Birmingham, Alabama, 23. vii. 76, Wayne Harbin 1216(DTJ)*

Pileus quanto 35 mm latus, planus convexusque convertens in plano superficie diend in leviter depresso ad centrum, margo non striatus, albus ad argenteum albumque colorem, glaber; volva incomposite propensus, floccosa pulverulentaque, fusca canaque, facile removitus. Lamellae annexae ad ipsum liberantem statum, densae, fragiles, gilvae cum puniceocolore. Stipes quanto 40 x 8 mm; solidi, albi ad gilvum colorem, glaberosi ad fundum, bulbus ad basim sub radici, volva fusca canaque pulvis in humiliore stipte et bulbo ad basim; partialis tegumen superior, fugax alba. Caro pilei, stipitis atque bulbi ad basim sufflavus cum contusus. Sporae 8.6-10.2 x 4.7-5.5 µm, nonamyloideae.

PILEUS: up to 35 mm broad, plano-convex to plane to slightly depressed at center, margin non-striate, slightly appendiculate, pileipellis easily separable, white to silvery-white, glabrous, flesh white, up to 3 mm at center, tapering to margin; volval remnants as a thick, irregularly disposed, floccose-pulverulent layer, brownish-gray, thinning to absent on margin, easily removed. LAMELLAE: adnexed to just free, close, fragile, cream with pale pinkish tint, edges finely pulverulent; lamellulae numerous, attenuate. STIPE: up to 40 x 8 mm, tapering slightly downward, solid, white to cream, glabrous to near basal bulb, bulb subradicate, up to 20 x 12 mm; volval remnants as brownish-gray pulverulence on lower stipe and basal bulb, irregularly distributed; partial veil superior, fugacious, white. No distinct smell or taste. Flesh of pileus, stipe, and basal bulb turning yellowish upon bruising.

PILEIPELLIS: filamentous hyphae densely interwoven, very slightly gelatinized, hyaline to slightly yellowish in alkaline solution. PILEUS TRAMA: filamentous hyphae undifferentiated, moderately branched, no clamps, up to 8 µm diam; inflated cells abundant, terminal or short, terminal chains, fusiform, clavate, to elliptic, up to 93 x 31 µm.

---

* DTJ = The author's herbarium

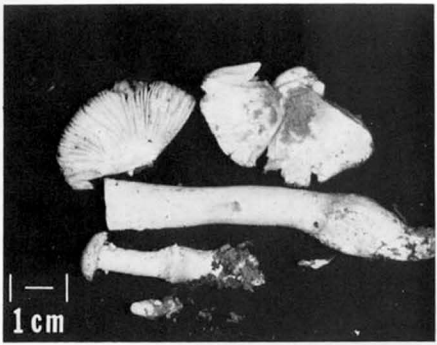


Fig. 1. *Amanita pallidoflavescens* Jenkins DTJ 1216

LAMELLA TRAMA: bilateral, filamentous hyphae undifferentiated, moderately branched, no clamps, up to 8 µm diam; inflated cells elongate, terminal. SUBHYMENIUM: hyphae ramose to slightly inflated ramose, clampless. BASIDIA: up to 43 x 3-8.5 µm, mostly 1- and 2-sterigmate, with some 4-sterigmate, thin walled, clampless. VOLVA: filamentous hyphae on pileus very sparse, clampless, sparsely branched, up to 9 µm diam; inflated cells very abundant, mostly broadly elliptic, pyriform, to elliptic, up to 70 x 54 µm, with few oblong elliptic to clavate, up to 30 x 12 µm, terminal or short, terminal chains, irregularly disposed, many pedicellate: tissue at base of stipe with more filamentous hyphae, similar to that on pileus; inflated cells mostly globose to subglobose, up to 65 x 65 µm, also broadly elliptic to clavate, not as many pedicellate, terminal or short, terminal chains, irregularly disposed. STIPE TRAMA: filamentous hyphae undifferentiated and conspicuous, sparsely branched, up to 9 µm diam, clampless; inflated cells terminal, clavate to oblong elliptic, longitudinally oriented, up to 218 x 25 µm. PARTIAL VEIL: filamentous hyphae dominant, moderately branched, up to 8 µmdiam, clampless; inflated cells abundant, very similar to those of volva.

SPORES: 4.7-5.5 x 8.6-10.2 µm ($\underline{E}$ = 1.56-2.17; $\underline{E}^{m}$ = 1.76), elliptical to cylindrical, often adaxially flattened, hyaline, amyloid, thin walled; contents guttulate; apiculus sublateral, short cylindrical.

Habitat and distribution: terrestrial, mixed coniferous and deciduous forest, stream bank, Birmingham, Alabama.

Collections examined: Homewood Park, Birmingham, Alabama, 23. vii. 76, Wayne Harbin 1216(DTJ); Homewood Park, Birmingham, Alabama, 10. vi. 79, David T. Jenkins 1496(DTJ).

DISCUSSION

Amanita sect. *Lepidella*, subsect. *Solitariae*, stirps *Cinereoconia* is characterized by small to medium fruit bodies, a grayish or brownish, pulverulent volva, elliptical to cylindrical spores, and clampless basidia (Bas, 1969). By all of these characters, A. *pallidoflavescens* fits comfortably in the stirps. It also shares certain specific characters of other members of this stirps, *viz.*, a yellowish staining reaction of the flesh, similar to that in A. *cinereoconia* var. *crocee-scens* and A. *lutescens*; a spore size similar to A. *cinereoconia* var. *cinereoconia*, A. *lutescens*, and A. *odorata*; and an irregular orientation of volval elements similar to A. *lutescens*, A. *griseofarinosa*, and A. *vestita*. The uniqueness of this organism results from a combination of the above characters with a white to silvery-white pileus, cream colored gills with a faint pinkish tint, and basidia that are mostly 1- and 2-sterigmate.

LITERATURE CITED

Bas, C. 1969. Morphology and Subdivision of *Amanita* and a Monograph on its Section *Lepidella*. Persoonia 5(4): 462.

MYCOTAXON

Vol. X, No. 2, pp. 299-349 January-March 1980

NOTES ON COLORADO FUNGI IV: *MYXOMYCETES*

D. H. MITCHEL and S. W. CHAPMAN
Denver Botanic Gardens
909 York Street, Denver, Colorado 80206
and
M. L. FARR
Mycology Laboratory, Plant Protection Institute
Agricultural Research, Science and Education Administration
United States Department of Agriculture
Beltsville, Maryland 20705

INTRODUCTION

Since Sturgis published his article "The *Myxomycetes* of Colorado II" in 1913 (32), no attempt has been made to record the myxomycete flora of the State. In his first paper in 1907, Sturgis (31) listed 94 species and described 2 new varieties. In his second paper he added 33 other species for a total of 127 prior to 1913. However, some of these records are in doubt. In his first paper Sturgis reported 7 species which he had not found but were listed with a reference to a manuscript of Macbride's which recorded them as occurring in Colorado. Apparently this manuscript was never published and, since five of the seven were never listed by Macbride as occurring in Colorado in either his 1899 or 1922 editions of *The North American Slime-Moulds* (26, 27), there is serious doubt that they had actually been found in Colorado prior to 1907. Two have not yet been specifically reported from Colorado. A few taxa, reported by Sturgis as varieties, are now given species rank, but many he listed as species have now been placed in synonymy so that of the 127 he reported only 116 are now considered valid. During the past sixty-five years, 54 more have been recorded from Colorado by various authors bringing the total to 170. Of necessity most publications record the distribution of many common species as "cosmopolitan" or "world-wide" or "throughout North America" without enumerating specific states in which these species have been recorded. This makes verification of records for any given state difficult to impossible without searching all the herbaria for collections from that state.

In an attempt to update the Colorado flora we have compiled a chart (Figure 1) which shows the 170 species previously specifically reported from Colorado, the 2 unverified ones reported by Sturgis, 4 found as Colorado collections in the U.S.D.A. Herbarium at Beltsville, Md. (BPI), and 49 which have been collected and, for the greater part, identified by the first two authors over the past ten years. Some of the latter are new records for Colorado and some are merely verified Colorado collections of species generally described as occurring in this region but not specifically reported from the State. This brings the total to 225 species reported from Colorado to date. The number of collections of each species now in the Denver Botanic Gardens

Herbarium of Fungi (DBG) is stated. The small number of specimens of *Licea* and other slime molds too minute to be readily visible with a 10x lens, is probably due to our relying almost entirely on field work, only recently supplemented by moist chamber cultures.

The differences between Sturgis' list and ours, we feel, are due not only to the different collecting techniques but also to the changes that have occurred in the ecology of Colorado in the past 65 years. Though Sturgis and his ardent collector, Professor Ellsworth Bethel, found many species on the plains between 1,500 and 2,150 m (±5,000 and 7,000 feet) elevation in Denver, Aurora and Colorado Springs, we have not found slime molds (except for a few moist chamber fruitings) in these areas which are now part of the front range urban sprawl of highly developed industrial and residential suburbs. Presumably the slime molds have disappeared with the destruction of their habitat or what few are left are on inaccessible private property. Conversely, Sturgis and Bethel rarely collected above 2,750 m (9,000 ft), presumably because of limited access to the forest above the railroad terminals. They also evidently collected only in the summer months, but during this time apparently did so daily without interruption in a given area. Most of our collecting has been done in the montane and subalpine life zones of the mountains of central Colorado between 2,150 m (7,000 ft) and timberline, ±3,500 m (11,500 ft), and, though we collected only sporadically on weekends and holidays, we continued from March through November. Most of the species we have found that Sturgis did not record were gathered in the early spring or at high altitudes near the edge of melting snowbanks. Sturgis p. 449 (32) stated that he could not account for the rarity of "species of *Lamproderma* in the mountainous districts of Colorado". The reason now is obvious; most of the Colorado *Lamproderma* species fruit only in the early spring near melting snow, when he was not collecting.

The area in which most of our collections have been made is generally within the range of the aspen tree, *Populus tremuloides* Michx. whose decayed wood and bark form a common substrate for species of myxomycetes. Decayed spruce and fir logs and litter, as well as dead grass and shrubs, at the edge of melting snowbanks are also likely sites for fruitings. As noted by previous authors (11,20,22,30), many alpine collections are more robust and have spores 1-2 µm larger in diameter than lowland collections of the same species.

In this region there are generally two fruiting seasons: 1) at the edge of melting snowbanks in the spring and early summer; and 2) during rainy periods in the late summer and early fall. Thus the date of fruiting is not meaningful unless the location is also considered since the "snowbank flora" may start maturing in the foothills in early March and still be fruiting in late July at timberline, and the summer flora may start in June and last until November depending on the season. We have therefore, when possible, listed the species as "snowbank (SB)", "summer (S)", "both (B)", or "moist chamber (MC)" in the chart.

FIGURE 1

Name	Seasonal Occurrence	Number of DBG Collections	Previous Colorado Citation	Remarks
CERATIOMYXALES				
CERATIOMYXACEAE				
Ceratiomyxa fruticulosa (Müll.) Macbr.	B	10	(31)	
LICEALES				
CRIBRARIACEAE				
Cribraria argillacea (Pers.) Pers.	S	12	(31)	
C. atrofusca Martin & Lovejoy	S	1	(29)	type locality
C. aurantiaca Schrad.		0	(31)	
C. elegans Berk. & Curt.		0	(31) BPI	verifying record
C. intricata Schrad.		0	(31)	unverified
C. macrocarpa Schrad.	S	0	(31)	
C. microcarpa (Schrad.) Pers.	MC	2	(12)	
C. minutissima Schw.		0	(31)	
C. oregana H. C. Gilbert	B	9		new Colorado record
C. piriformis Schrad.	S	0	(32)	
C. purpurea Schrad.	S	2	(27)	
C. rufa (Roth) Rost.	S	4		verifying record
C. violacea Rex	S	0	(31)	
C. vulgaris Schrad.		0	BPI	verifying record
Dictydium cancellatum (Batsch) Macbr.		1	(31)	
D. mirabile (Rost.) Meylan	S	17	(31)	
Lindbladia tubulina Fries	S	9	(31)	
LICEACEAE				
Licea belmontiana Nann.-Brem.	MC	18		new hemisphere record
L. castanea G. Lister	MC	2		new Colorado record
L. fimicola Dearness & Bisby	MC	0	(30)	

SB=snowbank; S=summer; B=both; MC-moist chamber

Name	Seasonal Occurrence	Number of DBG Collections	Previous Colorado Citation	Remarks
LICEALES (CONT.)				
LICEACEAE (CONT.)				
Licea kleistobolus Martin	MC	4	(12)	
L. minima Fries		2	(28)	
L. parasitica (Zukal) Martin	MC	4		verifying record
L. tenera Jahn	MC	0	(2)	
L. variabilis Schrad.		0	(32)	
RETICULARIACEAE				
Dictydiaethalium plumbeum (Schum.) Rost.		0	(31)	
Enteridium lycoperdon (Bull.) Farr	S	8	(31)	
E. olivaceum Ehrenb.	S	1	(31)	
E. splendens (Morgan) Macbr.		1	(31)	
E. splendens var. jurana (Meyl.) Härk.	S	5		new Colorado record
Lycogala epidendrum (L.) Fries	B	24	(26)	
L. flavofuscum (Ehrenb.) Rost.		0	(31)	
Tubifera ferruginosa (Batsch) J.F. Gmel.	S	9	(31)	
ECHINOSTELIALES				
ECHINOSTELIACEAE				
Echinostelium elachiston Alexop.	MC	0	(30)	
TRICHIALES				
DIANEMACEAE				
Calomyxa metallica (Berk.) Nieuwl.	MC	4	(12)	
Dianema corticatum A. Lister	B	6	(23)	
D. depressum (A. Lister) A. Lister	MC-B	8	(12)	
D. harveyi Rex	MC-S	1	(23)	
D. subretisporum Kowalski	SB	2		new Colorado record

TRICHIACEAE				
Arcyodes incarnata (Alb. & Schw.) O.F. Cook	B	10	(12)	
Arcyria cinerea (Bull.) Pers.	MC-B	38	(31)	
A. denudata (L.) Wettst.		0	(26)	
A. ferruginea Sauter	S	0	(32)	
A. globosa Schw.	S	5		new Colorado record on
A. incarnata (Pers.) Pers.	B	44	(31)	new substrate
A. insignis Kalchbr. & Cooke	MC	1		verifying record
A. nutans (Bull.) Grev.	S	18	(31)	
A. oerstedtii Rost.	S	6	(13)	
A. olivaceoglobosa Farr, Chapman & Mitchel	S	1	(11a)	type collection
A. pomiformis (Leers) Rost.	S	5	(31)	
A. stipata (Schw.) A. Lister	B	5	(31)	
A. versicolor Phill.	B	47	(31)	
Hemitrichia abietina (Wigand) G. Lister		0	(31)	
H. calyculata (Speg.) Farr	S	1		verifying record
H. clavata (Pers.) Rost.	B	38	(26)	
H. karstenii (Rost.) A. Lister	B	1	(32)	
H. montana (Morgan) Macbr.	B	22	(30)	
H. serpula (Scop.) Rost.	S	0	(32)	
Metatrichia vesparium (Batsch) Nann.-Brem.	B	16	(32)	
Oligonema fulvum Morgan	S	1	(30)	
O. schweinitzii (Berk.) Martin	S	1		new Colorado record
Perichaena chrysosperma (Currey) A. Lister	MC	3		verifying record
P. corticalis (Batsch) Rost.	B	40	(31)	
P. depressa Libert	MC	26	(31)	
P. vermicularis (Schw.) Rost.	MC-S	6	(32)	
Prototrichia metallica (Berk.) Massee	B	71	(26)	
Trichia alpina (R. E. Fries) Meylan	B	10		new Colorado record
T. botrytis (J. F. Gmel.) Pers.	B	3	(31)	
T. contorta (Ditmar) Rost.	B	40	(31)	
T. decipiens (Pers.) Macbr.	MC-B	55	(31)	
T. favoginea (Batsch) Pers.	S	38	(31)	

SB=snowbank; S-summer; B-both; MC-moist chamber

Name	Seasonal Occurrence	Number of DBG Collections	Previous Colorado Citation	Remarks
TRICHIALES (CONT.)				
TRICHIACEAE (CONT.)				
Trichia floriformis (Schw.) G. Lister	S	2		verifying record
T. lutescens (A. Lister) A. Lister	S	3	(28)	
T. scabra Rost.	B	8		verifying record
T. subfusca Rex	SB	10		verifying record
T. varia (Pers.) Pers.	B	89	(31)	
PHYSARALES				
DIDYMIACEAE				
Diachea leucopodia (Bull.) Rost.		0	(31)	
D. subsessilis Peck		0	(32)	
Diderma asteroides(A.& G. Lister) G. Lister	B	7	(32)	
D. brooksii Kowalski	SB	3		new Colorado record
D. chondrioderma (de Bary & Rost.) G. Lister		0	(30)	
D. cor-rubrum Macbr.		0	(30)	
D. crustaceum Peck	SB	1	(31)	verifying record
D. effusum (Schw.) Morgan	S	0	(32)	
D. floriforme (Bull.) Pers.	S	2		verifying record
D. globosum Pers.		2	(31)	
D. hemisphaericum (Bull.) Hornem.	S	0	(31)	
D. lyallii (Massee) Macbr.	SB	92	(30)	
D. montanum (Meylan) Meylan	B	55	(28)	
D. niveum (Rost.) Macbr.	B	81	(31)	
D. radiatum (L.) Morgan	B	6	(31)	
D. roanense (Rex) Macbr.	S	2	(23)	
D. sauteri (Rost.) Macbr.		0	(31)	unverified
D. spumarioides (Fries) Fries	S	4	(31)	
D. testaceum (Schrad.) Pers.	S	0	(31)	
D. trevelyani (Grev.) Fries	B	10	(31)	

Didymium anellus Morgan	MC-S	3	(31)	
D. clavus (Alb. & Schw.) Rab.	S	2	(32)	
D. crustaceum Fries	S	3	(32)	
D. decipiens Meylan	SB	1		new hemisphere record
D. difforme (Pers.) S. F. Gray	S	0	(31)	
D. dubium Rost.	SB	26	(28)	
D. fulvum Sturgis	MC-S	3	(33)	type locality
D. megalosporum Berk. & Curt.		0	(31)	
D. melanospermum (Pers.) Macbr.	B	15	(31)	
D. minus (A. Lister) Morgan	S	1		verifying record
D. nigripes (Link) Fries	S	1	(31)	
D. nivicolum Meylan	SB	23		new Colorado record
D. quitense (Pat.) Torrend	SB	8	(32)	
D. squamulosum (Alb. & Schw.) Fries	MC-S	18	(31)	
D. sturgisii Hagelst.	MC-S	2	(32)	type locality
Lepidoderma carestianum (Rab.) Rost.	SB	18		new Colorado record
L. chailletii Rost.	SB	12		new Colorado record
L. granuliferum (Phill.) R. E. Fries	SB	1		new Colorado record
L. tigrinum (Schrad.) Rost.	S	3	(32)	
Mucilago crustacea Wiggers	MC-S	1	(31)	
PHYSARACEAE				
Badhamia affinis Rost.	MC-S	5	(31)	
B. capsulifera (Bull.) Berk.	MC-S	1	(28)	
B. dearnessii Hagelst.	S	5		new Colorado record
B. foliicola A. Lister	MC-S	13		verifying record
B. gracilis (Macbr.) Macbr.	MC	24	(32)	type locality
B. macrocarpa (Ces.) Rost.	MC-B	6	(32)	
B. nitens Berk.	S	0	(31)	
B. ovispora Racib.	S	0	(12)	
B. panicea (Fries) Rost.	MC-S	7	(31)	
B. populina A. & G. Lister	MC-S	2	(31)	
B. utricularis (Bull.) Berk.	B	30	(31)	

SB=snowbank; S=summer; B=both; MC-moist chamber

Name	Seasonal Occurrence	Number of DBG Collections	Previous Colorado Citation	Remarks
PHYSARALES (CONT.)				
PHYSARACEAE (CONT.)				
Badhamia versicolor A. Lister	MC-S	1	(31)	
Badhamiopsis ainoae (Yama.) Brooks & Keller	MC	9		new Colorado record
Cienkowskia reticulata (Alb. & Schw.) Rost.	S	3	(31)	
Craterium aureum (Schum.) Rost.	S	1	(23)	
C. leucocephalum (Pers.) Ditmar	MC-S	23	(31)	
C. minutum (Leers) Fries	S	7	(31)	
C. obovatum Peck		1	BPI	verifying record
Fuligo cinerea (Schw.) Morgan	MC	1	(31)	
F. intermedia Macbr.	B	5	(27)	type locality
F. megaspora Sturgis	S	0	(32)	type locality
F. septica (L.) Wiggers	B	20	(31)	
Leocarpus fragilis (Dicks.) Rost.	B	30	(31)	
Physarum albescens Ellis, ex Macbr.	SB	173	(26)	type locality
P. alpinum (A. & G. Lister) G. Lister	SB	8		new Colorado record
P. ?auriscalpium Cooke	MC	23	(31)	
P. bethelii Macbr., ex Lister	S	22	(32)	type locality
P. bitectum G. Lister	B	26	(27)	
P. bivalve Pers.	S	4	(31)	
P. bogoriense Racib.	S	4	(31)	
P. brunneolum (Phill.) Massee	S	1	(32)	
P. carneum G. Lister & Sturgis	S	1	(24)	type locality
P. cinereum (Batsch) Pers.	S	8	(31)	
P. citrinum Schum.		0	(27)	
P. compressum Alb. & Schw.	MC	3	(31)	
P. conglomeratum (Fries) Rost.	S	1		new Colorado record
P. contextum (Pers.) Pers.	S	6	(31)	
P. decipiens Curtis	S	7	(32)	
P. diderma Rost.	S	1	(31)	
P. didermoides (Pers.) Rost.	S	0	(31)	

P. famintzinii Rost.	S	1		new Colorado record
P. flavicomum Berk.	S	0	(31)	
P. globuliferum (Bull.) Pers.		0	BPI	verifying record
P. gyrosum Rost.	MC	19		new Colorado record
P. lateritium (Berk. & Rav.) Morgan		0	(31)	
P. leucophaeum Fries	S	5	(32)	
P. leucopus Link	S	10	(32)	
P. listeri Macbr.	S	0	(32)	
P. luteolum Peck	SB	1	(12)	
P. megalosporum Macbr.	MC	1	(33)	type locality
P. mortonii Macbr.		0	(23)	
P. newtonii Macbr.		0	(25)	type locality
P. notabile Macbr.	S	57	(12)	
P. nudum Macbr.	MC-S	5		new Colorado record
P. nutans Pers.	S	53	(31)	
P. oblatum Macbr.	S	2	(32)	
P. polycephalum Schw.	MC	1		verifying record
P. pulcherrimum Berk. & Rav.		0	(30)	
P. pusillum (Berk. & Curt.) G. Lister	MC-S	19	(32)	
P. rubiginosum Fries	S	5	(27)	
P. stellatum (Massee) Martin	S	5	(31)	verifying record
P. sulphureum Alb. & Schw.		0	(23)	
P. superbum Hagelst.	SB	1		verifying record
P. vernum Somm.	B	24	(31)	
P. virescens Ditmar	S	0	(32)	
P. viride (Bull.) Pers.	S	18	(31)	
Protophysarum phloiogenum Blackwell & Alexop.	MC	15	(4)	type locality
STEMONITALES				
STEMONITACEAE				
Amaurochaete atra (Alb. & Schw.) Rost.		0	(27)	
A. ferruginea Macbr. & Martin		0	(30)	
Comatricha aequalis Peck		0	(31)	

SB=snowbank; S=summer; B=both; MC=moist chamber

Name	Seasonal Occurrence	Number of DBG Collections	Previous Colorado Citation	Remarks
STEMONITALES (CONT.)				
STEMONITACEAE (CONT.)				
Comatricha alpina Kowalski	SB	4		new Colorado record
C. elegans (Racib.) G. Lister	MC-S	12	(32)	
C. fimbriata G. Lister & Cran	MC-S	2		new Colorado record
C. irregularis Rex	S	1	(31)	
C. laxa Rost.	MC-B	21	(31)	
C. nigra (Pers.) Schroet.	B	65	(31)	
C. pulchella (C. Bab.) Rost.	S	1	(31)	
C. rubens A. Lister	S	1	(23)	
C. suksdorfii Ellis & Ev.	SB	35	(31)	
C. typhoides (Bull.) Rost.	S	21	(31)	
C. sp.(? nodulifera Wollm. & Alexop.)	SB	50		new Colorado record
Enerthenema berkeleyanum Rost.	S	0	(32)	
E. melanospermum Macbr. & Martin	SB	36		new Colorado record
E. papillatum (Pers.) Rost.	S	32	(31)	
Lamproderma arcyrioides (Sommerf.) Rost.	SB	17	(31)	
L. atrosporum Meylan	SB	52		verifying record
L. carestiae (Ces.& de Not.) Meylan	SB	32	(12)	
L. columbinum (Pers.) Rost.	S	5		verifying record
L. cribrarioides (Fries) R. E. Fries	SB	10	(28)	
L. cristatum Meylan	SB	1		new hemisphere record
L. echinosporum Meylan	SB	37		new Colorado record
L. fuscatum Meylan	SB	3		new Colorado record
L. gulielmae Meylan		0	(23)	
L. maculatum Kowalski	SB	1		new Colorado record
L. sauteri Rost.	SB	60	(31)	
L. scintillans (Berk. & Br.) Morgan	S	2	(32)	
Leptoderma iridescens G. Lister	S	2	(12)	
Stemonitis axifera (Bull.) Macbr.	S	11	(31)	
S. confluens Cooke & Ellis	S	1	(31)	

S. flavogenita Jahn	S	16		verifying record
S. fusca Roth	S	46	(31)	
S. herbatica Peck	S	6	(31)	
S. hyperopta Meylan		0	(12)	
S. nigrescens Rex		0	BPI	verifying record
S. smithii Macbr.	S	3	(31)	
S. splendens Rost.		0	(31)	
S. uvifera Macbr.	S	1		new Colorado record
S. virginiensis Rex	S	4	(12)	

SB=snowbank; S=summer; B=both; MC=moist chamber

ANNOTATED LIST OF SPECIES

The species of myxomycetes are listed in alphabetical order within the genera which, in turn, are arranged alphabetically within the families and they, under the orders: Ceratiomyxales, Liceales, Trichiales, Echinosteliales, Physarales and Stemonitales. The genus *Diachea* is placed in the Physarales rather than in the Stemonitales, as suggested by recent studies (1,10,11). We have followed Kowalski's (17,18) example in recording spore size to include ornamentation. In the interest of brevity, collection data are provided only on species not previously reported from Colorado. The localities are cited by counties. Unless more counties are represented, no more than five citations are given regardless of the total number of collections in the DBG herbarium. Only when our collections vary significantly from the type descriptions or the descriptions in Martin and Alexopoulos' *The Myxomycetes* (30) are observations made. Collection numbers are all (DBG) unless otherwise noted. Numbered color designations are from ISCC-NBS Centroid Color Charts (3).

ORDER CERATIOMYXALES

Ceratiomyxa fruticulosa (Müll.) Macbr., No. Am. Slime-Moulds 18. 1899.
Reported from Colorado by Sturgis in 1907, p. 11 (31)as *C. mucida* (Pers.) Schroet. from Boulder, El Paso, Gilpin, Jefferson, Ouray and San Juan counties.
Collected also in Clear Creek, Custer, Eagle, Garfield and Larimer counties and seen but not collected in many other areas over the State on decayed wood from early spring to late fall.

ORDER LICEALES

FAMILY CRIBRARIACEAE

Cribraria argillacea (Pers.) Pers., Neues Mag. Bot. 1:91. 1794.
Reported from Colorado by Sturgis in 1907, p. 35 (31)from Boulder, El Paso, and Gilpin counties.
Collected also in Clear Creek, Custer, Eagle, Larimer and Mineral counties on decayed wood that is often covered with moss and lichens, in spruce/fir forests in summer.

Cribraria atrofusca Martin & Lovejoy, Jour. Wash. Acad. 22:92. 1932.
Type locality: Colorado.
Reported from Colorado in the original description from a collection on coniferous wood, in 1909 (29). The county was not cited.
Collected in Eagle and Larimer counties on decayed wood of Englemann spruce in summer.

Cribraria aurantiaca Schrad., Nov. Gen. Pl. 5. 1797.
Reported from Colorado by Sturgis in 1907, p. 35 (31) from El Paso and Douglas counties.
Collected also in Custer County by Sturgis in July, 1912, two specimens in BPI.

Cribraria elegans Berk. & Curt., in Berk., Grevillea 2:67. 1837.
Reported from Colorado by Sturgis in 1907, p. 35 (31) quoting

Macbride's manuscript. A specimen from Tolland (Boulder County) determined by T. H. Macbride, dated 1906, is in BPI, as is a collection from Estes Park (Larimer County).

Cribraria intricata Schrad., Nov. Gen. Pl. 7. 1797.
Reported from Colorado by Sturgis in 1907, p. 36 (31) quoting Macbride's manuscript but not found by Sturgis or by us and there are no Colorado collections in BPI, COLO or RM.

Cribraria macrocarpa Schrad., Nov. Gen. Pl. 8. 1797.
Reported from Colorado by Sturgis in 1907, p. 35 (31) from a collection made in August, 1905 in Douglas County. A collection made by Bethel in August, 1905 in El Paso County is in BPI.

Cribraria microcarpa (Schrad.) Pers., Syn. Fung. 190. 1801. emend Nann.-Brem., K. Ned. Akad. Wet. Proc. C. 69:340. 1966.
Reported from Colorado by Hagelstein in 1944, p. 198 (12).
Appeared in moist chamber on decayed wood collected in Clear Creek County.

Cribraria minutissima Schw., Trans. Am. Phil. Soc. II 4:260. 1832.
Reported from Colorado by Sturgis in 1907, p. 35 (31)from Boulder and El Paso counties.

Cribraria oregana H.C. Gilbert, in Peck and Gilbert, Am. Jour. Bot. 19:142. 1932.
New Colorado record.
Clear Creek Co.: On underside of decayed Englemann spruce, Chicago Creek (11 km southwest of Idaho Springs on Colo. 103) 2,500 m, August 3, 1974, *4697*; on decayed wood, Squaw Pass (9.5 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,800 m, September 27, 1975, *6350*; August 7, 1976, *6991*.
Eagle Co.: On decayed spruce, West Lake Creek (9.5 km south of I-70) 2,800 m, July 27, 1973, *3939*; on decayed Englemann spruce near melting snow, West Lake Creek (11 km south of I-70) 3,000 m, June 29, 1975, *5808*.

Cribraria piriformis Schrad., Nov. Gen. Pl. 4. 1797.
Reported from Colorado by Sturgis in 1913, p. 450 (32) as *C. "pyriformis"* Schrad. from collections made in Custer County in July and August, 1912.

Cribraria purpurea Schrad., Nov. Gen. Pl. 8. 1797.
Reported from Colorado by Macbride in 1922, p. 228 (27).
Collected in Clear Creek, Custer, Eagle, Mesa and Summit counties on decayed conifer wood in late summer and fall.

Cribraria rufa (Roth) Rost., Mon. 232. 1875.
Described by Martin and Alexopoulos, p. 89 (30) as being widely distributed throughout the United States, but not specifically reported from Colorado.
Clear Creek Co.: On decayed conifer wood, Squaw Pass (9.5 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,800 m, August 28, 1977, *8232*.
Eagle Co.: On decayed conifer wood, West Lake Creek (9.5 km south of I-70) 2,800 m, October 11, 1975, *6426*.

Gilpin Co.: On decayed conifer wood, Pickle Gulch (9 km north of Black Hawk on Colo. 119) 2,800 m, September 10, 1975, *6091*.

Larimer Co.: A specimen from Estes Park is in BPI.

Summit Co.: On decayed conifer wood, Spring Creek (22 km southwest of Kremmling on Colo. 9) 2,600 m, July 28, 1973, *3831*.

Cribraria violacea Rex, Proc. Acad. Phila. 43:393. 1891.

Reported by Sturgis in 1907, p. 36 (31) from collections on the inner bark of cottonwood logs, El Paso County, September 1906.

Cribraria vulgaris Schrad., Nov. Gen. Pl. 5. 1797.

Described by Martin and Alexopoulos, p. 91 (30) as occurring in the United States but not specifically reported from Colorado.

A collection of Bethel's dated 1909 is in BPI.

Dictydium cancellatum (Batsch) Macbr., N. Am. Slime-Moulds 172. 1899.

Reported from Colorado by Sturgis in 1907, p. 36 (31) from collections in Denver, Douglas, El Paso, Gilpin, Grand, Jefferson and San Juan counties.

Observations: Sturgis (31) noted that the specimens from El Paso County showed an irregular net over the apex of the sporangium which he recognized as an "abnormal form called by Rostafinski *Heterodictyon*,...closely resembling *Cribraria*". This taxon was given variety status by Lister in 1911 (23) as *D. cancellatum* var. *alpinum* and is now accepted as a distinct species *D. mirabile* (Rost.) Meylan. All DBG material and all the Colorado specimens we have examined in BPI fit the description of *D. mirabile*, however a Boulder County collection (COLO *M-821*) is typical *D. cancellatum*.

Dictydium mirabile (Rost.) Meylan, Bull. Soc. Vaud. Sci. Nat. 57:305. 1931.

Reported from Colorado by Sturgis in 1907, p. 36 (31) as "abnormal form" of *D. cancellatum* from collections in El Paso County (see above).

Collected also in Clear Creek, Eagle, Gilpin, and Summit counties on decayed conifer wood in summer.

Observations: Though not so described or illustrated in Martin and Alexopoulos, all our material shows the ribs to be connected by delicate transverse bands (as in *D. cancellatum*) in the lower half of the sporangium after the fugacious calyculus disappears. The *Cribraria*-like net over the upper part does not have these bands. The plasmodium is jet black.

Lindbladia tubulina Fries, Summa Veg. Scand. 449. 1849.

Reported from Colorado by Sturgis in 1907, p. 35 (31) as *L. effusa* (Ehr.) Rost. from collections in El Paso and Jefferson counties.

Collected also in Clear Creek, Eagle, Gilpin, Gunnison, Larimer and Mineral counties on moss and lichen-covered decayed conifer logs, mostly spruce, in summer.

FAMILY LICEACEAE

Licea belmontiana Nann.-Brem., K. Ned. Akad. Wet. Proc. C. 69:337.1966.

New hemisphere record.

Arapahoe Co.: On bark of living elm and dead cottonwood in moist chamber, High Line Canal and South University Boulevard, 1,620 m,

1978, *8558* (determination confirmed by E. Nannenga-Bremekamp).

Boulder Co.: On bark of cottonwood in moist chamber, 1.6 km east of Niwot, 1,680 m, 1979, *9324*.

El Paso Co.: On bark of scrub oak in moist chamber, Helen Hunt's grave, 2,850 m, 1978, *8858*.

Jefferson Co.: On bark of living cottonwood, elm and juniper in moist chamber, Mount Olivet cemetery 1,640 m, 1978, *8390*.

San Miguel Co.: On bark of cottonwood in moist chamber, Ilium, 2,100 m, 1978, *9301*.

Licea castanea G. Lister, Jour. Bot. 49:61. 1911.

New Colorado record.

Denver Co.: On bark of living juniper in moist chamber, Robinson Park (1st and Forest streets) 1,600 m, 1978, *8528*.

San Miguel Co.: On bark of living narrow leaf cottonwood in moist chamber, Ilium, 2,100 m, 1978, *9255*.

Licea fimicola Dearness & Bisby, in Bisby, Buller and Dearness, Fungi Manit. 52. 1929.

Reported from Colorado by Martin and Alexopoulos in 1969, p. 44 (30) from moist chamber fruitings on cow and rabbit dung, and by Angel and Wicklow in 1975 (2) from moist chamber fruitings on pronghorned antelope dung collected in the Pawnee Grasslands in Weld County.

Licea kleistobolus Martin, Mycologia 34:702. 1942.

Reported from Colorado by Hagelstein in 1944, p. 210 (12) as *Orcadella pusilla* (Lipp.) Hagelst.

Collected in Boulder, Denver and Saguache counties on bark of cottonwood, scrub oak and juniper in moist chamber.

Licea minima Fries, Syst. Myc. 3:199. 1829.

Reported from Colorado by Macbride and Martin in 1934, p. 225 (28) from a collection on an old polypore.

Collected in Clear Creek and Eagle counties on decayed wood in spring.

Licea parasitica (Zukal) Martin, Mycologia 34:702. 1942.

Described by Martin and Alexopoulos, p. 46 (30) as being widely distributed, but not specifically reported from Colorado.

Boulder Co.: On bark of American elm in moist chamber, 7 km north of Lafayette on U.S. 287, 1,600 m, 1979, *9397*.

San Miguel Co.: On narrow leaf cottonwood bark, in moist chamber, Ilium, 2,100 m, 1978, *9255*; Saw Pit, 2,200 m, 1978, *9221*, *9222*.

Licea tenera Jahn, Ber. Deuts. Bot. Ges. 36:665. 1919.

Reported from Colorado by Angel and Wicklow in 1975 (2) from moist chamber fruitings on dung of cow, rabbit and pronghorned antelope, collected in the Pawnee Grasslands in Weld County.

Licea variabilis Schrad., Nov. Gen. Pl. 18. 1797.

Reported from Colorado by Sturgis in 1913, p. 450 (32) as *L. flexuosa* Pers. from a scanty collection on decayed conifer wood on Cheyenne Mountain in El Paso County.

Collected also in Boulder County, exsiccati in COLO.

FAMILY RETICULARIACEAE

Dictydiaethalium plumbeum (Schum.) Rost., in Lister, Mycet. 157. 1894.
Reported from Colorado by Sturgis in 1907, p. 36 (31) from specimens collected by Bethel in Boulder and El Paso counties.

Enteridium lycoperdon (Bull.) Farr, Taxon 25:514. 1976.
Reported from Colorado by Sturgis in 1907, p. 37 (31) as *Reticularia Lycoperdon* Bull. He stated that it appeared to be common throughout the state, occurring frequently on rotting portions of living trees.
Collected in Archuleta, Boulder, Clear Creek, Douglas, Eagle, El Paso, Gilpin and Summit counties on decayed spruce in summer.

Enteridium olivaceum Ehrenb., Fahrb. Gewächsk. 1(2):57. 1819.
Reported from Colorado by Sturgis in 1907, p. 37 (31) from a single collection made by Bethel in El Paso County in June, 1901. Three other collections of Bethel's dated 1902, county unknown, are in BPI.

Enteridium splendens (Morgan) Macbr., N. Am. Slime-Moulds 151. 1899.
Reported from Colorado by Sturgis in 1907, p. 37 (31) as *"Enteridium Rozeanum* Wing." from collections made in Boulder and Custer counties.

Enteridium splendens (Morgan) Macbr. var. jurana (Meyl.) Härk., Karstenia 19:5. 1979. (Note. This taxon antedates the same combination by Farr, Nova Hedwigia 31(1/2). 1979).
New Colorado record.
Clear Creek Co.: On decayed conifer wood, Squaw Pass (9 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,800 m, August 7, 1976, *7067;* Chicago Creek (11 km southwest of Idaho Springs on Colo. 103) 2,400 m, August 8, 1976, *6874, 6875;* August 19, 1976, *7153.*
Summit Co.: On decayed spruce wood, Spring Creek (26 km southwest of Kremmling on Colo. 9) 2,800 m, October 4, 1975, *6374.*

Lycogala epidendrum (L.) Fries, Syst. Myc. 3:80. 1829.
Reported from Colorado by Macbride in 1899, p. 175 (26).
Collected in Boulder, Clear Creek, Eagle, Gilpin, Grand, Gunnison, Huerfano, Ouray, Park, Pitkin and Summit counties on decayed conifer logs associated with moss and lichen from spring to fall.

Lycogala flavofuscum (Ehrenb.) Rost., in Fuckel, Jahrb. Nass.Ver. Nat. 27-28: 68. 1873.
Reported from Colorado by Sturgis in 1907, p. 42 (31) from Boulder and Denver counties.

Tubifera ferruginosa (Batsch) J. F. Gmel., Syst. Nat. 2:1472. 1791.
Reported from Colorado by Sturgis in 1907, p. 36 (31) as *Tubulina Cylindrica* (Bull.) Rost. from collections made in Douglas, El Paso and Gilpin counties.
Collected also in Boulder, Clear Creek, Eagle and Summit counties on decayed spruce wood, covered with moss and lichen, in summer.

ORDER ECHINOSTELIALES

Echinostelium elachiston Alexop., Mycologia 50:52. 1958.
Reported from Colorado by Martin & Alexopoulos in 1969, p. 98 (30).
A collection numbered UTMC-*1346* from Boulder County, Colorado, collected by Wilson Stewart from moist chamber fruiting on the bark of *Ulmus*, cultured and determined by C.J. Alexopoulos, is in BPI.

ORDER TRICHIALES

FAMILY DIANEMACEAE

Calomyxa metallica (Berk.) Nieuwl., Am. Midl. Nat. 4:335. 1916.
Reported from Colorado by Hagelstein in 1944, p. 266 (12) as *Margarita metallica* (Berk.) A. Lister.
Collected in Boulder, Douglas and Jefferson counties on bark of living cottonwood and juniper in moist chamber.

Dianema corticatum A. Lister, Mycet. 205. 1894.
Reported from Colorado by Lister in 1925, p. 256 (23).
Collected in Eagle County on dead conifer wood from spring to fall.

Dianema depressum (A. Lister) A. Lister, Mycet. 204. 1894.
Reported from Colorado by Hagelstein in 1944, p. 269 (12), with the comment that there were only three reported collections from North America. The Colorado material was not seen by him.
Collected in Clear Creek, Eagle and Gilpin counties on decayed conifer wood from spring to fall, and in Denver County on bark of living cottonwood in moist chamber.

Dianema harveyi Rex, Proc. Acad. Phila. 43:397. 1891.
Reported from Colorado by Lister in 1925, p. 253 (23) from a collection made by Sturgis in August; previously collected in Britain as a winter species.
Collected in Jefferson County on bark of living juniper in moist chamber.

Dianema subretisporum Kowalski, Mycologia 59: 1080. 1967.
New Colorado record.
Eagle Co.: On decaying grass stems, twigs and thistle near melting snow, West Lake Creek (9.5 km south of I-70) 2,800 m, May 19, 1978, *8657*, *8660* (determination by D. T. Kowalski).

FAMILY TRICHIACEAE

Arcyodes incarnata (Alb. & Schw.) O. F. Cook, Science 15:651. 1902.
Reported from Colorado by Hagelstein in 1944, p. 259 (12) as *Lachnobolus congestus* (Somm.) Lister.
Collected in Clear Creek, Eagle, Gilpin, Jefferson and Summit counties on decayed wood from spring to fall.

Arcyria cinerea (Bull.) Pers., Syn. Fung. 184. 1801.
Reported from Colorado by Sturgis in 1907, p. 40 (31) from Boulder and El Paso counties.

Collected also in Clear Creek, Eagle, Gilpin, Huerfano and Summit counties on decaying wood and forest debris from spring to fall, and in moist chamber.

Observations: Eighty percent of our collections are the pale gray, cylindric to ovoid form. Twenty percent are ochraceous. Without any relation to color or shape of sporangia, most of our collections have larger spores than the 6-7 µm range described for this species. The most common spore size is 7.5-9 µm, but in over half of our collections there are spores up to 9.5 µm in diameter. In addition to the variations in the capillitium and its ornamentation described by Martin and Alexopoulos (30), some of our collections (*4684*, *6058*, *6993* and *7752*) have large balloon-like swellings of the capillitial threads to twice their usual diameter, as reported by Farr (8).

Arcyria denudata (L.) Wettst., Verh. Zool.-Bot. Ges. Wien 35: Abh. 535. 1886.

Reported from Colorado by Macbride in 1899, p. 196 (26) and by Sturgis in 1907, p. 40 (31) as *A. punicea* Pers. from scanty material from El Paso and San Juan counties.

Collected also in Boulder and Huerfano counties, exsiccati in COLO.

Arcyria ferruginea Sauter, Flora 24:316. 1841.

Reported from Colorado by Sturgis in 1913, p. 451 (32) from one small collection made on charred wood in El Paso County, August, 1912.

Collected also in Boulder County, exsiccati in COLO.

Arcyria globosa Schw., Schr. Nat. Ges. Leipzig 1:64. 1822.

New Colorado record.

Clear Creek Co.: On decayed blue spruce, Squaw Pass (20 km west on Colo. 103 from Bergen Park junction with U.S. 73) 3,100 m, August 3, 1974, *4696*.

Eagle Co.: On decayed spruce, West Lake Creek (14.5 km south of I-70) 2,900 m, July 21, 1973, *3927*; (9.5 km south of I-70) 2,800 m, July 29, 1973, *3944*.

Pitkin Co.: On decayed spruce, Independence Pass (16 km southwest of Aspen on U.S. 82) 3,200 m, July 28, 1976, *6942*.

Summit Co.: On decayed wood, Spring Creek (26 km southwest of Kremmling on Colo. 9) 2,800 m, July 29, 1973, *3841-A*.

Observations: To our knowledge, this is the first listing of this species from Colorado and the first time it has been found on spruce, further attesting to the capability of this species to adapt to new substrates, following the disappearance of the American chestnut.

Arcyria incarnata (Pers.) Pers., Obs. Myc. 1:58. 1796.

Reported from Colorado by Sturgis in 1907, p. 40 (31) from Boulder, El Paso and Gilpin counties.

Collected also in Clear Creek, Eagle, Grand, Park and Summit counties from early spring to late fall on forest litter and decayed wood, both conifer and angiosperm.

Observations: There are two distinct color variants in our material. The most common is deep reddish-orange #36 before opening and the spore-covered capillitium when expanded is strong reddish-brown #40. The other, occurring only half as frequently, has a dark pink

#6 peridium, and the expanded capillitium and spores are dark yellow-pink #30.

Arcyria insignis Kalchbr. & Cooke, in Kalchbr., Grevillea 10:143.

Described by Martin and Alexopoulos, p. 130 (30) as being cosmopolitan, but not specifically reported from Colorado.

Boulder Co.: On dead wood, 7.3 km south of Nederland, 2,600 m, in moist chamber, 1958, COLO *M-146*.

Jefferson Co.: On bark of living cottonwood, W. Colfax and Cole Rd., 1,600 m, in moist chamber, 1978, *9293*.

Arcyria nutans (Bull.) Grev., Fl. Edin. 455. 1824.

Reported from Colorado by Sturgis in 1907, p. 41 (31) from Boulder, Douglas, El Paso, Gilpin, Ouray and San Juan counties on pine logs.

Collected also in Clear Creek, Custer, Eagle and Huerfano counties, usually on decaying spruce wood in summer.

Observations: Sturgis called this the most common and most striking species of *Arcyria* in Colorado. We find it to be much less common than *A. incarnata* and certainly less common and striking than *A. versicolor*. Our specimens are more robust than fruitings from the eastern United States, have a more open capillitial net, and have larger spores that reach 9-10 µm in diameter rather than the 7-8 µm usually described. The stalks are filled with spore-like cells that reach 15-20 µm in diameter. The hypothallus, confluent between sporangia, is variably rough and veined or smooth, glistening, and translucent in some shade of cream, tan or brown.

Arcyria oerstedtii Rost., Mon. 278. 1875.

Reported from Colorado by Kauffman in 1921 (13) from collections made on conifer logs, Gilpin County, 1920.

Collected also in Eagle and Summit counties on decayed wood, moss and forest litter in summer and fall.

Arcyria olivaceoglobosa Farr, Chapman & Mitchel, in Farr (in press, Nova Hedwigia).

Type collection.

Clear Creek Co.: On decayed wood, Chicago Creek (11 km southwest of Idaho Springs on Colo. 103) 2,500 m, August 3, 1974, *5431*.

Arcyria pomiformis (Leers) Rost., Mon. 271. 1875.

Reported from Colorado by Sturgis in 1907, p. 40 (31) from Boulder, Denver, Douglas, El Paso and Ouray counties.

Collected also in Clear Creek, Eagle and Larimer counties in summer and early fall.

Arcyria stipata (Schw.) A. Lister, Mycet. 189. 1894.

Reported from Colorado by Sturgis in 1907, p. 41 (31) from a single collection made by Bethel in 1902.

Collected in Eagle and Gilpin counties on dead wood in spring and fall.

Arcyria versicolor Phill., Grevillea 5:115. 1877.

Reported from Colorado by Sturgis in 1907, p. 41 (31) as *A. vitellina* Phill. from collections made in Gilpin, Grand and San Juan counties.

Collected also in Archuleta, Boulder, Clear Creek, Eagle, Gunnison, Mineral and Summit counties on dead conifer wood from early spring to late fall.

Observations: This montane species is the most abundant *Arcyria* in the Colorado Rockies. Fruitings often exceed 20 cm in diameter and may completely cover the lower surface of decayed spruce logs or completely encircle a rotten spruce stump. The color may vary in one collection from dull red through many shades of greenish-yellow, yellow, gold and orange. Other collections are uniformly brilliant canary yellow. Color is the only variable character. The plasmodium, not described in most texts, is white at first, changes to salmon-egg red to coral pink and finally yellow before fruiting.

Hemitrichia abietina (Wigand) G. Lister, Mycet. ed. 2. 227. 1911.

Reported from Colorado by Sturgis in 1907, p. 39 (31) as *H. ovata* (Pers.) Macbr. from collections made in Douglas, El Paso, Gilpin, and Ouray counties.

Collected also in Boulder, Custer and Larimer counties, exsiccati in BPI and COLO.

Hemitrichia calyculata (Speg.) Farr, Mycologia 66:887. 1974.

Described by Martin and Alexopoulos, p. 148 (30) (as *H. stipitata)* as being worldwide in distribution, but not specifically reported from Colorado.

Boulder Co.: Bethel, September, 1906, exsiccati in BPI.

Eagle Co.: On moss-covered decayed conifer wood, West Lake Creek (9 km south of I-70) 2,800 m, August 31, 1974, *5321*.

Hemitrichia clavata (Pers.) Rost., in Fuckel, Jahrb. Nass. Ver. Nat. 27-28:75.1873.

Reported from Colorado by Macbride in 1899, p. 207 (26).

Collected in Clear Creek, Eagle and Summit counties on moss, litter and decayed conifer and angiosperm wood from early spring to late fall.

Observations: This is the most common *Hemitrichia* in Colorado and shows a great deal of variation in the capillitium: elasticity, slight to marked; width, 4.5-8 µm; ornamentation, 4 to 8 minutely pilose to smooth spirals; color, yellow (concolorous with spores) to ochraceous and reddish-brown. The spore size, as in many montane collections of other species, is somewhat larger than in the text description (7-9 µm), reaching 11 µm in some fruitings.

Hemitrichia karstenii (Rost.) A. Lister, Mycet. 178. 1894.

Reported from Colorado by Sturgis in 1913, p. 451 (32) from collections made in Custer and Gilpin counties in August 1911 and 1912 on the bark of *Populus*.

Collected also in Eagle County on decayed aspen bark in the spring.

Hemitrichia montana (Morgan) Macbr., N. Am. Slime-Moulds 208. 1899.

Reported from Colorado by Martin and Alexopoulos in 1969, p. 152 (30).

Collected in Boulder, Clear Creek, Eagle, Grand and Summit counties from spring to fall on dead wood.

Hemitrichia serpula (Scop.) Rost., in Lister, Mycet. 179. 1894.
Reported from Colorado by Sturgis in 1913, p. 451 (32) from collections made in Custer County in August 1911.

Metatrichia vesparium (Batsch) Nann.-Brem., K. Ned. Akad. Wet. Proc. C. 69:346. 1966.
Reported from Colorado by Sturgis in 1913, p. 450 (32) as *Hemitrichia vesparium* (Batsch) Macbr. from a single collection made in Custer County in September, 1912.
Collected also in Eagle County in spring and fall on moss-covered decayed aspen wood.
Observations: All our 16 collections have been taken from one and the same aspen log over a period of 2 years. The fruitings are typical in every respect except that they have spines on the capillitium up to 7 µm long, which is over 3 times the length of that described for the species or that found on material we have examined from North Carolina. This is almost twice the length described for the spines of *M. horrida* Ing.

Oligonema fulvum Morgan, Jour. Cinc. Soc. Nat. Hist. 16:36. 1893.
Reported from Colorado by Martin and Alexopoulos in 1969, p. 119 (30) who, however, questioned the determination of the single Colorado specimen they had examined.
Boulder Co.: On decayed wood, 4 km southwest of Boulder, 1,900 m, May 23, 1958, COLO *M-149*.
Summit Co.: On decayed spruce bark, grass, leaves, and herbaceous stems, Spring Creek (26 km southwest of Kremmling on Colo. 9) 2,800 m, May 26, 1973, *3665*.

Oligonema schweinitzii (Berk.) Martin, Mycologia 39:460, 1947.
New Colorado record.
Gilpin Co.: On decayed aspen wood, Pickle Gulch (9 km north of Black Hawk on Colo. 119) 2,800 m, August 5, 1978, *9023*.

Perichaena chrysosperma (Currey) A. Lister, Mycet. 196. 1894.
Described by Martin and Alexopoulos, p. 110 (30) as being cosmopolitan, but not specifically reported from Colorado.
Arapahoe Co.: On bark of dead cottonwood stump, High Line Canal and So. University Blvd., 1,620 m, in moist chamber, 1978, *8513*.
Douglas Co.: On bark of living cottonwood, Larkspur junction on I-25, 1,650 m, in moist chamber, 1978, *8534*.
Jefferson Co.: On bark of living juniper, Mt. Olivet Cemetery, 1,640 m, in moist chamber, 1978, *8544*.

Perichaena corticalis (Batsch) Rost., Man. 293. 1875.
Reported from Colorado by Sturgis in 1907, p. 42 (31) from collections made in Denver and El Paso counties on cottonwood and willows.
Collected also in Boulder, Chaffee, Clear Creek, Douglas, Eagle, Gilpin, Park, San Juan and Summit counties from early spring to late fall on the inner bark of decaying aspen.
Observations: This is one of the most common slime molds in the mountainous areas of Colorado. Large fruitings can be found on aspen logs protruding from snowbanks as early as March and whenever moisture conditions permit, throughout the summer and fall. It is so common that we collect only unusual fruitings, and we have

frequently observed the species fruiting in counties other than those cited. We have found it only on aspen wood, and only on the strands of inner bark.

Perichaena depressa Libert, Pl. Crypt. 378. 1837.

Reported from Colorado by Sturgis in 1907, p. 41 (31) as occurring commonly on the bark of cottonwood and willows in Boulder, Denver and El Paso counties.

Collected also in Arapahoe, Delta, Jefferson, Ouray and Park counties from moist chamber fruitings on bark of alder, juniper and cottonwood, oak leaves, grape stems and yucca.

Observations: The areas in which Sturgis collected this species are now part of the Boulder-Denver-Colorado Springs urban sprawl and most of the remaining trees are inaccessible for collecting. Since we had not found *P. depressa* in over 10 years of collecting, we assumed it had disappeared. However, when we started collecting bark from native trees still remaining in parks and cemeteries and kept it in moist chambers, *P. depressa* fruited profusely.

Perichaena vermicularis (Schw.) Rost., Mon. App. 34. 1876.

Reported from Colorado by Sturgis in 1913, p. 451 (32) from collections made in El Paso County near Colorado Springs.

Collected also in Denver County by Bethel in 1897 (exsiccati in BPI) and in Archuleta, Clear Creek and San Miguel counties from bark of cottonwood in moist chamber.

Prototrichia metallica (Berk.) Massee, Jour. Roy. Micr. Soc. 1899:350. 1889.

Reported from Colorado by Macbride in 1899, p. 200 (26) as *P. flagellifera* (Berk. & Br.) Rost. from collections made in Gilpin and Grand counties.

Collected also in Boulder, Clear Creek, Eagle, Larimer, Mineral, Ouray and Summit counties on dead conifer and aspen wood from early spring through late fall.

Observations: The description of this species given by Martin and Alexopoulos, p. 145 (30) takes in the gamut of variations we have seen in this common montane slime mold. Our material is easily separated into three forms as follows:

The most abundant form occurs in large fruitings in the early spring near melting snowbanks. The sporangia are robust (to 2.5 mm), coppery rose-brown with pink and gold iridescence. The capillitium is dark red-brown, much darker than the spores. Microscopically the capillitium consists of uniform bundles of spirally-wound rope-like threads (hollow, as demonstrated by Kowalski [16]) which fray at the penicillate ends into smaller and smaller strands tapering to fine tips attached to the peridium. Only rarely are amorphous strands seen.

Fruiting at the same time, on the same substrates, but never intermingled with the coppery forms, are slightly smaller (to 1.7 mm) sporangia that are tobacco brown with peridial highlights of blue and gold. Grossly, the capillitium is a drab umber brown that is much lighter than the spore mass. Microscopically, the capillitium varies from simple smooth threads, often with funnel tips, to amorphous sheets, and rarely to penicillate, spiral ropes with single to multiple pointed tips.

In late summer and fall, small fruitings of small (to 1.3 mm) red-orange sporangia with gold, rose and blue iridescence occur. In

these fruitings, as in the coppery form, the capillitium is dark red-brown, darker than the spore mass, and composed entirely of the uniform rope-like, spirally-wound threads with penicillate ends and slender tapering tips, without any amorphous strands.

Variations in color and capillitial characteristics may prove to be nothing more than developmental features produced by dry weather and/or cold temperatures as suggested by Lister in 1925, p. 257 (23). We have been unable to demonstrate constant differences that would justify varietal names other than mere color designations. The sporangia are sessile on a constricted base with only an occasional sporangium being short-stalked. They are seated on a confluent hypothallus that is completely colorless in most collections, but occasionally varies to amber tints in the copper-colored fruitings. The spores fall within the range of measurements described in most texts (10-15 µm), are spinulose, and in a few collections of the brown form have an olivaceous tinge to the usual pale yellow color.

Trichia alpina (R. E. Fries) Meylan, Bull. Soc. Vaud. Sci. Nat. 53:460. 1921.

New Colorado record.

Clear Creek Co.: On decayed wood, Squaw Pass (6.5 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,600 m, June 12, 1974, *4294*; July 24, 1974, *4665*.

Eagle Co.: On herbaceous stems near melting snow, West Lake Creek (9 km south of I-70) 2,800 m, May 15, 1976, *6570*.

Gilpin Co.: On herbaceous stems, Perigo (13 km north of Black Hawk on Colo. 119) 2,900 m, August 7, 1976, *6846*.

Summit Co.: On decayed wood near melting snow, Mayhan Lake Road (16 km southwest of Heeney) 3,100 m, July 13, 1975, *5762*.

Observations: Our material varies somewhat from the descriptions of Martin and Alexopoulos, p. 55 (30) in that the hypothallus is an extensive, confluent, translucent, yellow-brown #66 sheet, rather than "very delicate", and the spore size varies from 12-14 µm in one collection (*5762*) to 17-19 µm in another (*8004*). Spores of the other collections fit the 14-18 µm range described.

Trichia botrytis (J. F. Gmel.) Pers., Neues Mag. Bot. 1:89. 1794.

Reported from Colorado by Sturgis in 1907, p. 39 (31) from a single collection made in El Paso County in 1906.

Collected also in Boulder, Clear Creek, Custer, Eagle, Gilpin, Gunnison and Routt counties on decorticate wood in spring and summer.

Observations: Our collections agree with the text descriptions except that the spore size in three otherwise identical collections was 10-11 µm, 12-14 µm and 13-16 µm, respectively (instead of 9-11 µm). The last two of these size ranges even exceed that given by Kowalski (21) for *T. flavicoma*.

Trichia contorta (Ditmar) Rost., Mon. 259. 1875.

Reported from Colorado by Sturgis in 1907, p. 38 (31) (as *T. contorta* var. *inconspicua* Rost.) as common on the inner bark of box elder throughout the State, specifically from Boulder, Denver, El Paso, Larimer and Ouray counties. In 1913, p. 450 (32) he reported it from Gilpin County on the inner bark of *Populus*.

Collected also in Clear Creek, Douglas, Eagle, Huerfano, Jefferson, Mesa and Summit counties, on decayed wood, particularly the inner bark of aspen, from early spring to late fall.

Observations: We have found this to be as plentiful as, and often associated with, *Perichaena corticalis* (Batsch) Rost. Our material shows a black hypothallus rather than white as described by Martin and Alexopoulos, p. 157 (30). Our collection *7602* fits the description of *T. contorta* var. *attenuata* Meylan.

Trichia decipiens (Pers.) Macbr., N. Am. Slime-Moulds 218. 1899.

First reported from Colorado by Sturgis in 1907, p. 38 (31) as *T. fallax* Pers. from collections in El Paso, Gilpin and Summit counties.

Collected also in Clear Creek, Eagle and Grand counties on dead wood from early spring to late fall and in moist chamber.

Observations: This common species occurs in two distinct color forms: olive and orange-yellow. Each color is homogeneous throughout (peridium, stalk, capillitium and spores), without intergradation, and we agree with Kowalski (22) that there are two distinct varieties. Sixty percent of our collections are var. *olivacea* Meylan and forty percent are var. *decipiens*.

Trichia favoginea (Batsch) Pers., Neues Mag. Bot. 1:90. 1794.

Reported from Colorado by Sturgis in 1907, p. 37 (31) as *T. persimilis* Karst., and p. 38 as *T. affinis* DBy. from collections in Douglas, El Paso, Ouray and San Juan counties.

Collected also in Boulder, Clear Creek, Eagle, Fremont, Gilpin, Grand, Park, Pitkin and Summit counties on rotting wood, conifer duff and soil, often associated with moss, through summer and fall.

Trichia floriformis (Schw.) G. Lister, Jour. Bot. 57:110. 1919.

Described by Martin and Alexopoulos, p. 161 (30) as being widely distributed, but not specifically reported from Colorado.

Clear Creek Co.: On decayed conifer wood, Squaw Pass (9 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,800 m, October 25, 1976, *7574*.

Eagle Co.: On decayed conifer wood, West Lake Creek (9 km south of I-70) 2,800 m, September 10, 1976, *7283*.

Observations: Our material is of the western robust variety described by Martin and Alexopoulos, p. 161 (30), attaining 2 mm in height, displaying a deep infundibuliform calyculus with a petaloid margin. The hypothallus varies from blackish-red to almost colorless, and the spores and capillitium are golden to brownish-orange, but never "brick red".

Trichia lutescens (A. Lister) A. Lister, Jour. Bot. 35:216. 1897.

Reported from Colorado by Macbride and Martin in 1934, p. 285 (28) as the first American record.

Collected in Boulder, Clear Creek, Eagle and Larimer counties on dead wood in summer.

Trichia scabra Rost., Mon. 258. 1875.

Described by Martin and Alexopoulos, p. 163 (30) as cosmopolitan, but not specifically reported from Colorado.

Eagle Co.: On decayed aspen wood, West Lake Creek (11 km south of I-70) 2,900 m, October 31, 1976, *7610, 7657*; May 22, 1977, *7784, 7792*.

Gilpin Co.: On decayed aspen, Pickle Gulch (9 km north of Black Hawk on Colo. 119) 2,800 m, July 16, 1977, *7836*.

Trichia subfusca Rex, Proc. Acad. Phila. 42:192. 1890.
Described by Martin and Alexopoulos, p. 164 (30) as widespread, but not specifically reported from Colorado.
Clear Creek Co.: On decayed wood at edge of melting snowbanks, Squaw Pass (6.5 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,600 m, May 15, 1974, *4217;* June 26, 1974, *4628.*
Gilpin Co.: On decayed wood at edge of melting snowbank at Pickle Gulch (9 km north of Black Hawk on Colo. 119) 2,800 m, June 22, 1974, *4618.*
Summit Co.: On decayed wood at edge of melting snowbank on Spring Creek (28 km southwest of Kremmling on Colo. 9) 2,900 m, May 23, 1971, *3020;* May 22, 1976, *6605.*

Trichia varia (Pers.) Pers., Neues Mag. Bot. 1:90. 1794.
Reported from Colorado by Sturgis in 1907, p. 39 (31) as "common everywhere" from collections made in Boulder, Denver and Ouray counties.
Collected also in Clear Creek, Eagle, Gilpin, Larimer and Summit counties, on dead wood, from early spring to late fall.

ORDER PHYSARALES

FAMILY DIDYMIACEAE

Diachea leucopodia (Bull.) Rost., Mon. 190. 1874.
Reported from Colorado by Sturgis in 1907, p. 26 (31) from collections on dead leaves in Boulder County.

Diachea subsessilis Peck, Ann. Rep. N.Y. State Mus. 31:41. 1879.
Reported from Colorado by Sturgis in 1913, p. 445-446 (32) from collections in Custer, El Paso and Gilpin counties.

Diderma asteroides (A.& G. Lister) G. Lister, in Lister, Mycet. ed. 2. 113. 1911.
Reported from Colorado by Sturgis in 1913, p. 445 (32) from a collection made in El Paso County in September, 1908. This was the first recorded occurrence in North America.
Collected also in Boulder, Clear Creek and Larimer counties on dead wood and bark from early spring to late fall.

Diderma brooksii Kowalski, Mycologia 60(3): 595-603. 1968.
New Colorado record.
Summit Co.: On decorticate spruce in melting snow, Spring Creek (26 km southwest of Kremmling on Colo. 9) 2,800 m, May 13, 1978, *8596* (confirmed by D. T. Kowalski), *8620;* June 6, 1978, *8783.*
Observations: This species appears to be intermediate between *Diderma* and *Physarum.* The general aspect and the coarse, dark capillitium are certainly *Diderma*-like, but the latter, in the Colorado material, contains fairly abundant lime nodes in the lower portion of the sporangia, and there are only vestigial traces of limy columellae, such as found in the type specimen of *D. brooksii.* Although the capillitium suggests that of *D. evelinae* (Meylan) Kow., it is also similar to brown portions of capillitium we have observed in some collections of *Physarum albescens* Ellis ex Macbr. (which see). In these collections, the fruiting bodies are elongated and the limy nodes may be aggregated into pseudocolumellae. Further evidence may

well necessitate the transfer of *D. brooksii* to *Physarum*.

Diderma chondrioderma (de Bary & Rost.) G. Lister, in Lister, Mycet., ed. 3. 258. 1925.
Reported from Colorado by Martin and Alexopoulos in 1969, p. 353 (30).

Diderma cor-rubrum Macbr., N. Am. Slime-Moulds ed. 2. 140. 1922.
Reported from Colorado by Martin and Alexopoulos in 1969, p. 354 (30).

Diderma crustaceum Peck, Ann. Rep. N.Y. State Mus. 26:74. 1874.
Reported from Colorado by Sturgis in 1907, p. 26 (31) quoting Macbride's manuscript, but not previously verified from Colorado.
Eagle Co.: On decayed bark of elder near melting snow, West Lake Creek (9 km south of I-70) 2,800 m, June 6, 1976, *6755*.

Diderma effusum (Schw.) Morgan, Jour. Cinc. Soc. Nat. Hist. 16:155. 1894.
Reported from Colorado by Sturgis in 1913, p. 445 (32) from a single collection made in Custer County in August, 1911.
Collected also in Gilpin County, exsiccati COLO *M-548*.

Diderma floriforme (Bull.) Pers., Neues Mag. Bot. 1:89. 1794.
Described by Martin and Alexopoulos, p. 358 (30) as being widely distributed in north temperate regions, but not specifically reported from Colorado.
Clear Creek Co.: On decaying wood, Chicago Creek (11 km southwest of Idaho Springs on Colo. 103) 2,700 m, August 28, 1976, *7193*.
Gilpin Co.: On decaying wood, Pickle Gulch (9 km north of Black Hawk on Colo. 119) 2,800 m, September 17, 1978, *9046*.

Diderma globosum Pers., Neues Mag. Bot. 1:89. 1794.
Reported from Colorado by Sturgis in 1907, p. 26 (31) from a collection made by Bethel in Boulder County, exsiccati in BPI.
Collected also in Clear Creek, Custer, El Paso and Larimer counties, exsiccati in BPI.

Diderma hemisphaericum (Bull.) Hornem., Fl. Dan. 33:13. 1829.
Reported from Colorado by Sturgis in 1907, p. 25 (31) as *D. michelii* (Lib.) Corda, from a single collection made by Bethel in Aurora, Arapahoe County, in August 1906.

Diderma lyallii (Massee) Macbr., N. Am. Slime-Moulds 99. 1899.
Reported from Colorado by Martin and Alexopoulos in 1969, p. 362 (30).
Collected in Boulder, Clear Creek, Eagle, Larimer, Mineral and Summit counties on plant litter at the edge of melting snow in early spring at 2,800 - 3,000 m.
Observations: This is the most abundant snowbank *Diderma* in Colorado; it is also one of the most variable. In addition to the variations in spore ornamentation described in standard texts, many other variations occur. The sporangia, usually subglobose or obovate, may be pulvinate (*5550*), pendent (*5578, 5579, 5580*) or so strikingly clavate (*4358, 4375*) as to suggest a distinct variety. The peridium, usually double, may have the thick outer layer so densely encrusted

with limy scales as to form a third layer. Occasionally the middle and/or outer layer contains coarse patches of crystalline lime in the form of rosettes or rectangles (*2409*) as in *D. trevelyani* or *Lepidoderma*. The peridium may vary in color from stark white to cream or buff and is often mottled (*4275*) or areolate (*5583*) over the apex. The columella varies almost directly in size and almost inversely in depth of color with the amount of lime it contains. In limy fruitings it is prominent, white, clavate, reaching the center of the sporangium. When lime is scanty (*4328, 4334, 4336, 4362, 6817*) or lacking (*3389, 3390*) the columella appears as a small, shrivelled, brown to black thread. The capillitium varies from purplish brown to hyaline and from smooth to rough or beaded.

Diderma montanum (Meylan) Meylan, Ann. Cons. Jard. Genève 16:311. 1913.

Reported from Colorado by Macbride and Martin in 1934, p. 132 (28).

Collected in Clear Creek, Eagle, Gilpin, Mineral, Park and Summit counties on plant litter, leaves and mosses from early spring to late fall.

Observations: This species, described as being widely scattered but "not common" in the north temperate regions (30), is very common in the Colorado Rocky Mountains. It is also more variable than generally described. As in many other species, our montane collections have spores exceeding the 8-10 µm range described in the texts, with diameters reaching 13.5 µm. Spore ornamentation varies from minutely spinulose to prominently spinulose with incomplete reticulation. In many collections (*3825, 4845, 5322, 6064, 6328, 6352, 6372, 6373, 6375*) the lime in the outer layer of the peridium is porcelainized.

Diderma niveum (Rost.) Macbr., N. Am. Slime-Moulds 100. 1899.

Reported from Colorado by Sturgis in 1907, p. 26 (31) from a single collection made by Bethel in 1902.

Collected in Boulder, Clear Creek, Douglas, Eagle, Gunnison, Larimer and Summit counties on decayed wood, herbaceous stems, granite pebbles and litter under mixed woods near melting snowbanks in spring and on decayed wood in summer.

Observations: We originally tried to separate our material into *Diderma alpinum* Meylan and *D. niveum*, but we found, as observed by Kowalski (22), that *D. alpinum* is much more variable than described by previous authors. The color of the peridium, usually pure white, may be a sordid, pinkish Isabelline or drab, grayish-white. The columella, usually prominent though pulvinate, may in some plasmodiocarps be merely an inconspicuous ridge at the base and may vary from ochraceous-orange or fawn to ivory or even pure white. The pigment when present appears to be confined to the base of the inner layer of the peridium and this, like the capillitium, may vary from hyaline to pigmented. The spores range in size from 10.5-15.0 (-17.0) µm; some are evenly spinulose while others have clusters of larger, darker spines separated by lighter bands. Some fruitings (*4230, 4234, 4235, 7525*) are nearly limeless, in some (*4263, 5509*) the lime in the outer layer of the peridium is porcelainized; and some (*6746, 6751*) display crystalline lime in the base. These variations appear to be unrelated and do not warrant segregation into varieties or species.

We had assigned over 70 collections to *D. alpinum* mainly because

they fruited in the early spring near melting snow, and only one (*6329*), which was found on decayed wood in summer, to *D. niveum*. Three collections (*3667, 3690, 4617*) we could not confidently place in either species. We agree with Farr (11) that the two species are conspecific.

Diderma radiatum (L.) Morgan, Jour. Cinc. Soc. Nat. Hist. 16:151. 1894.

Reported from Colorado by Sturgis in 1907, p. 24 (31) as *D. stellare* (Schrad.) Pers. from Boulder, El Paso and Gilpin counties on decayed cottonwood.

Collected also in Chaffee, Clear Creek, Custer, Eagle and Larimer counties in spring and fall on decayed wood.

Diderma roanense (Rex) Macbr., N. Am. Slime-Moulds 104. 1899.

Reported from Colorado by Lister in 1925, p. 97 (23).

Collected in Eagle County on decayed wood in summer.

Diderma sauteri (Rost.) Macbr., N. Am. Slime-Moulds 103. 1899.

Reported from Colorado by Sturgis in 1907, p. 26 (31), quoting Macbride's manuscript, but not found by Sturgis or by us and there are no Colorado collections in BPI, COLO, or RM.

Diderma spumarioides (Fries) Fries, Syst. Myc. 3:104. 1829.

Reported from Colorado by Sturgis in 1907, p. 24 (31) from Boulder, El Paso and San Juan counties.

Collected also in Archuleta, Clear Creek, Custer and Gilpin counties on forest litter in summer.

Diderma testaceum (Schrad.) Pers., Syn. Fung. 167. 1801.

Reported from Colorado somewhat uncertainly by Sturgis in 1907, p. 25 (31) from a single small collection made in El Paso County in September, 1906.

Collected also in Gilpin County, exsiccati in COLO.

Diderma trevelyani (Grev.) Fries, Syst. Myc. 3:105. 1829.

Reported from Colorado by Sturgis in 1907, p. 25 (31) from collections made by Bethel in Boulder and Jefferson counties.

Collected also in Chaffee, Clear Creek, Custer, Eagle, Gilpin, San Juan and Summit counties on decayed wood, both aspen and conifer; dead leaves; and living and dead herbaceous stems in spring and summer.

Didymium anellus Morgan, Jour. Cinc. Soc. Nat. Hist. 16:148. 1894.

Reported from Colorado by Sturgis in 1907, p. 27 (31) from a collection made by Bethel on dead leaves in Boulder County in September, 1906.

Collected also in Clear Creek and El Paso counties on inner bark of decayed cottonwood and aspen logs in summer, and in Delta County on bark of living juniper in moist chamber.

Didymium clavus (Alb. & Schw.) Rab., Deuts. Krypt.-Fl. 1:280. 1844.

Reported from Colorado by Sturgis in 1913, p. 447 (32) from Archuleta County on bark of fir in August, 1911.

Collected also in Custer, Eagle, El Paso and Larimer counties on bark of fir and on leaves and bark of aspen in summer.

Didymium crustaceum Fries, Syst. Myc. 3:124. 1829.

Reported from Colorado by Sturgis in 1913, p. 445 (32) from Custer, El Paso and Gilpin counties.

Collected also in Eagle and Summit counties on decayed wood, leaves and twigs in summer.

Didymium decipiens Meylan, Bull. Soc. Vaud. Sci. Nat. 58:319. 1935.

New hemisphere record.

Clear Creek Co.: On dead twigs of shrubs near melting snowbank, Squaw Pass (18 km west on Colo. 103 from Bergen Park junction with U.S. 73) 3,200 m, June 15, 1975, *5599*.

Observations: To our knowledge this is the first time this species has been found outside the Swiss Alps. The large coarsely warted spores and the light brownish (or pinkish) yellow capillitial threads twisted and spiralled and wrapped around other strands are characteristic. These resemble the capillitium of *Prototrichia metallica* (Berk.) Massee.

Didymium difforme (Pers.) S. F. Gray, Nat. Arr. Brit. Pl. 1:571. 1821.

Reported from Colorado by Sturgis in 1907, p. 28 (31) from collections made by Bethel in Denver County on "dead leaves, twigs and bits of glass [sic]."

Collected also in Jefferson County (Golden) by Bethel, August, 1906, exsiccati in BPI.

Didymium dubium Rost., Mon. 152. 1874.

Reported from Colorado by Macbride and Martin in 1934, p. 109 (28).

Collected in Clear Creek, Douglas, Eagle, Gilpin and Summit counties on herbaceous stems, twigs, leaves and bark near melting snowbanks in early spring.

Observations: This is one of the most common *Didymium* species of the montane snowbank flora in Colorado. Like many of our montane species, it shows variations not described in the texts. The inconspicuous columella or the thickened base of the plasmodiocarps may vary in color from white to cream to light brown, the thin (1 µm) capillitial threads are beaded with dark brown nodes ± 3 µm in diameter. The hypothallus, consisting of a thin translucent sheet, extends only slightly beyond the edge of individual plasmodiocarps but when crowded becomes confluent with that of neighboring fructifications and is occasionally covered with crystalline lime. The spores, as in many other species, are on the large side of the 10-15 µm range described (mostly 12-15 µm) and vary in color and ornamentation. In most collections they are evenly colored and uniformly warted; in others (*4301*, *6768*, *6779*) they are lighter over one-third of the surface and incompletely reticulate.

Didymium fulvum Sturgis, Mycologia 9(6):327. 1917.

Type locality: Colorado.

Described from specimens collected on dead twigs, leaves and other refuse, Wet Mountain Valley, Custer County, August, 1913.

Appeared in moist chamber on yucca fronds collected in Jefferson County.

Observations: In our material (all moist chamber fruitings) the spores are 9-10 µm in diameter rather than the 12-14 µm as described for *D. fulvum* and the hypothallus is limeless and scanty rather than

"lime encrusted".

Didymium megalosporum Berk. & Curt., Grevillea 2:53. 1873.
Reported from Colorado by Sturgis in 1907, p. 28 (31) as *D. eximium* Peck, from collections made in Boulder and El Paso counties.

Didymium melanospermum (Pers.) Macbr., N. Am. Slime-Moulds 88. 1899.
Reported from Colorado by Sturgis in 1907, p. 26 (31) as *D. farinaceum* Schrad. from collections made in Boulder, El Paso and Gilpin counties.
Collected also in Clear Creek, Eagle, Grand, Larimer and Summit counties on dead wood, twigs and forest litter from early spring to late fall.

Didymium minus (A. Lister) Morgan, Jour. Cinc. Soc. Nat. Hist. 16:145. 1894.
Described by Martin and Alexopoulos, p. 393 (30) as being cosmopolitan, but not specifically reported from Colorado.
Grand Co.: On decorticate Englemann spruce, south fork of Williams Fork River (56 km southeast of Parshall) 2,600 m, August 2, 1975, *5937*.
Larimer Co.: A collection made in Estes Park by E. C. Smith in 1927 is in BPI.

Didymium nigripes (Link) Fries, Syst. Myc. 3:119. 1829.
Reported from Colorado by Sturgis in 1907, p. 28 (31) from a collection made in El Paso County.
Collected also in Clear Creek County on dead wood in summer.

Didymium nivicolum Meylan, Bull. Soc. Naud. Sci. Nat. 57:40. 1929.
New Colorado record.
Clear Creek Co.: On grass, herbaceous stems and living leaves near melting snow, Squaw Pass (9 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,800 m, May 5, 1976, *6551*.
Eagle Co.: On grass and herbaceous stems near melting snow, West Lake Creek (8 km south of I-70) 2,600 m, May 4, 1974, *4183*; May 24, 1975, *5528*; May 25, 1975, *5548*.
Summit Co.: On grass, leaves, and herbaceous stems in melting snowbank, Summit Lake, Loveland Pass, 3,500 m, June 25, 1978, *8930*.
Observations: Our experience with this species has been similar to that of Kowalski (22), in that we had separated our collections of *D. dubium* into two, equally common, distinct varieties labeled "thick" and "thin". Upon reading Kowalski's article in 1975, we immediately realized that our "thick" variety was *D. nivicolum* and his observations accurately describe our material. Both *D. dubium* and *D. nivicolum* are common near melting snowbanks. In our collections of both species the peridium may vary from smooth (egg-shell) (*5575*, *6551*) to flaky or, when lime is scant, iridescent (see *D. quitense*).

Didymium quitense (Pat.) Torrend, Broteria 7:90. 1908.
Reported from Colorado by Sturgis in 1913, p. 446 (32) from collections made in El Paso County in August 1912.
Collected also in Eagle and Lake counties on plant debris near melting snowbanks in early spring.
Observations: Eight of our collections of *Didymium* fit the description of this species but we agree with Kowalski (19) that this

is only a nearly limeless montane form of *D. dubium* with larger, darker spores and a blue iridescent inner peridium easily seen because of the sparse outer lime coating. If these variations are sufficient to warrant species designation then another species should be named to include our similar iridescent lime-deficient, large-spored collections of *D. nivicolum* (*5528, 5540*).

Didymium squamulosum (Alb. & Schw.) Fries, Symb. Gast. 19. 1818.

Reported from Colorado by Sturgis in 1907, p. 27 (31) from collections in Arapahoe, Boulder, Denver, El Paso, Gilpin and Larimer counties.

Collected also in Chaffee, Clear Creek, Eagle, Grand, Jefferson and Summit counties on decayed wood, forest litter and weasel dung in summer; in Weld County on cow and rabbit dung in moist chamber (2); and in Boulder County on yucca in moist chamber.

Observations: Many of our collections have spores 11-13 (-14) µm in diameter rather than 8-11 µm as usually described.

Didymium sturgisii Hagelst., Mycologia 29:397. 1927.

Type locality: Colorado.

First reported from Colorado by Sturgis in 1913, p. 444 (32) as *D. anomalum* Sturgis from collections made on the inner bark of *Populus*, Colorado Springs, El Paso County, July, 1911. One of these became the type collection.

Collected also in Boulder and Jefferson counties on yucca in moist chamber.

Lepidoderma carestianum (Rab.) Rost., Mon. 188. 1874.

New Colorado record.

Clear Creek Co.: On decayed wood and granite cobble, near melting snow, Squaw Pass (9 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,800 m, May 28, 1977, *7795*.

Eagle Co.: On charred spruce log, near melting snow, West Lake Creek (14.5 km south of I-70) 3,000 m, July 7, 1973, *3802*.

Gilpin Co.: On decayed wood near melting snow, Pickle Gulch (9 km north of Black Hawk on Colo. 119) 2,800 m, May 22, 1974, *4241*.

Grand Co.: On decayed aspen wood, near melting snow, Ute Pass (13 km northeast of Silverthorne) 2,900 m, May 26, 1975, *5708*.

Ouray Co.: On decayed conifer wood, Canyon Creek (3 km southwest of Ouray on Colo. 361) 2,400 m, August 28, 1975, *6063*.

Summit Co.: On decayed conifer wood, Mayhan Lake Road (16 km southwest of Heeney) 3,100 m, July 6, 1974, *4643*.

Observations: We have arbitrarily divided our material between *L. carestianum* and *L. chailletii* and have cited collections accordingly. However, of our thirty collections, half cannot be assigned to either species with any degree of confidence because of intergradation of all distinguishing characters. Either there is crossbreeding between these two closely related species or as Kowalski (19) suggests there is only one variable species, *L. carestianum*.

Lepidoderma chailletii Rost., Mon. 189. 1874.

New Colorado record.

Clear Creek Co.: On decayed wood, Squaw Pass (5 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,500 m, June 6, 1973, *3678*.

Eagle Co.: On decayed wood, near melting snow, West Lake Creek

(9.5 km south of I-70) 2,800 m, May 18, 1974, *4332*.

Gilpin Co.: On decayed aspen wood, Pickle Gulch (9 km north of Black Hawk on Colo. 119) 2,800 m, June 9, 1973, *3886*.

Grand Co.: On decayed conifer wood, in snowbank, Church's Park (16 km southwest of Tabernash) 3,000 m, June 17, 1978, *8833*.

Summit Co.: On grass and plant stems, near melting snow, Spring Creek (26 km southwest of Kremmling on Colo. 9) 2,800 m, May 20, 1978, *8728*.

Lepidoderma granuliferum (Phill.) R. E. Fries, Ark. Bot. 6 (7):3. 1906.

New Colorado record.

Lake Co.: On dead twigs of shrubs in snowbank, Independence Pass, 3,600 m, July 16, 1978, *8959*.

Lepidoderma tigrinum (Schrad.) Rost., in Fuckel, Jahrb. Nass. Ver. Nat. 27-28:73. 1873.

Reported from Colorado by Sturgis in 1913, p. 447 (32) from a single collection found on moss and decayed wood in spruce forest at Tolland, Gilpin County, in August, 1912.

Collected also in Clear Creek and Eagle counties on moss and decayed wood in summer.

Mucilago crustacea Wiggers, Prim. Fl. Holsat. 112. 1780.

Reported from Colorado by Sturgis in 1907, p. 29 (31) as both *Spumaria alba* Bull. and *Spumaria alba* var. *solida* Sturgis from collections made in Archuleta, Boulder, Denver and El Paso counties on dead wood and plant debris in 1906.

Reported also from Gilpin County by C. H. Kauffman in 1921 (13) as *M. spongiosus* (Ley.) Morg.

Collected also in Custer County on dead wood, and in Delta County on bark of living cottonwood in moist chamber.

FAMILY PHYSARACEAE

Badhamia affinis Rost., Mon. 143. 1874.

Reported from Colorado by Sturgis in 1907, p. 13 (31) as *B. orbiculata* Rex from a collection made by Bethel in Boulder County in September 1906, on bark of dead cottonwood.

Collected also in Denver, El Paso, Jefferson and Summit counties on decorticate wood in summer and on bark of living juniper and cottonwood in moist chamber. Collections from Custer and Larimer counties are in NYBG.

Badhamia capsulifera (Bull.) Berk., Trans. Linn. Soc. 21:153. 1853.

Reported from Colorado by Macbride and Martin in 1934, p. 29 (28).

Collected in Denver County (by Bethel in 1896 and 1907) exsiccati in BPI and in Larimer County, exsiccati in NYBG. Also appeared in moist chamber on bark of Douglas fir collected in El Paso County.

Badhamia dearnessii Hagelst., Mycologia 34:117. 1942.

New Colorado record.

Clear Creek Co.: On bark of Colorado blue spruce, Squaw Pass (9 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,800 m, August 7, 1976, *6956*.

Eagle Co.: On bark of dead conifer, West Lake Creek (11 km south

of I-70) 2,900 m, August 28, 1976, *7370*.

Gilpin Co.: On bark of dead conifer, Perigo (13 km north of Black Hawk on Colo. 119) 2,900 m, August 8, 1976, *6981*, *7527*.

Summit Co.: On decorticate spruce log, Spring Creek (27 km southwest of Kremmling on Colo. 9) 2,850 m, July 29, 1974, *4686*.

Badhamia foliicola A. Lister, Jour. Bot. 35:209. 1897.

Described by Martin and Alexopoulos, p. 253 (30) as widespread, but not specifically reported from Colorado.

Arapahoe Co.: On bark of living cottonwood, High Line Canal and So. University Blvd., 1,620 m, in moist chamber, 1978, *8547*.

Clear Creek Co.: On dead wood, bark, herbaceous stems and living and dead leaves, Chicago Creek (11 km southwest of Idaho Springs on Colo. 103) 2,700 m, August 21, 1977, *7886*.

Eagle Co.: On dead stems of cow parsnip (*Heracleum lanatum* Michx.), West Lake Creek (14.5 km south of I-70) 2,900 m, July 27, 1974, *4536*.

Gilpin Co.: On herbaceous stems, Perigo (13 km north of Black Hawk on Colo. 119) 2,900 m, June 22, 1974, *4620*.

Summit Co.: On decayed wood, Spring Creek (28 km southwest of Kremmling on Colo. 9) 2,800 m, July 28, 1973, *3828*.

Badhamia gracilis (Macbr.) Macbr., in Macbr.& Martin, Myxom. 35. 1934.

Type locality: Leyden, Jefferson County, Colorado.

Reported from Colorado by Sturgis in 1913, p. 438 (32) as *B. macrocarpa* (Ces.) Rost. from what became the type collection made by Bethel on old yucca stems at Leyden, Jefferson County, Colorado, Jan. 25, 1910.

Collected also in Boulder and Denver counties on bark of cottonwood and grape and yucca stems in moist chamber.

Badhamia macrocarpa (Ces.) Rost., Mon. 143. 1874.

Reported from Colorado by Sturgis in 1913, p. 438 (32) from collections made in El Paso County.

Collected also in Eagle, Gilpin, Jefferson, Larimer (RM-*13254*) and Summit counties on dead wood, herbaceous stems, leaves and twigs, in spring and summer, and on bark of living cottonwood and juniper in moist chamber.

Badhamia nitens Berk., Trans. Linn. Soc. 21:153. 1853.

Reported from Colorado by Sturgis in 1907, p. 13 (31) from collections made by Bethel on the bark of *Abies concolor* (Gord. & Glend.) Hoopes in Ouray County in August 1905.

Badhamia ovispora Racib., Rozp. Akad. Umiej. 12:72. 1884.

Reported from Colorado by Hagelstein in 1944, p. 27 (12) from collections made by E. C. Smith on decayed aspen wood in Jefferson County, 1925 (NYBG *10635*) and in Larimer County, 1931 (NYBG *10632*).

Collected also by Henry Aldrich (HA *13*) on the inner bark of decaying gymnosperm, 3,100 m, Boulder County, August, 1964 (6).

Observations: These three Colorado collections are the only known examples of this species except for the single type collection made by Raciborski on *Populus* near Cracow, Poland, 1882 (14).

Badhamia panicea (Fries) Rost., in Fuckel, Jahrb. Nass. Ver. Nat. 27-28: 71. 1873.

Reported from Colorado by Sturgis in 1907, p. 11 (31) from collections on cottonwood and box elder in Boulder, Jefferson and Larimer counties from June to September.

Collected also in Clear Creek and Summit counties on decayed aspen wood and leaves in summer, and in Delta County on bark of juniper in moist chamber. Collections from Custer and El Paso counties are in NYBG.

Observations: In some of our collections and in many collections at BPI, the spores are 9-11 µm in diameter with coarser darker spines arranged in clumps, rather than "minutely punctate, 11-14 µm in diameter" as described in the texts. G. Lister (23) reports var. *heterospora* as being "found repeatedly" in Colorado.

Badhamia populina A.& G. Lister, Jour. Bot. 42:129. 1904.

Reported from Colorado by Sturgis in 1907, p. 11 (31) from collections made by Bethel in Boulder and Denver counties on the bark of cottonwood and box elder in the summer of 1906.

Collected also in Archuleta, El Paso, Jefferson and Larimer counties, exsiccati in BPI and NYBG. Also appeared in moist chamber on bark of living angiosperm collected in Gilpin County.

Badhamia utricularis (Bull.) Berk., Trans. Linn. Soc. 21:153. 1853.

Reported from Colorado by Sturgis in 1907, p. 14 (31) from a collection made by Bethel at Tolland, Gilpin County in September 1906.

Collected also in Alamosa, Clear Creek, Custer, Eagle, El Paso, Larimer, Park, Pitkin and Summit counties on decayed bark (particularly aspen), leaves, twigs and basidiocarps of polypores from early spring to late fall.

Badhamia versicolor A. Lister, Jour. Bot. 39:81. 1901.

Reported from Colorado by Sturgis in 1907, p. 13 (31) from a collection made by Bethel on the bark of box elder in Boulder County in July, 1906. This collection, verified by Lister, was the first American collection.

Collected also in El Paso and Larimer counties, exsiccati in BPI and COLO, and in Jefferson County on bark of living cottonwood in moist chamber.

Badhamiopsis ainoae (Yama.) Brooks & Keller, Mycologia 68 (4): 834-841. 1976.

New Colorado record.

Boulder Co.: On bark of living juniper in moist chamber, Boulder Cemetery, Boulder, 1,650 m, 1978, *8595, 8731.*

Denver Co.: On bark of living juniper in moist chamber, Fairmount Cemetery, Denver, 1,600 m, 1978, *8519.*

Jefferson Co.: On bark of living juniper in moist chamber, Mount Olivet Cemetery, 1,620 m, 1978, *8525;* 1979, *9278.*

Observations: Our collections are all from the bark of living *Juniperus virginiana* L. (the most common host for this species in America) and fit the revised description given by Brooks and Keller (15) except for the spores which they describe as "minutely verrucose, 9-11 µm diam." In all nine of our collections the spores are 12-16 µm in diameter and densely covered with dark, coarse spines 0.5-1 µm long. Although this divergence in spore characteristics in our material is apparently stable (as indicated by its repeated appearance) we have only moist chamber fruitings. In the absence of specimens developed

under natural field conditions, we would hesitate to set up a new taxon at this time.

Cienkowskia reticulata (Alb. & Schw.) Rost., Mon. 91. 1874.
Reported from Colorado by Sturgis in 1907, p. 22 (31) from collections made in Boulder County in September, 1906.
Collected also in Custer, Gilpin and Larimer counties on dead aspen wood in summer.

Craterium aureum (Schum.) Rost., Mon. 124. 1874.
Reported from Colorado by Lister in 1925, p. 80 (23).
Collected in Clear Creek and El Paso counties on dead conifer wood in summer.

Craterium leucocephalum (Pers.) Ditmar, in Strum, Deuts. Fl. Pilze 1:21. 1813.
Reported from Colorado by Sturgis in 1907, p. 22 (31) from collections in Boulder, El Paso, Gilpin and Jefferson counties.
Collected also in Arapahoe, Clear Creek and Custer counties on grass, leaves, forest litter and decayed wood, both aspen and conifer, in summer and in moist chamber.
Observations: Three of our collections fit the description of var. *rufum* G. Lister, Mycet. ed. 3. 78. 1925; one fits the description of var. *cylindricum* (Massee) G. Lister, Mon. ed. 2. 97. 1911; and one var. *scyphoides* (Cke. & Balf.) G. Lister (determined by E. Nannenga-Bremekamp).

Craterium minutum (Leers) Fries, Syst. Myc. 3:151. 1829.
Reported from Colorado by Sturgis in 1907, p. 23 (31) from collections by Bethel in Boulder County in September, 1906.
Collected also in Clear Creek County on dead leaves, decayed wood and moss in summer.

Craterium obovatum Peck, Bull. Buff. Soc. Nat. Sc. 1:64. July, 1873.
Described by Martin and Alexopoulos, p. 257 (30) (as *Badhamia obovata* [Peck] S. J. Smith) as occurring in temperate North America, but not specifically reported from Colorado.
A collection from Colorado labelled *Badhamia rubiginosa* (Chev.) Rost., determined by Macbride, is in BPI and one from Larimer County is in NYBG.

Fuligo cinerea (Schw.) Morgan, Jour. Cinc. Soc. Nat. Hist. 19:33. 1896.
Reported from Colorado by Sturgis in 1907, p. 22 (31) as *F. ellipsospora* (Rost.) List. from a collection made by Bethel in Gilpin County.
Collected also in Arapahoe County on bark of living cottonwood in moist chamber.

Fuligo intermedia Macbr., N. Am. Slime-Moulds ed. 2. 30. 1922.
Type locality: Colorado.
First described by Macbride in 1922 from a collection made by Bethel in Denver County.
Collected also in Douglas, Eagle, Gilpin and Summit counties on decayed wood and forest litter from spring to fall.

Fuligo megaspora Sturgis, Colo. Coll. Publ. Sci. 12:443. 1913.
Type locality: Colorado.
First described by Sturgis from collections made on twigs and dead bark of *Abies* and *Pinus*, Cheyenne Mountain, El Paso County, July, 1911.

Fuligo septica (L.) Wiggers, Prim. Fl. Holsat. 112. 1780.
Reported from Colorado by Sturgis in 1907, p. 22 (31) from Archuleta, Boulder, Douglas, El Paso, Gilpin, Grand, Jefferson and Ouray counties.
Collected also in Arapahoe, Clear Creek, Denver, Eagle, Gunnison, Park, Pitkin and Summit counties on rotten wood, forest litter, living plants and bare soil from spring to fall.

Leocarpus fragilis (Dicks.) Rost., Mon. 132. 1874.
Reported from Colorado by Sturgis in 1907, p. 23 (31) from El Paso and Gilpin counties.
Collected also in Boulder, Clear Creek, Douglas, Eagle, Grand, Gunnison, Jefferson and Summit counties on forest litter and living herbaceous plants from spring to fall.

Physarum albescens Ellis, ex Macbr., No. Am. Slime-Moulds ed 2. 86. 1922.
Type locality: Clear Creek County, Colorado.
First described from Colorado by Macbride in 1899, p. 82 (26) as *Leocarpus fulvous* based on a single collection made by Bethel in June, 1896 "on living willow growing in snow at 11,000 ft. (3,400 m) alt. Loveland Pass, (Clear Creek County) Colo". Sturgis in 1907, p. 23 (31) described it as a "very rare species" and noted its identity with *Physarum albescens* Phillips. For an interesting but confusing account of name changes over the past 70 years see Sturgis 1907, p. 24 (31), Macbride 1922, p. 87-89 (27) and Martin and Alexopoulos, p. 284 (30).
Collected also in Boulder, Chaffee, Custer, Douglas, Eagle, Gilpin, Grand, Larimer and Summit counties on grass, shrubs, leaves, dead and living twigs, forest litter and granite boulders near and under snowbanks in spring.
Observations: This alpine, "snowbank" slime mold produces massive fruitings over large areas of alpine meadows and forest floors in May and June between 2,800 and 3,400 m. Despite Sturgis' allusion to it as very rare, *P. albescens* is one of the most abundant of the Colorado snowbank species. We agree with Kowalski (20) that the variability of this species is far greater than previously recorded and cite his 1973 description as accurately describing our material. In our material the spore size varies only 1-2 µm in any given collection but varies from collection to collection from 10-12 µm in some to 13-15 µm in others, suggesting a range of (10-) 11-14 (-15) µm for the species. In many of our specimens (*4187, 4287, 4300, 4307*) the peridium is porcelainized and in *6554* some irregular rhomboid crystals are present in the base of the peridium. In *5502* the lime nodes are small and scanty but in others they are large and numerous and, as described by Kowalski, "aggregated in the center to form an irregular small to massive pseudocolumella". In many collections (*4250, 4287, 4372, 4609, 4612, 5502, 6533, 6552* and *6615*) some of the "hyaline" threads of capillitium contain a light brown pigment either as a diffuse discoloration of the narrow central portion of the thread or as a transverse brown ring ±1µm in width. There seems to be no

correlation of these unusual characters to indicate distinct varieties within this variable species.

Physarum alpinum (A.& G. Lister) G. Lister, Jour. Bot. 48:73. 1910.
New Colorado record.
Clear Creek Co.: On grass at edge of melting snow, Squaw Pass (9 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,800 m, April 25, 1976, *6516*; May 2, 1976, *6525*; April 11, 1976, *6456*; June 19, 1976, *6904*.
Gilpin Co.: On decayed wood in snowbank, Pickle Gulch (9 km north of Black Hawk on Colo. 119) 2,800 m, May 22, 1974, *4247*.

Physarum ?auriscalpium Cooke, Am. Lyc. N.Y. 11:384. 1877.
Reported from Colorado by Sturgis in 1907, p. 21 (31) from Boulder, El Paso and San Juan counties.
Collected also in Arapahoe, Custer, Delta, Denver, Jefferson, Ouray, Saguache and San Miguel counties on bark of juniper, cottonwood, elm and scrub oak in moist chamber.
Observations: All our material fits the description of Farr (7) in distinguishing this species from *P. decipiens* but it was all obtained from moist chamber fruitings. In view of the suggestion by Farr (9) that these two species may be conspecific, we have placed the (?) before the species name.

Physarum bethelii Macbr., ex Lister, Mycet. ed. 2. 1911.
Type locality: Tolland, Gilpin Co., Colorado.
Reported from Colorado by Sturgis in 1913, p. 439 (32) as *Physarum viride* var. *bethelii* from a collection made in August 1908 in El Paso County.
Collected also in Clear Creek, Eagle, Grand and San Juan counties on decayed wood in late summer and fall.
Observations: As Martin and Alexopoulos, p. 287 (30) suggest, this doubtful species bears little resemblance to *P. viride*. The plasmodium of *4815* was orange-red near vivid orange #48.

Physarum bitectum G. Lister, Mycet. ed. 2. 78. 1911.
Reported from Colorado by Macbride in 1922, p. 54 (27).
Collected in Boulder, Eagle, Gilpin, Larimer and Summit counties on inner bark of decaying aspen logs from early spring to late fall.
Observations: The spores in our collections all show ornamentation similar to that of *P. straminipes* with conspicuous light bands or ridges separating the clustered, dark warts.

Physarum bivalve Pers., Ann. Bot. Usteri 15:5. 1795.
Reported from Colorado by Sturgis, 1907, p. 18 (31) as *P. sinuosum* (Bull.) Weinm. from Boulder, Chaffee, El Paso, Gilpin and Jefferson counties.
Collected also in Clear Creek County on decayed aspen wood in summer.
Observations: Collection *8241* consists almost entirely of a plasmodiocarpous, intricately reticulate fruiting, while *8431* is wholly sporangiate with gregarious to scattered sporangia shaped like clam shells.

Physarum bogoriense Racib., Hedwigia 37:52. 18 F. 1898.
Reported from Colorado by Sturgis in 1907, p. 20 (31) as

Physarum pallidum (B. & C.) List. from a single collection made by Bethel in Gilpin County in October 1906.

Collected also in Clear Creek and Custer counties on dead leaves and decayed wood in late summer and fall.

Observations: The suggestion of Braun and Keller (5), that two varieties or species are included in the description of Martin and Alexopoulos (30), is of interest since the spores of *6997*, *6999* and *7859* are clustered, and darker than the free spores of *6969* and Bethel's collection at BPI.

Physarum brunneolum (Phill.) Massee, Mon. 280. 1892.

Reported from Colorado by Sturgis in 1913, p. 441 (32) from a a collection found on the dead bark of *Populus* on Mount Manitou, El Paso County in July, 1912.

Collected also in Clear Creek County on bark of conifer in summer.

Physarum carneum G. Lister & Sturgis, Jour. Bot. 48:73. 1910.

Type locality: Colorado.

Type specimen collected by Sturgis on dead wood on Cheyenne Mountain, El Paso County, September 10, 1908 (24).

Collected also in Clear Creek County on dead wood in summer.

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

Reported from Colorado by Sturgis in 1907, p. 16 (31) from collections found by Bethel on grass, leaves and fallen twigs in Boulder and Jefferson counties.

Collected also in Clear Creek, Gilpin and Grand counties on dead wood and forest litter in summer.

Physarum citrinum Schum., Enum. Pl. Saell. 2:201. 1803.

Reported from Colorado by Macbride in 1922, p. 66 (27).

Physarum compressum Alb. & Schw., Consp. Fung. 97. 1805.

Reported from Colorado by Sturgis in 1907, p. 16 (31) as *P. nephroideum* Rost. from Boulder, Gilpin, Larimer, Mesa and Ouray counties.

Collected also in Douglas, El Paso and Jefferson counties on bark of elm and alder and on yucca in moist chamber. A collection from Archuleta County is in BPI.

Physarum conglomeratum (Fries) Rost., Mon. 108. 1874.

New Colorado record.

Clear Creek Co.: On grass, herbaceous stems and leaves, Squaw Pass (9 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,800 m, September 7, 1977, *8402*.

Observations: The smaller (8-10 µm), paler, smoother spores distinguish this species from *P. contextum*.

Physarum contextum (Pers.) Pers., Syn. Fung. 168. 1801.

Reported from Colorado by Sturgis in 1907, p. 16 (31) from collections on fallen twigs, leaves and bark from Boulder, El Paso and Jefferson counties.

Collected also in Eagle and Gilpin counties on bark and dead grass in summer.

Observations: In our material, as well as that studied at BPI, many collections have spores up to 15 µm and occasionally to 17 µm.

Even though the spore size stated in most texts [(10-) 11-13 (-14)] allows some overlap with the spore size of *P. conglomeratum*, the darker color and coarse ornamentation of the spores of *P. contextum* are diagnostic.

Physarum decipiens Curtis, Am. Jour. Sci. II. 6:352. 1848.

Reported from Colorado by Sturgis in 1913, p. 437 (32) as *Badhamia decipiens* (Curt.) Berk. from collections made on Cheyenne Mountain, El Paso County, in September, 1908 and August, 1909.

Collected also in Clear Creek and Gilpin counties on bark and forest litter in summer.

Observations: Two characteristics of our collections are noteworthy. The hypothallus, though inconspicuous, is reddish-brown to black and may be extended upward into weak stalks. The spores have clusters of darker spines with lighter bands between them as in *P. bitectum* and *P. straminipes*.

Physarum diderma Rost., Mon. 110. 1874.

Reported from Colorado by Sturgis in 1907, p. 18 (31) as both *P. testaceum* Sturgis, and *P. diderma* Rost. from collections by Bethel in Boulder and Ouray counties, on the bark of *Abies* in August 1905.

Collected also in Eagle and Larimer counties on stems of dead grass and herbaceous plants in summer.

Physarum didermoides (Pers.) Rost., Mon. 97. 1874.

Reported from Colorado by Sturgis in 1907, p. 18 (31) from Boulder County.

Collected also in Larimer County on decayed wood in summer.

Physarum famintzinii Rost., Mon. 107. 1874.

New Colorado record.

Clear Creek Co.: On decayed conifer stick, Chicago Creek (11 km southwest of Idaho Springs on Colo. 103) 2,700 m, August 24, 1977, *8449*.

Observations: This fruiting was 6 cm long and 3-4 cm wide, wrapped around the stick to form a honeycomb-like pseudoaethalium of sporangia that were crowded and in places, heaped.

Physarum flavicomum Berk., Lond. Jour. Bot. 4:66. 1845.

Reported from Colorado by Sturgis in 1907, p. 21 (31) as *P. berkeleyi* Rost. from a collection made in El Paso County in September, 1906.

Physarum globuliferum (Bull.) Pers., Syn. Fung. 175. 1801.

Described by Martin and Alexopoulos, p. 303 (30) as cosmopolitan, but not specifically reported from Colorado.

Three Colorado collections are in BPI. One is dated 1906, as labeled by T. H. Macbride; the second is dated 1907, collected by E. Bethel, determined by Macbride, and the third collected by E. C. Smith in Larimer County in 1931.

Physarum gyrosum Rost., Mon. 111. 1874.

New Colorado record.

Arapahoe Co.: On bark of living cottonwood in moist chamber, High Line Canal and So. University Blvd., 1,620 m, 1978, *8517*.

Boulder Co.: On bark of living cottonwood in moist chamber, 1.6

km east of Louisville, 1,600 m, 1979, *9342*.

Delta Co.: On bark of living juniper in moist chamber, Cedaredge, 2,000 m, 1978, *8986*.

Denver Co.: On bark of cottonwood, elm and grapevine in moist chamber, Denver, 1,600 m, 1978, *8550*.

Douglas Co.: On bark of living elm in moist chamber, 8 km south of Sedalia on county road 105, 1,850 m, 1978, *8356*.

Gilpin Co.: On bark of living angiosperm in moist chamber, 8 km south of Black Hawk on Colo. 119, 2,400 m, 1978, *8553*.

Jefferson Co.: On bark of living juniper in moist chamber, Mount Olivet Cemetery, 1,640 m, 1978, *8385*.

Physarum lateritium (Berk. & Rav.) Morgan, Jour. Cinc. Soc. Nat. Hist. 19:23. 1896.

Reported from Colorado by Sturgis in 1907, p. 21 (31) from a single collection made by Bethel in Boulder County, exsiccati in BPI.

Physarum leucophaeum Fries, Symb. Gast. 24. 1818.

Reported from Colorado by Sturgis in 1913, p. 442 (32) as *P. nutans* var. *leucophaeum* from El Paso County, 1912.

Collected also in Clear Creek, Gilpin, Pitkin, San Miguel and Summit counties on dead wood, moss and forest litter in summer.

Physarum leucopus Link, Ges. Nat. Freunde Berlin Mag. 3:27. 1809.

Reported from Colorado by Sturgis in 1913, p. 439 (32) from a single scanty collection made on Cheyenne Mountain, El Paso County, September, 1908.

Collected also in Eagle, Pitkin and Summit counties on decayed wood, and particularly aspen bark, in summer.

Observations: At least three variations occur. One (*8478*) has sulcate stalks with a few small veins at the base, but no apparent hypothallus. The second (*2075*) has a terete, beaded stipe with prominent veins at the base arising from a translucent sheet of hypothallus. The third (*7092*) has an extensive, limy, white to ochraceous hypothallus from which the stipes arise as weak furrowed extensions. Microscopically the three are identical and seem to intergrade.

Physarum listeri Macbr., in Macbr. & Martin, Myxom. 62. 1934.

Reported from Colorado by Sturgis in 1913, p. 439 (32) as *P. luteo-album* List. from a collection made on decayed wood in Custer County, in August, 1911, which was the first record of this species in America.

Physarum luteolum Peck, Ann. Rep. N.Y. State Mus. 30:50. 1878.

Reported from Colorado by Hagelstein in 1944, p. 76 (12.).

Collected in Gilpin County on bark of spruce near melting snow in June.

Physarum megalosporum Macbr., N. Am. Slime-Moulds ed. 2. 63. 1922.

Type locality: Colorado.

Reported from Colorado by Sturgis in 1917, p. 323 (33) as *P. melanospermum* Sturgis from collections on dead twigs and leaves in Arapahoe and El Paso counties in 1913 and 1914. One of these collections became the type specimen.

Collected also from moist chamber fruiting on juniper bark from Jefferson County.

Physarum mortonii Macbr., N. Am. Slime-Moulds ed. 2. 58. 1922.
Reported from Colorado by Lister in 1925, p. 60 (23) as *Physarum contextum* var. *"mortoni"* from a specimen collected by Bethel.

Physarum newtonii Macbr., Bull. Nat. Hist. Univ. Iowa 2:390. 1893.
Type Locality: Colorado.
First described by Macbride in 1893 (25) from a collection made by G. W. Newton on dead wood on Pikes Peak, El Paso County, Colorado.

Physarum notabile Macbr., N. Am. Slime-Moulds ed. 2. 80. 1922.
Reported from Colorado by Hagelstein in 1944, p. 61 (12).
Collected in Archuleta, Boulder, Clear Creek, Custer, Eagle, El Paso, Gilpin, Larimer, Park and Summit counties on dead wood, especially the inner bark of aspen, and aspen leaves in summer.
Observations: This is one of the most common summer-fruiting species of *Physarum* in the Colorado mountains. Text descriptions include broad variations and our material shows even greater variability, suggesting that more than one taxon may be involved. Most of our collections have dark stalks as described by Martin and Alexopoulos, p. 315 (30), but many collections have yellowish, buff or red-brown stalks as described for *P. connatum* by Lister, p. 51 (23) which is now placed in synonymy. The amount of lime in the peridium varies greatly. When the lime is scanty the peridium shows a blue iridescence; on the other hand it may be so densely encrusted with lime as to appear double. The hypothallus is also variable, from inconspicuous translucent basal discs with yellow-brown strands extending into the ribs of the stalk in scattered sporangia, to a massive brown to black confluent sheet in crowded fruitings.

Physarum nudum Macbr., in Peck & Gilbert, Am. Jour. Bot. 19:134. 1932.
New Colorado record.
Clear Creek Co.: On decayed wood and forest litter, Chicago Creek (11 km southwest of Idaho Springs on Colo. 103) 2,700 m, August 21, 1977, *7895, 8434;* August 24, 1977, *8200, 8207.*
Delta Co.: On bark of living juniper in moist chamber, Cedaredge, 1,500 m, 1979, *9254.*

Physarum nutans Pers., Am. Bot. Usteri 15:6. 1795.
Reported from Colorado by Sturgis in 1907, p. 14 (31) from Boulder, El Paso, Gilpin, Larimer and Ouray counties.
Collected also in Clear Creek, Eagle and Summit counties on dead wood in summer.

Physarum oblatum Macbr., Bull. Nat. Hist. Univ. Iowa 2:384. 1893.
Reported from Colorado by Sturgis in 1913, p. 440 (32) as *P. maydis* Morgan from a collection on Cheyenne Mountain, El Paso County, August, 1912.
Collected also in Boulder, Clear Creek and Larimer counties on decayed wood in summer.

Physarum polycephalum Schw., Schr. Natur. Ges. Leipzig 1:63. 1822.
Described by Martin and Alexopoulos, p. 322 (30) as being widely distributed in the United States, but not specifically reported from Colorado.
Douglas Co.: On bark of living angiosperm in moist chamber, Larkspur, 2,000 m, 1978, *8729.*

Physarum pulcherrimum Berk. & Rav., Grevillea 2:65. 1873.
Reported from Colorado by Martin & Alexopoulos in 1969, p. 324 (30).
Two collections made by Bethel in 1913 and 1914 are in BPI.

Physarum pusillum (Berk. & Curt.) G. Lister, Mycet. ed. 2. 64. 1911.
Reported from Colorado by Sturgis in 1913, p. 441 (32) from a collection made on dead twigs and leaves in El Paso County, August, 1912.
Collected also in Adams and Summit counties on dead wood and living herbaceous plants in summer, and in Clear Creek, Denver, Douglas, Gilpin, Jefferson and San Miguel counties on bark of cottonwood, elm, grape and juniper in moist chamber.

Physarum rubiginosum Fries, Symb. Gast. 21. 1917.
Reported from Colorado by Macbride in 1922, p. 62 (27) from a collection made by Bethel in El Paso County.
Collected also in Boulder, Clear Creek, Eagle and Grand counties on dead wood, aspen leaves and living herbaceous plants in summer.

Physarum stellatum (Massee) Martin, Mycologia 39:461. 1947.
Reported from Colorado by Sturgis in 1907, p. 22 (31) as *P. compactum* (Wing.) List. quoting Macbride's manuscript, but not found by Sturgis. Described by Martin and Alexopoulos in 1969, p. 331 (30) as being widely distributed in North America, but not specifically reported from Colorado.
Clear Creek Co.: On decayed conifer wood, Squaw Pass (9 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,800 m, September 10, 1977, *8301, 8302, 8317, 8329*.
Summit Co.: On decayed spruce wood, Spring Creek (28 km southwest of Kremmling on Colo. 9) 2,900 m, August 9, 1976, *6886*.

Physarum sulphureum Alb. & Schw., Consp. Fung. 93. 1805.
Reported from Colorado by Lister in 1925, p. 26 (23) from collections made by Sturgis in Custer County.

Physarum superbum Hagelst., Mycologia 32:385. 1940.
Described by Martin and Alexopoulos, p. 333 (30) as being widely distributed over North America, but not specifically reported from Colorado.
Clear Creek Co.: On bare granite boulder near melting snow, Squaw Pass (9 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,800 m, May 5, 1976, *6706*.

Physarum vernum Somm., in Fries, Syst. Myc. 3:146. 1829.
Reported from Colorado by Sturgis in 1907, p. 17 (31) from a collection made by Bethel in Denver County in September, 1906.
Collected also in Boulder, Clear Creek, Eagle, Gilpin, Park and Summit counties on dead grass, dead and living herbaceous stems, decayed wood, aspen leaves and bare granite from spring to fall.
Observations: Though *P. vernum* is described as having a single, rugulose, membranous peridium, this is true in only a slight majority of our collections; in these, the lime is relatively scant. Almost half our specimens are very limy and the wall appears to consist of two tightly appressed layers.

Physarum virescens Ditmar, in Sturm, Deuts. Fl. Pilze 1:123. 1817.
Reported from Colorado by Sturgis in 1913, p. 443 (32) from a collection made on the bark of fallen *Abies* at Tolland, Gilpin County, late in August 1912.

Physarum viride (Bull.) Pers., Ann. Bot. Usteri 15:6. 1795.
Reported from Colorado by Sturgis in 1907, p. 14 (31) from collections in Boulder, El Paso and Gilpin counties.
Collected also in Clear Creek and Eagle counties on dead wood and old polypores in summer.

Protophysarum phloiogenum Blackwell & Alexopoulos, Mycologia 67 (1): 32. 1975.
Type locality: Colorado.
First reported from Colorado by Blackwell and Alexopoulos from moist chamber fruitings on bark of living American elm collected in Boulder County, May 1965.
Collected also from moist chamber fruitings on bark of living cottonwood, elm, grape stems, yucca and miscellaneous angiosperms from Arapahoe, Denver, Douglas and Jefferson counties.
Observations: A collection that fruited on yucca contained some sporangia that were over 300 µm in diameter, twice the maximum size stated in the original description of this species.

ORDER STEMONITALES

Amaurochaete atra (Alb. & Schw.) Rost., Mon. 211. 1874.
Reported from Colorado by Macbride in 1922, p. 150 (27) as *A. fuliginosa* (Sowerby) Macbr.

Amaurochaete ferruginea Macbr. & Martin, Jour. Wash. Acad. 22:89. 1932.
Reported from Colorado by Martin and Alexopoulos in 1969, p. 173 (30).

Comatricha aequalis Peck, Ann. Rep. N.Y. State Mus. 31:42. 1879.
Reported from Colorado by Sturgis in 1907, p. 34 (31) as *C. nigra* var. *aequalis* Pk. from a collection made by Bethel in Boulder County.

Comatricha alpina Kowalski, Madrono 22(3):152. 1973.
New Colorado record.
Clear Creek Co.: On decorticate spruce wood near melting snow, Loveland Pass, 3,400 m, June 23, 1979, *9609*.
Eagle Co.: On decayed conifer wood in melting snow, West Lake Creek (14 km south of I-70) 3,100 m, July 12, 1975, *5859*.
Grand Co.: On decorticate conifer wood in snowbank, east of Church's Park (13 km southwest of Tabernash) 3,100 m, June 21, 1975, *5741*.
Summit Co.: On decayed wood, Spring Creek (22 km southwest of Kremmling) 2,800 m, August 14, 1971, *3089*.

Comatricha elegans (Racib.) G. Lister, Guide Brit. Mycet. ed. 3. 31. 1909.
Reported from Colorado by Sturgis in 1913, p. 448 (32) from collections made in Custer and El Paso counties in July and August, 1912.

Collected also in Boulder, Delta, Denver, Jefferson, Saguache and San Miguel counties on bark of cottonwood, Douglas fir, juniper, Russian olive and scrub oak in moist chamber.

Comatricha fimbriata G. Lister & Cran, in G. Lister, Jour. Bot. 55:122. 1917. New Colorado record.

El Paso Co.: On bark of dead Douglas fir, in moist chamber, Helen Hunt's Grave, Colorado Springs, 3,000 m, 1978, *8814*.

Mineral Co.: On decayed wood, Wolf Creek Pass (3 km west of the summit on U.S. 160) 3,200 m, July 20, 1976, *6941*.

Comatricha irregularis Rex, Proc. Acad. Phila. 43:393. 1891.

Reported from Colorado by Sturgis in 1907, p. 34 (31) from collections made in Boulder and Larimer counties, on cottonwood logs in August, 1906.

Collected also in Custer and Gilpin counties on litter in mixed woods in summer.

Comatricha laxa Rost., Mon. 201. 1874.

Reported from Colorado by Sturgis in 1907, p. 34 (31) from Bethel's collections in Adams, Boulder and Gilpin counties.

Collected also in Chaffee and Clear Creek counties on decayed wood in spring and in Arapahoe, Denver, Douglas, El Paso, Jefferson and Saguache counties on bark of cottonwood, elm, juniper, Douglas fir and Russian olive in moist chamber.

Comatricha nigra (Pers.) Schroet., Krypt.-Fl.Schles. 3(1):118. 1885.

Reported from Colorado by Sturgis in 1907, p. 33 (31) from Boulder, Denver, El Paso, Gilpin and Ouray counties.

Collected also in Clear Creek, Eagle, Grand, Huerfano, Jefferson and Summit counties on dead wood from early spring to late fall.

Comatricha pulchella (C. Bab.) Rost., Mon. App. 27. 1876.

Reported from Colorado by Sturgis in 1907, p. 34 (31) as *C. persoonii* Rost. from a single collection by Bethel in San Juan County in July, 1897, on dead leaves.

Comatricha rubens A. Lister, Mycet. 123. 1894.

Reported from Colorado by Lister in 1925, p. 148 (23).

Collected in Summit County on decorticate aspen wood in summer.

Comatricha suksdorfii Ellis & Ev., Bull. Washburn Lab. Nat. Hist. 1:5. 1894.

Reported from Colorado by Sturgis in 1907, p. 33 (31) as *C. nigra* var. *suksdorfii* Ell. & Ev. from collections by Bethel in Gilpin and Grand counties.

Collected also in Clear Creek, Eagle, Mineral, Park and Summit counties on decorticate conifer wood at the edge of melting snowbanks in early spring.

Observations: This common snowbank slime mold fruits in the same areas and at the same time as an even more common robust, black *Comatricha* here tentatively referred to *C. ?nodulifera* Wollm. & Alexop. (see below).

Comatricha typhoides (Bull.) Rost., in Lister, Mycet. 120. 1894.

Reported from Colorado by Sturgis in 1907, p. 34 (31) as *C.*

typhina (Wigg.) Rost. from collections in Boulder, El Paso, Gilpin, Ouray and San Juan counties.

Collected also in Clear Creek, Eagle, Grand and Summit counties on decayed conifer wood in summer.

Comatricha sp. (? **nodulifera** Wollm. & Alexop., Canad. J. Bot. 46:157. 1968.)

Collected in Boulder, Clear Creek, Eagle, Gilpin, Grand, Mineral, Park and Summit counties on decorticate conifer wood, in melting snowbanks.

Observations: This species, even more common than *C. suksdorfii*, is represented by 50 Colorado collections from the above counties. It is also known from Oregon (Farr *4400* and *4457*) and from Washington (DBG *6807*, *6812*, and *6828*). Structurally, it closely resembles *C. nodulifera* Wollman and Alexopoulos, but is much larger and more robust in all aspects, and has denser, darker capillitium and larger, more strongly marked and differently colored spores. Unfortunately, *C. nodulifera* is known only from moist chamber and laboratory cultures, while our species is represented only by field collections. Unless field collections fitting into *C. nodulifera* are found, or until the robust Colorado slime mold can be cultured, the relationship between these two entities will remain uncertain. Currently we cannot escape the possibility that *C. nodulifera* represents a depauperate development conspecific with the field-collected specimens. If fruited under natural conditions, it would most likely reflect the more typical expression of the species.

Enerthenema berkeleyanum Rost., Mon. App. 29. 1876.

Reported from Colorado by Sturgis in 1913, p. 448 (32) as *E. syncarpon* from collections on decayed pine in Archuleta County, August 1911.

Enerthenema melanospermum Macbr. & Martin, in Martin, Jour. Wash. Acad. 22:91. 1932.

New Colorado record.

Clear Creek Co.: On spruce wood, near melting snow, Squaw Pass (9 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,800 m, May 18, 1974, *4233*.

Eagle Co.: On decorticate conifer wood near melting snow, West Lake Creek (11 km south of I-70) 3,000 m, July 4, 1975, *5831*.

Grand Co.: On decayed conifer wood, near melting snow, Church's Park (16 km southwest of Tabernash) 3,000 m, June 21, 1975, *5737*.

Huerfano Co.: On decayed spruce wood, near melting snow, Apishapa Pass (pass summit, 40 km south of Walsenburg) 3,400 m, June 15, 1974, *4603*.

Summit Co.: On decayed lodgepole pine, in and near melting snowbanks, Spring Creek (24 km southwest of Kremmling on Colo. 9). 2,700 m, May 5, 1974, *4203*.

Observations: This species differs from *E. papillatum* not only by its larger sporangia, discs and spores, but also by its intensely black color, and by its capillitium being beaded throughout the entire length. Furthermore, *E. melanospermum* is limited to snowbank fruitings.

Enerthenema papillatum (Pers.) Rost., Mon. App. 28. 1876.

Reported from Colorado by Sturgis in 1907, p. 34 (31) from

collections in Boulder, El Paso and Gilpin counties.

Collected also in Clear Creek, Douglas, Eagle, Lake, Pitkin and Summit counties on decorticate conifer wood, often associated with lichen and algae, in summer.

Observations: This smaller, lighter brown species fruits only in summer. Its capillitium is smooth throughout most of its length and beaded only at the tips in contrast to that of *E. melanospermum*. Despite the obvious differences in the two species above, we have found seven moist chamber fruitings which are intermediate between the two in that the stature and size of the disc resemble *E.papillatum* but the spore size is that of *E. melanospermum*. The color is intermediate between the two and the capillitium is distinct from both in that it is smooth throughout the entire length and has expanded, branched tips. We have not found either *E. melanospermum* or *E. papillatum* in moist chamber.

Lamproderma arcyrioides (Sommerf.) Rost., Mon. 206. 1874.

Reported from Colorado by Sturgis in 1907, p. 35 (31) as *L. violaceum* (Fr.) Rost. from two of Bethel's collections, one from Ouray County.

Collected also in Clear Creek, Douglas, Eagle, Grand, Huerfano and Summit counties, in and near melting snowbanks in spring, on decorticate conifer wood and on a bare granite boulder.

Lamproderma atrosporum Meylan, Bull. Soc. Vaud. Sci. Nat. 46:51. 1910.

Described by Martin and Alexopoulos, p. 213 (30) as occurring in the mountains of the western United States, but not specifically reported from Colorado.

Clear Creek Co.: On decayed wood near melting snow, Squaw Pass (9 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,800 m, June 13, 1973, *3693*.

Douglas Co.: On herbaceous stems and living leaves, in melting snow, Jarre Canyon road (21 km southwest of Sedalia) 2,600 m, May 12, 1974, *4311*.

Eagle Co.: On twigs, grass, herbaceous stems and leaves near melting snow, West Lake Creek (8 km south of I-70) 2,600 m, May 9, 1976, *6562*.

Gilpin Co.: On dead bark near melting snow, Pickle Gulch (9 km north of Black Hawk on Colo. 119) 2,800 m, June 9, 1973, *3685*.

Grand Co.: On decayed conifer bark in melting snow, Church's Park, (16 km southwest of Tabernash) 3,000 m, June 17, 1978, *8846*.

Huerfano Co.: On decayed wood near melting snow, Apishapa Pass summit (40 km south of Walsenburg) ±3,500 m, June 15, 1974, *4611*.

Summit Co.: On granite boulder near melting snow, Spring Creek (28 km southwest of Kremmling on Colo. 9) ±2,900 m, May 20, 1973, *3655*.

Observations: Our collections fit the very detailed description by Kowalski (18). The sporangia range from stipitate and globose to sessile and clavate and from 1.0-2.5 mm in height. In globose sporangia, the columella usually ends abruptly at the center of the sporangium whereas, in elongated ones, it may attain two-thirds the length of the sporangium.

Lamproderma carestiae (Ces. & de Not.) Meylan, Bull. Soc. Vaud. Sci. Nat. 57:368. 1932.

Reported from Colorado by Hagelstein in 1944, p. 175 (12) as

L. violaceum var. *carestiae* (Ces. & de Not.) Lister.
Collected in Clear Creek, Eagle, Gilpin, Grand, Mineral and Summit counties, near melting snowbanks on leaves, dead wood, bare granite, and herbaceous stems, in spring.

Lamproderma columbinum (Pers.) Rost., in Fuckel, Jahrb. Nass. Ver. Nat. 27-28:69. 1873.
Described by Martin and Alexopoulos, p. 214 (30) as occurring in temperate North America, but not specifically reported from Colorado.
Denver Co.: On dead leaf, 1,600 m, 1910, collected by J. R. Weir, exsiccati in BPI.
Eagle Co.: On decayed conifer wood, West Lake Creek (9 km south of I-70) 2,800 m, August 15, 1970, *2731*; August 28, 1971, *2954*.
Gunnison Co.: Cottonwood Lake, 2,900 m, June 21, 1930, collected by R. W. Davidson, exsiccati in BPI; Gothic Natural Area, 3,100 m, July 4, 1955, collected by W. A. Weber, COLO *M-128*.
Mesa Co.: Mesa Lake, 2,800 m, June 16 & 17, 1930, two collections by R. W. Davidson, exsiccati in BPI.
Ouray Co.: Collected by Bethel, exsiccati in BPI.
Summit Co.: On decayed conifer wood, Elliott Ridge (30 km southwest of Kremmling) 3,400 m, July 31, 1976, *6840*.

Lamproderma cribarioides (Fries) R. E. Fries, Sv. Bot. Tidskr. 4:259. 1911.
Reported from Colorado by Macbride and Martin in 1934, p. 194 (28) from collections made by Seaver and Shope in 1929 from Boulder County.
Collected in Clear Creek, Douglas, Eagle and Summit counties in and near melting snowbanks on decayed wood, twigs, grass, herbaceous stems and forest litter in spring.
Observations: Despite Macbride's observation that the Colorado material had uniform spore size (14-16 µm), our collections show a wide range of variation from 12 to 19 µm, as originally described by Lister (23) and reaffirmed by Kowalski (18). They also show a marked variation in spore ornamentation: from a pronounced coarse, completely banded reticulation to faint, low, unconnected ridges. The peridium is pitted, especially over the lower one-third, where the expanded funnel-like tips of the capillitium are firmly attached.

Lamproderma cristatum Meylan, Bull. Soc. Vaud. Sci. Nat. 53:457. 1921.
New hemisphere record.
Douglas Co.: On dead (?) aspen leaves under melting snowbank, Rampart Range (21 km southwest of Sedalia on Colo. 67) 2,600 m, May 12, 1974, *4317*.

Lamproderma echinosporum Meylan, Bull. Soc. Vaud. Sci. Nat. 55:241. 1924.
New Colorado record.
Clear Creek Co.: On grass, leaves and herbaceous stems under melting snowbanks, Squaw Pass (9 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,800 m, April 25, 1976, *6511*.
Eagle Co.: On decayed wood and herbaceous stems in melting snow, West Lake Creek (9 km south of I-70) 2,800 m, June 11, 1977, *8028* (determination confirmed by D. T. Kowalski).
Gilpin Co.: On decayed aspen wood and bark near melting snow,

Pickle Gulch (9 km north of Black Hawk on Colo. 119) 2,800 m, May 22, 1974, *4243*.

Summit Co.: On decayed wood near melting snow, Spring Creek (28 km southwest of Kremmling on Colo. 9) 2,900 m, May 19, 1973, *3651*; May 20, 1978, *8718* (determination confirmed by D. T. Kowalski).

Lamproderma fuscatum Meylan, Bull. Soc. Vaud. Sci. Nat. 57:372. 1932.

New Colorado record.

Clear Creek Co.: On dead wood in and near melting snowbanks, Squaw Pass (9 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,800 m, May 29, 1976, *6637*; (6.5 km west of Bergen Park) 2,600 m, May 19, 1976, *6625*; June 19, 1976, *6650* (determination confirmed by D. T. Kowalski).

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

Reported from Colorado by Lister in 1925, p. 158 (23).

Lamproderma maculatum Kowalski, Mycologia 62(4): 654. 1970.

New Colorado record.

Clear Creek Co.: On decayed conifer wood near melting snow, Squaw Pass (6.5 km west on Colo. 103 from Bergen Park junction with U.S. 73) 2,600 m, May 11, 1974, *4210* (determination confirmed by D. T. Kowalski).

Lamproderma sauteri Rost., Mon. 205. 1874.

Reported from Colorado by Sturgis in 1907, p. 35 (31) from a collection made by Bethel in 1902.

Collected in Boulder, Clear Creek, Custer, Douglas, Eagle, Gilpin, Grand and Summit counties on decaying wood, both conifer and aspen, stems of grass and herbaceous plants, aspen leaves and granite boulders, in and near snowbanks in early spring.

Observations: This variable species is the most common *Lamproderma* in the central Colorado Rockies and fruits abundantly in the spring near melting snowbanks. Some fruitings extend over an area of one to two meters by twenty to thirty cm covering, like a splash of blue paint, all the fallen logs, dead grass and herbaceous stems in the area, as the edge of the covering snowbank recedes.

Lamproderma scintillans (Berk. & Br.) Morgan, Jour. Cinc. Soc. Nat. Hist. 16:131. 1894.

Reported from Colorado by Sturgis in 1913, p. 449 (32) from collections in El Paso County in August 1908 and El Paso and Gilpin counties in August 1912.

Collected also in Clear Creek, Custer and Eagle counties on dead aspen bark and aspen leaves in summer.

Leptoderma iridescens G. Lister, Jour. Bot. 51:1. 1913.

Reported from Colorado by Hagelstein in 1944, p. 139 (12) from a single collection by Dr. E. C. Smith, which was apparently a new record for this hemisphere.

Collected in Clear Creek County on decorticate conifer wood in summer.

Stemonitis axifera (Bull.) Macbr., N. Am. Slime-Moulds 120. 1889.

Reported from Colorado by Sturgis in 1907, p. 32 (31) and again in 1913, p. 447 (32) as *S. ferruginea* Ehrenb. from collections in

Boulder, El Paso, Gilpin and San Juan counties.
Collected also in Clear Creek, Eagle, Huerfano, Pitkin and Summit counties on dead wood in summer.

Stemonitis confluens Cooke & Ellis, Grevillea 5:51. 1876.
Reported from Colorado by Sturgis in 1907, p. 31 (31) as *S. splendens* var. *confluens* (Cooke & Ellis) A. Lister from a collection found in Denver.
Collected also in Boulder and Summit counties on Englemann spruce bark in summer.

Stemonitis flavogenita Jahn, Verh. Bot. Ver. Brand. 45:165. 1904.
Described as widespread by Martin and Alexopoulos, p. 193 (30), but not specifically reported from Colorado.
Boulder Co.: On decayed wood, 8 km southwest of Lyons, 2,150 m, August 24, 1958, COLO *M-241*.
Clear Creek Co.: On decayed angiosperm wood, Montane Ridge (1.5 km south of Idaho Springs) 2,300 m, July 26, 1974, *4529*.
Eagle Co.: On decayed conifer wood, West Lake Creek (9 km south of I-70) 2,800 m, September 11, 1976, *7273*.
Gilpin Co.: On decayed aspen wood, Pickle Gulch (9 km north of Black Hawk on Colo. 119) 2,800 m, August 26, 1975, *6050*.
Summit Co.: On decayed conifer wood, Spring Creek (24 km southwest of Kremmling on Colo. 9) 2,700 m, July 28, 1973, *3826*.

Stemonitis fusca Roth, Mag. Bot. Romer & Usteri 1(2):26. 1787.
Reported from Colorado by Sturgis in 1907, p. 30-31 (31) from collections in Boulder, El Paso and Gilpin counties.
Collected also in Clear Creek, Custer, Eagle, Gunnison, Mineral, Park and Summit counties on decayed wood in summer.
Observations: Half of our collections fit var. *fusca*, one-third are typical of var. *papillosa* Meyl. as defined by Martin and Alexopoulos, p. 194 (30), and four collections are typical of var. *rufescens* A. Lister (23).

Stemonitis herbatica Peck, Ann. Rep. N.Y. State Mus. 26:75. 1874.
Reported from Colorado by Sturgis in 1907, p. 31 (31) from collections in Boulder, El Paso, Gilpin and San Juan counties.
Collected also in Clear Creek County on dead wood in summer.

Stemonitis hyperopta Meylan, Bull. Soc. Vaud. Sci. Nat. 52:97. 1918.
Reported from Colorado by Hagelstein in 1944, p. 145 (12).

Stemonitis nigrescens Rex, Proc. Acad. Phila. 43:392. 1891.
Described by Martin and Alexopoulos, p. 198 (30) as known from widely scattered localities in the United States, but not specifically reported from Colorado.
Larimer Co.: Collected by E. C. Smith at Cedar Cove, Big Thompson Canyon, 1,650 m, 1931, exsiccati in BPI.

Stemonitis smithii Macbr., Bull. Nat. Hist. Univ. Iowa 2:381. 1893.
Reported from Colorado by Sturgis in 1907, p. 33 (31).
Collected in Clear Creek and Gilpin counties on dead wood in summer.

Stemonitis splendens Rost., Mon.195. 1874.

Reported from Colorado by Sturgis in 1907, p. 31 (31) from collections in Boulder, Denver, El Paso and Ouray counties.
Collected also in Custer County, exsiccati in COLO.

Stemonitis uvifera Macbr., N. Am. Slime-Moulds ed. 2. 161. 1922.
New Colorado record.
Summit Co.: On dead wood in the Gore Wilderness area (9 km west of Heeney) 2,500 m, August 11, 1976, *7119*.

Stemonitis virginiensis Rex, Proc. Acad. Phila. 43:391. 1891.
Reported from Colorado by Hagelstein in 1944, p. 145 (12).
Collected in Clear Creek, Gilpin and Larimer counties on dead wood in summer.

ACKNOWLEDGEMENTS

We thank Dr. Constantine J. Alexopoulos for identifying specimens and reading the manuscript; Drs. M. Blackwell, M. S. Gilliam, H. W. Keller, D. T. Kowalski, K. McKnight and E. Nannenga-Bremekamp for identifying specimens and helpful suggestions and Drs. C. T. Rogerson and P. K. Holmgren, New York Botanic Gardens (NYBG), W. A. Weber, University of Colorado (COLO) and R. L. Hartman and P. M. Fazio, University of Wyoming (RM) for the loan of specimens from their herbaria and from the Wilhelm G. Solheim collection.

BIBLIOGRAPHY

1. Alexopoulos, C. J. and J. A. Sáenz. 1975. "The Myxomycetes of Costa Rica." *Mycotaxon* 2(2): 223-271.
2. Angel, K. and D. T. Wicklow. 1975. "Relationships between coprophilous fungi and fecal substrates in a Colorado grassland." *Mycologia* 67(1): 63-74.
3. Anonymous (Kelly, K. L. and D. B. Judd. 1965). "ISCC-NBS color-name charts illustrated with centroid colors." Standard sample #2106. Suppl. to Nat'l. Bur. Standards Circ. 553, U. S. Government Printing Office, Washington, D. C.
4. Blackwell, M. and C. J. Alexopoulos. 1975. "Taxonomic studies in the Myxomycetes IV. Protophysarum phloiogenum, a new genus and species of Physaraceae." *Mycologia* 67(1): 32-37.
5. Braun, K. L. and H. W. Keller. 1976. "Myxomycetes of Mexico I." *Mycotaxon* 3(2): 297-317.
6. Cooke, W. B. 1968. "The 1964 Colorado foray." *Mycologia* 60(5): 1093-1098.
7. Farr, M. L. 1961. "Badhamia decipiens reinstated in Physarum." *Brittonia* 13(4): 339-345.
8. Farr, M. L. 1962. "Arcyria cinerea and A. pomiformis revised." *Mycologia* 54(5): 516-520.
9. Farr, M. L. 1967. "Notes on Myxomycetes." *Mycopathologia et Mycologia Applicata* 31(3/4): 305-313.
10. Farr, M. L. 1974. "Some new myxomycete records from the neotropics and some taxonomic problems in the Myxomycetes." *Proceedings Iowa Academy Sci.* 81(1): 37-40.
11. Farr, M. L. 1976. *Flora neotropica monograph no. 16 Myxomycetes.* New York Botanic Gardens, New York. 304 p.

11a. Farr, M.L. 1979. In press (Nova Hedwigia).
12. Hagelstein, R. 1944. *The Mycetozoa of North America.* Publ. by the author. Mineola, New York. 306 p, 16 pl.
13. Kauffman, C.H. 1921. "The mycological flora of the higher Rockies of Colorado." *Papers Mich. Acad. Sci.* 1: 101-150.
14. Keller, H. W., H. C. Aldrich, T. E. Brooks, and J. D. Schoknecht. 1975. "The taxonomic status of Badhamia ovispora: A Myxomycete with unique spores." *Mycologia* 67(5): 1001-1011.
15. Keller, H. W. and T. E. Brooks. 1976. "Corticolous Myxomycetes IV: Badhamiopsis, a new genus for Badhamia ainoae." *Mycologia* 68(4): 834-841.
16. Kowalski, D. T. 1967. "Observations on the Dianemaceae." *Mycologia* 59(6): 1075-1084.
17. Kowalski, D. T. 1968. "Observations on the genus Lamproderma." *Mycologia* 60(4): 756-768.
18. Kowalski, D. T. 1970. "The species of Lamproderma." *Mycologia* 62(4): 621-672.
19. Kowalski, D. T. 1971. "The genus Lepidoderma." *Mycologia* 63(3): 490-516.
20. Kowalski, D. T. 1973. "Notes on western Myxomycetes." *Madrono* 22(3): 151-153.
21. Kowalski, D. T. 1974. "Notes on two species of Trichia." *Mycologia* 66(2): 369-374.
22. Kowalski, D. T. 1975. "The myxomycete taxa described by Charles Meylan." *Mycologia* 67(3): 448-494.
23. Lister, A. 1925. *A monograph of the Mycetozoa.* (ed. 3 rev. G. Lister), British Museum, London. 296 p, 222 pl.
24. Lister, G. and W. C. Sturgis. 1910. "Two new Mycetozoa." *Journal of Botany* 48:73.
25. Macbride, T. H. 1893. "A new Physarum from Colorado." *Bull. Lab. Nat. Hist. Univ. Iowa* 2:390.
26. Macbride, T. H. 1899. *The North American Slime-Moulds.* Macmillan Co., New York. 231 p, 18 pl.
27. Macbride, T. H. 1922. *The North American Slime-Moulds* (ed. 2). Macmillan Co., New York. 299 p, 23 pl.
28. Macbride, T. H. and G. W. Martin, 1934. *The Myxomycetes.* Macmillan Co., New York. 339 p, 21 pl.
29. Martin, G. W. 1932. "New species of slime-molds." *Journal of the Washington Academy* 22(4): 88-92.
30. Martin, G. W. and C. J. Alexopoulos. 1969. *The Myxomycetes.* University of Iowa Press, Iowa City. 560 p, 41 pl.
31. Sturgis, W. C. 1907. "The Myxomycetes of Colorado." *Colorado College Pubs. Sci. Ser.* 12: 1-43.
32. Sturgis, W. C. 1913. "The Myxomycetes of Colorado, part II." *Colorado College Pubs., Sci. Ser.* 12: 435-454.
33. Sturgis, W. C. 1917. "Notes on new or rare Myxomycetes." *Mycologia* 9(6): 323-333.

MYCOTAXON

Vol. X, No. 2, p. 350 January-March 1980

VALIDATION OF ENTOMOPHTHORA AQUATICA[1]

JOHN F. ANDERSON AND SANDRA L. ANAGNOSTAKIS

Department of Entomology and Department of Genetics, The Connecticut Agricultural Experiment Station, New Haven, Connecticut, 06504, U.S.A.

Entomophthora aquatica infecting larvae and pupae of *Aedes canadensis* and larvae of *Culseta morsitans* was described by Anderson and Ringo (1969), but no holotype was listed. The name is therefore invalid under article 37.1 of the International Code of Botanical Nomenclature. In this note we validate the name by listing below a holotype and referring to the previously published Latin description.

Entomophthora aquatica Anderson & Ringo *ex* Anderson & Anagnostakis[2] sp. nov.
= *Entomophthora aquatica* Anderson & Ringo, J. Invert. Pathol. 13:386. 1969. (invalid, Art. 37.1).
Holotype: on *Aedes canadensis*, June 4, 1968, Granby, Hartford Co., Connecticut (FH).
Paratype: on *Aedes canadensis*, May 25, 1968, Granby, Hartford Co., Connecticut (FH).
Type specimens are microscope slides of hematoxylin-eosin stained sections.

REFERENCE

Anderson, J. F. and S. L. Ringo. 1969. *Entomophthora aquatica* sp. n. infecting larvae and pupae of floodwater mosquitoes. J. Invert. Pathol. 13:386-393.

[1]The authors are grateful to D. H. Pfister for help in preparing this note.

[2]S. L. Ringo = Sandra L. Anagnostakis

MYCOTAXON

Vol. X, No. 2, pp. 351-364 January-March 1980

ANALYSIS OF THE BASIDIUM OF HIGHER BASIDIOMYCETES ON THE BASIS OF GEOMETRICAL DEPENDENCIES

S. P. WASSER AND E. G. BERGER

N. G. Kholodny Institute of Botany, Academy of Sciences Ukrainian SSR, Kiev

SUMMARY

This paper deals with studies of spore-spacing on basidia. The location of sterigmata and spores on basidia is associated with definite constants having a taxonomic trend. We have formulated 4 properties of the basidium new to science: *1.* The ratio of the outer circle and basidium outline diameters is equal to the ratio of the central and inner circles diameters and also to the ratio of the spore outline and sterigmatic patch diameters. *2.* The ratio of the central and inner circles diameters is equal to the ratio of the spore outline and sterigmatic patch diameters. *3.* The ratio of the central circle and spore outline diameters is equal to the ratio of the inner circle and sterigmatic patch diameters. *4.* The sum of the values which are inverse to the coefficients n and q is equal to 1. The data obtained on the basis of studying the geometric dependencies of the basidium and, in particular, the discovery of new parameters permitted us to use them as additional criteria of taxa of different ranks in higher Basidiomycetes.

Studies of higher Basidiomycetes are of great scientific interest as only a few genera have been subjected to critical analysis. At the same time differentiation of species and other taxonomic units as well as elucidation of phylogeny are complicated due to the polymorphism peculiar to them, notably phenomena of parallellism and convergence.

Disputable positions in systematics of species, genera, families and orders of higher Basidiomycetes point to an urgent need to evaluate the existing and to search for new, reliable, objective criteria determining characters of leading significance which are peculiar to taxa of all ranks.

Considerable attention should be given to studies of spores and basidia as they, being the generative organs, are subject to the least extent to the influences of environment. The studies of a few authors (Corner, 1947, 1948, 1950, 1968, 1972; Malençon, 1958; Perreau-Bertrand, 1967) showed that the sizes of spores, sterigmata and basidia are bound by definite constants having species and generic trends. In taxonomic descriptions, however, the sizes of spores, sterigmata and basidia are given independently, though they are interrelated and to a considerable extent depend on the character of the

generative hypha. The accurate establishment of these dependencies may result in one of the most reliable criteria of the species and of the genus in higher Basidiomycetes.

The geometry of spore position on the basidium has species and generic trends. As was stated by Corner (1972, p. 159), "...the problem [of basidial geometry] has loomed continually and is fundamental to the classification of the species [of the genus *Boletus*]."

Analysis of the basidium on the basis of geometrical dependencies opens a new trend in the studies of higher Basidiomycetes. These studies will help us understand the interrelation and interdependence among hymenial elements as well as to answer the question: how is the accuracy of spore-spacing on the basidium explained? And all these data will help to characterize and better evaluate the basidiocarp itself.

The study presented here deals with analysis of the geometrical peculiarities of spore-spacing on the basidium as well as with the basic relations between their sizes in order to use these relations as additional species and generic criteria in higher Basidiomycetes.

Research continues to develop from the investigations of Corner (1972), requiring a study of side and end positions of spores on basidia. To study basidia for geometrical dependencies, clear, accurate photographs of the end and side positions at high magnification showing spore-spacing on the basidia are necessary. Since the basidium cannot be examined simultaneously both in end-view and in side-view, it follows that average parameters must be taken from a set of measurements for each species (from 100 up to 1000), *i.e.*, the data for the "ideal" basidium are obtained.

As most higher Basidiomycetes have four spores on the basidium, the tetrad is considered to be a unit (n=4). The four spores in end-view are considered the angles of a square.* One can imagine the spores located in the square angles to be confined by an outer circle S' (FIG. 1a, 1b), a central circle S'' passing through the centers of the spores and an inner circle S'''. Then there is the real basidium circle (w), the diameter of which equals its maximal width. For the sterigmata, one can imagine a sterigmatic circle (M), passing through the tips of the sterigmata and the sterigmatic patch circle (m) which equals the sterigmata diameter.

Taking into account the law on the forces of electric regulation of free surfaces, this paper is based on the following postulates:

1. Adjacent basidia affect the position of basidiospores.
2. Spore tetrads are not contiguous.
3. Spores in a tetrad are not contiguous but separated from the basidium by sterigmata.
4. Spores of a basidium are at the same level.
5. Spores in a tetrad are arranged uniformly, *i.e.*, at

* If n=3 or n=5 the spores in end-view are considered, respectively, as the angles of an equilateral triangle or of a pentagon.

the same distance from each other.

θ. Mature basidia are separated from each other by the maturing basidia and cystidia.

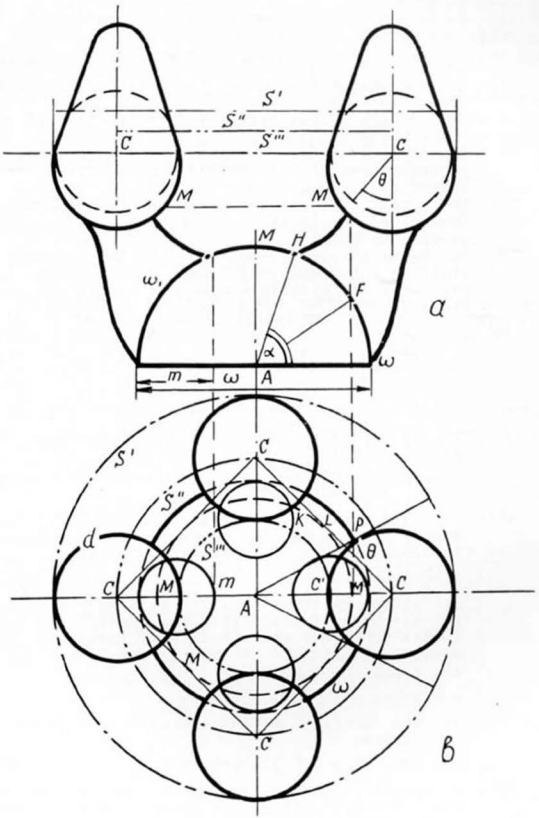


FIG. 1. Geometry of the basidium: a) side-view; b) end-view.

THE GEOMETRY OF THE BASIDIUM

Proceeding from numerous observations, a set of measurements and derivation of averages, it was established that the reciprocal position of sterigmata and spores on the basidium is subject to a scheme which is given in FIG. 1a, 1b (Corner, 1972). We have adopted Corner's designations in this paper to unify our observations.

Let us consider FIG. 1b, the end-view of the basidium:

d - the outline of the spore (the circle with the diameter d);

w - the outline of the basidium (the circle with the diameter w);

S'' - the central circle (the circle with the diameter S'' passing through the centers of the outlines of the spores);

S' - the outer circle (the circle with the diameter S', embracing the spores outlines, *i.e.*, externally tangential to them);

S''' - the inner circle (the circle with the diameter S''' limiting the "dead space" over the basidium, *i.e.*, the circle internally tangential to the spores outlines);

Obviously, then

$$S' = S'' + d \qquad (1)$$

$$S''' = S'' - d \qquad (2)$$

whence $S' + S''' = 2S''$, $S' - S''' = 2d$ (3), (4)

δ - the angle between the axis AC and tangential to the spore outline;

$$\sin \delta = \frac{PC}{AC} = \frac{2PC}{2AC} = \frac{d}{S''} \qquad (5)$$

M - the sterigmata circle (the circle with the diameter M passing through the sterigma tips); numerous measurements of Corner (1972) showed that

$$M = S'' - 0.7d \qquad (6)$$

m - sterigmata patch (the circle of diameter m which is a projection of the sterigmata base). By the hypothesis of Corner the circle m is inside the circle w being tangential to the circle w and straight line AP, *i.e.*,

$$m = S''' \cdot \sin \delta = d(1 - \sin \delta) \qquad (7)$$

and the center C' of the circle m lies on the circle S''', whence

$$w = S''' + m = S''' (1 + \sin \delta) \qquad (8)$$

$\overline{CC}$ - a segment connecting the spore circles centers; K and L - transverse points of this segment with the spores outlines;

$\overline{KL}$ - the shortest distance between the spores;

θ - the angle of the spore (the angle $\underline{CLM}$).

Let us now consider FIG. 1a,* the side view of the basidium.

ω_1 - outline of the basidium-apex. According to Corner (1972) the basidium-apex is an ellipsoid with a small spherical dome. Therefore ω_1 is an oval. Since prior to formation of a hyaline "cap" the basidium has a hemisphaerical apex, then in subsequent calculations the semicircle with the diameter ω is taken approximately as the ω_1 outline.

$\smile HF\omega$ - the arc on the outline of ω_1 which limits the sterigmata base;

α - the central angle, corresponding to the arc $HF\omega$.

It follows from the diagram that

$$\cos \alpha = \frac{S''' - m}{\omega} \tag{9}$$

or after the substitution (8)

$$\cos \alpha = \frac{S''' - m}{S''' + m} \tag{10}$$

The line M-M, projecting the sterigma circle M, crosses the arc $H\omega$ at the point F, dividing this arc into two parts (Corner, 1972), *i.e.*,

$\angle \omega AF = \frac{\alpha}{2}$, whence

$$M = \omega \cdot \cos\frac{\alpha}{2} = \omega\sqrt{\frac{1 + \cos \alpha}{2}} \tag{11}$$

The coefficient σ is introduced for the characteristic of spore position in the tetrad (Corner, 1972) which equals the ratio of the shortest distance between the spores, *i.e.*,

$$\sigma = \frac{KL}{CK + LC} = \frac{KL}{d} \tag{12}$$

Subsequently on the basis of (1) - (12) and the geometry of FIG. 1a, 1b, formulae are derived which determine the parameters of the basidium as functions σ, δ and α (TABLE I). By means of these formulae different geometrical ratios between the tetrad parameters may be deduced. In Corner's (1972) work, on the basis of the formulae in TABLE I, one obtains

$$\frac{S'}{S''} = 1 + \sin \delta \tag{13}$$

$$\frac{S'''}{S''} = 1 - \sin \delta \tag{14}$$

$$\cos \alpha = \frac{S'''}{S'} \tag{15}$$

---

* Only two extreme sterigmata with the spores are shown for the purpose of reading the diagram in FIG. 1a.

TABLE I

FORMULAE DETERMINING PARAMETERS OF THE BASIDIUM AS FUNCTIONS σ, δ AND α

Argument / Parameter	σ	δ	α
I	2	3	4
S''	$S'' = d\sqrt{2}\ (1 + \sigma)$ (22)	$S'' = \frac{d}{\sin\delta} = d\ \mathrm{cosec}\ \delta$ (23)	$S'' = d\,\frac{1 + \cos\alpha}{1 - \cos\alpha}$ (24)
S'	$S' = d\sqrt{2}\ (1 + \sigma) + d$ (25)	$S' = d\,\frac{1 + \sin\delta}{\sin\delta}$ (26)	$S' = \frac{2d}{1 - \cos\alpha}$ (28)
		$S' = d\ (1 + \mathrm{cosec}\ \delta)$ (27)	
S'''	$S''' = d\sqrt{2}\ (1 + \sigma) - d$ (29)	$S''' = d\,\frac{1 - \sin\delta}{\sin\delta}$ (30)	$S''' = 2d\,\frac{\cos\alpha}{1 - \cos\alpha}$ (32)
		$S''' = d\ (\mathrm{cosec}\ \delta - 1)$ (31)	
M	$M = d[\sqrt{2}\ (1 + \sigma) - 0.7]$ (33)	$M = d\ (\mathrm{cosec}\ \delta - 0.7)$ (35)	$M = 4d\,\frac{\cos\alpha}{\sin^2\alpha} \cdot \cos\frac{\alpha}{2}$ (38)
	$M = d(\kappa - 1)\sqrt{\frac{\kappa + 1}{\kappa}}$,	$M = d \cdot \mathrm{ctg}\ \delta \cdot \cos\delta \cdot \sqrt{\frac{1}{1 + \sin\delta}}$ (36)	$M = \frac{2\sqrt{2}\ d \cdot \cos\alpha}{(1 - \cos\alpha)\sqrt{1 + \cos\alpha}}$ (39)
	where $\kappa = \sqrt{2}\ (1 + \sigma)$ (34)	$M = d\left(\frac{1}{\sin\delta} - \sin\delta\right)\sqrt{\frac{1}{1 + \sin\delta}}$ (37)	
m	$m = d\,\frac{\sqrt{2}\ (1 + \sigma) - 1}{\sqrt{2}\ (1 + \sigma)}$ (40)	$m = d(1 - \sin\delta)$ (41)	$m = 2d\,\frac{\cos\alpha}{1 + \cos\alpha}$ (42)
w	$w = d\,\frac{2(1 + \sigma)^2 - 1}{\sqrt{2}\ (1 + \sigma)}$ (43)	$w = d \cdot \mathrm{ctg}\ \delta \cdot \cos\delta$ (44)	$w = 4d\,\frac{\cos\alpha}{\sin^2\alpha}$ (45)
σ	σ	$\sigma = \frac{\mathrm{cosec}\ \delta}{\sqrt{2}} - 1$ (46)	$\sigma = \frac{1 + \cos\alpha}{\sqrt{2}\ (1 - \cos\alpha)} - 1$ (47)

δ	$\sin\delta = \frac{1}{\sqrt{2}\ (1+\sigma)}$	(48)	$\sin\delta = \frac{1-\cos\alpha}{1+\cos\alpha}$ (49)
α	$\cos\alpha = \frac{\sqrt{2}\ (1+\sigma) - 1}{\sqrt{2}\ (1+\sigma) + 1}$	(50)	α
θ	$\sin\theta = \kappa - (\kappa - 1)\sqrt{\frac{\kappa+1}{\kappa}}$, where $\kappa = \sqrt{2}\ (1+\sigma)$	(53)	

δ	$\tg^2\frac{\alpha}{2} = \sin\delta$	(51)	$\sin\theta = (1+\cos\alpha)^2 - 4\cos\alpha\cdot\cos^2\frac{\alpha}{2}$ (55)
	$\cos\alpha = \frac{1-\sin\delta}{1+\sin\delta}$	(52)	$\sin^2\alpha$
	$\sin\theta = \operatorname{cosec}\delta - \frac{\cos^2\delta}{\sin\delta}\sqrt{\frac{1}{1+\sin\delta}}$	(54)	

$$\cos\frac{\alpha}{2} = \sqrt{\frac{S''}{S'}} \tag{16}$$

$$\sin\delta = \frac{S'' - M}{S''\cdot\sin\theta}\ , \text{ or}$$

$$\sin\theta = \frac{S'' - M}{S''\cdot\sin\delta} = \frac{S'' - M}{d} \tag{17}$$

whence
$$d = \frac{S'' - M}{\sin\theta} \tag{18}$$

$$M = w\sqrt{\frac{S''}{S'}} = S'''\sqrt{\frac{S'}{S''}} \tag{19}$$

$$w = \frac{S'\cdot S'''}{S''} \tag{20}$$

$$w\cdot S'' = S'\cdot S''' \tag{21}$$

DEDUCTION OF NEW RATIOS BETWEEN THE BASIDIUM PARAMETERS

Let us, however, note that the coefficient $\sigma\frac{KL}{d}$ introduced in Corner's (1972) work is not convenient from the point of view of carrying out measurements, as it calls for measurement of the segment KL, which is difficult to realize in practice. Besides, use of σ as an argument results in complex formulae for determining the parameters of the basidium (see TABLE I).

Proceeding from this, let us introduce the following coefficients:

a) for characteristics of spore distribution on the basidium we shall use the coefficient n, which is equal to the ratio of the central circle diameters and the spore outline, *i.e.*,

$$n = \frac{S''}{d}$$

b) for determining the ratios between the basidium parameters we shall introduce the coefficient q, which is equal to the ratio of the outer circle diameters and the basidium outline, *i.e.*,

$$q = \frac{S'}{w}$$

The main peculiarity of these coefficients is the simplicity of measuring all the constituent values as well as using the "real" outlines d and w, *i.e.*, the outlines easily observable and mea-

surable under the microscope and on basidium photographs.

On the basis of these coefficients we obtain new formulae for determination of all geometrical parameters of the basidia (TABLE II).

TABLE II

FORMULAE DETERMINING GEOMETRICAL PARAMETERS OF THE BASIDIUM AS FUNCTIONS n AND q

Argument / Parameter	n		q	
S''	$S'' = d \cdot n$	(56)	$S'' = d\,\frac{q}{q-1}$	(57)
S'	$S' = d(n+1)$	(58)	$S' = w \cdot q = d\,\frac{2q-1}{q-1}$	(59)
S'''	$S''' = d(n-1)$	(60)	$S''' = \frac{d}{q-1}$	(61)
M	$M = d(n-1)\sqrt{\frac{n+1}{n}}$	(62)	$M = \frac{d}{q+1}\sqrt{\frac{2q-1}{q}}$	(63)
m	$m = d\,\frac{n-1}{n}$	(64)	$m = \frac{d}{q}$	(65)
w	$w = d\,\frac{n^2-1}{n}$	(66)	$w = d\,\frac{2q-1}{q(q-1)}$	(67)
$\sin\delta$	$\sin\delta = \frac{1}{n}$	(68)	$\sin\delta = \frac{q-1}{q}$	(69)
$\cos\alpha$	$\cos\alpha = \frac{n-1}{n+1}$	(70)	$\cos\alpha = \frac{1}{2q-1}$	(71)
$\sin\theta$	$\sin\theta = n-(n-1)\sqrt{\frac{n+1}{n}}$	(72)	$\sin\theta = \frac{q-\sqrt{\frac{2q-1}{q}}}{q-1}$	(73)
n	n		$n = \frac{q}{q-1}$	(74)
q	$q = \frac{n}{n-1}$	(75)	q	

The simplicity of the formulae obtained permits easily finding new ratios between the basidial parameters. For example, from (65) we have $q = \frac{d}{m}$ and from (57) and (61) we obtain $q = \frac{S''}{S'''}$, *i.e.*, $q = \frac{S}{w} = \frac{S''}{S'''} = \frac{d}{m}$ (76)

whence the following properties of basidia are formulated:

1. The ratio of the outer circle and basidium outline diameters is equal to the ratio of the central and inner circles diameters and also to the ratio of the spore outline and sterigmatic patch diameters.

2. The ratio of the central and inner circles diameters is equal to the ratio of the spore outline and sterigmatic patch diameters.

3. The ratio of the central circle and spore outline diameters is equal to the ratio of the inner circle and sterigmatic patch diameters.

The coefficient n may also be expressed by the product of ratios of sterigmatic circle, basidium outline and sterigmatic patch diameters in a form

$$n = \frac{M}{w} \cdot \frac{M}{m} \qquad (77)$$

which follows from formulae (62), (64) and (66). And from (77) and (19)

$$n = \frac{w}{m} \cdot \frac{S''}{S'} \text{ , or } \quad n = \frac{S'''}{m} \cdot \frac{S'''}{w} \cdot \frac{S'}{S''} \qquad (78), (79)$$

From (74) and (75) it follows:

$$\frac{1}{n} + \frac{1}{q} = 1 \qquad (80)$$

4. The sum of the values which are inverse to the coefficients n and q is equal to 1.

If in (80) we substitute n and q by their values according to (76), (77), etc., we shall obtain a set of new ratios among the basidial parameters. Thus, using functional dependencies represented in TABLE II, we can obtain new ratios, such as (76) - (80) as well as

$$\frac{S'}{d} = \frac{w}{m} \; ; \quad \frac{S'}{w} = \frac{S''}{S'''} \; ; \quad M^2 = w \cdot S'' \qquad (81), (82), (83)$$

and others, each of them expressing a definite geometrical property of the basidia.

Consequently the study of basidial geometry permits determining many of their properties by simple mathematical operations accessible to the mycologist who has forgotten the elements of higher mathematics.

DETERMINATION OF THE BASIDIAL PARAMETERS

Let us determine the parameters of the basidium in the function n. The limits of measuring n we shall establish from 1.5 to 5.0 as n is the value inverse to sin δ and the angle δ can change within the limits of 45°-10° according to Corner (1972).

1. For determining S', S'', S''' we shall use formulae (56), (58) and (60). These values may also be found graphically, as is demonstrated in FIG. 2. Let us draw the number

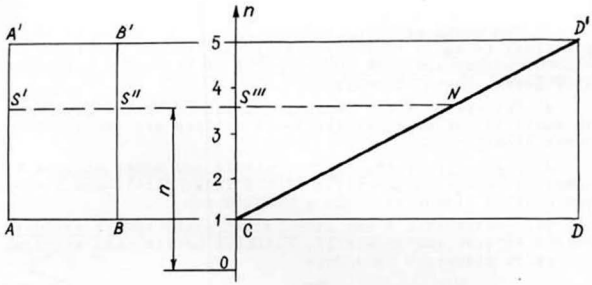


FIG. 2. Graphic plotting for determination of S', S'', S'''.

axis n and in the selected design scale from the point C on the mark $n=1$ lay the segments $CB=d$, $CA=2d$ and $CD=4d$. Through the points obtained, A, B and D, draw the vertical straight line up to the mark $n=5$. Connect the points C and D'. If we lay the arbitrary value n from 0 and draw a horizontal straight line, its intersection with the straight lines AA', BB' and CD' will determine the segments $NS'''=S'''$, $NS''=S''$, $NS'=S'$.

2. The value m is determined according to formula (64). Graphic determination of m is shown in FIG. 3. Let us draw the number axis n and in the selected scale of the design construct the isosceles right triangle CAB in such a way that $\overline{CA}=\overline{AB}=d(\overline{OC}=1)$. If we lay from 0 the arbitrary value $n(ON=n)$ and draw the straight line CN, its intersection with the straight line AB determines the segment $\overline{BN''}=m$.

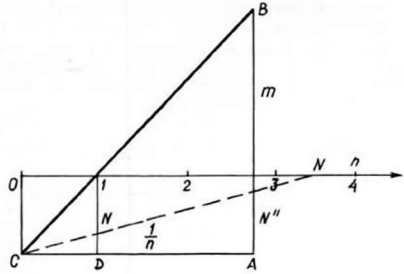


FIG. 3. Graphic plotting for determination of m and sin δ.

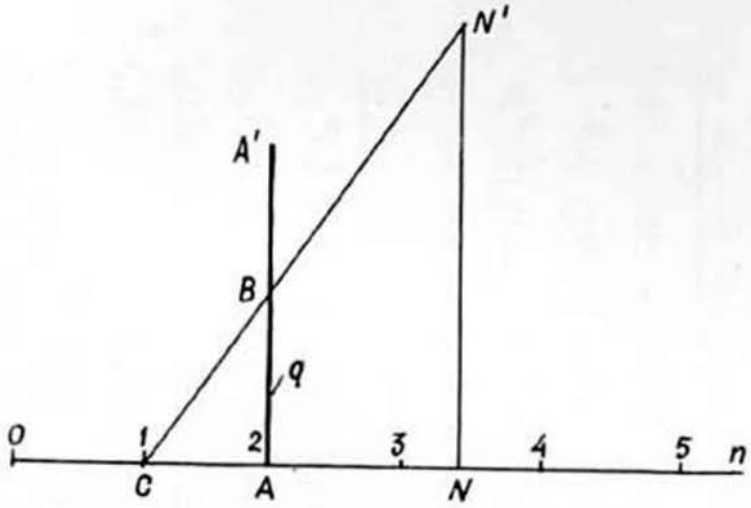


FIG. 4. Graphic plotting for determination of M.

3. The value of sin δ is determined according to formula (68). The preliminary plotting may also be used for graphic determination of sin δ. The straight line CN (FIG. 3) crosses the vertical straight line ID at the point N' in such a way that $\overline{DN'} = \sin\delta$.

4. It is convenient to determine the value w according to formula (8). Under these conditions w is determined graphically by the simple addition of the segments S''' and m, *i.e.*, if we lay the sections $AD=S'''$ and $DC=m$, the segment $AC=w$ (FIG. 4).

5. FIG. 4 shows graphic determination of the value M. Lay $AB=S'''$ and construct the semicircle on the segment BC, as on the diameter. Its intersection with the vertical straight line AM will determine the segment $\overline{AM}=m$. This corresponds to the determination of the value M according to formula (83).

6. The value q is determined by formula (75). Its graphic determination is shown in FIG. 5. The points $C(\overline{OC}=1)$, $A(\overline{OA}=2)$ are marked on the number axis n and the vertical straight line AA' is drawn. If we lay the arbitrary segments $ON=NN'=n$, the straight lines AA' and CN' cross at point B in such a way that $AB=q$.

7. Graphic determination of cos α is shown in FIG. 6a, 6b.

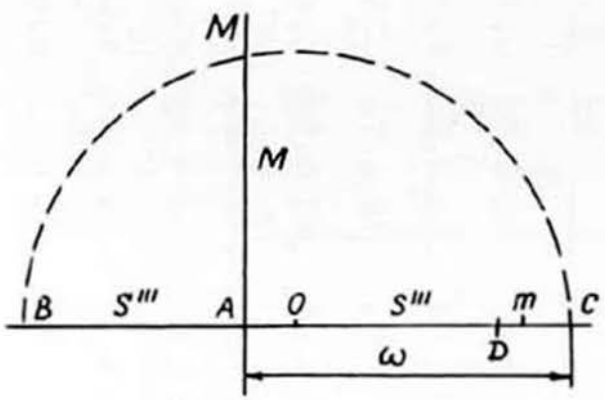


FIG. 5. Graphic plotting for determination of q.

TABLE III

NUMERICAL VALUES OF THE BASIDIAL PARAMETERS IN FUNCTION d AND n

n	S'	S''	S'''	m	$\sin\delta$	δ	w	M	q	$\cos\alpha$	α	$\sin\theta$	θ
1.5	2.5d	1.5d	0.5d	0.3333d	0.6666	41°48′	0.8333d	0.645d	3.0000	0.2000	78°29′	0.855	58°46′
1.6	2.6d	1.6d	0.6d	0.3750d	0.6255	38°42′	0.9750d	0.965d	2.6666	0.2308	76°39′	0.835	56°37′
1.7	2.7d	1.7d	0.7d	0.4118d	0.5881	36°1′	1.1180d	0.885d	2.4285	0.2593	74°58′	0.815	54°36′
1.8	2.8d	1.8d	0.8d	0.4444d	0.5555	33°45′	1.2444d	0.999d	2.2500	0.2857	73°24′	0.801	53°14′
1.9	2.9d	1.9d	0.9d	0.4737d	0.5263	31°45′	1.3737d	1.120d	2.1111	0.3103	71°53′	0.780	51°18′
2.0	3.0d	2.0d	1.0d	0.5000d	0.5000	30°	1.5000d	1.225d	2.0000	0.3333	70°32′	0.775	50°48′
2.5	3.5d	2.5d	1.5d	0.6000d	0.4000	23°35′	2.1000d	1.770d	1.6666	0.4286	64°37′	0.730	46°54′
3.0	4.0d	3.0d	2.0d	0.6666d	0.3333	19°28′	2.6666d	2.308d	1.5000	0.5000	60°	0.692	43°48′
3.5	4.5d	3.5d	3.5d	0.7143d	0.2857	16°36′	3.2143d	2.830d	1.4000	0.5555	56°15′	0.670	42°40′
4.0	5.0d	4.0d	3.0d	0.7500d	0.2500	14°28′	3.7500d	3.354d	1.3333	0.6000	53°6′	0.646	40°15′
4.5	5.5d	4.5d	3.5d	0.7777d	0.2222	13°50′	4.2777d	3.871d	1.2857	0.6364	50°29′	0.629	38°58′
5.0	6.0d	5.0d	4.0d	0.8000d	0.2000	11°32′	4.8000d	4.380d	1.2500	0.6666	48°12′	0.620	38°19′

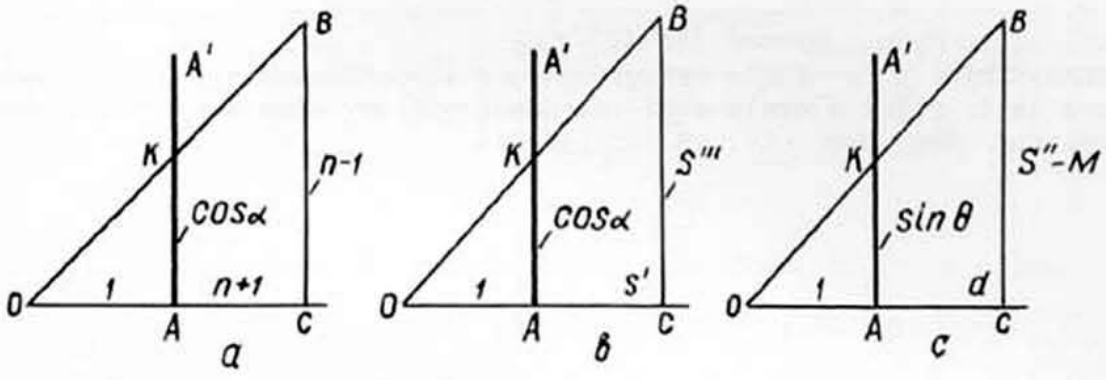


FIG. 6. Graphic plotting for determination of cos α (a, b) and sin θ (c).

In the design scale we construct the right triangle OBC in such a way that OC=n+1, BC=n-1 (FIG. 6a), and through the point A($\overline{OA}$=1) draw the vertical straight line AA'. The intersection of this straight line with the hypotenuse of the triangle determines the point K in such a way that $\overline{AK}$=cos α according to formula (70). Under these conditions the segments OC and BC must be laid equal to OC=S', BC=S''' (FIG. 6b).

8. If in the preliminary plotting we lay the segments OC=d and BC=S''-M (FIG. 6c), the intersection of the hypotenuse of triangle OBC with the straight line AA' will determine the segment $\overline{AK}$=sin θ. This plotting corresponds to the determination of sin θ according to formula (17). The numerical values of the basidial parameters in the function d and n are presented in TABLE III.

CONCLUSION

The investigations carried out show that the introduction of the mathematical apparatus opens interesting and reassuring prospects for studying the basidia of higher Basidiomycetes on the basis of geometrical dependencies and, in particular, in opening a number of new parameters having specific and generic implications. The task of further investigations is to determine the application of the established ratios for the ideal basidium as criteria of species, genus and, probably, family in a great number of representatives of higher Basidiomycetes.

LITERATURE CITED

CORNER, E.J.H. 1947. Variation in the size and shape of spores, basidia and cystidia in Basidiomycetes. *New Phytol.* 46: 195-228.

CORNER, E.J.H. 1948. Studies in the basidium. I. The ampoule effect, with a note on nomenclature. *New Phytol.* 47: 22-51.

CORNER, E.J.H. 1950. A monograph of *Clavaria* and allied genera. *Ann. Bot. Mem.* 1: 1-740.

CORNER, E.J.H. 1968. A monograph of *Thelephora* (Basidiomycetes). *Beih. Nova Hedwigia* 27: 1-110.

CORNER, E.J.H. 1972. Studies in the basidium: spore-spacing and the *Boletus* spore. *Gard. Bull. Straits Settlem. (Singapore)* 26: 159-192.

MALENÇON, G. 1958. Le développement des spores chez les Phylactériés.

Bull. Soc. Mycol. France 74: 423-435.
PERREAU-BERTRAND, J. 1967. Recherches sur la différenciation et la structure de la paroi sporale chez les Homobasidiomycètes à spores ornées. *Ann. Sci. Nat. Bot.* sér. 12, 8: 639-745.

MYCOTAXON

Vol. X, No. 2, pp. 365-368 January-March 1980

Absconditella duplicella and *Cryptodiscus rutilus*: Additions to the Ostropalean Fungi

Amy Y. Rossman*

Plant Pathology Herbarium, Cornell University
Ithaca, New York 14853 USA

During a recent study of *Calonectria* type specimens, two species were found to be related to the ostropalean fungi. These were transferred without descriptions to more appropriate genera in a preceding publication (Rossman, 1979). As yet, these species are known only from the type specimens. Because the specimens are scanty, descriptions and illustrations of *Absconditella duplicella* and *Cryptodiscus rutilus* are given below.

ABSCONDITELLA DUPLICELLA (Nyl.) Rossm., Mycotaxon 8:505. 1979. Figure 1.

≡ *Calonectria duplicella* (Nyl.) Karst., Bidrag. Kännedom Finlands Natur Folk 23:218. 1873.

≡ *Sphaeria duplicella* Nyl., Not. Sällsk. Fauna Fl. Fenn. Förh. 10:89. 1868.

Holotype: Finland. In Lapponia orientali extrema, ad Ponoi, supra caespites Jungermanniarum, N. I. Fellman. (H). Additional isotype slides deposited at FH.

ASCOCARPS scattered, solitary, sessile, superficial on bleached, matted area about 1 cm^2, without evident lichen thallus, apothecioid, fleshy, doliform with raised margins, 190-270 µm diam x 160-250 µm tall, ascocarp margins white, sunken hymenial disc orange.

ASCOCARP MARGIN 45-50 µm wide, non-crystalline, composed of cells forming textura intricata, cells 1.5 µm diam, cells compact in middle becoming more loosely intertwined toward margin; subhymenium 15-20 µm thick, composed of irregularly-shaped cells, up to 5 µm diam, forming textura angularis.

PARAPHYSES numerous, filiform, unbranched, hooked at apices, about 1 µm diam, nonseptate, exceeding asci in length by about 10 µm, slightly inflated near apical 7-10 µm, up to 2 µm wide, apices clavate or tapering to rounded ends.

*Present address: Cryptogamic Herbarium, New York Botanical Garden, Bronx, New York 10458.

ASCI unitunicate, cylindric to slightly obclavate, 90-110 x 19-21 µm, with distinctly thickened apices, up to 7.5 µm thick in immature asci, I-, asci arising in an even layer from basal tissue.

ASCOSPORES broadly clavate-fusiform with rounded ends, 40-44 x 8-10 µm, 3-, rarely 4-, septate, slightly constricted at each septum, hyaline, smooth, thin-walled, 2 or 4 per ascus, overlapping monostichous.

This species has asci each with a thickened apex characteristic of the Ostropales. *Absconditella duplicella* does not have a distinct lichen thallus, but based on all other characters, it is best placed in the lichen genus *Absconditella*. Although included in the Gyalectaceae by Vězda (1965), Sherwood (1977) suggests that "*Absconditella* is strikingly similar to *Cryptodiscus* and is accepted as Ostropalean...". The type of the genus, *Absconditella sphagnorum* Vězda & Poelt, occurs on moss and has a poorly developed thallus. Unlike *A. sphagnorum* and other species of *Absconditella*, *A. duplicella* lacks a thallus and has asco:rps which become completely superficial at maturity. In addition, the ascospores of *A. duplicella* are multiseptate and larger than those of *A. sphagnorum*.

CRYPTODISCUS RUTILUS (Kirschst.) Rossm., Mycotaxon 8:541. 1979. Figure 2.
≡ *Calonectria rutila* Kirschst., Ann. Mycol. 37:116. 1939.

Holotype: Germany. Wald bei Rathenow. a. d. H. Auf morschem Kieferholz. (B). Isotype slides deposited at NY.

ASCOCARPS scattered, solitary, at first completely immersed, becoming erumpent and eventually almost entirely superficial with only the base immersed, apothecioid, when immature, closed, appearing perithecioid, small, 250-305 µm diam, about 110 µm tall, red-orange to orange, becoming scarlet on drying.

ASCOCARP MARGIN 25-40 µm becoming narrower at base, raised, slightly scurfy externally but non-crystalline, composed of small, indistinct cells forming textura angularis, tissue immediately surrounding the hymenium orange, pigmentation apparently part of cytoplasm, cells walls only slightly thickened, up to 0.5 µm, outermost layer of cells hyaline.

PARAPHYSES numerous, filiform, unbranched, 0.5-0.5 µm diam, nonseptate, often inflated up to 2 µm diam at apex.

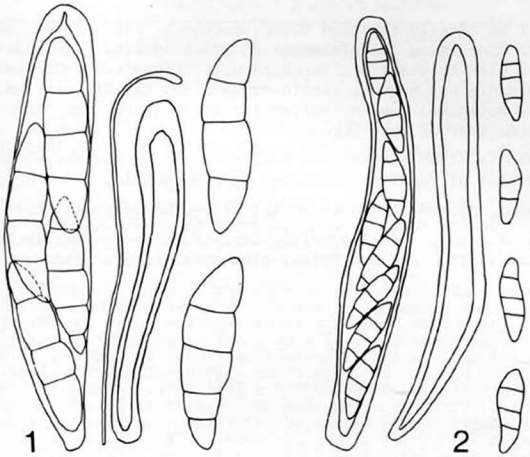


Figure 1. *Absconditella duplicella* ascus, paraphysis, immature ascus, and ascospores. 1000 x. Figure 2. *Cryptodiscus rutilus* ascus, immature ascus, and ascospores. 1000 x.

ASCI unitunicate, cylindric to slightly obclavate, 56-68 x 6-8 µm, with apices thickened, up to 5 µm, and penetrated by a narrow pore in immature asci, I-, walls of asci thickened about 2 µm at maturity and remaining so after spore discharge, asci arising in an even layer from basal tissue.

ASCOSPORES ovoid-ellipsoid, 12-16 x 4-5 µm, distinctly 2- to 3-septate, not constricted at each septum, hyaline, smooth, thin-walled, eight spores per ascus, monostichous but sometimes distichous toward base of ascus.

The holotype specimen consists of one piece of very rotten, decorticated pine wood. Numerous small ascocarps of *Cryptodiscus rutilus* are present. The apothecial margin encloses the hymenium of immature ascocarps thus they appear perithecioid. The thickened ascal apex is penetrated by a narrow pore when immature suggesting placement in the Ostropales. Although all other species of *Cryptodiscus* are almost completely immersed in the substrate, even at maturity, *C. rutilus*, with ascocarps which become superficial, is best accommodated in this genus.

I am greatly indebted to Dr. Martha A. Sherwood for her advice concerning the placement of these species. In addition I wish to thank Dr. Burghard Hein, Botanischer Garten und Botanisches Museum, Berlin-Dahlem, and the Director and Staff, Botanical Museum, University of Helsinki, for the generous loan of type specimens.

Rossman, A. 1979. Mycotaxon 8:485-558. A preliminary account of the taxa described in *Calonectria*.

Sherwood, M. 1977. Mycotaxon 5:1-277. The ostropalean fungi.

Vězda, A. 1965. Preslia 37:237-245. Flechtensystematische Studien II. *Absconditella*, eine neue Flechtengattung.

MYCOTAXON

Vol. X, No. 2, pp. 369-371 January-March 1980

FILAMENTOUS FUNGI ASSOCIATED WITH LEAF SURFACES OF RED ALDER AND DOUGLAS FIR SEEDLINGS IN WESTERN OREGON

Amy Y. Rossman and K. C. Lu*

Forest Service, U. S. Department of Agriculture
Pacific Northwest Forest and Range Experiment Station
Forestry Sciences Laboratory
Corvallis, Oregon 97331

During a study of the effects of ozone on leaf-surface microorganisms of red alder [*Alnus rubra* Bong.] and Douglas fir [*Pseudotsuga menziesii* (Mirb.) Franco] seedlings, many species of filamentous fungi were isolated and identified. No other study of red alder leaf-surface fungi has been made. Douglas fir needle-surface fungi were examined *in situ* by Bernstein & Carroll (1973) and Sherwood & Carroll (1974). Using cultural techniques the endophytic fungi of conifer needles including Douglas fir have been enumerated by Bernstein & Carroll (1977), Carroll, *et al.* (1977) and Carroll & Carroll (1978). Most of the fungi listed below have not been previously reported from this habitat.

Filamentous fungi were isolated from leaf surfaces of two year Douglas fir seedlings obtained from a local nursery and two year red alder seedlings which had been transplanted from their natural habitat. All plants were grown in chambers through which ozone was continuously blown at concentrations of 0, 5, 10 and 20 parts per hundred million. Red alder was sampled monthly throughout the growing season from 3 May 1975-3 November 1975 while Douglas fir was sampled from 3 May 1975-13 January 1976. Although both first and second year needles were used in the study, this age difference was not considered significant at the time and the data were pooled. Fresh tissue was washed twice in 0.1% Tween 20 and rinsed in sterile water. Serial dilutions of wash water were incorporated into Cooke Rose Bengal agar (Difco-Bacto), 2% malt agar (Difco-Bacto) and 2% soil extract agar (Difco-Bacto made with 500 ml water percolated through 75 g forest soil). Washed leaves (4 mm^2) and whole needles were placed on the same three kinds of media. After ten days filamentous fungi were subcultured, as they grew through the agar or from the tissue, and identified.

The following list of filamentous fungi is presented as base data for future work on the effects of air pollutants on the phyllosphere flora. Table I lists the filamentous fungi associated with leaf surfaces either actively or inactively as resting propagules. *Aureobasidium pullulans* was isolated most frequently from both red alder and Douglas fir, often

*Presently at the New York Botanical Garden, Bronx, NY 10458.

occurring on 100% of the samples. All species listed were isolated at least twice. No attempt was made to identify the *Penicillium* species; many isolates produced only sterile mycelium.

TABLE I.

	Red Alder	Douglas Fir
Acremonium strictum W. Gams	X	-
Alternaria alternata (Fr.) Keissler	X	X
Arthrinium arundinis (Corda) Dyko & Sutton	X	-
Aspergillus clavatus Desm.	-	X
A. niger Van Tiegh	X	X
Aureobasidium pullulans (De Bary) Arnaud	X	X
Botrytis cinerea Pers. ex Pers.	X	X
Chaetomium cochliodes Palliser	X	-
C. elatum Kunze ex Fr.	-	X
C. funicolum Cooke	X	X
Cladobotryum verticillatum (S. F. Gray) Hughes	-	X
**Cladosporium cladosporioides* (Fresen) De Vries	X	X
**C. herbarum* (Pers.) Link ex S. F. Gray	X	X
C. macrocarpum Preuss.	X	X
**C. oxysporum* Berk. & Curt.	X	X
C. sphaerospermum Penz.	X	X
Curvularia lunata (Wakker) Boedijn	X	-
Cylindrocarpon obtusisporum (Cooke & Hark.) Wollenw.	-	X
Dinemasporium sp.	-	X
Emericella nidulans (Eidam) Vuill.	X	-
**Epicoccum purpurascens* Ehrenb. ex Schlecht.	X	-
Fusarium arthrosporioides Sherb.	X	-
F. tabacinum (Beyma) W. Gams	-	X
Gelasinospora tetrasperma Dowding	X	-
Gelatinosporium sp.	-	X
Geniculisporium sp.	X	-
Gliosporium sp.	X	-
Humicola fuscoatra Traaen	X	X
**Khuskia oryzae* Hudson	-	X
Melanconium sp.	-	X
Memnoniella echinata (Riv.) Falloway	X	X
Monocillium sp.	X	-
Monodictys castaneae (Wallr.) Hughes	-	X
Monodictys sp.	X	-
Monochaeta sp.	-	X
Mortierella ramanniana (Moel.) Linn. var. *angulispora* (Naumov) Linnemann	X	X
Nodulisporium sp.	X	X
Neurospora sitophila Shear & Dodge	X	-
Penicillium spp.	X	X
Pestalotia cfr. *clavispora* Atk.	-	X
P. microspora Sacc.	X	-
P. vaccinii (Shear) Guba	-	X
Phialophora hoffmannii (Beyma) Schol-Schwarz	X	X
P. verrucosa Medlar	X	-
Phoma glomerata (Corda) Wollenw. & Hochapf.	-	X
P. herbarum Westend.	-	X

Table I. (continued)	Red Alder	Douglas Fir
Rhizopus sp.	-	X
Scopulariopsis asperula (Sacc.) Hughes	X	-
S. brevicaulis (Sacc.) Bain.	X	X
S. brumptii Salvanet-Duval	X	-
Scytalidium lignicola Pesante	X	X
Selenophoma sp.	-	X
Septonema chaetospira (Grove) Hughes	-	X
Sordaria fimicola (Roberge) Ces. & De Not.	-	X
S. minima Sacc. & Speg.	-	X
Stephanosporium ceralis (Thüm.) Swart	-	X
Talaromyces luteum (Zukal) Benj.	X	-
Trichocladium asperum Harz	X	-
Trichoderma viride Pers. ex Fr.	X	-
Trichothecium roseum Link ex Fr.	X	X
**Ulocladium botrytis* Preuss.	X	X
U. chartarum (Preuss.) Simmons	X	X
Varicosporium sp.	-	X

*Previously reported to occur on Douglas fir needle surfaces (Sherwood & Carroll, 1974).

Acknowledgements

This project was financed in part with federal funds from the United States Environmental Protection Agency under Interagency Agreement No. IAG-D5-F469. The contents do not necessarily reflect the views and policies of the E. P. A., nor does mention of trade names or commercial products constitute endorsement for use.

References Cited

Bernstein, M. E. & G. C. Carroll, 1977. Internal fungi in old-growth Douglas fir foliage. Can. J. Bot. 55:644-653.

Bernstein, M. E., H. M. Howard & G. C. Carroll, 1973. Fluorescence microscopy of Douglas fir foliage epiflora. Can. J. Microbiology 19:1129-1130.

Carroll, G. C. & F. E. Carroll, 1978. Studies on the incidence of coniferous needle endophytes in the Pacific Northwest. Can. J. Bot. 56:3034-3043.

Carroll, R. E., E. M. Müller & B. C. Sutton, 1977. Preliminary studies on the incidence of needle endophytes in some European conifers. Sydowia 29:87-103.

Sherwood, M. A. & G. Carroll, 1974. Fungal succession on needles and young twigs of old-growth Douglas fir. Mycologia 66:499-506.

MYCOTAXON

Vol. X, No. 2, pp. 372-374 January-March 1980

NOTES ON HYPHOMYCETES. XXXIII. *STACHYBOTRYS SPHAEROSPORA* SP. NOV. FROM SOUTH AFRCIA

G. Morgan-Jones

Department of Botany and Microbiology
Auburn University Agricultural Experiment Station
Auburn, Alabama 36830, U.S.A.

and

Robert C. Sinclair

Department of Botany
University of Pretoria, Pretoria 0002, South Africa

ABSTRACT

Stachybotrys sphaerospora Morgan-Jones and Sinclair is described and illustrated from a collection made on decorticated wood in South Africa.

INTRODUCTION

During the course of collecting microfungi on decaying decorticated wood at Golden State Highlands National Park, Orange Free State, South Africa, material was obtained of a species of *Stachybotrys* Corda which has subsequently been determined to represent an undescribed taxon. The fungus, which has been isolated in pure culture, resembles *S. chartarum* (Ehrenb. ex Link.) Hughes, the type species, in a number of respects but differs from it in conidium size and morphology.

TAXONOMIC PART

Stachybotrys sphaerospora sp. nov. (Fig. 1).

Coloniae effusae, densae, griseae vel atrae, pilosae. Mycelium in substrato immersum, ex hyphis ramosis, septatis, hyalinis vel pallide brunneis, laevibus, 1-2.5µm crassis compositum. Conidiophora macronemata, mononemata vel laxe intertexta, erecta, flexuosa, ramosa, septata, cylindrica, laevia vel minute verruculosa, pallide brunnea vel olivaceo-brunnea, usque ad 250µm longa, 2.5-3µm crassa. Cellulae conidogenae phialidicae, discretae, terminales, determinatae, 6 - 7 in verticillo disposae, obovatae, pallide brunneae, leviae vel minute verruculosae, 9-10 X 2.5-5µm. Conidia enteroblastica, sphaerica, nonseptata, atrobrunnea vel atra,

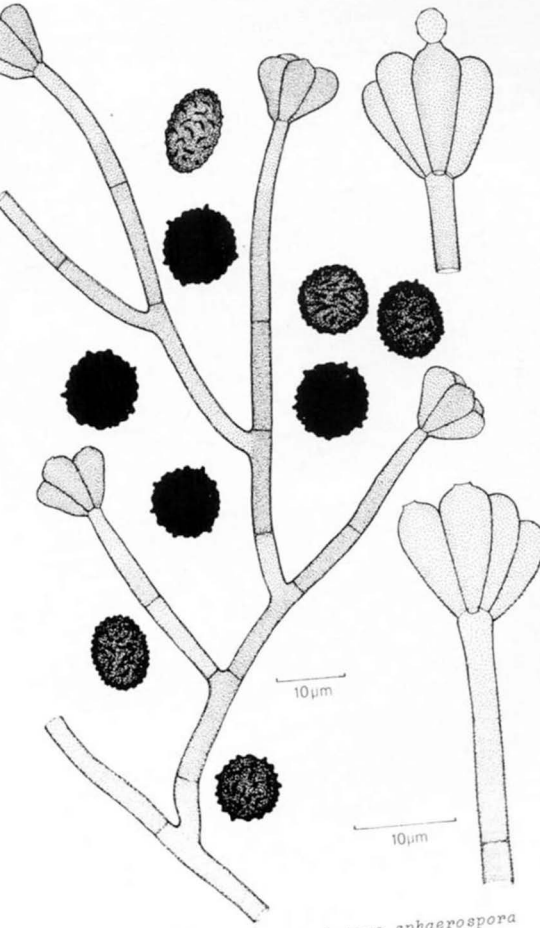


FIGURE 1. *Stachybotrys sphaerospora*

irregulariter porcata, 11-12µm diam.

In lignis putredinis, Golden Gate Highlands National Park, Orange Free State, South Africa, March 14, 1979, R.C. Sinclair, AUA, holotypus.

Colonies effuse, dense, grey to black, hairy. Colonies on PDA extremely thin, slow growing, colourless at first, hen becoming park olive green to blackish with the production of abundant conidia. Mycelium immersed in the substratum, composed of branched, septate, hyaline to pale olivaceous brown or pale brown, smooth, 1-2.5µm thick hyphae. Conidiophores macronematous, mononematous but sometimes loosely intertwining, erect, flexuous, abundantly branched, septate, cylindrical, smooth or minutely verruculose, pale brown to olivaceous brown, up to 250µm long, 2.5-3µm wide. Conidiogenous cells phialidic, discrete, terminal, determinate, arranged in a verticil of 6 - 7, obovate, pale brown, smooth or minutely verruculose particularly toward their base, 9-10 X 2.5-5µm. Conidia enteroblastic, at first ellipsoid to oval, spherical when mature, nonseptate, dark brown to black, ornamented by irregular but prominent ridges, 11-12µm in diameter.

On rotten wood; South Africa.

Collection examined: on rotten, decorticated wood, Golden Gate Highlands National Park, Orange Free State, South Africa, March 14, 1979, R.C. Sinclair, AUA, type.

S. sphaerospora is unique in possessing spherical, ridged conidia. In respect of conidium shape at maturity it closely resembles the condition found in *S. microspora* (Mathur and Sankhla) Jong and Davis and *S. nilagirica* Subramanian. In the former, however, the conidia are much smaller [5-6µm in diameter (Jong and Davis, 1976)] and are warty rather than ridged, and in the latter the conidia are much larger (16-20µm in diameter) and tuberculate (Matsushima, 1975). *S. sphaerospora* bears the following similarities to *S. chartarum*: ridged conidium ornamentation, the presence of a short but easily discernible collarette at the phialide apex, and branched conidiophores.

ACKNOWLEDGMENT

Dr. J. Leland Crane, Illinois Institute of Natural Resources, kindly reviewed the manuscript.

REFERENCES

JONG, S.C. and E.E. DAVIS. 1976. Contribution to the knowledge of *Stachybotrys* and *Memnoniella* in culture Mycotaxon 3: 409-485.

MATSUSHIMA, T. 1975. Icones microfungorum a Matsushima lectorum. Kobe. Published by the author.

MYCOTAXON

Vol. X, No. 2, pp. 375-404 January-March 1980

NOTES ON HYPHOMYCETES. XXXIV. SOME MYCOPARASITIC SPECIES.

Dennis J. Gray and G. Morgan-Jones

Department of Botany and Microbiology
Auburn University Agricultural Experiment Station
Auburn, Alabama 36830, U.S.A.

ABSTRACT

Thirteen species of mycoparasitic Hyphomycetes that inhabit basidiomycete carpophores are described and illustrated. They include *Arnoldia clavispora* Gray & Morgan-Jones, a new genus and species, four species of *Cladobotryum* Nees ex Steudel, two species of *Mycogone* Link, *Sepedonium mycophilum* (Pers.) Nees, three species of *Sibirina* Arnold, of which two, *S. gamsii* Gray & Morgan-Jones and *S. purpurea* Morgan-Jones, are new, *Verticillium fungicola* (Preuss) Hassebrauk, and the anamorph of *Hypomyces tulasneanus* Plowright.

INTRODUCTION

Among the many substrates that are known to be colonized by fungi are the mycelia and/or fruiting structures of other fungi. Those that utilize other living fungi as a food source, known as mycoparasites, are common in nature, although frequently overlooked. A large and diverse group of mycoparasites is made up of Hyphomycetes many of which are known to inhabit the carpophores of some of the higher fungi.

A survey of mycoparasitic Hyphomycetes occurring on members of the Agaricales and Aphyllophorales in Alabama has yielded collections of fourteen species (Gray, 1979). In a preceeding publication in this series (Morgan-Jones and Gray, 1979) a new species of *Mycogone, M. psilocybina* Morgan-Jones & Gray, collected during the course of this study, was described. In the present publication thirteen further taxa are described and illustrated. Included are three previously undescribed species, one of which is accommodated in a new genus. Descriptions of four species are based on cultures and/or specimens obtained from the American Type Culture Collection and fellow mycologists.

TAXONOMIC PART

Arnoldia gen. nov.

Deuteromycotina, Hyphomycetes.

Coloniae late effusae, albidae vel pallide stramineae, lanosae. Mycelium partim superficiale, partim immersum, ex hyphis ramosis, septatis, hyalinis, laevibus compositum. Conidiophora semimacronemata, mononemata, erecta, recta vel leviter flexuosa, laevia, hyalina, septata, verticillatim vel irregulariter plureis ramosa. Cellulae conidiogenae polyblasticae, sympodiales. Conidia holoblastica, acrogena apice cellularum conidiogenarum oriunda, clavata, hyalina, laevia, 1 ad 2-septata, hilo minuta praedita.

Species typica: *Arnoldia clavispora* Gray & Morgan-Jones.

Colonies broadly effuse, whitish to pale straw-yellow, lanose. Mycelium partly superficial, partly immersed, composed of branched, septate, hyaline, smooth hyphae. Conidiophores semimacronematous, mononematous, erect, straight or slightly flexuous, smooth, hyaline, septate, verticillately or irregularly branched. Conidiogenous cells polyblastic, sympodial. Conidia holoblastic, acrogenous, produced at the apex of the conidiogenous cells, clavate, hyaline, smooth, 1 to 2-septate, with a narrow subtruncate base.

The new genus is named in honour of Dr. G.R.W. Arnold.

Arnoldia clavispora sp. nov. (Fig. 1, Plate 1 G-H).

Coloniae late effusae, albidae vel pallide stramineae, lanosae. Mycelium partim superficiale, partim in substrato immersum, ex hyphis ramosis, septatis, hyalinis, laevibus, 4-9µm crassis compositum. Conidiophora semimacronemata, mononemata, erecta, recta vel leviter flexuosa, laevia, hyalina, septata, verticillatim vel irregulariter plureis ramosa. Cellulae conidiogenae polyblasticae, sympodiales, cylindricae, 40-100 X 4-5µm. Conidia holoblastica, acrogena apice cellularum conidiogenarum oriunda, clavata, hyalina, laevia, 1 ad 2-septata, hilo minuta praedita, 15-33 X 6-8µm.

Ad carposomata Corioli, Chewacla State Park, Lee County, Alabama, March 23, 1978, D.J. Gray, AUA, holotypus.

Colonies broadly effuse, white to pale straw-yellow, thick, lanose. Colonies on PDA spreading up to 22mm per 24h at 25°C. Mycelium partly superficial, partly immersed in the substratum, composed of branched, septate, hyaline, smooth, frequently anastomosing, 4-9µm wide hyphae. Conidiophores semimacronematous, mononematous, erect, straight or slightly flexuous, smooth, hyaline, septate, verticillately or irregularly branched. Conidiogenous cells polyblastic, sympodial, cylindrical, attenuating gradually towards the apex, indeterminate, terminal on the conidiophore or as small lateral branches of the main stipe,

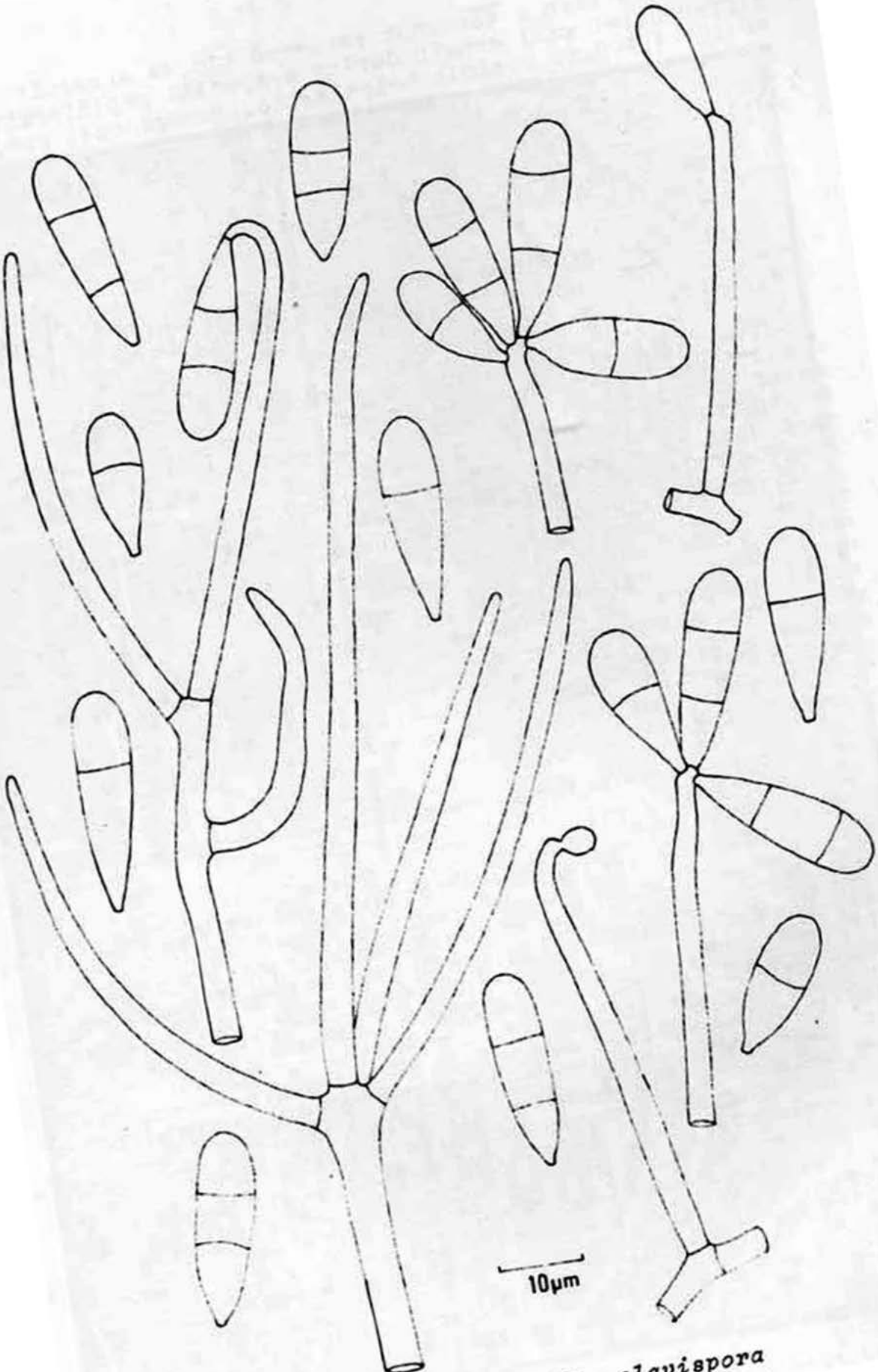


FIGURE 1. *Arnoldia clavispora*

frequently with a somewhat recurved tip as a result of differential wall growth during sympodial proliferation, 40-100 X 4-5µm. Conidia holoblastic, acrogenous, produced at the apex of the conidiogenous cells, clavate, hyaline, smooth, 1 to 2-septate, with a narrow subtruncate base, 15-33 X 6-8µm.

On carpophores of *Coriolus versicolor* (Fr.) Quelet; North America.

Collection examined: on *C. versicolor*, Chewacla State Park, Lee County, Alabama, March 23, 1978, D.J. Gray, AUA, type.

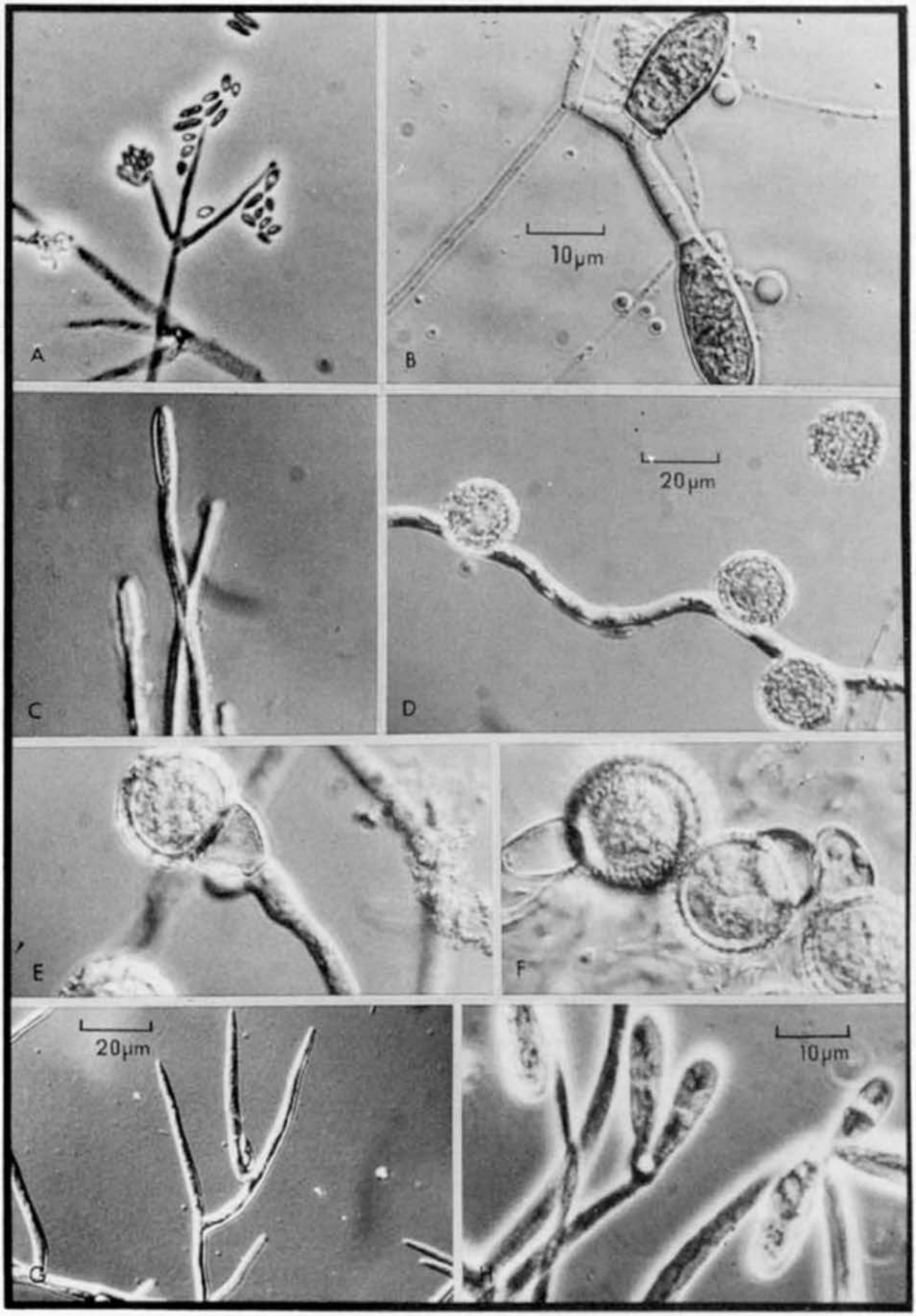
Superficially *A. clavispora* resembles species of *Cladobotryum*, but the development of its conidiogenous cells is different from that of *C. varium* and *C. mycophilum*. Production of an acropetal succession of conidia by sympodial proliferation distinguishes *A. clavispora* from fungi of similar morphology. In this respect it resembles *C. dendroides* (Bull. ex Merat) Gams & Hoozem. [anamorph of *Hypomyces rosellus* (Alb. & Schw. ex Fr.) Tul.] which Barron (1968) and Cole and Kendrick (1971) consider to be unsatisfactorily classified in *Cladobotryum*. *C. dendroides* would, perhaps, be better classified in *Arnoldia*. *A. clavispora* also bears some similatiry to *Trichothecium roseum* Link, but again differs significantly in the peculiarities of conidiogenesis. Kendrick and Cole (1969) have shown *T. roseum* to produce meristem arthrospores of a unique kind.

Cladobotryum apiculatum (Tubaki) Gams & Hoozemans, Persoonia 6: 97, 1970 (Fig. 2).

≡ *Cylindrophora apiculata* Tubaki, Nagaoa 5: 6, 1955.

Colonies effuse, white to cream, thick, covering much of the host pileus. Mycelium mostly superficial, composed of branched, septate, hyaline, smooth, 4-7µm wide hyphae. Chlamydospores formed terminally or laterally on very short branches, solitary, dry, minutely verruculose, relatvely thick-walled, subhyaline to very pale brown, composed of from two to four cells, distinctly constricted at the septa separating individual cells, 34-65µm long, up to 32µm wide at the broadest part. Conidiophores semimacronematous, mononematous, branched, straight or somewhat flexuous, hyaline, smooth, septate, cylindrical, up to 170µm long. Conidiogenous cells discrete, borne terminally and laterally on the conidiophores, more or less cylindrical but attenuating towards the apex, up to

PLATE 1. A. *Hypomyces tulasneanus*, conidiophores and conidia; B. *H. tulasneanus*, chlamydospores; C. *Sepedonium mycophilum*, conidiophores and conidia; D. *S. mycophilum*, chlamydospores; E. *Mycogone perniciosa*, chlamydospores; F. *Mycogone rosea*, chlamydospores; G-H. ***Arnoldia clavispora***, conidiophores and conidia.


A
B
10µm
C
D
20µm
E
F
20µm
G
10µm
H

67µm long, 3-4.5µ wide, 1-1.5µm wide at the extreme apex. Conidia holoblastic, produced as a terminal blow-out of individual conidiogenous cells, cylindrical to narrowly obovoid, smooth, non-septate, hyaline, with a narrow truncate base, 17-28 X 5-6.5µm.

On carpophores of *Amanita*, *Lactarius* and *Russula*; Europe, Japan and North America.

Collection examined: on *Lactarius* sp., off Rt. 50, 5ml. south of Lafayette, Chambers County, Alabama, July 26, 1979, D.J. Gray and G. Morgan-Jones, AUA.

The name *Blastotrichum puccinioides* Preuss [*Mycogone puccinioides* (Preuss) Saccardo] is based on the chlamydospore state of this fungus.

To our knowledge the Alabama collection represents the first record of its occurrence in North America.

Cladobotryum mycophilum (Oudem.) Gams & Hoozemans, Persoonia 6: 102, 1970 (Fig. 3, Plate 2 A-B).

≡ *Dactylium mycophilum* Oudemans, Arch. Neerl. Sci. 2: 42, 1867.

= *Diplocladium elegans* Bain. & Sart., Ann. Mycol. 11: 359, 1913.

[Anamorph of *Hypomyces odoratus* Arnold, Česká Mykol. 11: 144, 1964]

Colonies effuse, hyaline to pale rose, thin, floccose. Mycelium superficial on hymenial surface of carpophores, composed of cylindrical, flexuous, branched, septate, hyaline, smooth-walled, 5-10µm wide hyphae. Conidiophores semimacronematous, mononematous, branched, straight or slightly flexuous, hyaline, smooth, cylindrical, bearing a terminal verticil of up to five conidiogenous cells; conidiogenous cells also formed on short lateral branches and intercalarily from the main stipe immediately below septa towards the distal end. Conidiogenous cells discrete, arranged verticillately, narrowly lageniform to more or less cylindrical but narrower at the blunt apex, 25-60 X 5-6µm. Conidia holoblastic, produced as a terminal blow-out at the tip of individual conidiogenous cells, usually developing asymmetrically, clavate to ellipsoid, hyaline, smooth, 1 to 3-septate, narrowly truncate at the base, 20-31 X 5-9µm.

On carpophores of members of the Agaricales and Aphyllophorales; Europe, Japan and North America.

Collection examined: on *Coriolus versicolor*, Chewacla State Park, Lee County, Alabama, March 23, 1978, D.J. Gray, AUA.

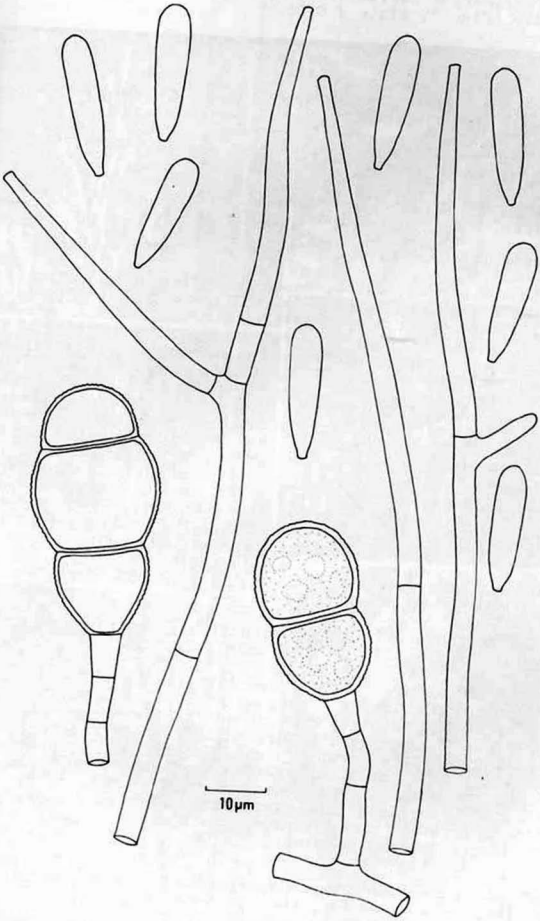


FIGURE 2. *Cladobotryum apiculatum*

Cladobotryum varium Nees, Syst. Pilze Schwamme 56, 1816 (Fig. 4, Plate 2 C-D).

≡ *Dactylium varium* (Nees) Fr., Syst. Mycol. 3: 414, 1832.

= *Botrytis variospermum* Link, Mag. Ges. Naturf. Freunde, Berlin 7: 36, 1816.

= *Cladobotryum variospermum* (Link) Hughes, Can. J. Bot. 36: 750, 1958.

[Anamorph of *Hypomyces aurantius* (Pers. ex S.F. Gray) Tul., Sel. Fung. Carpol. 3: 43, 1865]

For full nomenclator see Gams and Hoozemans (1970).

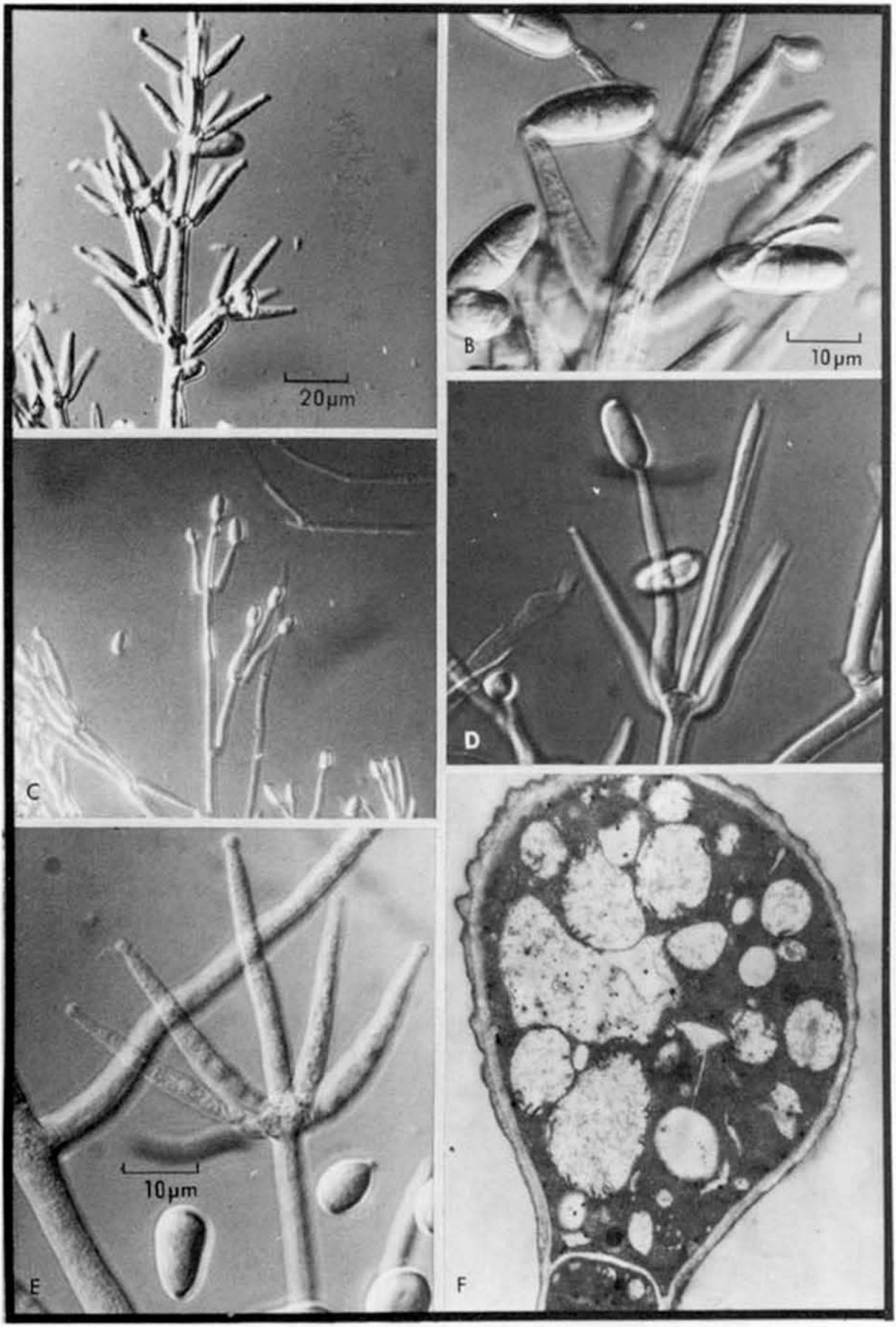
Colonies effuse, white, becoming yellowish tan with age, thin, matted. Colonies on PDA spreading rapidly (up to 22mm per 24h at 25°C), radiate zones of thicker growth soom apparent, reverse pale yellow. Mycelium mostly superficial on carpophores, white, composed of cylindrical, flexuous, branched, septate, hyaline, smooth-walled, 5-10µm wide hyphae. Conidiophores semimacronematous, mononematous, branched, straight or flexuous, hyaline, smooth, cylindrical, bearing a terminal verticil of up to five compactly arranged conidiogenous cells, with one or two conidiogenous cells borne on non-divergent lateral branches originating immediately below septa towards the distal end. Conidiogenous cells discrete, arranged verticillately, single or in pairs, more or less cylindrical, blunt at the apex, 24-50 X 3-5µm. Conidia holoblastic, ellipsoid to ovoid, hyaline, smooth, 1-septate, 10-16 X 6-7µm, truncate at the base.

On basidiomycete carpophores, in soil and on rotten wood; Europe and North America.

Collection examined: isolated from soil, North Bay, Ontario, Canada, 1965. G.L. Barron, ATCC 16080.

Cole and Kendrick (1971) demonstrated that the conidiogenous cells of *C. varium* produce a series of conidia in basipetal succession and become progressively shorter in the process. Kendrick (1971) referred to these conidia as meristem arthrospores. Hashmi (1977) showed that the conidia of *C. mycophilum* are produced holoblastically from a determinate, retrogressive conidiogenous cell. Although *C. verticillatum* also bears holoblastic conidia there is no known commensurate reduction in conidiogenous cell length in that species.

PLATE 2. A-B. *Cladobotryum mycophilum*, conidiophores and conidia; C-D. *C. varium*, conidiophores and conidia; E. *C. verticillatum*, conidiophores and conidia; F. *C. verticillatum*, thin section of conidiophore tip and developing conidium (transmission electron micrograph).


20µm
B
10µm
C
D
10µm
E
F

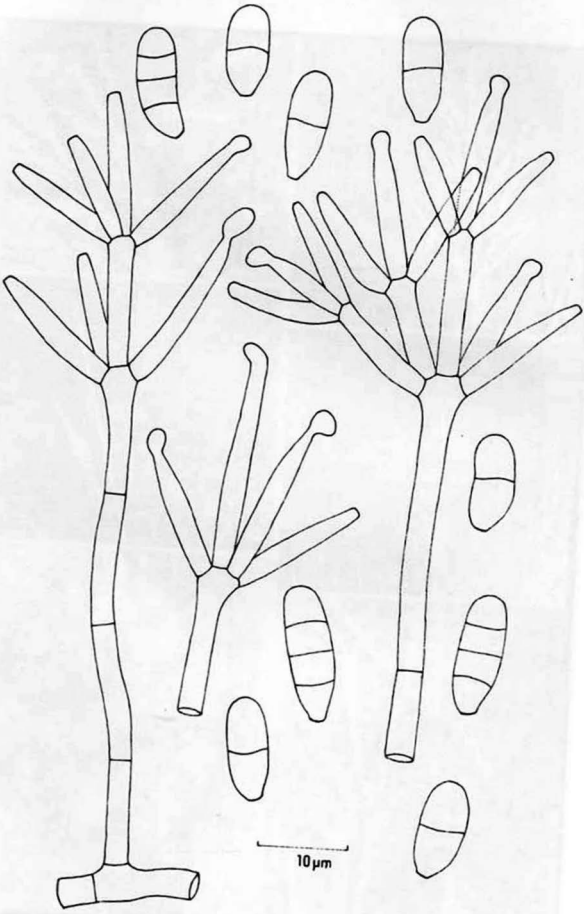


FIGURE 3. *Cladobotryum mycophilum*

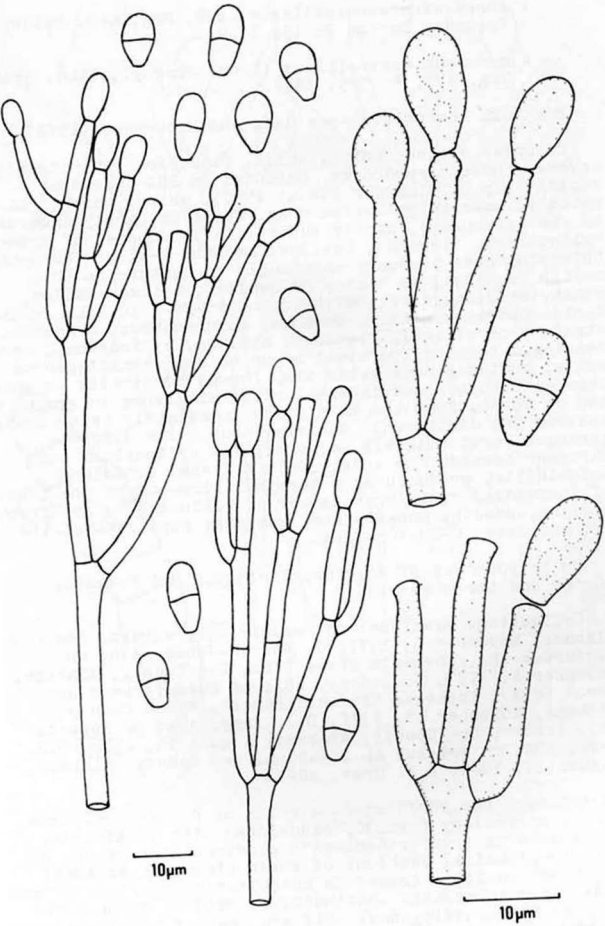


FIGURE. 4. *Cladobotryum varium*

Cladobotryum verticillatum (Link) Hughes, Can. J. Bot. 36: 750, 1958 (Fig. 5, Plate 2 E-F).

≡ *Acremonium verticillatum* Link, Mag. Ges. Naturf. Freunde, Berlin 3: 15, 1809.

≡ *Mycogone verticillata* (Link) Spreng., Linn. Syst. Veg. XVI, 4: 555, 1827.

For full nomenclator see Gams and Hoozemans (1970).

Colonies effuse, white, thick, floccose, often totally covering host carpophores. Colonies on PDA spreading rapidly (up to 31mm per 24h at 25°C), white, thick, cottony, reverse yellowish gray. Mycelium partly immersed in the carpophore, partly superficial, composed of branched, cylindrical, flexuous, hyaline, smooth, 4-11µm wide hyphae. Chlamydospores produced abundantly in culture on PDA, mostly terminal, as chains of swollen, thicker-walled, constricted, pale yellowish-brown, 15-30 X 10-25µm cells. Conidiophores semimacronematous, mononematous, branched, straight or slightly flexuous, hyaline, cylindrical, smooth, bearing a terminal verticil of up to four conidiogenous cells; conidiogenous cells also formed terminally on short, lateral branches and intercalarily, singly or in groups os two or three, from the main stipe immediately below septa towards the distal end. Conidiogenous cells discrete, arranged verticillately, more or less cylindrical but narrower towards the apex, 30-75 X 2-4µm. Conidia holoblastic, produced as a terminal blow-out at the tips of individual conidiogenous cells, ellipsoid to pyriform, hyaline, smooth, non-septate, somewhat papillate at the extreme base, 8-20 X 5-11µm.

On carpophores of *Boletus, Lactarius* and *Russula*; Europe and North America.

Collections examined: on *Russula* sp., Auburn, Lee County, Alabama, November 6, 1977, G. Morgan-Jones, AUA; on *Lactarius* sp., Chewacla State Park, Lee County, Alabama, November 8, 1977, D.J. Gray, AUA; on *Russula emetica* (Fr.) Pers., Tuskegee National Forest, Macon County, Alabama, November 11, 1977, D.J. Gray, AUA; on *Russula* sp., Auburn, Lee County, Alabama, August 11, 1978, D.J. Gray, AUA; on *Boletus* sp., Auburn, Lee County, Alabama, August 12, 1978, D.J. Gray, AUA.

Although the conidiogenous cells of *C. verticillatum* have a morphology normally associated with a phialide, it is evident from transmission electron micrographs of thin longitudinal sections of their tips that at least the first conidium formed is holoblastic in origin (Plate 2 F). An uninterupted continuity is evident between the wall of the conidiogenous cell and that of the developing conidium.

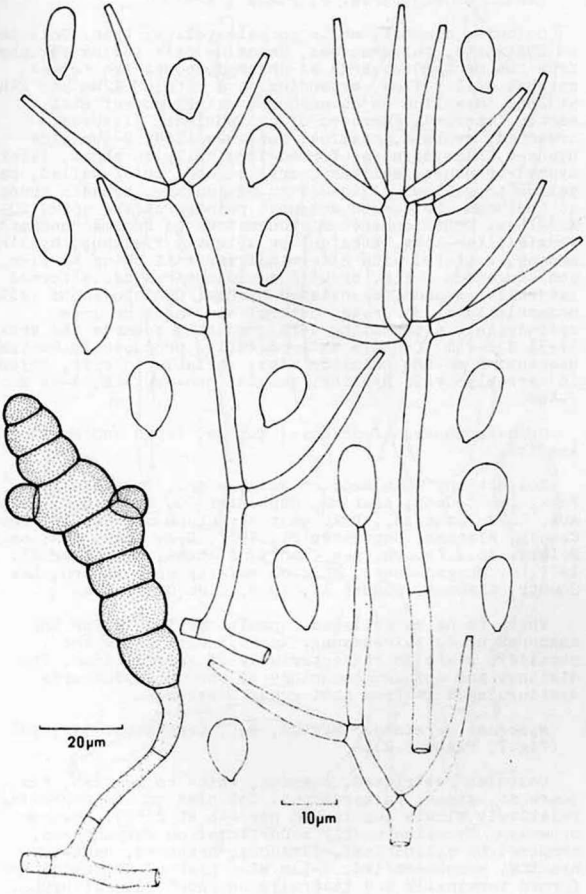


FIGURE 5. *Cladobotryum verticillatum.*

Hypomyces tulasneanus Plowright, Grevillea 9: 46, 1882 [anamorph of], (Fig. 6, Plate 1 A-B).

Colonies compact, white to pale yellow, thin. Colonies on PDA white, pulveraceous, becoming pale yellow to ochre from the center outwards as chlamydospores are formed, reverse dull yellow, extending at a rate of 17mm per 24h at 25°C. Mycelium on carpophores mainly superficial, partly immersed, composed of cylindrical, flexuous, branched, septate, hyaline, smooth-walled, 2-4µm wide hyphae. Chlamydospores formed terminally on short, lateral hyphal branches, solitary, dry, smooth, thick-walled, pale yellow to yellow, ellipsoid to naviculate, broadly truncate at the base, obtuse to somewhat pointed at the apex, 20-35 X 7-15µm. Conidiophores micronematous to semimacronematous, *Verticillium*-like, straight or slightly flexuous, hyaline, smooth, septate, with a terminal verticil of up to five conidiogenous cells, or with conidiogenous cells formed laterally on undifferentiated hyphae. Conidiogenous cells monophialidic, discrete, determinate, more or less cylindrical, attenuating very gradually towards the apex, 17-36 X 1-2µm. Conidia enteroblastic, produced in basipetal succession at the phialide tips, variable in size, oblong to narrowly oval, hyaline, smooth, non-septate, 4-14 X 2-4µm.

On carpophores of *Boletus*; Europe, Japan and North America.

Collections examined: on *Boletus* sp., Chewacla State Park, Lee County, Alabama, September 20, 1977, D.J. Gray, AUA; on *Boletus* sp., 2ml. west of Auburn off Hwy 14, Lee County, Alabama, September 21, 1977, D.J. Gray, AUA; on *Boletus* sp., Auburn, Lee County, Alabama, September 23, 1977, G. Morgan-Jones, AUA; on *Boletus* sp., Auburn, Lee County, Alabama, August 11, 1978, D.J. Gray, AUA.

There is no established binomial available for the anamorph of *H. tulasneanus*. As indicated above the phialidic state is characteristic of *Verticillium*. The distinct and unique morphology of the chlamydospores distinguishes it from that genus however.

Mycogone perniciosa Magnus, Bot. Centralbl. 394, 1888 (Fig.7, Plate 1 E).

Colonies restricted, compact, white to greyish, thin, somewhat lanose, pulveraceous. Colonies on PDA spreading relatively slowly (up to 9mm per 24h at 25°C), reverse brownish. Mycelium mostly superficial on carpophores, composed of cylindrical, flexuous, branched, septate, hyaline, smooth-walled, 2-5µm wide hyphae. Chlamydospores formed terminally and laterally on short lateral hyphal branches, solitary, dry, 1-septate, with a large, spherical, thick-walled, subhyaline to yellowish, verrucose, 20-24µm wide upper cell and a smaller, subhyaline, 10-15µm wide

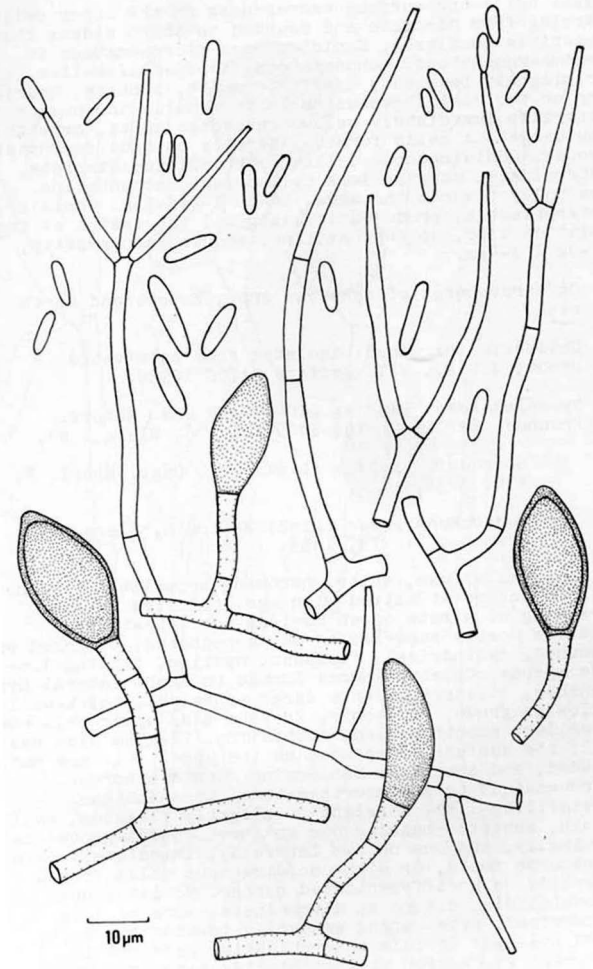


FIGURE 6. *Hypomyces tulasneanus.*

basal cell; the surface excresences on the upper cell varying from discrete and rounded to short ridges that sometimes coaslesce. Conidiophores micronematous to semimacronematous, mononematous, *Verticillium*-like, straight or slightly flexuous, hyaline, smooth, septate, bearing one or two conidiogenous cells terminally and one or two laterally immediately below transverse septa, or with conidiogenous cells formed laterally on undifferentiated hyphae. Conidiogenous cells monophialidic, discrete, determinate, more or less cylindrical, attenuating gradually towards the apex, 20-60 X 2.5-3µm. Conidia enteroblastic, produced in basipetal succession at the phialide tips, oblong, hyaline, smooth, non-septate, 12-22 X 3-4µm.

On carpophores of *Agaricus* spp.; Europe and North America.

Collection examined: isolated from cultivated mushroom, U.S.A., W.T. Jeffers, ATCC 10934.

Mycogone rosea Link ex Link, Mag. Ges. Naturf. Freunde, Berlin 3: 18, 1809 (Fig. 8, Plate 1 F).

≡ *Sepedonium roseum* (Link) Fr., Syst. Mycol. 3: 438, 1832.

≡ *Mycobanche rosea* (Link) Wallroth, Flora Crypt. German., 2: 273, 1833.

Colonies effuse, white, becoming brownish in patches, thin, floccose at matted with age. Colonies on PDA spreading at a rate of up to 12mm per 24h at 25°C. Mycelium mostly superficial on carpophores, composed of branched, cylindrical, flexuous, hyaline, smooth, 1.5-3µm wide hyphae. Chlamydospores formed on short lateral hyphal branches, solitary, with a large spherical, thick-walled, yellowish brown, verrucose, 20-28µm wide upper cell and a smaller, smooth-walled, subhyaline, 12-15µm wide basal cell; the surface excresnces on the upper cell are small, crowded, and sometimes coalescing. Conidiophores micronematous to semimacronematous, mononematous, *Verticillium*-like, straight or slightly flexuous, hyaline, smooth, septate, bearing one to three conidiogenous cells terminally, and one or two laterally, immediately below transverse septa, or with conidiogenous cells formed laterally on undifferentiated hyphae. Conidiogenous cells monophialidic, discrete, determinate, more or less cylindrical, attenuating gradually towards the apex, 20-40 X 3-4µm. Conidia enteroblastic, produced in basipetal succession at the phialide tips, somewhat variable in size, oblong to cylindrical, obtuse at the ends, hyaline, smooth, non-septate or, more rarely 1 to 2-septate, 10-15 X 3-4µm.

On carpophores of members of the Agaricales; Europe.

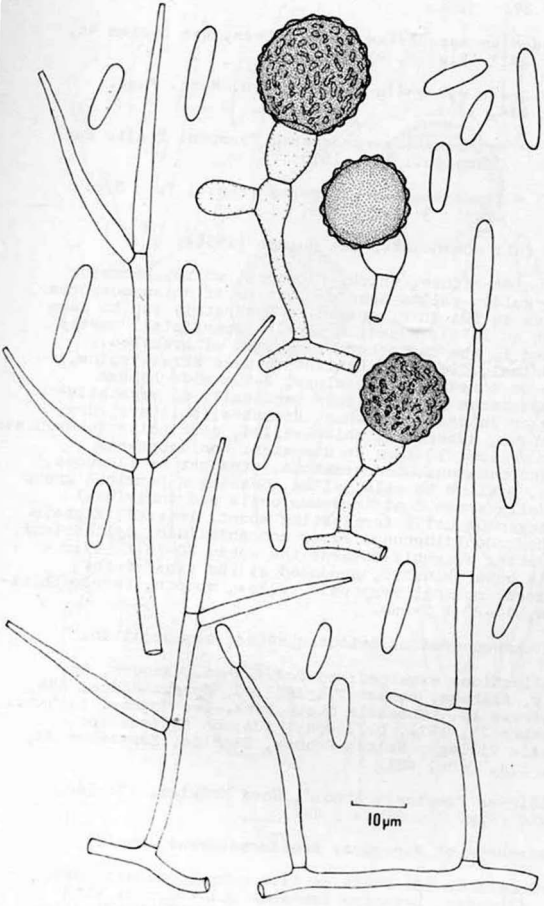


FIGURE 7. *Mycogone perniciosa.*

Collection examined: isolated from *Amanita fulva* (Schaeff.) Pers., near Augustów, Poland, 1966, W. Gams, CBS 488.67.

Sepedonium mycophilum (Pers.) Nees, Das System 44, 1816/1817 (Fig. 9, Plate 1 C-D).

≡ *Uredo mycophila* Persoon, Syn. Meth. Fung.: 214, 1801.

= *Mycobanche chrysosperma* Persoon, Traite sur Champign.: 133, 1818.

= *Sepedonium chrysosperma* (Pers.) Fr., Syst. Mycol. 3: 438, 1832.

For full nomenclator see Hughes (1958).

Colonies effuse, thick, floccose, white, becoming bright golden yellow upon production of chlamydospores. Colonies on PDA thin, spreading moderately (up to 14mm per 24h at 25°C). Mycelium partly superficial, partly immersed in the carpophore, composed of branched, cylindrical, flexuous, hyaline to pale straw yellow, smooth or somewhat verruculose, 2-5µm wide hyphae. Chlamydospores formed either terminally on vegetative hyphae or laterally on short branches, solitary, dry, acrogenous, spherical, thick-walled, distinctly tuberculate, golden yellow, 13-18µm in diameter. Conidiophores semimacronematous, mononematous, straight or flexuous, smooth, hyaline to pale yellow, bearing a terminal group of usually three conidiogenous cells and individual conidiogenous cells terminating short, lateral, septate branches. Conidiogenous cells monophialidic, cylindrical, attenuating slightly towards the apex, 20-75 X 3-4µm. Conidia enteroblastic, produced at the tips of the phialides, oblong, very pale yellow, smooth, fairly thick-walled, 17-22 X 2-6µm.

On carpophores of Basidiomycetes; cosmopolitan.

Collections examined: on *Boletus* sp., Auburn, Lee County, Alabama, August 11, 1977, G. Morgan-Jones, AUA; on *Boletus* sp., Chewacla State Park, Lee County, Alabama, September 21, 1977, D.J. Gray, AUA; on *Boletus* sp., Fourmile Village, Walton County, Florida, September 23, 1979, C.A. Carr, AUA.

Sibirina fungicola Arnold, Nova Hedwigia 19: 300, 1970 (Fig. 10, Plate 3 G-H).

[Anamorph of *Hypomyces semitranslucens* Arnold]

Colonies on PDA white to pale ochraceous with age, thin, floccose, becoming somewhat pulveraceous with conidium production, reverse yellowish brown. Mycelium

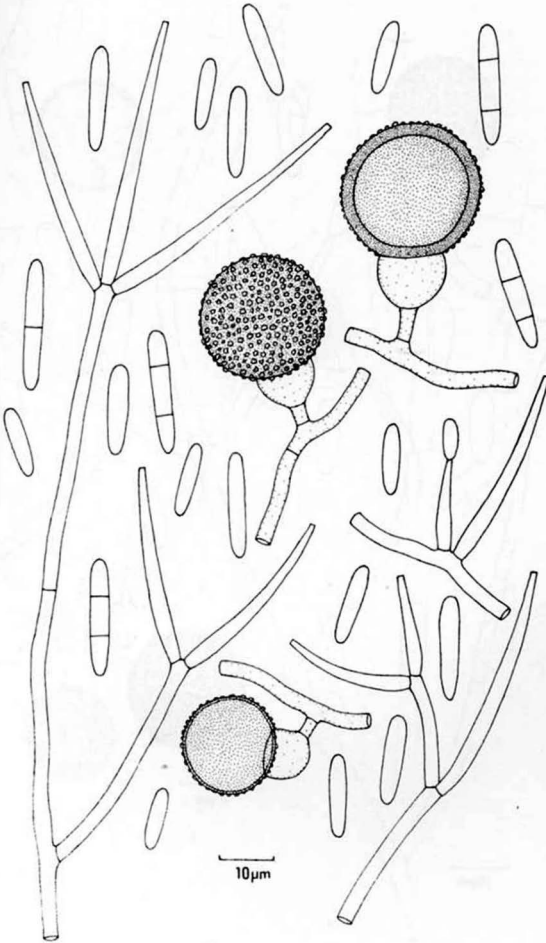


FIGURE 8. *Mycogone rosea*

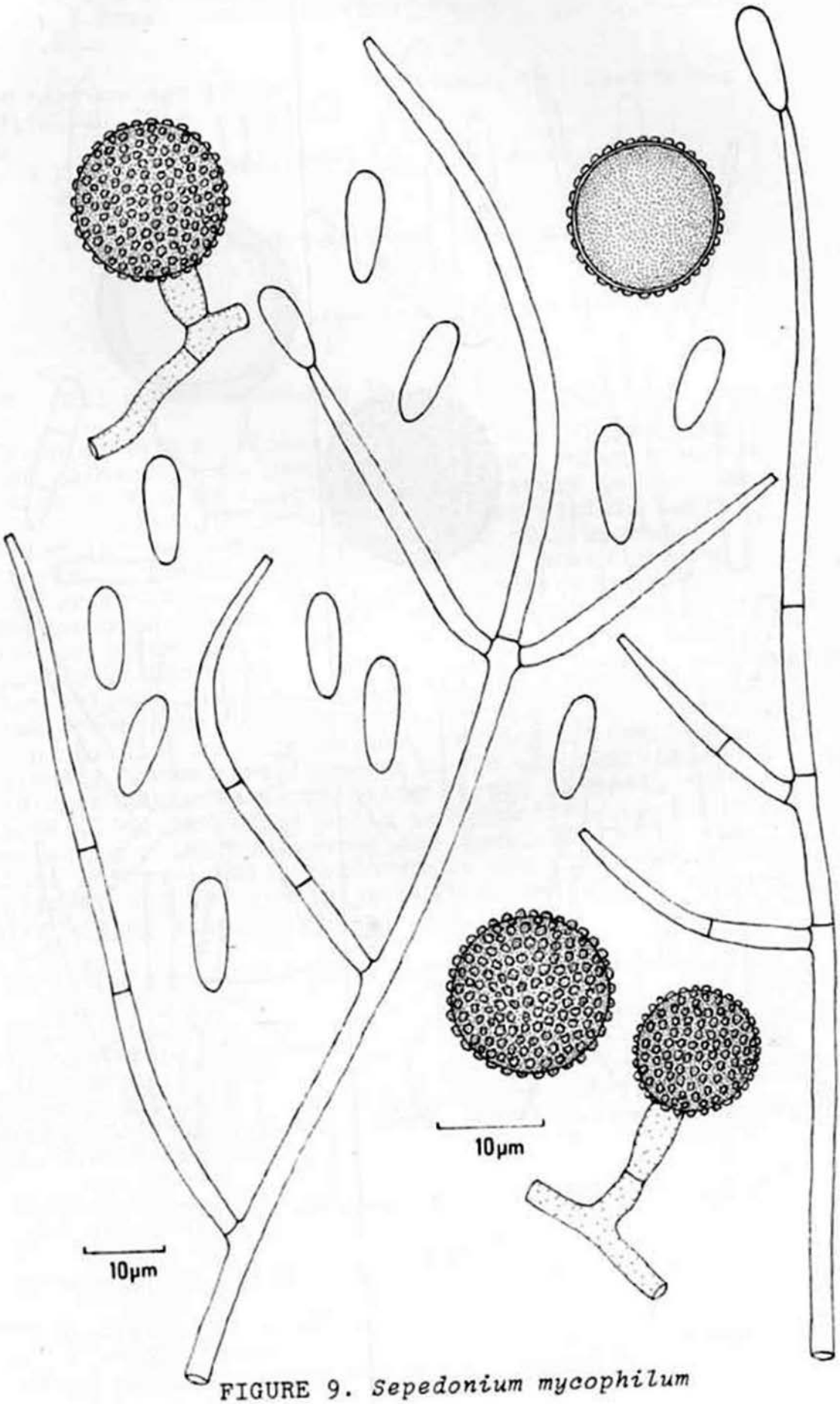


FIGURE 9. *Sepedonium mycophilum*

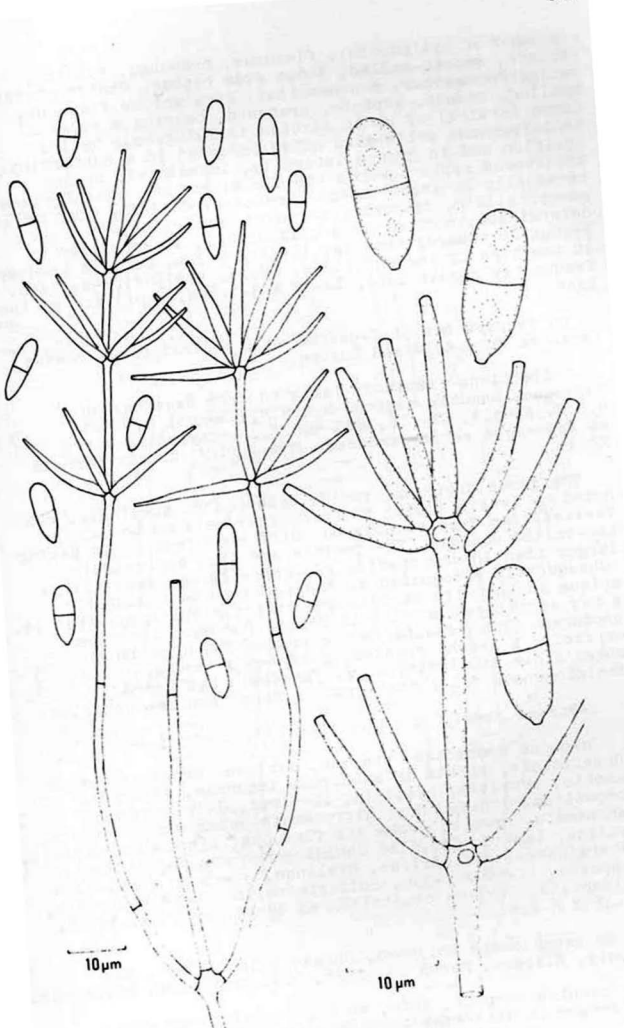


FIGURE 10. *Sibirina fungicola*

composed of cylindrical, flexuous, branched, hyaline, septate, smooth-walled, 3-6µm wide hyphae. Conidiophores semimacronematous, mononematous, straight or flexuous, hyaline, smooth, septate, branched, bearing a terminal dense verticil of up to sixteen conidiogenous cells; conidiogenous cells also often produced in a subterminal position and in groups laterally, immediately below transverse septa towards the distal end or, less frequently, terminally on short lateral branches. Conidiogenous cells monophialidic, discrete, arranged verticillately, determinate, more or less cylindrical, attenuating gradually towards the tip, 15-34 X 2-3µm. Conidia produced at the tips of the phialides, ovoid, hyaline, 1-septate, frequently biguttulate, 12-20 X 3-5.5µm, papillate at the base.

On carpophores of *Lentinus* sp., and *Polyporus varius* Pers. ex Fr.; Asia and Europe.

Collections examined: isolated from *Lentinus* sp., Rassocha, Lakutsk region, U.S.S.R., August 3, 1968, G.R.W. Arnold, JE, LE, CBS 458.71, isotype; received as *Hypomyces semitranslucens* from G.R.W. Arnold (Arnold M309).

The genus *Sibirina* Arnold, based on *S. fungicola*, was noted by Arnold (1970) to be closely related to *Verticillium* Nees ex Link but differing from it in having two-celled conidia. The conidia are also appreciably larger than in any species of *Verticillium*. Gams (1973) subsequently recognized *S. fungicola* to be somewhat unique in that its conidia are strictly solitary; that is, a new conidiogenous cell is formed for each conidium produced. This results in the production of a dense verticil. A second species, *Sibirina orthospora* Gams, shows close similarity to *S. fungicola* but bears conidiogenous cells that produce more than one conidium.

Sibirina gamsii sp. nov. (Fig. 11, Plate 3 A-B).

Coloniae compactae, sparsae, albidae. Mycelium partim superficiale, partim in substrato immersum, ex hyphis ramosis, septatis, hyalinis, laevibus, 3-7µm crassis compositum. Conidiophora micronemata vel semimacronemata, mononemata, erecta, recta vel flexuosa, simplicia, septata, hyalina, laevia. Cellulae conidiogenae monophialidicae, determinatae, cylindricae, hyalinae, 3 - 5 in verticillo disposae, 11-30 X 2-3µm, collario nullo. Conidia obovata, uniseptata, levites constricta ad septa, hyalina, levia, 13-18 X 6-8µm.

Ad carposomata Polypori, Chewacla State Park, Lee County, Alabama, March 23, 1978, D.J. Gray, AUA, holotypus.

Colonies compact, thin, white, becoming somewhat pulveraceous with conidium production, reverse yellowish

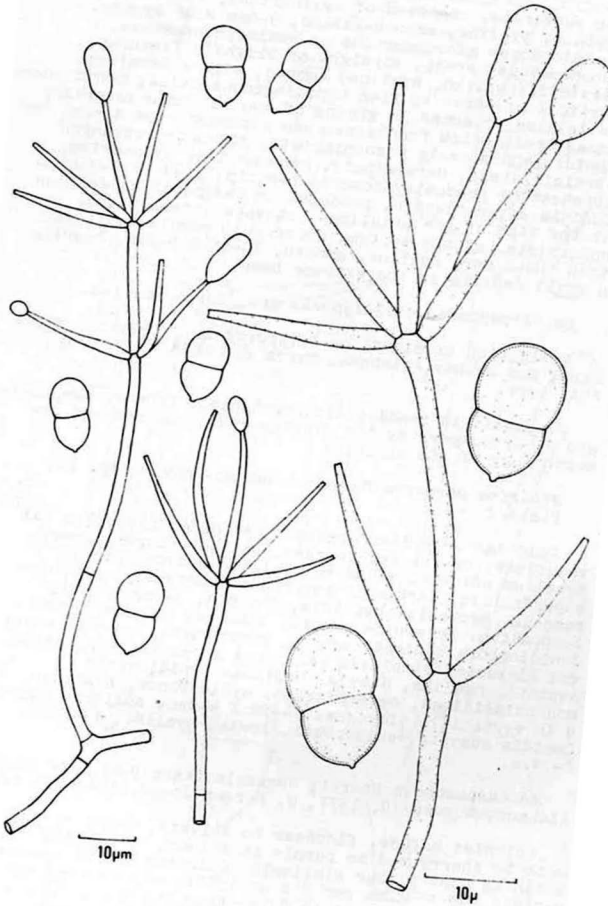


FIGURE 11. *Sibirina gamsii*

brown. Colonies on PDA spreading at a rate of 8mm per 24h at 25°C. Mycelium partly superficial, partly immersed in the substrate, composed of cylindrical, flexuous, branched, septate, hyaline, smooth-walled, 3-6µm wide hyphae. Conidiophores micronematous or semimacronematous, mononematous, erect, straight or slightly flexuous, *Verticillium*-like, hyaline, smooth, with a terminal verticil of three to five conidiogenous cells; conidiogenous cells also produced in groups of two to three laterally, immediately below transverse septa towards the distal end. Conidiogenous cells monophialidic, discrete, arranged verticillately, determinate, more or less cylindrical, attenuating gradually towards the tip, 11-30 X 2-3µm. Conidia enteroblastic, produced in basipetal succession at the tips of the phialides, obovate, one-septate, constricted at the septum, upper cell regularly larger than the lower, hyaline, smooth, 13-18 X 6-8µm, bearing a small papilla at the extreme base.

On carpophores of *Polyporus* sp.; North America.

Collection examined: on *Polyporus* sp., Chewacla State Park, Lee County, Alabama, March 23, 1978, D.J. Gray, AUA, type.

S. gamsii is readily distinguishable from *S. fungicola* and *S. orthospora* by its slender conidiophores and the morphology of its conidia.

Sibirina purpurea Morgan-Jones sp. nov. (Fig. 12, Plate 3 C-E).

Coloniae celeriter crescunt, effusae, floccosae vel velutinae, densae vel sparsae, roseae vel purpureae. Mycelium effusum, album vel pallide roseum, partim superficiale, partim in substrato immersum, ex hyphis ramosis, septatis, hyalinis, levibus, 3-7µm crassis compositum. Sclerotia minuta, alba vel brunnea adsunt. Conidiophora semimacronemata, mononemata, erecta, recta vel flexuosa, simplicia vel parce irregulariter ramsoa, septata, hyalina, laevia. Cellulae conidiogenae monophialidicae, determinatae, cylindricae, hyalinae, 2 - 8 in verticillo disposae, 30-50 X 4-5µm, collario nullo. Conidia obovata, uniseptata, levia, hyalina, 11-17 X 6-14µm.

Ad carposomata Sterei, Chewacla State Park, Lee County, Alabama, August 10, 1977, G. Morgan-Jones, AUA, holotypus.

Colonies effuse, floccose to velvety, dense or sparse, rose to cherry red to purple in colour, frequently staining host tissue similarly. Colonies on PDA spreading rapidly (up to 20mm per 24h at 25°C), at first rather sparse, white to cream to pale straw yellow, becoming reddish and velvety to floccose, medium eventually staining deep cherry red. Mycelium at first white, later

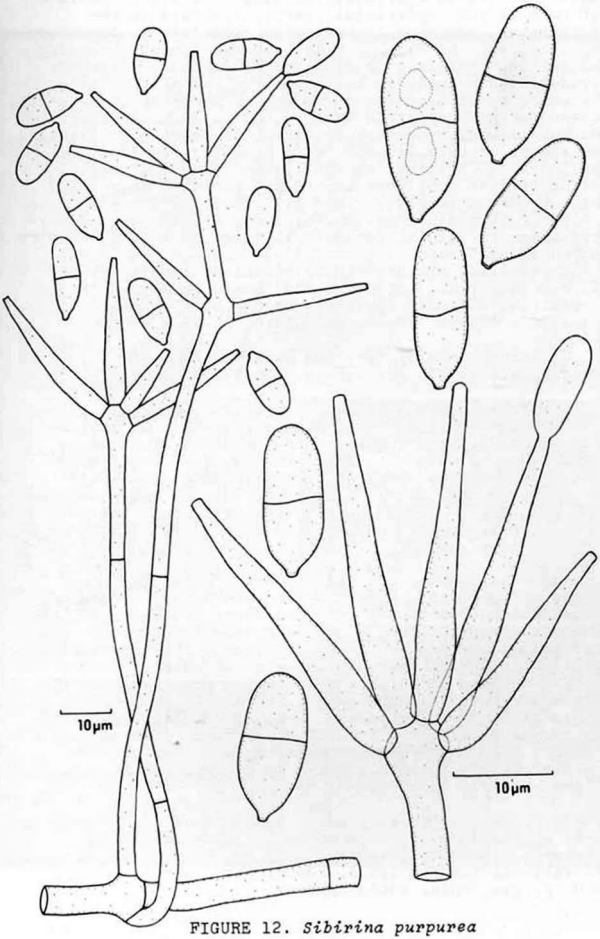


FIGURE 12. *Sibirina purpurea*

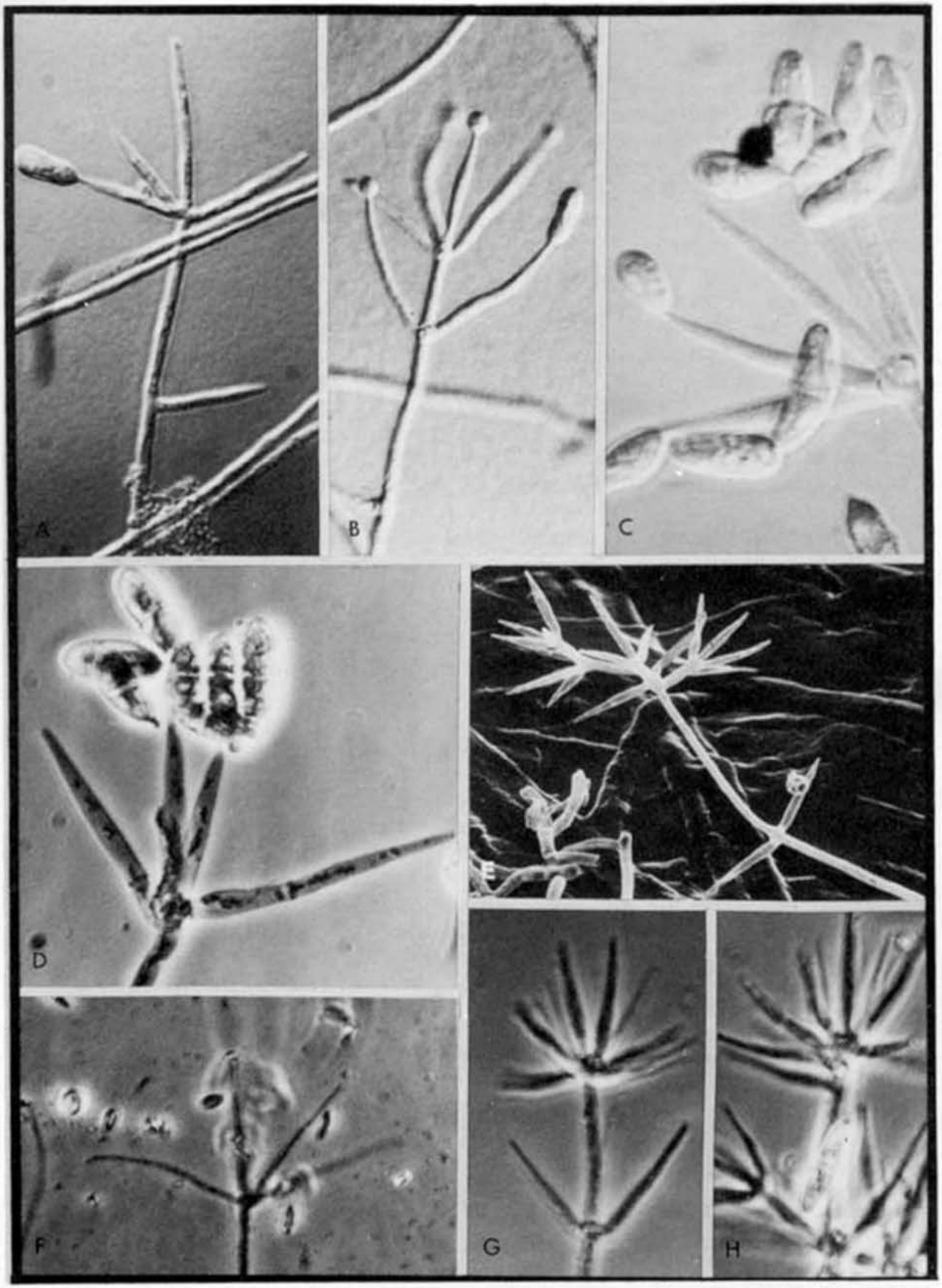
appearing rosy-pink. Reverse dark brown. Colonies on 2% malt agar thick, floccose, becoming yellowish. Mycelium on host partly superficial, partly immersed in the substratum, composed of branched, cylindrical, flexuous, hyaline, smooth, 2.5-7µm wide hyphae. Pigment appearing as yellow crystals encrusting mature hyphae. Sclerotia produced abundantly in culture, at first white, later becoming reddish-brown, up to 1mm in diameter at maturity, pseudoparanchymatous in texture. Conidiophores semi-macronematous, mononematous, erect, straight or slightly flexuous, septate, simple or irregularly branched, cylindrical, hyaline, smooth, with a terminal verticil of up to five conidiogenous cells; conidiogenous cells also produced in groups laterally directly from the main stipe or terminally on short lateral branches. Conidiogenous cells monophialidic, determinate, more or less cylindrical, attenuating towards the tip, 30-50 X 4-5µm. Conidia enteroblastic, produced in basipetal succession at the tips of the conidiogenous cells, ovoid, hyaline, smooth, 1-septate, slightly papillate at the base, basal cell usually a little larger, guttulate, 11-17 X 6-14µm.

On carpophores of *Lenzites betulina* L. ex Fr., *Marasmius* spp. and *Stereum* sp.; North America.

Collections examined: on *Stereum* sp., Chewacla State Park, Lee County, Alabama, August 10, 1977, G. Morgan-Jones, AUA, CBS 154.78, JE, type; on *L. betulina*, Tallassee, Elmore County, Alabama, September 20, 1977, D.J. Gray, AUA; on *Marasmius* spp., Rt. 50, 5ml. south of Lafayette, Chambers County, Alabama, July 26, 1979, G. Morgan-Jones and D.J. Gray, AUA; on *L. betulina*, F.D. Roosevelt State Park, Harris County, Georgia, August 16, 1979, G. Morgan-Jones, AUA.

Sibirina purpurea differs from *S. fungicola* in a number of respects. More than one conidium is produced from each conidiogenous cell and there are fewer of them per conidiophore. The conidia and details of conidiophore morphology are also different. Cultural characteristics, particularly pigmentation, are also at variance. *Sibirina purpurea* seems closely related to the anamorphs of the *Hypomyces rosellus* complex but it is not the conidial state of *H. dactylarioides* Arnold, *H. odoratus* Arnold, *H. paconius* Berk. and Br., or *H. rosellus* (Alb. & Schw. ex Fr.) Tul. An odor is produced by cultures of *S. purpurea* similar to that known in *Hypomyces ochraceus* (Pers. ex Fr.) Tul.

PLATE 3. A-B. *Sibirina gamsii*; conidiophores and conidia; C-D. *S. purpurea*, conidiophores and conidia; E. *S. purpurea*, conidiophores (scanning electron micrograph); F. *Verticillium fungicola*, conidiophore and conidia; G-H. *S. fungicola*, conidiophores.


A
B
C
D
F
G
H

Verticillium fungicola (Preuss) Hassebrauk, Phytopath. Z. 9: 514, 1936 (Fig. 13, Plate 3 F).

≡ *Acrostalagmus fungicola* Preuss, Linnaea 24: 124, 1851.

Colonies compact, white to cream, thin, pulveraceous. Colonies on PDA spreading rapidly (up to 10mm per 24h at 25°C), white, floccose, reverse pale yellowish. Mycelium mostly superficial on carpophore, composed of cylindrical, flexuous, branched, septate, hyaline, smooth, 1-3µm wide hyphae. Conidiophores semimacronematous, mononematous, straight or flexuous, hyaline, smooth, with a terminal verticil of up to eight conidiogenous cells; conidiogenous cells also produced in groups of two to six laterally, immediately below transverse septa towards the distal end. Conidiogenous cells monophialidic, discrete, arranged verticillately, determinate, more or less narrowly cylindrical, attenuating gradually towards the tip, 15-35 X 1-2µ. Conidia enteroblastic, produced in basipetal succession at the tips of the phialides, variable, oval to ellipsoid, hyaline, smooth, non-septate, 2-10 X 1-2µm.

On carpophores of members of the Agaricales; Europe and North America.

Collection examined: isolated from *Agaricus bisporus* (Large) Imbach, P.J. Wuest, ATCC 32849; on *Pleurotus sapidus* (Schulzer) Kalch., Auburn, Lee County, Alabama, August 7, 1978, D.J. Gray, AUA.

ACKNOWLEDMENTS

We have had the benefit of consultation with Drs. Günter R.W. Arnold, Friedrich-Schiller-Universität Jena, Weimar, East Germany and Walter Gams, Centraalbureau voor Schimmelcultures, Baarn, The Netherlands, concerning several matters taxonomic. Both of these gentlemen have also provided us with cultures of several mycoparasitic hyphomycetes. Dr. Richard T. Hanlin, University of Georgia, reviewed the manuscript and offered helpful suggestions for which we are grateful.

REFERENCES

ARNOLD, G.R.W. 1970. Uber *Sibirina* und *Sympodiophora* zwei neue gattungen der Moniliales. Nova Hedwigia 19: 299-304.

BARRON, G.L. 1969. The genera of Hyphomycetes from soil. Williams and Wilkins, Baltimore: 1-364.

COLE, G.T. and W.B. KENDRICK. 1971. Conidium ontogeny in hyphomycetes. Development and morphology of *Cladobotryum*. Can. J. Bot. 49: 595-599.

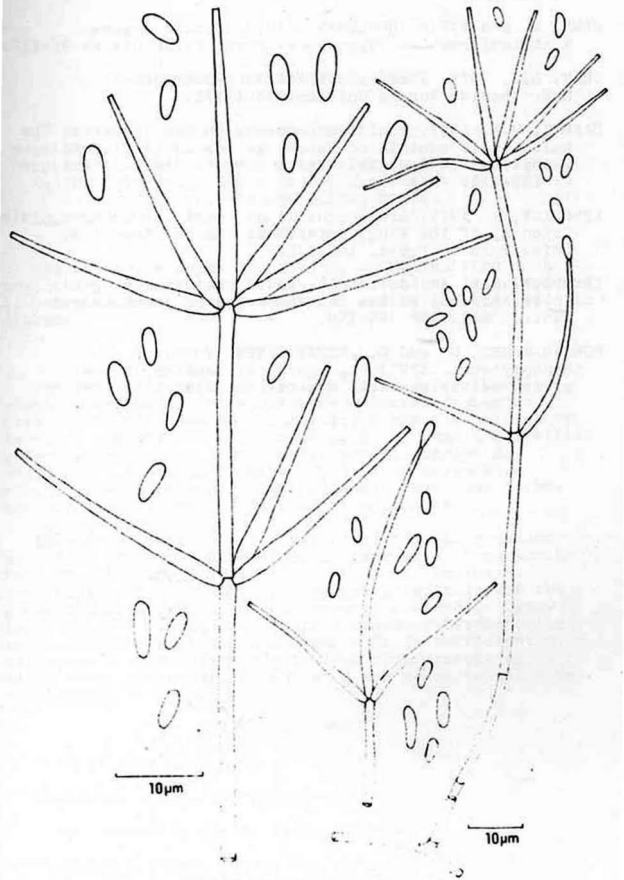


FIGURE 13. *Verticillium fungicola*

GAMS, W. 1973. Phialides with solitary conidia? Remarks on conidium ontogeny in some hyphomycetes. Persoonia 7: 161-169.

GAMS, W. and A.C.M. HOOZEMANS. 1970. *Cladobotryum*-konidienformen von *Hypomyces*-arten. Persoonia 6: 95-110.

GRAY, D.J. 1979. Some mycoparasitic Hyphomycetes. M.S. thesis, Auburn University: 1-135.

HASHMI, M.H. 1977. Conidium ontogeny in Hyphomycetes: The holoblastic conidia of *Hypomyces roseus* (= *Cladobotryum mycophilum* (Oudem.) W. Gams & Hoozem.) Pak. J. Bot., 9: 115-118.

KENDRICK, B. 1971. Arthroconidia and meristem arthroconidia. Taxonomy of the Fungi Imperfecti. Ed. B. Kendrick. Univ. Toronto Press: 160-175.

KENDRICK, W.B. and G.T. Cole. 1969. Conidium ontogeny in *Trichoderma roseum* and its meristem arthrospores. Can. J. Bot. 47: 345-350.

MORGAN-JONES, G. and D.J. GRAY. 1979. Notes on Hyphomycetes. XXVII. *Mycogone psilocybina*, a new mycoparasitic species. Mycotaxon 8: 144-148.

MYCOTAXON

Vol. X, No. 2, pp. 405-408 January-March 1980

NOTES ON HYPHOMYCETES. XXXV. *STENELLOPSIS* GEN. NOV.

G. Morgan-Jones

Department of Botany, Plant Pathology and Microbiology,
Auburn University Agricultural Experiment Station,
Auburn, Alabama 36830, U.S.A.

ABSTRACT

Heterosporium magnoliae Weedon, is relassified in a new genus, *Stenellopsis* Morgan-Jones, and is described and illustrated from its type material and collections made in Alabama.

INTRODUCTION

The fungus known as *Heterosporium magnoliae* Weedon, which is common in the southeastern United States as black sooty blotches on the abaxial surface of leaves of *Magnolia grandiflora* L., cannot properly remain classified under *Heterosporium* Klotzsch [lectotype species *H. ornithogali* Klotzsch (Hughes, 1958), ≡ *Cladosporium ornithogali* (Klotzsch) de Vries] since this name is now considered a synonym of *Cladosporium* Link ex Fr.

Recent collections of *H. magnoliae* from Alabama and access to its type material have afforded an opportunity to redescribe and illustrate the species. Unlike *H. ornithogali* it does not bear the characteristics of the genus *Cladosporium*. Although resembling *Stenella* Sydow in a number of ways, *H. magnoliae* cannot satisfactorily be classified in that genus either. It is sufficiently different from similar dematiaceous hyphomycetes as to necessitate the establishment of a new genus in which to accommodate it.

TAXONOMIC PART

Stenellopsis gen. nov.

Deuteromycotina, Hyphomycetes.

(Etym. *Stenella* et Gr. *opsis*, aspect)

Coloniae effusae, fuscae vel atrae. Mycelium superficiale, ex hyphis repentibus, ramosis, septatis, pallide brunneis, verruculosis compositum. Conidiophora

semimacronemata vel macronemata, mononemata, simplicia vel ramosa, recta vel flexuosa, septata, pallide brunnea vel brunnea, verruculosa. Cellae conidiogenae monoblasticae vel polyblasticae, in conidiophoris incorporatae, cylindricae. Conidia solitaria, sicca, septata, pallide brunnea, cylindrica, verruculosa.

Species typica: *Stenellopsis magnoliae* (Weedon) Morgan-Jones

Colonies effuse, brown to black. Mycelium superficial, composed of repent, branched, septate, pale brown, verruculose hyphae. Conidiophores semimacronematous to macronematous, mononematous, simple or branched, straight or flexuous, septate, pale brown to brown, verruculose. Conidiogenous cells monoblastic or polyblastic, integrated, terminal or intercalary, cylindrical. Conidia solitary, dry, septate, pale brown, cylindrical, verruculose.

Stenellopsis magnoliae (Weedon) comb. nov. (Fig. 1).

≡ *Heterosporium magnoliae* Weedon, Mycologia 18: 222, 1926.

Colonies abundant, hypophyllous, brownish-black, sooty in appearance, suborbicular with a ragged margin or irregular in shape, discrete or confluent, densely gregarious or, less frequently, scattered, up to 2.5cm. in diameter. Mycelium effuse, superficial, composed of pale brown, repent, much branched, septate, verruculose, 2.5-3.5µm wide hyphae, forming a dense network. Conidiophores semimacronematous to macronematous, mononematous, arising terminally on and as lateral branches of the mycelial hyphae, usually numerous, simple or, more frequently, branched, straight or flexuous, pale to mid brown, cylindrical, frequently with nodose swellings that are sometimes unilateral in arrangement, verruculose, up to 480µm long, 3-4.5µm wide. Conidiogenous cells monoblastic or polyblastic, integrated, terminal and sympodial or intercalary, conidial scars thin and inconspicuous; if intercalary inflated at the conidiogenous loci which usually occur immediately below transverse septa to give a nodose appearance. Conidia solitary, dry, cylindrical, straight or slightly curved, pale brown, verruculose to rugulose, 1 to 5, or rarely 7-septate, broadly obtuse towards the apex, attenuated towards a narrow, subhyaline, truncate, unthickened hilum, 14-48 X 3.5-4.5µ.

On dead leaves of *Magnolia grandiflora* L.; North America.

Collections examined: on *M. grandiflora*, St. Petersburg, Florida, February 15, 1923, A.G. Weedon, BPI, type; on *M. grandiflora*, Auburn, Lee County, Alabama, May 3, 1976,

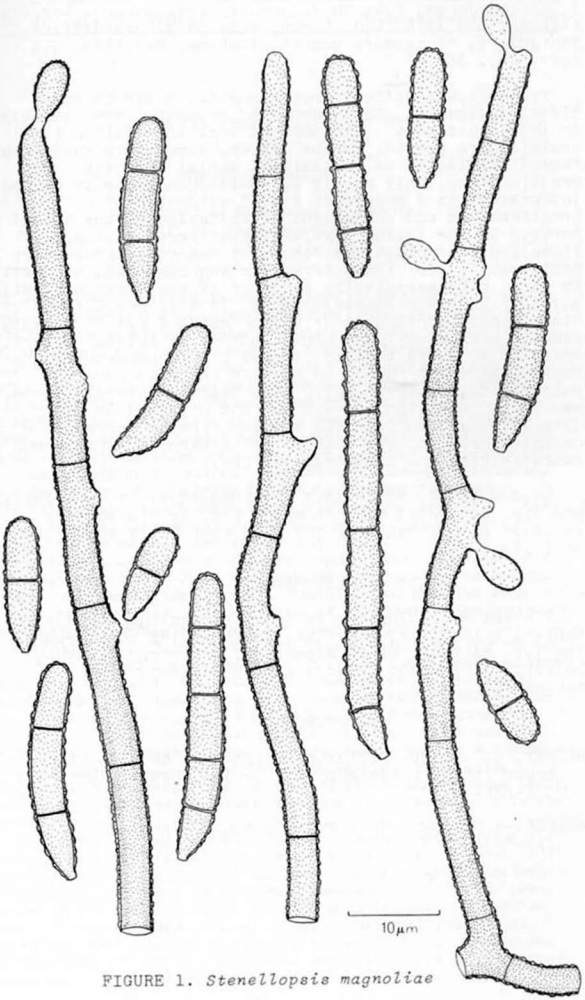


FIGURE 1. *Stenellopsis magnoliae*

G. Morgan-Jones, AUA; on *M. grandiflora*, Auburn, Lee County, Alabama, May 1976, L.G. Brown, AUA; on *M. grandiflora*, Montgomery, Montgomery County, Alabama, May 1979, G.W. Karr, Jr., AUA.

Stenellopsis differs from *Stenella*, which it most closely resembles, in a number of respects, most notably in the location of conidiogenous loci in relation to conidiophore growth. In the latter, successive conidia are formed terminally as a result of serial sympodial proliferation. Only rarely do conidiogenous cells become intercalary as a result of distal extension by proliferation and subsequent delimitation of the apical portion by the laying down of a transverse septum. *Stenellopsis* conidia are formed at numerous intercalary meristematic loci in an irregular sequence and, at least in part, retrogressively. A number of conidiogenous cells may thereby become conidiogenous. In this respect *Stenellopsis* appears to be unique among fungi of broadly similar morphology. The conidiophores of *Fulvia* Ciferri, based on *F. fulva* (Cooke) Ciferri [≡ *Cladosporium fulva* Cooke], have a tendency to exhibit the same growth pattern and, interestingly, also bear unilateral, nodose swellings. Additional features that distinguish *Stenellopsis* from *Stenella* are its densely verruculose conidiophores and the absence of thickened, conspicuous scars marking the conidiogenous loci.

Weedon (1926) recognized the uniqueness of *S. magnoliae* and even suggested that it might best be placed in a separate genus, based on the fact that it is superficial on leaves.

ACKNOWLEDGMENTS

I thank Mrs. Flora G. Pollack, Agricultural Research Center, Beltsville, Maryland, for allowing me access to the type material of *H. magnoliae*. Dr. Roger D. Goos, University of Rhode Island, kindly reviewed the manuscript.

REFERENCES

HUGHES, S.J. 1958. Revisiones hyphomycetum aliquot cum appendice de nominibus rejiciendis. Can. J. Bot. 36: 727-836.

WEEDON, A.G. 1926. Some Florida fungi. Mycologia 18: 218-223.

MYCOTAXON

Vol. X, No. 2, pp. 409-412 January-March 1980

NOTES ON THE GENUS SUBULICYSTIDIUM

ANTHONY E. LIBERTA

Department of Biological Sciences
Illinois State University
Normal, Illinois 61761, U.S.A.

Subulicystidium was erected by Parmasto in 1968 and was characterized by its arachnoid to cottony-textured fruitbody, distinct, loosely interwoven, clamped hyphae, subulate cystidia with thickened walls, and fusoid spores. The genus is typified by the well known species *Peniophora longispora* Pat. Jülich (1969) added an important character to the generic description when he reported that repetobasidia are produced by *P. longispora* and *P. nikau* G. H. Cunn. My own interpretation of the generic limits suggests that the minimum complement of characters that a taxon should possess in order to be included in *Subulicystidium* would be: long, subulate cystidia with ribbon-shaped wall ornamentation, repetobasidia, loosely interwoven, clamped hyphae, and an arachnoid to cottony-textured fruitbody.

In 1975, Jülich published several excellent SEM micrographs illustrating the wall ornamentation of the cystidia. He reported that the ornamentation was composed of two rows of "ribbon-like" structures rather than four rows of regularly spaced short crystals. His micrographs leave little doubt that the cystidial wall ornamentation is formed by the deposition of wall material rather than the accumulation of crystals. That interpretation is important in the following discussion regarding the taxonomic limits of the genus.

Peniophora ralla H. S. Jackson has been recently transferred to *Subulicystidium* by Hjortstam and Ryvarden (1979). The crystal-coated cystidia of *P. ralla* are morphologically similar to the previously included species of *Subulicystidium* but lack the ribbon-like ornamentation of wall material illustrated by Jülich. In evaluating this difference, I have concluded that the accumulation of crystals on cystidial walls represents a type of ornamentation that is not homologous to the production of morphologically stable wall deposits. Since *P. ralla* also lacks repetobasidia (Hjortstam and Ryvarden 1979), it therefore deviates significantly from the other species within the genus.

Circumscribing the taxonomic limits of each species of *Subulicystidium* is also a difficult enterprise due to the extreme variability in spore size and morphology that one encounters within individual collections and among collections. Oberwinkler (1977) has provided one of the first detailed discussions concerning these difficulties. He reported two collections (FO 17359, 17371) with long, narrow spores that possibly represent a new species and two Venezuelan collections (FO 15970, 16014) whose spore length is between those reported for *S. longisporum* (Pat.) Parm. and *S. brachysporum* (Talbot

and Green) Jülich. He also described *S. meridense* and *S. naviculum* as new species.

In an attempt to better understand the magnitude of variability found among spores in collections that could be assigned to *Subulicystidium*, I have calculated a length-to-width ratio for spores observed in the type collections of *P. longispora* Pat. var. *brachyspora* Talbot and Green, *P. nikau*, and in specimens collected from a single geographic area (Venezuela) by Liberta and Navas (1978). Twenty spores from each collection were measured, a ratio calculated for each spore, and a range of ratios recorded for each collection. These ratios are illustrated in Figure 1 and they depict a continuum, each ratio overlapping a few collections with shorter spores as well as a few with longer spores. The continuum begins with ratios representing the spores of *S. nikau* and ends with a collection whose spores are longer and narrower than those reported for the type of *P. longispora* (Oberwinkler 1977). In addition, various ratios along this continuum represent the relative positions of several species that have been described by previous investigators. For example, ratios *e* and *m* represent collections whose spores are very similar to those reported for the type collections of *S. meridense* and *S. longisporum*, respectively. Also, ratio *p* represents a collection similar in spores size to FO 17359 cited by Oberwinkler (1977). Of greatest importance to this discussion, however, are the numerous "intermediate" collections whose taxonomic disposition among the described species is unclear. For example, Figure 1 includes seven collections whose spore sizes and ratios are intermediate between ratio *e*, representing *S. meridense*, and ratio *m*, representing *S. longisporum*.

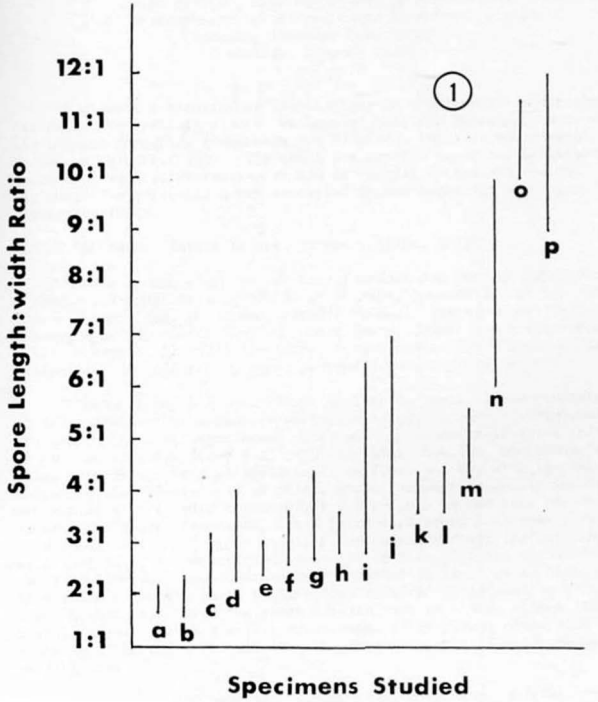
It is interesting to note that a similar continuum of spore size

---

Fig. 1 Length-to-width ratios for spores of type specimens and Venezuelan collections representing taxa of *Subulicystidium*. *a:* Venezuelan collections identified as *S. nikau*, spores 5-9 x 3-3.5 µm (ISU 1421, 1487, 1488, 1590); *b:* Isotype of *S. nikau*, spores 6.5-8.5 x 3.5-4.5 µm (K); *c:* Holotype of *Peniophora longispora* var. *brachyspora*, spores 6.5-8 x 2.5-3 µm (PREM); *d:* six Venezuelan collections identified as *S. brachysporum*, spores 7-11 x 2.5-3.5 µm (ISU 1465, 1467, 1468, 1600, 1603, 1605); *e:* collections identified as *S. meridense*, spores short, cylindrical to suballantoid, 6-7 x 2.5 µm (ISU 1597, 1618); *f.* collection with spores short, cylindrical, 6.5-9 x 2.5 µm (ISU 1478); *g:* collection with spores, moderately long, fusiform, 8-11 x 2.5-3 µm (ISU 1575); *h:* collection with spores either short-cylindrical 7-9 x 2.5 µm, or fusiform, 9.5-10 x 3 µm (ISU 1466); *i:* collection with spores moderately long, cylindrical, 7-13 x 2-2.5 µm (ISU 1622); *j:* collection with spores moderately long, fusiform, 10-13.5 x 2-3 µm (ISU 1623); *k:* collection with spores moderately long, cylindrical, 9-11 x 2.5 µm (ISU 1420); *l:* collection with spores moderately long, fusiform, 9-9.5 x 2-2.5 µm (ISU 1604); *m:* collection identified as *S. longisporum*, spores moderately long, fusiform, 13-15 x 2-2.5 µm (ISU 1470); *n:* collection with spores long, cylindrical to filiform, 14-17 x 1.5-2.5 µm (ISU 1609); *o:* collection with spores long, cylindrical to filiform, 20-23 x 2 µm (ISU 1613); *p:* collection with spores long, cylindrical to filiform, 15.5-18 x 1.5-2 µm (ISU 1607).

extremes in *Xerulina asprata* (Berk.) Pegler has been reported by Redhead and Ginns (pers. com.). Steyaert (1975) has also reported a wide range of spores sizes in *Ganoderma tornatum* (Pers.) Bres.

Caution should be exercised when dealing with taxa of *Subulicystidium* until additional data generated by compatibility studies, culture characterization, and disc electrophoresis clarify the species limits. In the meantime, and solely based upon morphological characters, I have concluded that *S. nikau* and possibly *S. naviculum* represent distinct species, but *S. brachysporum*, *S. longisporum*, *S. meridense*, and the "intermediates" noted in Figure 1 belong to a single species complex.



LITERATURE CITED

HJORTSTAM, K., and L. RYVARDEN. 1979. Notes on Corticiaceae (Basidiomycetes) IV. Mycotaxon 9: 505-519.

JÜLICH, W. 1969. Uber die Gattungen *Piloderma* gen. nov. und *Subulicystidium* Parm. Ber. Deutsch. Bot. Ges. 81: 414-421.

JÜLICH, W. 1975. Studien an Cystiden -I. *Subulicystidium* Parm. Persoonia 8: 187-190.

LIBERTA, A. E., and A. NAVAS. 1978. Notes on Venezuelan Corticiaceae (Basidiomycetes). Can. J. Bot. 56: 1777-1781.

OBERWINKLER, F. 1977. Species-and generic-concepts in the Corticiaceae. Pages 331-348 in H. Clémençon, ed. The species concept in Hymenomycetes. J. Cramer, Vaduz.

PARMASTO, E. 1968. Conspectus systematus Corticiacearum. Tartu.

STEYAERT, R. L. 1975. The concept and circumscription of *Ganoderma tornatum*. Trans. Br. Mycol. Soc. 65: 451-467.

MYCOTAXON

Vol. X, No. 2, pp. 413-420 January-March 1980

THREE NEW ENDOMYCORRHIZAL *GLOMUS* SPP. ASSOCIATED WITH ACTINORRHIZAL SHRUBS

SHARON L. ROSE
Oregon State University, Department of Soil Science

JAMES M. TRAPPE
Forest Service, U.S. Department of Agriculture
Pacific Northwest Forest and Range Experiment Station
Forestry Sciences Laboratory
Corvallis, Oregon 97331

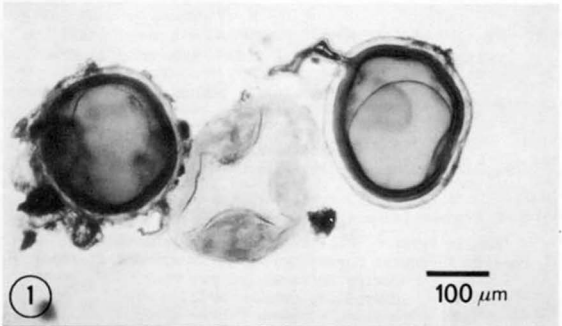
In assessing mycorrhizal associations of non-leguminous dinitrogen-fixing (actinorrhizal) plants, we sampled soil for Endogonaceae by wet-sieving and decanting (Gerdemann and Nicolson, 1963) as modified by Smith and Skipper (1979). The three new species described below were associated with actinorrhizal shrubs in central Oregon and coastal England. The collections are deposited in the herbarium of Oregon State University (OSC).

GLOMUS HALONATUS Rose & Trappe sp. nov. (Figs. 1-3)

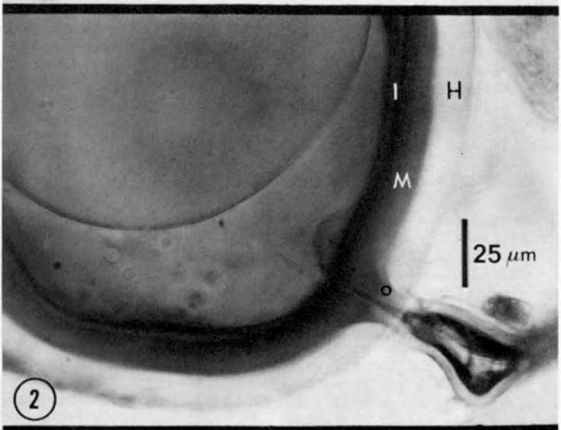
Chlamydosporae singulae vel laxe fasciculatae in solo efformatae, globosae vel subglobosae, 200-280 µm in diam, brunneolae vel tabacinae. Sporae tunica 18-35 µm crassa, stratis duobus: exteriore 8-12(-20) µm crasso, hyalino, mucilagino, juventute laevi, deinde scabro; interiore 10-15 µm crasso, brunneo, lamellato, minute echinulato. Hypha affixa ad tunicam eporae constricta, infra constrictionem inflata, septo.

Chlamydospores borne singly in soil or in small, loose clusters of 3-7 spores within a loosely wefted peridium, globose to subglobose, 200-280 µm in diam, light brown to brown. *Spore walls* 18-35 µm thick, of two layers: the outer 8-12 (-20) µm thick, hyaline, amorphous, sometimes with obscure radial striations, in youth smooth, with age becoming roughened; the inner 10-15 µm thick, brown, often prominently lamellate, ornamented with crowded spines 0.5 x 0.2 µm that extend into the outer layer. Old spores sometimes with a third dark brown innermost layer ± 5 µm thick. *Attached hypha* straight, extending through the outer hyaline wall wherein it is constricted to 5-6 µm in diam. At the surface of the outer hyaline wall, subtending hypha expanded to 11-13 µm in diam, and at ± 10 µm below the outer hyaline wall inflated to as much as 17 µm in diam; hyphal walls near the spore totaling 5-8 µm thick, with a thick hyaline outer layer and a thin brown inner layer; hypha often with a septum ± 30 µm below the attachment. *Spore contents* of oil globules of varying size.

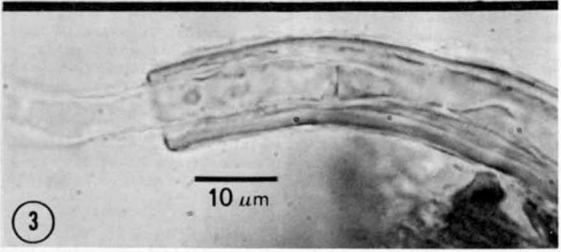
DISTRIBUTION AND HABITAT: Central Oregon in arid, volcanic soils, in sand dunes in coastal England, and grasslands in Veracruz, Mexico.



1



2



3

MYCORRHIZAL ASSOCIATIONS: Associated in the field with vesicular-arbuscular (VA) mycorrhizae of *Ceanothus velutinus* Dougl. and *Hippophae rhamnoides* L.

ETYMOLOGY: Latin, "haloed"; in transmitted light in optical cross section, the thick, hyaline outer spore wall appears as a bright ring around the spore.

COLLECTIONS EXAMINED: HOLOTYPE-ENGLAND, Lincolnshire, Gibralter Point, under *Hippophae rhamnoides*, Nov. 1978, col. C. T. Youngberg, Rose S-225 (OSC). PARATYPE - UNITED STATES, Oregon, Deschutes Co., under *Ceanothus velutinus*, May 1979, Rose S-250. Mexico - Veracruz, with roadside grasses, 1977, no. 3594.

Glomus halonatus differs from *G. caledonius* (Nicol. & Gerd.) Trappe & Gerd. in having an amorphous poorly separable outer wall and echinulate inner wall vs. the nonmucilagenous, separable outer wall and smooth inner wall of the latter. The echinulations of the inner wall of *G. halonatus* resemble those of *G. monosporus* spores which, however, have but a thin outer wall, a hyphal mantle partially to totally enclosing the spore, and a subtending hypha that typically recurves along the spore surface. The spores of *G. halonatus* are cyanophilous in cotton blue but do not react distinctively to Melzer's reagent. The halo effect created by the outer wall in transmitted light in optical cross section is striking. The radial striations in the outer wall appear to extend from the spines on the inner wall and can be seen clearly only in some spores.

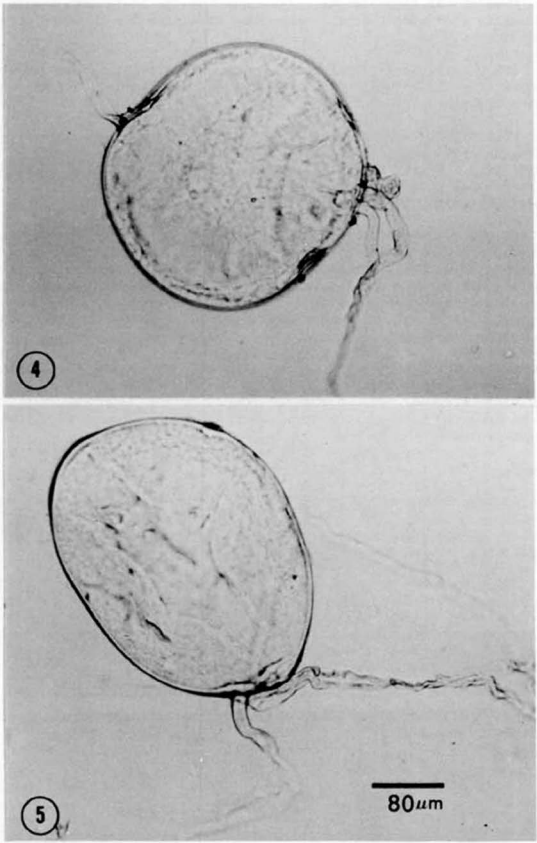
GLOMUS LACTEUS Rose & Trappe sp. nov. (Fig. 4 & 5)

Chlamydosporae singulae in solo efformatae, globosae vel subglobosae, 150-220 µm in diam, lacteae. Sporae tunica una, 3-5 µm crassa, hyalina, laevis. Hyphae affixae 1-3, 6-12 µm in diam, hyalina, tunicis parum incrassatis. Contentum sporae granulatum vel globulosum.

Chlamydospores borne singly in soil, globose to subglobose, 150-220 µm in diam, opaque, milky white, shiny smooth. *Spore walls* single, 3-5 µm thick, hyaline. *Attached hyphae* 1-3 per spore, 6-12 µm in diam, straight, hyaline, with walls slightly thickened only for a short distance from the spore; in most spores two hyphae merge near the spore to form a single attachment. *Spore contents* hyaline, granular or of globules of varying size.

DISTRIBUTION AND HABITAT: Central Oregon in arid, volcanic soil in edaphically stressed sites.

Figs. 1-3. *Glomus halonatus*. 1. Two mature spores in poly-vinyl-lactophenol (PVL) showing the typical outer "halo" as seen in transmitted light. 2. Wall layering in mature spores; (H) outermost hyaline layer forming a halo, (M) middle lamellate layer, and (1) inner layer found in mature specimens only. 3. Germination by regrowth of subtending hypha.



Figs. 4 & 5. *Glomus lacteus* with arrangement of two merging hyphae at the spore base and a third hypha situated some distance away.

MYCORRHIZAL ASSOCIATIONS: Associated in the field with VA mycorrhizae of *Ceanothus velutinus* and *Purshia tridentata* (Pursh) D.C. Forming VA mycorrhizae with *Bromus tectorum* L. in pot culture.

ETYMOLOGY: Latin, "milk-white", referring to the opaque milky appearance of the spores under incident light.

COLLECTIONS EXAMINED: TYPE: UNITED STATES, Oregon, Deschutes Co., 1 km north of Benham Falls, elev. 1100 m., 1-15 cm deep in soil under *Ceanothus velutinus*, April 1978, Rose S-210 (OSC). PARATYPE: Oregon, Deschutes Co., 1 km west of Pine Mtn., elev. 1500 m, 1-15 cm deep in soil under *Purshia tridentata*, Sept. 1978, Rose S-219 (OSC).

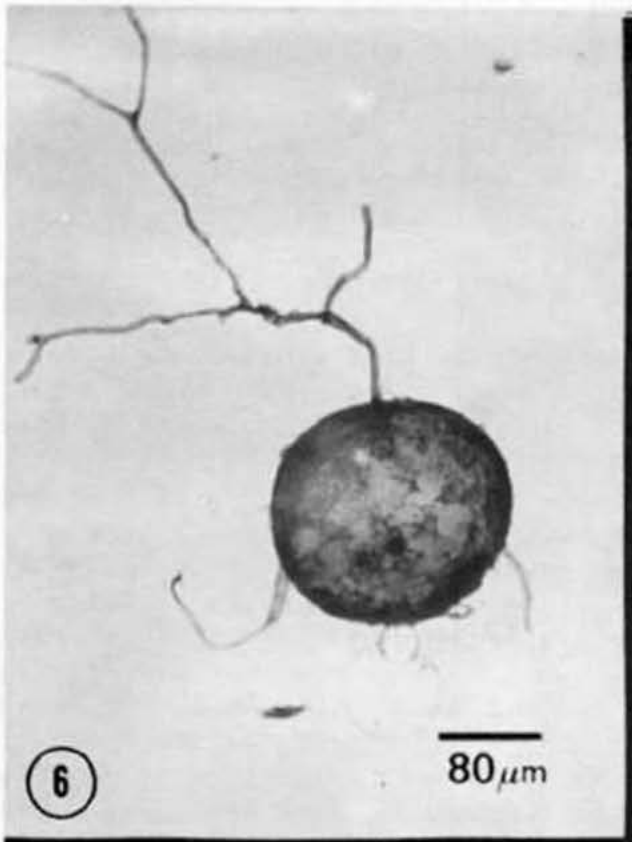
Glomus lacteus spores are distinctive in their combination of frequently multiple hyphal attachments, white color, and a thin, smooth, singly layered spore wall. Spores of *G. lacteus* closely resemble spores of *Glomus albidus* sp. nov. (Walker and Rhodes, manuscript in preparation) but can be differentiated by wall morphology. Young spores of *G. albidus* posses two walls of equal thickness, each 0.5-2.0 µm, whereas only one thin spore wall, 3-5 µm thick, appears on *G. lacteus* regardless of spore age. Spores of *G. albidus* and *G. clarus* both possess an outer spore wall that sloughs off at maturity, leaving a roughened outer surface on most spores. The spore wall of *G. lacteus* does not slough off; the spore surface is always smooth. *Glomus multicaulis* Gerd. and Bakshi spores frequently have more than one hyphal attachment but the spore walls are dark brown and ornamented with rounded projections in contrast to the white, smooth *G. lacteus* spores (Gerdemann & Bakshi, 1976). Occasional spores of other *Glomus* spp. have two hyphal attachments (e.g. *G. fasciculatus, G. microcarpus, G. monosporus, G. mosseae,* and *G. albidus*) but the phenomenon in these cases is atypical (Gerdemann & Trappe, 1974; Gerdemann & Bakshi, 1976; Walker and Rhodes, manuscript in preparation).

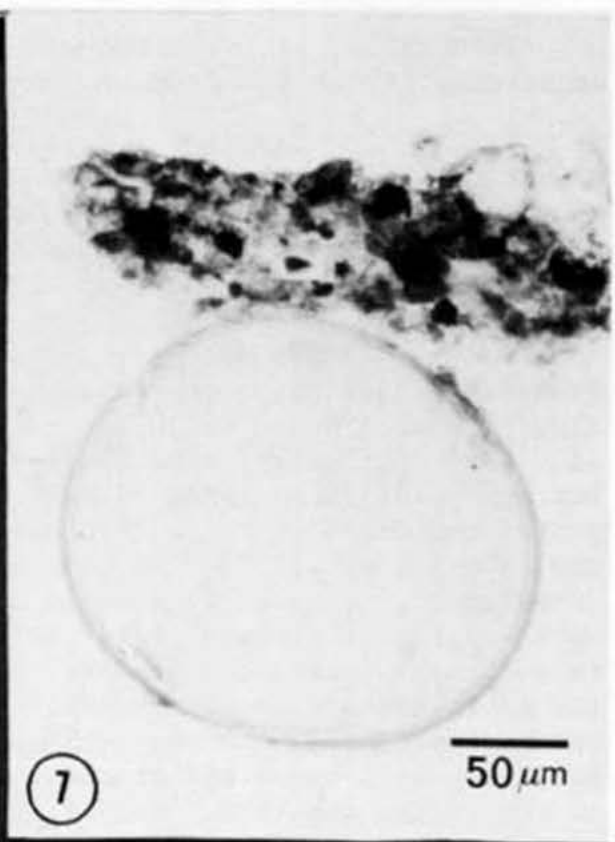
In *G. lacteus* two hyphae often grow parallel to each other for some distance, then merge near the spore to form a single attachment. Another hypha often is attached 10-20 µm away from the attachment point of the merged hyphae, and sometimes yet another hypha is attached at a still greater distance from that of the merged hyphae. These multiple attachments resemble the progametangia of zygospores of *Endogone multiplex* Thaxter (1922) and of some Kickxellaceae (Benjamin, 1966). It is thus possible that *G. lacteus* as we describe it is zygosporic rather than chlamydosporic. As presently circumscribed the genus *Endogone* contains only sporocarpic species and is not known to be VA mycorrhizal. The assignment of this new species to *Glomus* seems to be best until more is known of its life cycle.

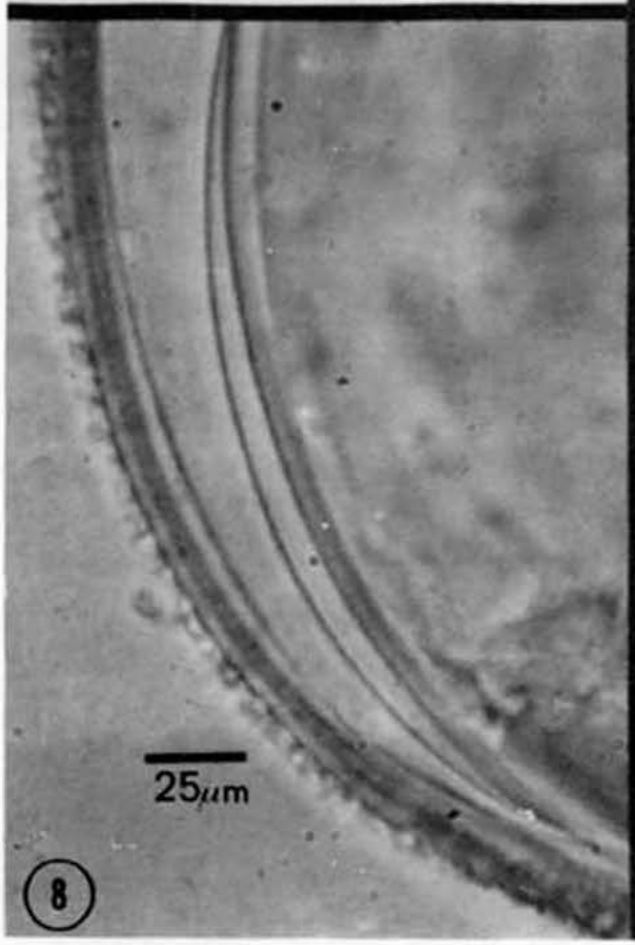
GLOMUS SCINTILLANS Rose & Trappe sp. nov. (Figs. 6-9)

Chlamydosporae singulae in solo efformatae, globosae vel subglobosae, 180-210 µm in diam, hyaline. Sporae tunica 7-10 µm in diam, stratis tribus: exteriore 2-4 µm crasso, hyalino, nodulis congestis, hyalinis, 1-3 x 0.4 - 1.2 (-3) µm ornatis; medio 2-3 µm crasso, hyalino, ex strato exteriore separabili; interiore 2-3 µm crasso, ad stratum medium adherenti. Hypha affixa 7-9 µm in diam, hyalina.

Chlamydospores borne singly in soil, globose to subglobose, 180-210 µm in diam, hyaline. *Spore walls* 7-10 µm thick, of three layers; the outer 2-4 µm thick, hyaline, with a surface ornamentation of hyaline


80 μm
6


50 μm
7


25μm
8


25μm
9

knobs 1-3 x 0.4 - 1.2 (-3) µm; the middle layer 2-3 µm thick, hyaline, separable from the outer layer; and the inner layer, 2-3 µm thick, hyaline, adherent to the middle layer. *Attached hypha* straight, 7-9 µm in diam, hyaline; occasionally 2 hyphae merging near the spore to form a single attachment. *Spore contents* of hyaline globules 7-20 µm in diameter. Spores strongly cyanophilous in cotton blue but do not react distinctively to Melzer's reagent.

DISTRIBUTION AND HABITAT: Central Oregon in loamy pumice soil in desert areas with typically hot, dry summers.

MYCORRHIZAL ASSOCIATIONS: Associated in the field with VA mycorrhizae of *Cercocarpus ledifolias* Nutt. and *Purshia tridentata*.

ETYMOLOGY: Latin, "sparkling", referring to the way the spores sparkle under incident light due to reflections off the surface ornamentation.

COLLECTIONS EXAMINED: TYPE: UNITED STATES, Oregon, Lake Co., near Picture Rock Pass, 1500 m elev., 1-15 cm deep in soil under *Cercocarpus ledifolias*, Sept. 1978, Rose S-220 (OSC). FARATYPE: Oregon, Deschutes Co., 1 km west of China Hat Mtn., in soil under *Purshia tridentata*, May 1979, Rose S-251 (OSC).

Glomus scintillans closely resembles *Glomus clarus* in size and color, but differs in having a knobby surface, in lacking a bulging pore septum in the subtending hypha at the spore base, and the spores do not turn yellow with age as is commonly the case with *G. clarus*. It differs from *Complexipes moniliformis* gen. et sp. nov. (Walker, 1979) ("crenulate spore", Mosse & Bowen, 1968a) by its lack of color and hyphal septation.

Glomus scintillans will key out to spore WUM 4 (couplet #59) in the key to the Endogonaceae (Hall and Fish, 1979). No samples of WUM 4 were compared with *Glomus scintillans* spores for this description.

Spore germination is by hyphal extension directly through the spore wall (Fig. 9) as is commonly observed in *Glomus pallidus* and in species of *Gigaspora* (e.g. *G. margarita* and *G. rosea*).

ACKNOWLEDGEMENTS

Drs. B. Mosse and C. T. Youngberg kindly furnished spore collections from England. S. Morris, J. Fuller, M. Guilemette, and G. Spiro generously contributed their time and help during sampling periods. This is Technical Paper No. 5355, Oregon Agricultural Experiment Station. Facilities for

Figs. 6-9. *Glomus scintillans*. 6. Spore stained with Cotton Blue showing cyanophilous reaction and multiple hyphal attachments. 7. Spore in PVL, wall layering and surface ornamentation is visible. 8. Detail of surface protrusions and wall layering. 9. Germination directly through the spore wall; spore contents aggregates near the point of germination.

the research were provided by the U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory.

LITERATURE CITED

Benjamin, R. K. 1966. The merosporangium. Mycologia 58:1-42.

Gerdemann, J. W. and B. K. Bakshi. 1976. Endogonaceae of India: two new species. Trans. Br. Mycol. Soc. 66:340-343.

Gerdemann, J. W. and T. H. Nicolson. 1963. Spores of mycorrhizal *Endogone* species extracted from soil by wet sieving and decanting. Trans. Br. Mycol. Soc. 46:235-244.

Gerdemann, J. W. and J. M. Trappe. 1974. The Endogonaceae of the Pacific Northwest. Mycologia Mem. 5:1-76.

Hall, I. R. and B. J. Fish. 1979. A key to the Endogonaceae. Trans. Br. Mycol. Soc. (In press).

Mosse, B. and G. D. Bowen. 1968. A key to the recognition of some *Endogone* spore types. Trans. British Mycol. Soc. 51:469-483.

Smith, G. W. and H. D. Skipper. 1979. Comparison of methods to extract spores of vesicular-arbuscular mycorrhizal fungi. Soil Sci. Soc. Am. J. 43(4):722-725.

Thaxter, R. 1922. A revision of the Endogonaceae. Proc. Amer. Acad. Arts. Sci. 57:291-351.

Walker, C. 1979. *Complexipes moniliformis*: A new genus and species tentatively placed in the Endogonaceae. Mycotaxon 10(1):99-104.

MYCOTAXON

Vol. X, No. 2, pp. 421-427 January-March 1980

TERATOSPERMA OLIGOCLADUM, A NEW HYPHOMYCETOUS MYCOPARASITE ON SCLEROTIA OF SCLEROTINIA SCLEROTIORUM, S. TRIFOLIORUM, AND S. MINOR

F. A. UECKER

Mycology Laboratory, Plant Protection Institute,
Science and Education Administration,
U. S. Department of Agriculture,
Beltsville, Maryland 20705, U.S.A.

and

W. A. AYERS and P. B. ADAMS

Soilborne Diseases Laboratory, Plant Protection Institute
Science and Education Administration,
U. S. Department of Agriculture,
Beltsville, Maryland 20705, U.S.A.

SUMMARY

A dematiaceous hyphomycete recently discovered in soil from California is illustrated and described as a new species, Teratosperma oligocladum. The primary conidia are phragmoseptate and are pentaradiate, having an elongate axis and three arms radiating from the second or third cell from the base. The fungus is mycoparasitic on sclerotia of Sclerotinia sclerotiorum, S. trifoliorum, and S. minor. It has a Selenosporella state and produces bulbils.

Sporidesmium sclerotivorum Uecker et al. (1978) was recently described as a dematiaceous hyphomycete that: 1) produces phragmoseptate conidia as blown-ends of the conidiophores, the conidiophores proliferating percurrently from the tip of the former penultimate cell through the broken terminal cell; 2) produces a Selenosporella state, often on the same hypha with the Sporidesmium state; and 3) occurs as a mycoparasite on sclerotia of

Sclerotinia sclerotiorum (Lib.) dBy. In this paper we report the discovery of another dematiaceous hyphomycete having the same characteristics enumerated above, but differing in several morphological features. We describe it here as a new species of Teratosperma.

Terminology regarding conidial development and structure follows the recommendations of Kendrick (1971). Names of herbaria are abbreviated according to the Index Herbariorum (Holmgren and Keuken, 1974).

Teratosperma oligocladum Uecker, Ayers, et Adams, sp. nov.

Coloniae super Sclerotiniae sclerotiorum, S. trifoliorum, et S. minor sclerotia efformantes. Hyphae 3-7µm latae, pallide vel mediocriter brunnescentes. Bulbilli 40-60µm diametro, nigri ubi in culturis super papyrum ad percolandum crescentes. Conidiophorum simplex, erectum, leve, diametro et colore idem atque hypha assimilitiva, aetate provectum obscurius, 2-4 cellulare, cellula terminali conidiogena, prolificatione probabiliter percurrente. Cellula conidiogena holoblastica, integrata. Conidium mediocriter brunneum, atrobrunneum vel fuscum, (130-)150-260(-390)µm longum, axis prolongatione hyalina inclusa; axis conidii multiseptatus, (0-)1-3(-4) ramis ex cellula secunda vel tertia supra basin exorientibus, 50-180 X 6-9 µm, apicem versus attenuatis, apice 2-3µm lato ornatus.

In hyphis eisdem ac Teratosperma vel sejunctis orta Selenosporellae fructificatio. Huius conidiophora simplicia vel ramosa, 45-152µm longa, ad basim 6-8µm lata, apicem versus 3-5µm lata. Cellulae conidiogenae indeterminatae, sympodiales, in verticillis binis vel septenis vel numero interjecentes e conidiophoro vel eius ramulis ortae, (15-)25-45(-52)µm longae, ad basim 3-5µm latae, apicem versus attenuatae, 1µm latae vel angustiores, parte terminali denticulas paucas vel multas conidiogenas producente. Loci conidiogeni multiplices, seriales, progredientes. Conidia hyalina, falcata vel fusiformia, utrinque rotundati, 7-8 X 1-1.5µm, in guttulae mucosae aggregatae.

Holotypus BPI 71912; isotypi in DAOM, NY, et IMI.

Etymology; Gr. oligo = few, klados = branch.

Colonies developing on sclerotia of Sclerotinia sclerotiorum, S. trifoliorum, and S. minor. Hyphae 3-7µm wide, light or becoming medium brown. Bulbils 40-60µm

diameter, black when growing on filter paper. Conidiophore simple, erect, smooth, the same diameter and color as the assimilative hypha, becoming darker with age, 2-4 cells long, terminal cell conidiogenous, probably proliferating percurrently. Conidiogenous cell holoblastic, integrated. Conidium medium brown or dark brown or fuscous, (130-)150-260(-390)µm long including the hyaline prolongation of the axis, axis of the conidium multiseptate, adorned with (0-)1-3(-4) limbs developing from the second or third cell above the base, limbs 50-180 X 6-9µm, attenuate toward the apex, apex 2-3µm wide.

Selenosporella state and Teratosperma state developing on the same hypha or on different ones. Conidiophore of Selenosporella state simple or branched, 45-142µm long, 6-8µm wide at base, tapering to 3-5µm at apex. Conidiogenous cells indeterminate, sympodial, arising in whorls of up to 7 from the conidiophore or its branches, (15)25-45(-52)µm long, 3-5µm wide at base, attenuate toward the apex, terminal part 1µm wide or less, producing few or many conidiogenous denticles. Conidiogenous loci multiple, serial, progressive. Conidia hyaline, falcate or fusiform, ends rounded, 7-8 X 1µm, aggregated in mucous droplets.

Teratosperma oligocladum was collected from soils obtained from farms near Salinas and Tulelake, California. Soil samples taken from fields having a history of Sclerotinia infestations were baited with sclerotia obtained from cultures on autoclaved oat seeds. Sclerotia were transferred to moist filter paper at 4- week intervals. The fungus appeared on sclerotia removed from the soil sample after 4 weeks incubation. It grew onto the filter paper and was identifiable after 7-10 days, and continued producing conidia for several weeks. The first plates contained mostly the Teratosperma state, whereas in later transfers the Selenosporella state was preponderant. For routine cultivation in the laboratory, infested sclerotia were placed on water agar. On this medium the Selenosporella state developed profusely, whereas the Teratosperma state developed much less readily. The fungus also grew on sclerotia of S. trifoliorum Erickss. and S. minor Jagger (Fig. 1) on moist filter paper but has not been tested on sclerotia of other fungi. Its potential as a biological control agent against the sclerotia of species of Sclerotinia is under study.

Conidia of the Teratosperma state develop as blown-out ends of the terminal cell of the conidiophore. The radiating arms develop as simple extensions from the

distal part of the second or third cell above the point of attachment of the conidium to the conidiophore. The arms become elongate, attenuate, and septate (Figs. 2, 3, 4). At maturity the main axis of the condium may be as much as 310μm long, including the thin, terminal, non-septate appendage. Three arms usually radiate symmetrically from the axis of the conidium. Sometimes arms fail to develop or only one or two form. Sometimes a fourth arm develops (Fig. 4) from the first or second cell above the others. The Selenosporella state (Fig. 6) develops either on the same hypha (Fig. 7) as the Teratosperma state or on different hyphae. A reduced form of the Selenosporella state often develops in culture from any arm of the Teratosperma state conidia (Fig. 4).

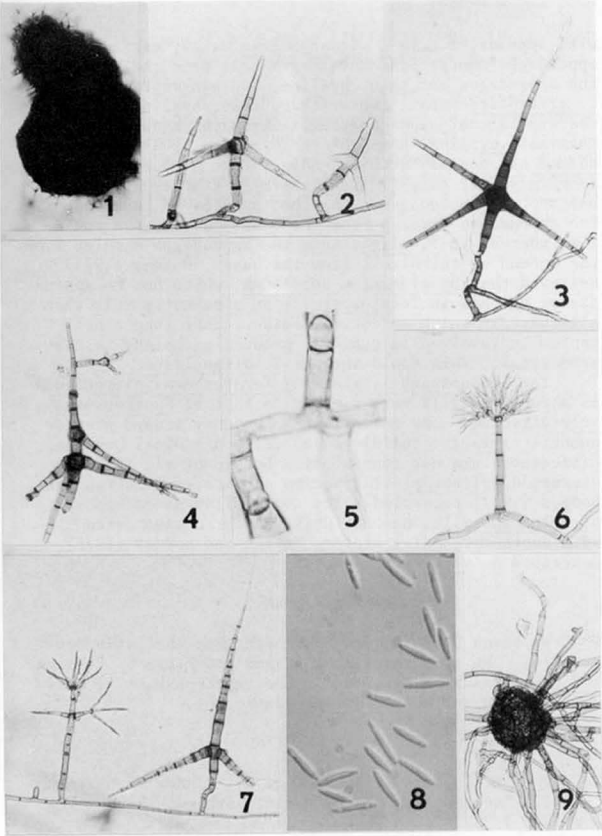
The diagnostic feature of T. oligocladum is its large, dematiaceous, holoblastic, phragmoseptate, usually pentaradiate conidia that develop as blown-out ends of conidiophores, which probably proliferate percurrently. Other distinctive characteristics include the possession of a Selenosporella state (Figs. 6, 7, 8); the production of bulbils (Fig. 9); and the mycoparasitic habit on sclerotia of Sclerotinia sclerotiorum.

It is an assumption, but a reasonable one, that the conidiophore proliferates percurrently. The conidiophore looks like those of Sporidesmium subulatum (Cke. & Ellis) Hughes and S. sclerotivorum, both when the conidum is attached and after it has seceded. Furthermore, some conidiophores begin to proliferate through the tip of the former penultimate cell of the conidiophore (Fig. 5). However, we have not yet observed an undisputed example of percurrent conidiophore proliferation in this fungus.

The unique conidia of this fungus allow us only two viable taxonomic options. It would be reasonable to describe it as the sole member of a new genus. The other option, the one we have chosen, is to place this fungus in the genus Teratosperma as a new species. Members of only a few genera produce conidia as blown-out ends of the conidiophores and produce conidiophores that proliferate percurrently. Of the genera that do both, only Chaetendophragmia and Teratosperma have phragmoseptate conidia

---

Figs. 1-9. Teratosperma oligocladum. Fig. 1. Conidia on sclerotium of Sclerotinia minor, X75. Fig. 2. Young conidia, one showing the origin of two radiating arms, X220. Fig. 3. Mature conidium, X220. Fig. 4. Mature conidium with extra arm; Selenosporella state formed on



two arms, X220. Fig. 5. Beginning of percurrent proliferation of conidiophore, X1000. Fig. 6. Selenosporella state, X220. Fig. 7. Teratosperma and Selenosporella states developing from the same hypha, X195. Fig. 8. Selenosporella state conidia, X1000. Fig. 9. Bulbil, X220.

with appendages. In C. triangularia Mats., one to three appendages emerge from the fourth cell from the base but the appendages are thin, hyaline, and non-septate. In C. triseptata Mats., two or three thin, hyaline, non-septate lateral appendages arise from the base of the terminal, hyaline, non-septate appendage. Only Teratosperma has conidia with appendages that are septate. Even in this genus, only T. singulare Syd. (the type species) has septate appendages. In other species of Teratosperma the appendages develop from the basal cell of the conidium, whereas in T. oligocladum the appendages develop from the second or third cell from the base. Hughes (1971) believed that Sporidesmium subulatum, which has no appendages, belongs in Teratosperma. He apparently felt that all fungi in which an entire septum rather than a half septum is involved in conidial production belong in the same genus. This would include T. oligocladum.

The Selenosporella state of Teratosperma oligocladum is morphologically very similar to that of Sporidesmium sclerotivorum. The former has a tendency toward greater numbers of larger conidiogenous cells per whorl but the differences are not consistent. Uecker et al. (1978) discussed Selenosporella species and states. Sutton and Hodges (1977) presented a key to the five named species of Selenosporella, none of which has been associated with another conidial state. Sutton and Hodges (1978) described S. verticillata also.

ACKNOWLEDGMENTS

We thank D. P. Rogers for correcting the Latin description. We also thank J. L. Crane and Flora G. Pollack for their valuable opinions on the relationships of this organism and for reviewing the manuscript.

LITERATURE CITED

Holmgren, P. K., and W. Keuken. 1974. Index Herbariorum I. The herbaria of the world. 6th ed. Regnum Veg. 92: 1-397.

Hughes, S. J. 1971. Percurrent proliferations in fungi, algae, and mosses. Canad. J. Bot. 49: 215-231.

Kendrick, W. B. (ed). 1971. Taxonomy of the Fungi Imperfecti. Toronto, U. of Toronto Press. 309 pp.

Sutton, B. C., and C. S. Hodges, Jr. 1977. Eucalyptus microfungi miscellaneous hyphomycetes. Nova Hedwigia 28: 487-498.

Sutton, B. C., and C. S. Hodges, Jr. 1978. Eucalyptus microfungi Chaetendophragmiopsis gen. nov. and other hyphomycetes. Nova Hedwigia 29: 593-607.

Uecker, F. A., W. A. Ayers, and P. B. Adams. 1978. A new hyphomycete on sclerotia of Sclerotinia sclerotiorum. Mycotaxon 7:275-282.

MYCOTAXON

Vol. X, No. 2, pp. 428-454 January-March 1980

THE PENIOPHOROID FUNGI OF THE WEST INDIES

A. PUNUGU[1], *M. T. DUNN*[2], *& A. L. WELDEN*

Dept. of Biology, Tulane Univ., New Orleans, La. 70118

-Abstract-

Thirty-seven taxa of peniophoroid fungi are reported from the West Indies. Of these, thirty are considered valid reports authenticated by fertile (spore-bearing) specimens. Seven are considered dubious because their reports are based on sterile (non-spore-bearing) specimens. A few of the dubious reports are based on sterile type, isotype, or paratype material. The thirty authenticated taxa are distributed into eight genera: *Amphinema (1)*, *Hyphoderma (4)*, *Hyphodontia (2)*, *Peniophora (4)*, *Phanerochaete (6)*, *Subulicystidium (2*, one of which is a new species), *Tubulicrinis* (1), and *Xenasma (1)*, and nine are listed as *"Peniophora"*. These nine cannot be considered true peniophoras, nor can they at present be transferred to more suitable genera.

That *Peniophora*, as used by Burt and some of his contemporaries, is an aggregation of unrelated species is well known to the present generation of mycologists. This has led to a certain awkwardness of treatment. The cystidia upon which *Peniophora sensu lato* is founded are often striking objects capable of easy detection. It seemed to us that grouping these cystidia-bearing resupinates together might facilitate identification of collections, especially at this stage

---

[1]Present address: Dept. of Botany, A.P.A.A. College, Palni, Tamilnandu, India.

[2]Present address: Dept. of Botany, Univ. British Columbia, Vancouver, B.C., Canada.

of flux in both the taxonomy of *Peniophora s. l.* and in our developing knowledge of the mycoflora of the West Indies. At the same time some acknowledgement should be made of the taxonomic advances in the realinement of this heterogeneous group. We have, therefore, included genera which appear, in our eyes, to have merit. Where there does not appear to be a valid generic concept or where such a concept still seems vague, we have left the taxon under *"Peniophora"*. The interminable nomenclatorial changes occurring in today's mycological studies clearly shows that only two taxonomic categories can claim any degree of stability; the class and the species. Therefore, the species of peniophoroid fungi are listed alphabetically in this report according to their specific epithet. This is followed by the basionym, if different, and, finally, by the currently accepted synonyms in capital letters, if necessary. Obligate synonyms are listed in the same paragraph; facultative synonyms in a separate paragraph. Numbers without prefixes or names refer to collections by A. L. Welden on deposit in the Tulane University Herbarium (NO).

KEY TO SPECIES

1. Context hyphae darkly pigmented; cystidia heavily incrusted 2
1. Context hyphae hyaline or dilutely pigmented . . . 5
   2. Basidiocarp with large embedded crystalline masses visible on the hymenial surface with a hand lens; spores 5.5-14.5 x 3.5-4.5µm . . . . . PENIOPHORA CARNEA
   2. Basidiocarp lacking such crystalline masses . . 3
3. Dendrophyses present; basidiocarp generally loosening and curling away from the substrate; hymenial surface Natal Brown; spores 6-8 x 2.5-3µm . . . . . PENIOPHORA VERSIFORMIS
3. Dendrophyses absent; basidiocarp not generally separable 4
   4. Basidiocarp with dark tints; rose lilac to grayish black; context hyphae dark brown and generally without a distinct basal zone of hyphae adjacent to the substrate; spores 7-9 x 3-3.5µm . . . . . PENIOPHORA CINEREA
   4. Basidiocarp with brighter tints; orangish to rose gray; context hyphae more lightly pigmented and generally with a basal zone of ± loosely arranged hyphae adjacent to the substrate; spores 9 x 3.5-4µm . . . . . PENIOPHORA VERSICOLOR

5. Cystidia soluble in 10% KOH, biradicate, with very thick walls, long-cylindrical, arising from basal hyphae and protruding beyond the hymenium; spores 6-8 x 1.5-2µm . . . . . TUBULICRINIS GRACILLIMA
5. Cystidia not soluble in KOH. 6
6. Basidia produced almost exclusively as lateral extensions of the prostrate hyphae of the very thin, waxy or subpellicular, dry, adnate basidiocarp;spores 7.5-14 x 2.5-3.5µm, lunate to falcate . . . . . .XENASMA DUSSII
6. Basidia produced as terminal ends of hyphae, without bifurcate, non-septate bases 7
7. Context hyphae with short lateral branches with terminal and median inflations which are often incrusted; spores 3.5-4.5 x 1.5-3µm. . . . ."PENIOPHORA" INFLATA
7. Context hyphae without such inflations 8
8. Basidiocarp membranous, 2-layered with a well-developed loose subiculum in which hyphae are branched at ± right angles and are simple septate or with rare single, double,or multiple clamps in the subicular hyphae only 9
8. Basidiocarp without the above combination of characters 15
9. Notable or slight color change in KOH, some bleaching afterwards 10
9. Bleaching or no color change in KOH 13
10. Rhizomorphs present 11
10. Rhizomorphs absent 12
11. Basidiocarp wine red in KOH, bleaching afterwards; hymenial surface yellow ochre to buff; with conspicuous concolorous rhizomorphs; spores 4-5 x 2-4µm . . . . . PHANEROCHAETE FILAMENTOSA
11. Basidiocarp not wine red in KOH; hymenial surface bright yellow and slightly bleaching in KOH; with conspicuous yellow rhizomorphs; spores 3.5-4.5 x 2-2.5µm . . . . . .PHANEROCHAETE BURTII
12. Hymenial surface brick red, near maroon in KOH, not bleaching afterwards; cystidia 30 - 75 x 5-10µm, abundant, projecting ones generally unincrusted and with thin walls, embedded ones heavily incrusted and with thick walls; spores 4.5-6 x 2.5-3µm . . . . . PHANEROCHAETE AFFINIS
12. Hymenial surface near Topaz in KOH and bleaching afterwards; cystidia 30-52 x 5.5-9µm,abundant,conical, heavily incrusted, with thick walls,embedded and projecting; spores 4.5-8 x 3.5-4µm . . . . . .PHANEROCHAETE HUILCA

13. Rhizomorphs present; cystidia simple septate, 60-130 x 9-11µm, incrusted with golden yellow and crystalline granules, with thin walls; spores 4.5-7 x 2-3µm . . . . . PHANEROCHAETE SEPTOCYSTIDIA
13. Rhizomorphs absent 14
    14. Cystidia generally incrusted only toward the apex, 30-90 x 6-12µm, with walls-3µm thick; hymenial surface whitish, creamy, or light ochraceous, cracking and showing white subiculum; spores 4-6 x 2-3µm . . . . .PHANEROCHAETE CREMEA
    14. Cystidia heavily incrusted throughout, 74-151 x 12-20µm,fusiform, acuminate, with walls -7µm thick; hymenial surface tawny; spores 4.5-5.5 x 3.5-4.5µm. . . . . PHANEROCHAETE PHOSPHORESCENS
15. Cystidia aculeate, sometimes septate and clamped at the base;hyphae dilutely pigmented or hyaline; spores 4.5-6.0 x 3-5µm . . . . . AMPHINEMA BYSSOIDES
15. Cystidia not aculeate; hyphae hyaline 16
    16. Basidiocarp very thin, arachnoid; cystidia needle-shaped; spores more than 12µm long . . .17
    16. Basidiocarp thin or thick, arachnoid or not, but cystidia not needle-shaped and spores 11µm or less in length 18
17. Cystidia with acicular crystals ensheathing the middle of the cystidium; spores 20-27µm long, with the distal end often coiled or twisted . . . . . .SUBULICYSTIDIUM COCHLEUM
17. Cystidia with small flattened crystals distributed in longitudinal rows on the cystidium; spores 8-15µm long. . . . . SUBULICYSTIDIUM LONGISPORUM
    18. Hyphae distinct, clamped; cystidia elongate, sometimes incrusted, with relatively thin walls 19
    18. Hyphae not distinct,agglutinated, or if distinct, then basidiocarp waxy or waxy membranous and bright colored 26
19. Basidia clavate; hyphae thick-walled,clamped;cystidia incrusted; spores 4-6 x 3-3.5µm . ."PENIOPHORA" FLAVA
19. Basidia urniform, suburniform or ventricose, usually with large subulate and arcuate sterigmata, or if such sterigmata lacking, then with fibrous basidiocarp and hyphae with 3 branches at a septum 20
    20. Basidia relatively large, elongate urniform, suburniform, or ventricose, usually with large subulate and arcuate sterigmata 21
    20. Basidia relatively smaller; basidiocarp fibrous; hyphae with 3 branches at a septum 24

21. Stephanocysts present; spores 8-10 x 4.5-5μm . . . . . HYPHODERMA TENUIS
21. Without stephanocysts. 22
22. Cystidia septate, sometimes with clamps; spores 7.5-11 x 3.5-5μm.HYPHODERMA SETIGERA(cf.P.ASPERA)
22. Cystidia without septa or with false septa . . 23
23. Spores 6-9 x 4-4.5μm. . . . . HYPHODERMA ARGILLACEA
23. Spores 9-12 x 4-5μm . . . . . HYPHODERMA PILISETA
24. Spores 5-6 x 3-4μm . . . . . ROGERSELLA SAMBUCI
24. Spores 6-9 x 1.5-4μm 25
25. Cystidia 35-60μm long,emerging -15(-30μm *teste* Burt); Spores 6-8 x 3-4μm . . . . . ."PENIOPHORA" SACCHARI
25. Cystidia 70-120μm long, emergent -40μm; spores 7-9 x 1.5-2μm . . . . . HYPHODONTIA SUBALUTACEA
26. Cystidia with thin walls, incrusted or not;spores 4.5-6 x 2-3μm. . . . . "PENIOPHORA" LUDOVICIANA
26. Cystidia with relatively thick walls, heavily incrusted (metuloids) 27
27. Basidiocarp in section showing an intermediate layer of interwoven rarely clamped hyphae between zone of ± parallel hyphae and the stratosely thickening hymenium;spores 3-4.5 x 2-3μm. . . . "PENIOPHORA" SIMILIS
27. Basidiocarp in section without such an intermediate layer 28
28. Without a well-defined basal zone of ± parallel hyphae devoid of cystidia. 29
28. With a well-defined basal zone of ± parallel or tightly interwoven hyphae devoid of cystidia . 30
29. Cystidia 30-45 x 12-20μm; spores 4-5 x 2-3μm . . . . . "PENIOPHORA" RAVENELII
29. Cystidia 40-85 x 8-20μm; spores 5-6 x 3-4μm . . . . . ."PENIOPHORA" ROUMEGUERII
30. Cystidia not in tiers, i.e.,hymenium not thickening in stratose manner, tilted at different angles,70-120 x 15-25μm; spores 5-6.5 x 2.5-4μm . . . . . "PENIOPHORA" FLAVIDO-ALBA
30. Cystidia in tiers, i.e., hymenium thickening in stratose manner; cystidia 40-85 x 8-20μm; spores 5-6 x 3-4μm. . . . . ."PENIOPHORA" ROUMEGUERII

1. *Peniophora affinis* Burt, Ann. Missouri Bot. Gard. 12: 266. 1925 (1926); PHANEROCHAETE AFFINIS (Burt) Parm., Consp. Syst. Cort. 84 1968. *Vide* Rogers & Jackson, Farlowia 1: 318. 1943.

Membranous, separable, ca. 300-400μm thick;surface pruinose, orange-tan, turning red when wet with alkali; margin fimbriate, thinning, distinct, lighter

than the surface. Hyphae compact, branching ± at right angles, with single and multiple clamps; basal hyphae ± parallel to the substrate, thick-walled, some incrusted, up to 10µm in diam; subhymenial hyphae narrower, thin-walled, ca. 3µm in diam. Cystidia 33-85 x 2-8µm, thick-walled, subulate, incrusted. Basidia 19.5-50 x 4.5-5.5µm; 4 slender sterigmata. Spores 4.5-6 x 2.5-3.5µm, ellipsoid.

Specimens examined: Cuba [C.J. Humphrey 2805 as *P. laevis* (Fr.) Burt in NY]; Vermont (E. A. Burt TYPE in FH); St. Lucia (2018, 2019).

Illustration: Gilbertson, R.L. Fungi that Decay Ponderosa Pine. Univ. of Arizona Press, p. 168, fig. 208. 1974.

2. *Peniophora argillacea* Bres., Fungi Trid. 2 : 63.1898; HYPHODERMA ARGILLACEA (Bres.) Donk,Fungus 27:15.1957.

Floccose-arachnoid to pelliculose, 40-90µm thick, grayish white or yellowish, tinted brown in spots, often in discontinuous patches; surface distinctly pilose, sometimes cracking, sometimes lacunose with lacunae occasionally traversed by hyphal strands; margin arachnoid, thinning. Hyphae scanty to abundant, loosely interwoven, thin-walled to slightly thick-walled, ± perpendicular to the substrate, clamped,sometimes incrusted, often with yellowish contents, with 1-2 branches at a septum, 3-4µm in diam; in thicker fructifications there is often a subhymenial layer of yellowish brown granular material present. Cystidia 63-156 x 10-27µm wide at base, thin- to slightly thick-walled, subulate, or ventricose-cylindrical, arising immediately adjacent to the hymenium, sometimes collapsing. Basidia 14-23 x 5-5.5µm at apex and 7-8µm at base, ventricose-cylindrical to urniform or suburniform, sometimes flexuous; 4 subulate, slightly arcuate sterigmata each ca. 4-6µm long. Spores 6-9 x 4-4.5µm, ellipsoid to suballantoid, 0-2 guttulate.

Specimens examined:Jamaica (949a), Dominica(1845), St. Lucia (1955, 1959).

Illustration: Eriksson, J. and L. Ryvarden, The Corticiaceae of North Europe. Vol. 3. Fungiflora, Oslo, Norway, p. 456, fig. 200. 1975.

3. *Peniophora aspera* (Pers.) Sacc., Fl. Ital.Crypt. Hymen. p. 1182. 1916; *Thelephora aspera* Pers.,Mycol.Eur. 1: 153. 1822. *Vide* Rogs. & Jacks., Farlowia 1:282. 1943.

Thelephora setigera Fr., Elench. Fung. 1:208. 1828; HYPHODERMA SETIGERA (Fr.) Donk, Fungus 27: 15. 1957.

Adnate, pelliculose, up to 150µm thick between denticles, cream to yellowish when dry;surface denticulate, often cracking and exposing the pale fibrous context, sometimes discontinuous, the denticles pilose; margin thinning, whitish, floccose-arachnoid. Basal hyphae ± erect, hyphae branching at wide angles, walls slightly thickened, clamped, 3-4µm in diam. Cystidia projecting up to 65µm; thin-walled, septate with clamps, incrusted with coarse granules, apex rounded or slightly capitate, arising from basidial fasicles and surrounded by basidia. Basidia 12-22 x 3.5-6µm, arising in fasicles, suburniform to urniform; 4 sterigmata each -7µm long. Spores 7.5-11 x 3.5-5 µm, cylindrical, flattened to slightly depressed along one side, guttulate or not.

Specimens examined: Jamaica (406).

Illustration: Eriksson, J. and L. Ryvarden, *l. c.*, p. 528, fig. 246.

4. *Peniophora burtii* Romell in Burt, Ann. Missouri Bot. Gard. 12. 278. 1925 (1926); PHANEROCHAETE BURTII(Romell in Burt) Parm., Izv. Akad. Nauk. Estonsk.SSR. Ser. Biol. 16: 388. 1967.

Pelliculose, separable, 200-300µm thick; surface minutely pruinose, sometimes cracking, yellowish to yellow buff; margin thinning but distinct, irregular,almost white, often with yellow mycelial strands joining different fructifications. Hyphae loosely interwoven, thick-walled, without clamps, frequently branched at ± right angles, 3.5-5.5µm in diam, sometimes incrusted in subhymenium. Cystidia 30-44 x 3.5-5µm, thin- to slightly thick-walled, hyphoid to subclavate. Basidia 19-28 x 4.5-5.5µm, clavate; 4 thin sterigmata each ca. 1-2.5µm long. Spores 3.5-4.5 x 2-2.5µm, oblong-ellipsoid.

Specimens examined: Jamaica (594).

Illustration: Buddington, A.B. and R.L. Gilbertson. Southwest. Nat. 17:418. 1973.

5. *Peniophora byssoides* (Pers. ex Fr.) Bres. apud Brink., Westf. Prov.-Ver. Jahrsb. 26. 130. 1898; *Thelephora byssoides* Pers. ex Fr., Syst. Mycol. 1: 452. 1821; AMPHINEMA BYSSOIDES (Pers. ex Fr.) J. Erikss., Symb. Bot. Upsal. 16: 111. 1958.

Arachnoid, separable, thin; surface very uneven, pruinose, cream brown; margin indistinct, irregular, concolorous. Hyphae scant, thin-walled, clamped, 3.5-4.5µm in diam. Cystidia 50-73 x 4.5-5.5µm, thick-walled, aculeate, clamped at base, sometimes with 1 or more septa, clamped or not. Basidia 11-13.5 x 5.5-6µm, cylindrical-clavate; 4 thin sterigmata each ca. 2-3.5µm long. Spores 4.5-6 x 3-5 µm, globose to subglobose, becoming thick-walled in age.

Specimens examined: Jamaica (742). A very common fungus throughout the region,many other specimens examined.

Illustration: Eriksson, J. and L. Ryvarden. The Corticiaceae of North Europe. Vol. 2, p.80, fig. 29. 1973.

6. PENIOPHORA CARNEA (Berk. & Curt.) Cke., Grevillea 8: 21. 1879; *Corticium carneum* Berk. & Curt., N.Y. Acad. 1: 179. 1898.

Waxy, separable when moistened, 130-220µm thick, surface pruinose, buff to light gray, large embedded crystalline material visible from above; margin pruinose, thinning, indistinct, white. Hyphae agglutinated, darkly pigmented, running parallel to substrate and giving rise to light colored, less agglutinated, thin-walled hyphae 2-5µm in diam which form the hymenium; large crystalline masses about 110 x 66µm in extent, not associated with cystidia, embedded in context beyond the basal agglutinated layer. Cystidia 30-44 x 8.5-10µm, thick-walled, clavate, incrusted and embedded; other thin-walled cystidia 56-116 x 7.5-10.5 µm present, flexuous, and often protruding beyond the hymenium. Basidia not seen. Spores 5.5-14.5 x 3.5-4.5 µm, subglobose to ellipsoid.

Specimens examined: Cuba (Earle & Murrill 333 in NY); Texas (H.W. Ravenel 78 TYPE in K).

7. PENIOPHORA CINEREA (Fr.) Cke., Grevillea 8: 21. 1879; *Corticium cinereum* Fr., Elench. Fung. 1: 221. 1828.

Thin, adnate,waxy, at first in small round patches, then confluent, gray buff or pink to bluish gray or pure gray, 50-100µm thick; surface finely pruinose; margin thin, concolorous or paler. Hyphae compact, difficult to distinguish individually, stratose in some specimens, usually with a narrow basal horizontal zone adjacent to substrate. Cystidia 20-40 x 6-12µm, distributed throughout the context, arising at all levels, embedded or projecting up to 15µm, conical or fusiform, attenuated; young, thin-walled cystidia slightly or not at all incrusted; others

thick-walled and heavily incrusted with coarse crystals. Basidia 12-20 x 4-6µm, clavate; 4 sterigmata each ca. 4µm long. Spores 7-9 x 3-3.5µm, allantoid.

Specimens examined: Grenada (1409, 1468), Dominica (1834), St. Lucia (2013), St. Vincent (2046), Jamaica(680).

8. SUBULICYSTIDIUM COCHLEUM A. Punugu, *sp. nov.* Fig. 1.

Differt haec species a Subulicystidio longisporo (Pat.) Parm. cystidis acicularibus obtectis in partibus subterminalibus et sporis cochleatis.

Arachnoid-floccose, easily detached, hispidulose, bluish white, thin, ca. 35µm thick; margin indefinite. Hyphae scanty ± horizontal, thin-walled, hyaline, sometimes suberect and branched at ± right angles, rough walled because of incrustations, clamped, 2.5-3.5µm in diam. Cystidia 60-80µm long, acicular, projecting beyond the hymenium, erect or bent toward the middle, walls slightly thickened basally, sometimes slightly inflated and often ensheathed by large smooth crystals; enclosed in long acicular crystals above the middle, the crystals arranged in a cone-like fashion; the terminal exposed portion thin-walled, smooth, slender, and occasionally with granular contents. Basidioles subglobose, often surrounded by a thin crystalline sheath. Basidia 12.5-17 x 5-6µm, developing by elongation through the often persisting crystalline sheath, sometimes stipitate; 4 subulate, arcuate sterigmata, each ca. 5µm long. Spores 20-27 x 2-3µm, long, slender, the distal end folded back or twisted and curved, in which case the length is 12-17µm.

Specimens examined: St. Lucia (1363 TYPE in NO, 2037), St. Vincent (2059).

9. *Peniophora cremea* (Bres.) Sacc. & Syd., Syll. Fung. 16: 195. 1902; *Corticium cremea* Bres., Fung. Trid. II. 63. 1898; PHANEROCHAETE CREMEA (Bres.) Parm., Consp. Cort. 84. 1968.

Submembranous, ± separable, up to 450µm thick; surface pale cream, yellow to brownish buff, velutinous, often cracking and exposing pale or white context; smooth to sometimes grandinioid, margin wide, thinning to almost arachnoid. Hyphae loosely interwoven, ± erect, thick-walled, often incrusted, hyaline, branching at ± right angles, without clamps, 4-7µm in diam. Hymenium stratose in older specimens and of thin-walled, sometimes yellowish hyphae 2-

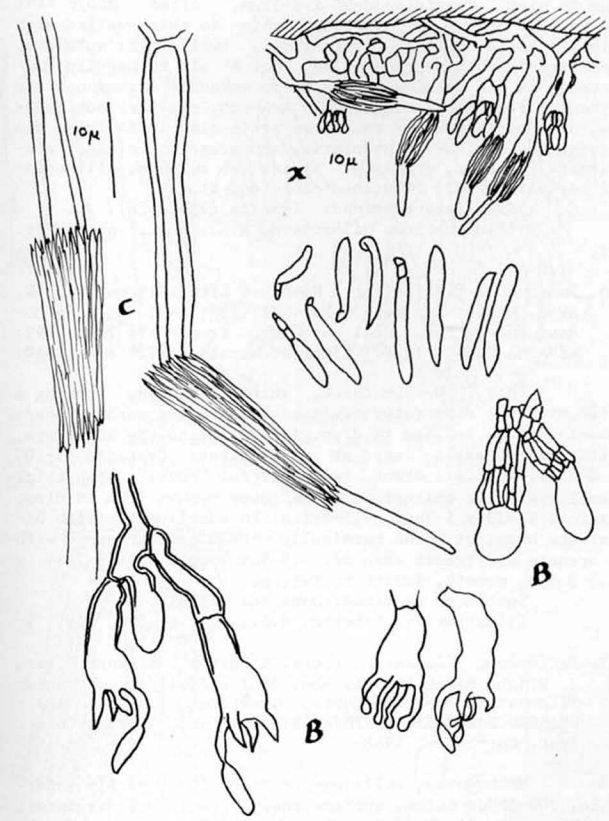


Fig. 1. *Subulicystidium cochleum* A. Punugu.X.Semi-schematic drawing of a section of the basidiocarp showing the thin-walled repent hyphae, cystidia, and basidia. C. Cystidia with acicular crystals. B. Basidial development; basidioles with persistent crystalline sheath and basidia showing thick walls in the basal portion exposed after the dissolution of the incrustation in dilute KOH.

3µm in diam. Cystidia 30-90 x 6-12µm, often projecting up to 35µm beyond the hymenium, thin- to thick-walled with almost solid apices, cylindrical, fusiform to subulate, sometimes with a narrow stipe, not at all to heavily incrusted at the usually obtuse apex, embedded throughout the hymenial strata. Basidia 10-15 x 4-6µm, clavate, subclavate, or sometimes urniform, often projecting in fasicles and giving the surface an undulating appearance; 4 slender sterigmata, each ca. 4µm long. Spores 4-6 x 2-3µm, ellipsoidal to cylindrical, flattened along one side.

Specimens examined: Jamaica (759, 626).

Illustration: Gilbertson, R.L., *l.c.*, p. 50, fig. 52.

10. *Peniophora dussii* (Pat.) Hoehn. & Lits., Sitsungeber. K. Akad. Wiss. Wien Math.--Nat. Kl. 116: 749. 1907; *Hypochnus dussii* Pat., Bull. Soc. Myc. France 15: 202. 1899; XENASMA DUSSII (Pat.) Liberta, Mycologia 52: 898. 1960.

Thin, 10-20µm thick, white or bluish, forming a film over the substrate, pruinose and hispid, easily separable. Hyphae 2-2.5µm in diam, ± parallel to the substrate, with clamps, walls fused or gelatinized. Cystidia 55-100 x 8-15µm, conical, erect, with several "roots", with thick lamellate walls ensheathed by delicate hyphae -1µm in diam. Basidia 12-29 x 5-7µm, cylindrical to subclavate, with bifurcate base, or borne terminally with a basal clamp, with 4 arcuate sterigmata each ca. 4.5-5µm long. Spores 7-14 x 2.5-3.5µm, smooth, lunate to falcate.

Specimens examined: Dominica (2774).

Illustration: Liberta, A.E., *l.c.*, p. 896, fig. 9.

11. *Peniophora filamentosa* (Berk. & Curt.) Burt apud Coker, J. Elisha Mitchell Sci. Soc. 36 : 162. 1921; *Corticium filamentosum* Berk. & Curt., Grevillea 1: 178. 1873; PHANEROCHAETE FILAMENTOSA (Berk. & Curt.) Parm., Consp. Syst. Cort. 83. 1968. Fig. 2.

Membranous, pellicose, soft or firm, easily separable, 300-350µm thick; surface rusty brown, finely pruinose, sometimes cracking and exposing the darker context; margin thinning, often with mycelial strands. Hyphae loosely interwoven, hyaline, thick-walled, ± erect, branching at ± right angles, with thinner walls and narrower diam toward the hymenium, without clamps, sometimes incrusted in the subhymenial region, 3-6µm in diam, with crystals in the context and subhymenium. Cystidia 55-80µm long, projecting

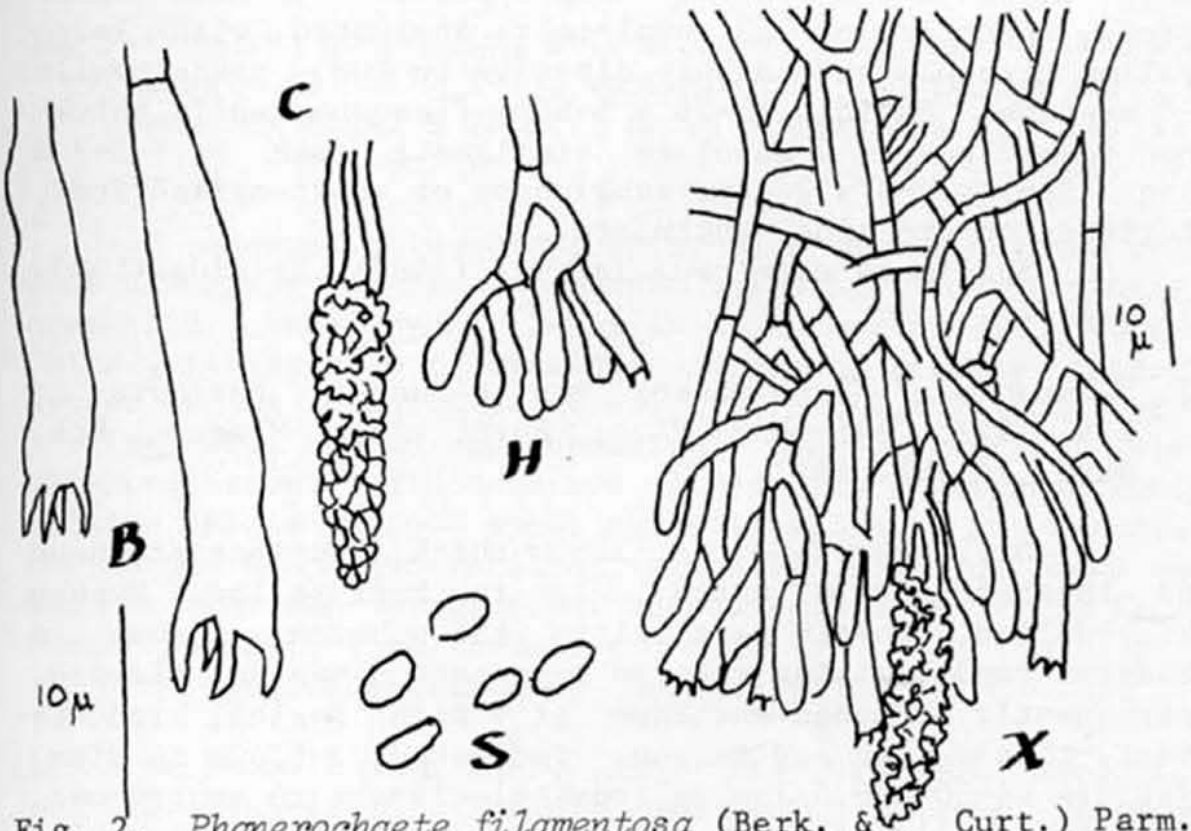


Fig. 2. *Phanerochaete filamentosa* (Berk. & Curt.) Parm. x. semi-schematic drawing of a section through the basidiocarp. B. Basidia. S. Spores. H. Fasicle of basidioles. C. Cystidium.

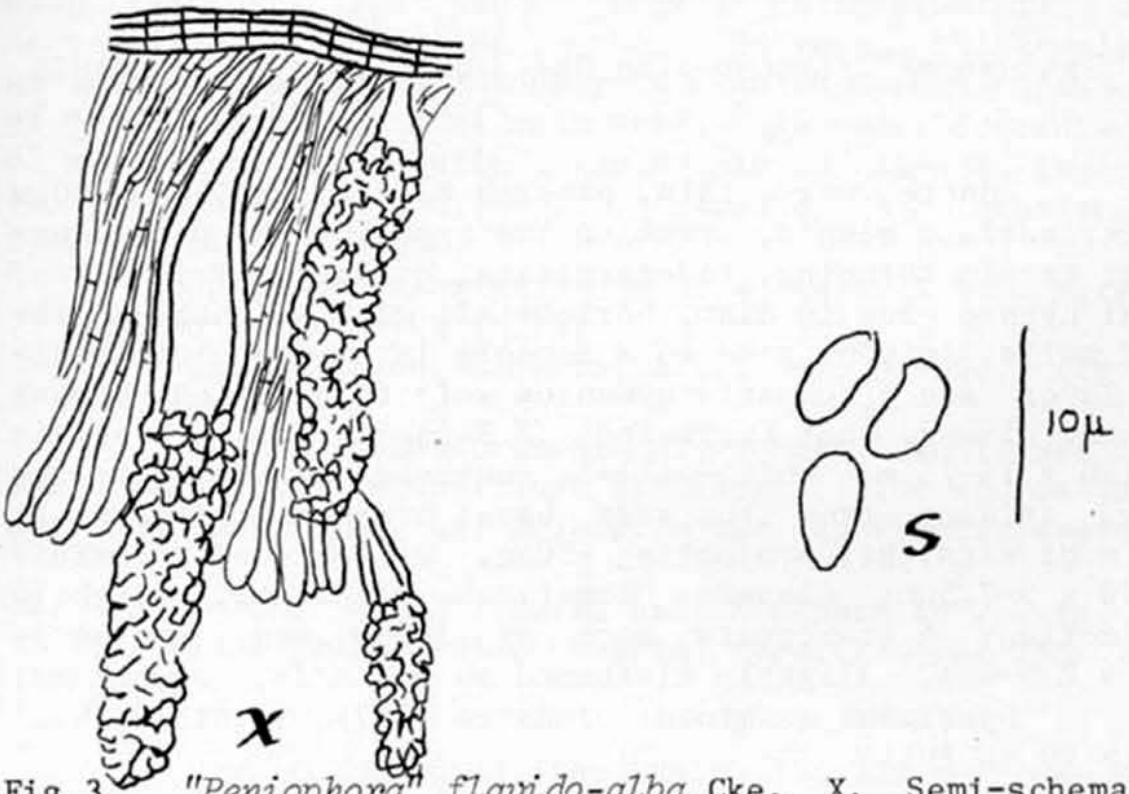


Fig. 3. *"Peniophora" flavido-alba* Cke. X. Semi-schematic drawing of a section of the basidiocarp showing the waxy context and large incrusted cystidia. C. Cystidia. S. Spores.

-10µm beyond the hymenium, long-cylindrical, with obtuse apices, upper 1/2 or 2/3 completely incrusted with large hyaline crystals that slowly dissolve in KOH, occasionally 2-3 septate. Basidia 18-28 x 5-6µm, flexuous, walls thickened toward base; 4 subulate sterigmata each ca. 3-7µm long. Spores 4-5 x 2-4µm, subglobose or short-cylindrical, flattened on one side, guttulate.

Specimens examined: Jamaica (1488), Trinidad(1593, 1727, 1777).

12. *"Peniophora" flava* (Burt) Rog. & Jacks., Farlowia 1: 278. 1943; *Coniophora flava* Burt, Ann. Missouri Bot. Gard. 4: 261. 1917.

Dry, separable, ca. 225µm thick; surface pruinose and inconspicuously warted, tan to buff yellow. Hyphae thick-walled, mostly parallel to the substrate, some in denser strands, giving rise to a compact hymenium, clamped, infrequently branched and then at ± right angles, branches erect, thin-walled and narrow, incrusted, 3-5.5µm in diam. Cystidia 44-60 x 6.5-7µm,cylindrical-clavate to ventricose, incrusted, walls slightly thickened. Basidia 22-25 x 4-5 µm, clavate; 4 sterigmata each ca. 3.5µm long. Spores 4-6 x 3-3.5µm ($\bar{x}$ 10 = 4.8 x 3.2µm).

Specimens examined: Jamaica (W.A. & E.L. Murrill 1089 TYPE in NY and ISOTYPE in FH).

13. *"Peniophora" flavido-alba* Cke., Grevillea 8:21. 1879. Fig. 3.

Adnate, waxy, thin, pinkish buff to tan, ca. 700µm thick; surface hispid, cracking and exposing the paler context; margin thinning, indeterminate, often paler in color. Basal hyphae -5µm in diam, horizontal, with slightly thickened walls, giving rise to a densely interwoven intermediate layer and a compact hymenium of thin-walled hyphae without clamps, not incrusted, 2.5-3µm in diam. Cystidia 70-120 x 15-25µm, thick-walled, incrusted, tapering at the apex, arising from the wide basal hyphae, tilted at an angle or straight, projecting -50µm, or embedded. Basidia 15-20 x 5-7.5µm, clavate, sometimes stipitate, slightly projecting; 4 sterigmata each ca. 3-5µm long. Spores 5-6.5 x 2.5-4µm, slightly flattened on one side, or curved.

Specimens examined: Jamaica (457), Trinidad (W.L. White 80 in FH).

14. *Peniophora gracillima* Ell. & Everh. ex Rogs. & Jacks., Farlowia 1: 317. 1943; TUBULICRINIS GRACILLIMA (Ell. & Everh. ex Rogs. & Jacks.) Donk, Fungus 26: 13. 1956. Fig. 4.

Adnate, thin, waxy, soft,-85µm thick; surface yellowish buff, even, hispid; margin thinning, indeterminate, arachnoid. Basal hyphae 2-3µm in diam, horizontal, thick-walled, giving rise to cystidia and erect, tightly compact hyphae ending in basidia. Cystidia 75-110 x 7-10µm, projecting -60µm beyond the hymenium, long-cylindrical with birooted bases, with a narrow lumen that often abruptly dilates into a bulbous apex, abruptly soluble in ammoniacal Congo Red (lyocystidia), slightly amyloid, neck and bulbous apex often incrusted. Basidia 15-25 x 4-5µm, flexuous. Spores 6-8 x 1.5-2µm.

Specimens examined: Grenada (1368).

15. *Peniophora hiulca* Burt, Ann. Missouri Bot. Gard. 12: 272. 1925 (1926); PHANEROCAETE HIULCA (Burt) Welden, *comb. nov.*

Pelliculose, separable, 500-1000µm thick; surface smooth, tan to ochraceous, cracked; margin pruinose, thinning, distinct, light tan. Hyphae 3-7µm in diam, in a dense basal layer parallel to the substrate, thick-walled, giving rise to erect, densely interwoven hyphae branching at ± right angles, some incrusted, clamped. Cystidia 30-52 x 5.5-9µm, thick-walled, lanceolate to clavate, incrusted. Basidia 17-30 x 4.5-5.5µm, clavate; 4 sterigmata. Spores 4.5-8 x 3.5-4µm.

Specimens examined: Jamaica (W.A. & E.L. Murrill 71 TYPE in NY, ISOTYPE in FH).

Illustration: Liberta, A.E., *l.c.*, p. 847. fig. 7.

The spore measurements given here are larger than those reported by either Burt or Liberta. The spores were not abundant and may not belong to the specimens examined.

16. *"Peniophora" inflata* Burt, Ann. Missouri Bot. Gard. 12: 267. 1925 (1926), *vide* Liberta, Mycologia 60: 855. 54. 1968.

Waxy, membranous, separable, 125-350µm thick; surface smooth to inconspicuously warted, pale yellow, cracking and peeling from the substrate; margin pruinose to arachnoid, thinning, indeterminate, white. Hyphae loosely

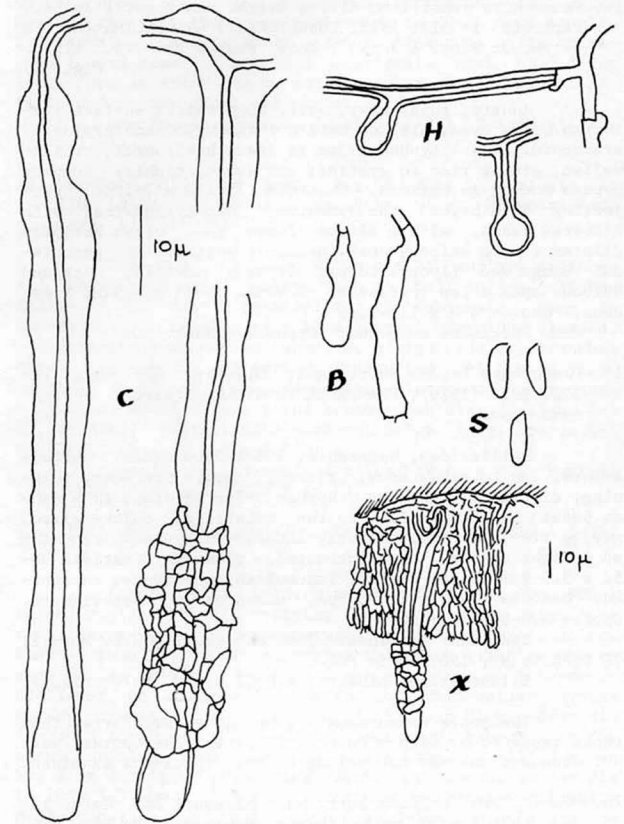


Fig. 4. *Tubulicrinis gracillima* (Ellis & Everh. ex Rogs & Jacks.) Donk. X. Semi-schematic drawing of a section of the basidiocarp showing waxy context and incrusted lyocystidia. H. Young cystidia developing from thin-walled hyphae. C. Mature lyocystidia with and without incrustation. B. Flexuous basidiole and basidium. S. Spores.

interwoven, thin-walled, clamped, hyaline, 1.5-4.5µm in diam, lateral branches 12-25 x 2-3.5µm, with terminal and median inflations often incrusted with ± parallel crystals; hymenium a thick layer of sometimes pseudoparenchymatous clamped hyphae. Cystidia 27-43 x 4.5-5.5µm, thick-walled, cylindrical, often slightly pointed at apex, incrusted, originating throughout the hymenium. Basidia 11-14 x 3-4µm, clavate; 4 sterigmata needle-like and each ca. 2-3µm long. Spores 3.5-4.5 x 1.5-3µm.

Specimens examined: Jamaica (W.A. & E.L. Murrill 4 TYPE in NY, ISOTYPE in FH).

Illustration: Liberta, A.E., *l.c.*, p. 853. fig.28.

17. *Peniophora longispora* (Pat.) Hoehn., Ann. Mycol. 3:235. 1905; *Hypochnus longisporus* Pat., J. Bot. 8:221. 1894; SUBULICYSTIDIUM LONGISPORUM (Pat.) Parm., Consp. Syst. Cort. 121. 1968. Fig. 5.

Thin, arachnoid-floccose to membranous, 30-100µm thick, white then bluish gray or yellowish; surface pubescent to pilose, often discontinuous; margin thinning, arachnoid, concolorous. Hyphae interwoven, a few horizontal at the base, the remainder erect, thin-walled, clamped, hyaline, branching ± at right angles without any relation to septa, often rough-walled, 2-3µm in diam. Cystidia 37-83 x 2-6µm, acicular, emergent -45µm beyond hymenium, base slightly flattened and often clamped, walls 1-1.5µm thick, incrusted with small orthorhomboidal crystals distributed in ± longitudinal rows, lumen narrow, apex pointed, oblique, or bifurcate. Basidia 9-13 x 4-6µm, suburniform, sometimes stipitate, frequently clamped at base; with 4 subulate, arcuate sterigmata, each 3-4µm long. Spores 8-15 x 2-3µm, cylindrical to suballantoid, guttulate.

Specimens examined: Jamaica (598, 757, 905, 949), Dominica (1906, 1925).

18. *"Peniophora" ludoviciana* Burt, Ann. Missouri Bot. Gard. 12: 224. 1925 (1926).

Peniophora flammea Burt, Ann. Missouri Bot. Gard. 12: 252. 1925. (*teste* Rogs. & Jacks.,Farlowia 1:316. 1943).

Waxy, separable when moistened, 90-200µm thick, yellow buff to orange, often turns red with KOH solution; surface minutely hispid to pruinose, uneven but generally not cracked; margin thinning but distinct, irregular, white. Context white and hymenium yellow, of agglutin-

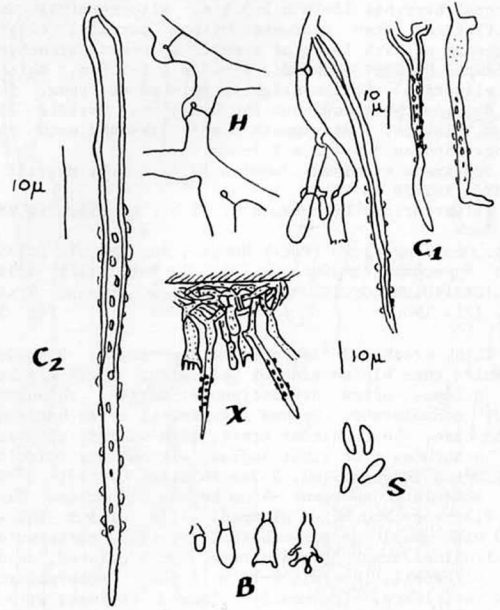


Fig. 5. *Subulicystidium longisporum* (Pat.) Parm. X. Semi-schematic drawing of a section through the basidiocarp showing repent hyphae, acicular cystidia, and basidia. C. Cystidia. B. Basidial development. S. Spores.

ated thin- to slightly thick-walled clamped, incrusted, hyphae, 2-3µm in diam; hymenium heavily incrusted, with some incrustations brown and dissolving in KOH and producing a red color. Cystidia 45-60 x 5.5-13.5µm, thin-walled, heavily incrusted and obclavate, or unincrusted and hyphoid. Basidia 20-22 x 4.5µm, clavate; 4 slender sterigmata each ca. 1.5-3µm long. Spores 4.5-6 x 2-3µm.

Specimens examined: St. Lucia (1898); Jamaica (597, 776); Louisiana (A.B. Langlois 1919, TYPE in FH).

19. *Peniophora phosphorescens* Burt, Ann. Missouri Bot. Gard. 12: 273. 1925 (1926); PHANEROCHAETE PHOSPHORESCENS (Burt) Welden, *comb. nov.*

Waxy, separable, 350-600µm thick; surface pruinose with some warts, dark brownish red to brownish orange; margin waxy, fimbriate, thinning, distinct, pale orange. Basal hyphae 2-7µm in diam, loosely interwoven, thick-walled, branching at ± right angles, without clamps; hymenium subtended by a layer of compact ± parallel hyphae, of agglutinated, thin-walled hyphae without clamps and variously branched, 2-3µm in diam. Cystidia 74-151 x 12-20µm, thick-walled, obclavate to cylindrical, incrusted, embedded in the lower reaches of the hymenium. Basidia 20-28 x 5.5-6µm, cylindrical to clavate, sometimes constricted in the middle; 4 slender sterigmata each ca. 3.5-5µm long. Spores 4.5-5.5 x 3.5-4.5µm.

Specimens examined: Jamaica (A.E. Wright 1909 TYPE in FH).

Illustration: Liberta, A.E., *l.c.*, p.848, fig. 21.

20. *Peniophora piliseta* Burt, Ann. Missouri Bot. Gard. 12: 242. 1925 (1926); HYPHODERMA PILISETA (Burt) Liberta, Mycologia 60: 835. 1968.

Thin, membranous, 100-120µm thick, ± separable; surface cream colored, finely pruinose, cracking slightly; margin thinning, arachnoid. Basal hyphae ± parallel to substrate, clamped, ca. 3µm in diam; intermediate hyphae thin-walled, loosely arranged, clamped, 2-3µm in diam. Cystidia 20-31 x 7.5-11µm, arising within context, incrusted, ± cylindrical, obtuse. Basidia 20-25 x 5-8µm, stipitate; 4 slender sterigmata each ca. 2µm long. Spores 9-12 x 4-5µm, flattened or slightly curved on one side, 1-2 guttulate.

Specimens examined: Jamaica(TYPE in Missouri Bot. Gard. Herb. 63243 in BPI).

Illustration: Liberta, A.E., *l.c.*, p. 836, fig.8.

21. *"Peniophora" ravenelii* Cke., Grevillea 8:21.1879.Fig.6.

Adnate,separable,waxy,300µm thick; surface finely pruinose or smooth, pinkish buff, cracking slightly; margin thinning, membranous. Basal hyphae erect, compact, pseudoparenchymatous, ca. 3µm in diam. Cystidia 30-45 x 12-20µm, abundant,distributed in close tiers throughout the basidiocarp, conical, broad at base, heavily incrusted with coarse granules, those of hymenium up to 15µm in diam. Basidia ca. 15 x 5µm, subclavate with a slight median constriction; 4 slender sterigmata each ca. 4.5µm long. Spores 4-5 x 2-3µm.

Specimens examined: Jamaica (600); South Carolina (Fungi Car. Exs. 2: 39 TYPE in BPI).

22. *"Peniophora" roumeguerii* (Bres.) Burt, Ann. Missouri Bot. Gard. 12: 270. 1925 (1926); *Corticium roumeguerii* Bres. Fungi Trid. 2: 36, 1892. Fig. 7.

Adnate, waxy, separable, 750µm thick; surface pruinose to hispid, sometimes grandinioid, often cracking and exposing the subiculum in the fissures, white, grayish buff, cream buff, yellow, or pinkish buff; margin thinning, indefinite, concolorous, sometimes paler. Hyphae thin-walled, agglutinated, ± pseudoparenchymatous, ± erect except in basal horizontal layer which is not always present, 2-3µm in diam. Cystidia 40-85 x 8-20µm, abundant, scattered in every strata and tier except zone adjacent to substrate, heavily incrusted, conical, tapering to acute apices, protruding ones long; hymenium zonate in some specimens. Basidia 15-25 x 3-5.5µm, cylindrical or with slight median constriction, or subulate. Spores 5-6 x 3-4µm, flattened on one side.

Specimens examined:Jamaica(546, 630, 1027, 1267); Grenada (1401).

23. *"Peniophora" sacchari* Burt, Ann. Missouri Bot. Gard. 12: 328. 1925 (1926). Fig. 8.

Membranous, thin, adnate, 20-140µm thick; surface brownish yellow with a darker center, cracking into small irregular areas showing a concolorous subiculum, smooth or finely pruinose; margin arachnoid, thinning, sometimes this thin zone quite extensive, discontinuous or lacunose,

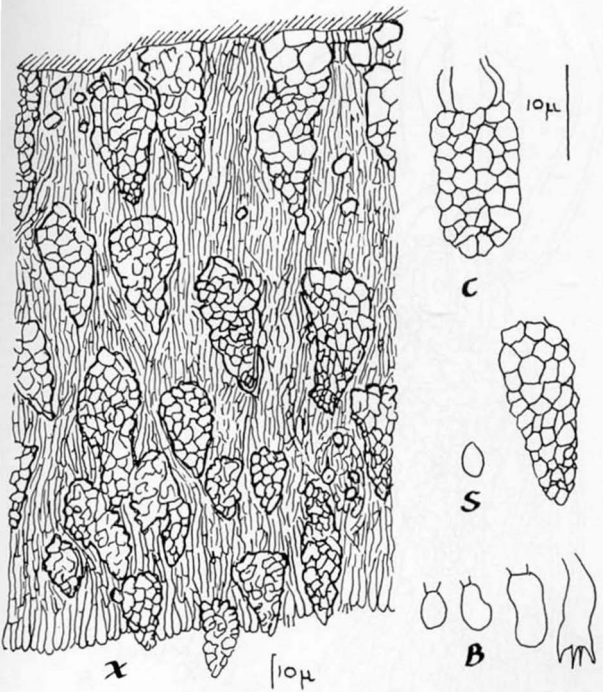


Fig. 6. *"Peniophora" ravenelli* Cke. X. Semi-schematic drawing of a section through the basidiocarp showing the waxy content and numerous cystidia. C. Incrusted cystidia. B. Basidial development. S. Spore.

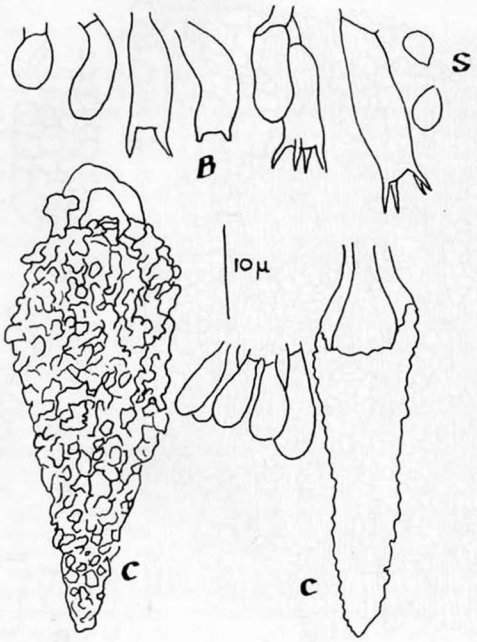


Fig. 7. *"Peniophora" roumeguerii* (Bres.) Burt. C. Cystidia. B. Basidial development. S. Spores.

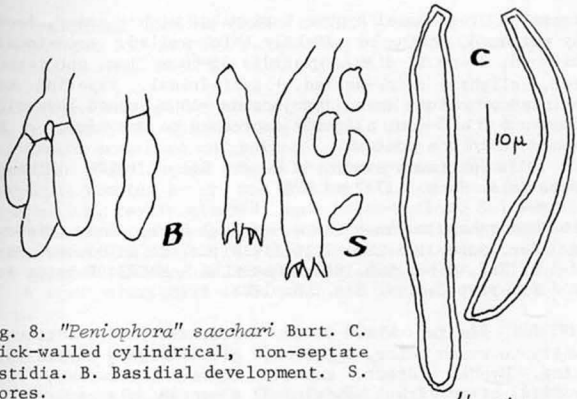


Fig. 8. *"Peniophora" sacchari* Burt. C. Thick-walled cylindrical, non-septate cystidia. B. Basidial development. S. Spores.

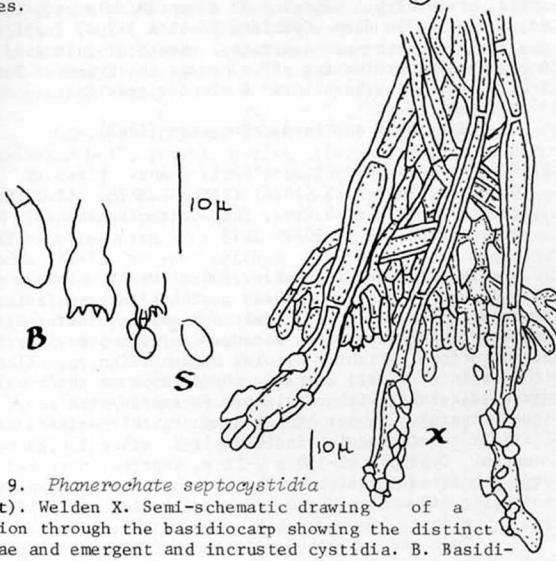


Fig. 9. *Phanerochate septocystidia* (Burt). Welden X. Semi-schematic drawing of a section through the basidiocarp showing the distinct hyphae and emergent and incrusted cystidia. B. Basidiole and basidia with spores. S. Spores.

cream colored. Basal hyphae horizontal with ± erect, loosely arranged, thin- or slightly thick-walled, occasionally clamped, 3-4µm in diam. Cystidia 35-60 x 11µm, not incrusted, slightly thick-walled, ± cylindrical, tapering to a pointed or obtuse apex, projecting -15µm beyond hymenium. Spores 6-8 x 3-4µm, slightly depressed on one side, a few embedded in the context.

Specimens examined: Puerto Rico, (TYPE Missouri Bot. Gard. Herb. 11787 in BPI).

24. *Peniophora sambuci* (Pers. ex Fr.) Burt, Ann. Missouri Bot. Gard. 12: 233. 1925 (1926);*Corticium sambuci* Pers. ex Fr., Epicr.565.1838;ROGERSELLA SAMBUCI (Pers.ex Fr.) Liberta, Can. J. Bot. 56: 1781. 1978.

Adnate, thin, -300µm thick; surface continuous, white to cream color, pruinose, grandinioid; margin thinning. Hyphae ± erect, somewhat loosely interwoven, thin-walled, often with 3 branches at a septum, clamped, incrusted, 2.5-3.5µm in diam. Cystidia 28-45 x 3-5µm, fusiform or subulate, tapering or capitate, smooth or incrusted with fine granules, projecting -35µm beyond the hymenium.Basidia 15-26 x 5-5.5µm, suburniform; 4 slender sterigmata. Spores 5-6 x 3-4µm.

Specimens examined: Dominica (1908).

25. *Peniophora septocystidia* Burt, Ann. Missouri Bot. Gard. 12: 260. 1925 (1926);PHANEROCHAETE SEPTOCYSTIDIA (Burt) J. Erikss. & Ryv., The Corticiaceae of North Europe. Vol. 3, p. 1021. 1978. Fig.9.

Membranous, separable, 400µm thick; surface sometimes discontinuous and widely cracking into small irregular areas exposing the floccose subiculum, sulfur yellow with reddish brown tints because of pigmented cystidial incrustrations, slightly hispid; margin thinning, floccose with distinct hyphal threads. Basal hyphae thick-walled, coarse, distinct, without clamps, incrusted with short flattened crystals; upper hyphae compact, thin-walled, erect, difficult to distinguish individually, often 3 branches at a septum. Cystidia 60-130 x 9-11µm, septate,incrusted with large pigmented granules,arising as thick-walled hyphae and projecting -40µm beyond the hymenium; 4 slender sterigmata each 4-5µm long. Spores 4.5-7 x 2-3µm, allantoid.

Specimens examined: Jamaica (TYPE Missouri Bot. Gard. Herb. 61492 in BPI).

26. *"Peniophora" similis* (Berk. & Curt.) Massee, J. Linn. Soc. Bot. 25: 147.1889; *Corticium simile* Berk. & Curt., J. Linn. Soc. Bot. 10: 337. 1868.

Membranous, separable, 1000µm thick; surface pruinose to smooth in thicker specimens, dirty white to pale tan; margin arachnoid to pruinose, thinning, indistinct, off-white. Basal hyphae densely interwoven, ± parallel to substrate, turning erect and forming a large zone beneath the hymenium, rarely clamped, some thick-walled, 2-4.5µm in diam; subhymenium ± pseudoparenchymatous and sometimes incrusted. Cystidia 20-44 x 5.5-8µm, somewhat clavate, arising from thick-walled hyphae, incrusted. Basidia 17.5-21 x 4-5 µm; 4 stout sterigmata each ca. 5 x 1.5µm. Spores 3-4.5 x 2-3µm.

Specimens examined: Cuba (C. Wright 543 ISOTYPE in FH, Earle & Murrill 42, 303 in NY).

27. *Peniophora subalutacea* (Karst.) Hoehn. & Lits., Sitzungsber.Kaiserl. Acad. Wiss., Math.-Naturwiss. Cl.,Abt.1. 115:1601.1906;*Corticium subalutaceum* Karst., Meddeland. Soc. Fauna Fl. Fenn.9: 65.1883; HYPHODONTIA SUBALUTACEA (Karst.) J. Erikss., Symb. Bot. Upsal. 16: 104. 1958.

Thin, pelliculose, 150µm thick; surface straw-buff to yellowish buff, sometimes discontinuous; margin indefinite, thinning, arachnoid-floccose. Hyphae unincrusted, with slightly thickened walls, coarse, branched at wide angles, clamped at most septa, profusely branched in upper parts and often with 3 branches at a septum, 2-4µm in diam. Cystidia 70-120 x 5-8µm neither incrusted nor septate, thick-walled and tubular with the lumen widening toward obtuse apex, originating from basal hyphae and projecting -40 µm beyond the hymenium. Basidia 12-20 x 4.5-5.5µm, with a slight median constriction; 4 slender sterigmata. Spores 7-9 x 1.5-2µm, allantoid.

Specimens examined: Jamaica (981).

Illustration: Eriksson, J. and L. Ryvarden, The Corticiaceae of North Europe. Fungiflora, Oslo, Norway, Vol. 4. p. 674, Fig. 330. 1976.

28. *Peniophora tenuis* (Pat.) Massee, J. Linn. Soc. Bot.25: 149. 1889. *Corticium tenue* Pat., Rev.Mycol.(Paris)7: 152. 1885; HYPHODERMA TENUIS (Pat.) Donk, Fungus 27: 15. 1957.

Adnate, separable when moist, 50-120µm thick;surface smooth to pruinose, buff-tan to buff-white; margin pruinose, thinning, indistinct, pale tan. Hyphae loosely arranged, thick-walled, clamped, branching variously, 2-5µm in diam. Cystidia 71-115 x 13µm, thin- to slightly thick-walled, obclavate to fusiform. Stephanocysts 9 x 10µm, globose. Basidia 20-33 x 7-8µm, clavate with narrow base, subtended by a clamp; 4 slender sterigmata each ca. 3-3.5µm long. Spores 8-10 x 4.5-5µm, guttulate.

Specimens examined: Jamaica (Murrill & Harris 1053 in FH). For a discussion of this taxon see Rogers & Jackson, Farlowia 1: 322. 1943 and J. Eriksson and L. Ryvarden, The Corticiaceae of North Europe 3: 505. 1975, as *H. praetermissum* (Karst.) J. Erikss. & Strid.

29. PENIOPHORA VERSICOLOR (Bres.) Sacc. & Syd. apud Sacc., Syll. Fung. 16: 193. 1902; *Corticium versicolor* Bres., Fungi Trid. 2: 61. 1892.

Adnate, waxy, 60-100µm thick;surface finely pruinose, near rose gray, slightly cracking; margin thinning, paler in color, or rusty. Hyphae ± erect, loosely interwoven, thick-walled, pigmented, giving rise to cystidia and to thin-walled hyphae which bear the basidia, 4 - 5µm in diam. Cystidia 30-50 x 8-12µm, stipitate, embedded or projecting -15µm beyond the hymenium, the portion below the incrustation with yellow or brown walls. Basidia 20 - 25 x 4-4.5µm, clavate or subclavate, arising from thin-walled hyphae; 4 slender sterigmata, each ca. 5µm long. Spores 9 x 3.5-4µm, slightly flattened on one side.

Specimens examined: Jamaica (499).

The only specimen studied fits well with the description and drawings given by Eriksson, Sym. Bot. Ups.10: 176. 1950.

30. PENIOPHORA VERSIFORMIS (Berk. & Curt.) Bourd. & Galz., Hym. de France 327. 1928; *Stereum versiforme* Berk. & Curt., Grevillea 1: 164. 1873.

Effused to effuso-reflexed, easily separable, or adnate, at first orbicular then spreading and becoming confluent, ca. 200-300µm thick; surface velutinous, zonate, Natal Brown, sometimes cracking, the curved hymenial surface often blackish; margin indefinite. Hyphae thick-walled, clamped, brown, ± horizontal next to substrate then rising obliquely toward hymenium; intermediate zone ± loosely arranged and intermingled with thin-walled hyphae

3-3.5µm in diam which give rise to basidia. Dendrophyses 1.5-2µm in diam, numerous, yellow brown, their bushy tips emergent beyond hymenium. Cystidia 35-70 x 18-25µm heavily incrusted, embedded or projecting beyond hymenium, confined to a single layer and mixed with basidia and dendrophyses. Basidia ca. 20 x 5µm; 4 slender sterigmata. Spores 6-8 x 2.5-3µm, allantoid.

Specimens examined: Jamaica (Powell 830 in NO).

DOUBTFUL RECORDS

1. *Peniophora citrinella* (Berk. & Curt.) Burt, Ann. Missouri Bot. Gard. 12: 327. 1925 (1926); *Corticium citrinellum* Berk. & Curt., J. Linn. Soc. Bot. 10:336. 1868.

The TYPE from Cuba (C. Wright 844 in Curtis Herb. in FH) and a Jamaican collection (Earle & Murrill 427 in FH & NY) are sterile. Other known Cuban material (Earle & Murrill 381 in FH and 427 in FH & NY) is also sterile. White's material from Cuba (W.L. White 880 in FH) is fertile. It is membranous, ca. 100µm thick, light clay colored, with a fibrillose rhizomorphic margin. The cystidia are 23-25 x 5-6µm and resemble the basidioles. The basidia are 25-32 x 4.5-6µm, subclavate and have 4 thin sterigmata, each ca. 3-4.5µm long. The non-amyloid, smooth, ellipsoid spores are 4.5-5.5 x 2-3µm.

2. *Peniophora galachroa* Bres., Hedwigia 35: 200. 1896.

The TYPE from Brazil (A. Möller in FH) is sterile. None of the West Indian material resembles the type. The Murrills' collections (Murrill & Murrill 33, 721 in NY) from Jamaica are the same taxon and differ from the Puerto Rican material (Stevenson 2985 in BPI). Only one of these is peniophoroid.

3. *Peniophora inconspicua* (Berk. & Curt.) Massee, J. Linn. Soc. Bot. 25: 149. 1889; *Corticium inconspicuum* Berk & Curt., J. Linn. Soc. Bot. 10: 336. 1868.

The ISOTYPE from Cuba (C. Wright 841 in FH) is sterile and constitues the only report of this taxon from the West Indies.

4. *Peniophora mutata* (Peck) Bourd. & Galz., Bull. Soc. Mycol. France 28:399. 1913; *Corticium mutatum* Peck, N.Y. State Mus. Rep. 43: 67, 1890; HYPHODONTIA MUTATUM (Peck) Donk, Fungus 27: 15. 1957.

The material upon which the West Indian report is based (Grenada: W.G. Farlow 4 in FH) is sterile.

5. *Peniophora pruinata* (Berk. & Curt.) Burt, Ann. Missouri Bot. Gard. 12: 340. 1925 (1926); *Stereum pruinatum* Berk. & Curt., J. Linn. Soc. Bot. 10: 332. 1868.

All of the West Indian material (Cuba: C. Wright 193 ISOTYPE in FH, W.L. White 601 in FH, and Earle & Murrill 516 in NY) is sterile.

6. *Peniophora seymouriana* Burt, Ann. Missouri Bot. Gard. 12: 337. 1925 (1926).

The Cuban material (Missouri Bot. Gard. Herb. 554-95 in BPI, PARATYPE) lacks spores. According to Liberta (Mycologia 60: 842. 1968) holotypic and paratypic material are of two different taxa; the former probably a member of *P. cinerea* group, the latter *P. versiformis* group.

7. *Peniophora tephra* (Berk. & Curt.) Cke., Grevillea 8:20. 1879; *Corticium tephrum* Berk. & Curt., J. Linn. Soc. Bot. 25: 143. 1889.

All West Indian material examined (Cuba: C. Wright 193 ISOTYPE in FH, Earle & Murrill 143 in NY) was sterile.

Note on Authorship and Support. Portions of this report were used by A. Punugu and M.T. Dunn as partial fulfillment of the requirements for the Master of Science degree in the Graduate School of Tulane University. The drawings are those of A. Punugu. Pertinent parts from the theses were abstracted by A.L. Welden, who also redesigned the keys and figures. The collecting of specimens upon which this paper is based was made possible by a grant (1960-63) to A.L. Welden from the National Science Foundation.

MYCOTAXON

Vol. X, No. 2, pp. 455-458 January-March 1980

TWO NEW SPECIES OF CERCOSPORA

R. C. Rajak

Phytopathological Laboratory, Department of Botany
Govt. Science College, Jabalpur - 482 001 (M.P.), India

ABSTRACT

Cercospora pentasii Rajak and C. amaryllicola Rajak from the living leaves of Pentas lanceolata and Amaryllis belladona respectively, are described and illustrated here.

INTRODUCTION

During a survey of phytopathogenic fungi in and around Jabalpur, the author has collected many Cercosporae out of which two are new to science and described and illustrated here.

TAXONOMIC PART

Cercospora pentasii sp. nov. (Fig. 1)

Coloniae effusae, griseae vel albae. Hypostromata olivaceo brunnea, minuta, 15-30 µm lata. Conidiophora fasciculata, 6-12 conidiophora per fasciculata, multiseptata, olivacea brunnea vel brunnea, apicem versus pallidiores, nonramosa, simplicia, recta vel flexuosa, geniculata, cicatrice eminente ad antice vel conidiis, 72-350 X 5-8.5 µm. Conidia hyalina, latus infra-fastigiata sursum, filiformes, recta vel curvata, 8-28 septata, ad basim truncata, apicem rotundata, distincta ad basim cicatrice, acropleurogena, 60-175 X 4-6 µm.

In foliis viventibus Pentate lanceolata (Forsk.) K. Schum., College garden, Jabalpur, January 1978, Leg. R. C. Rajak.

Typus positus in herb. IMI subnumero 225291.

Infection spots amphigenous, elongated to irregular, 2-6 cm., greyish brown, margin brownish black, rarely coalescing.

Colonies effuse, greyish to dull white. Stroma olivaceous brown, composed of few cells, 15-30 µm wide. Conidiophores fasciculate, in fascicles of 6-12, multiseptate, olivaceous brown, lighter at the apex, unbranched, simple, straight or flexuous, geniculate, with prominent scar of attachment to conidia, 72-350 X 5-8 µm. Conidia hyaline, broader below and tapering above, filiform, straight or curved, 8-28 septate, base truncate, apical ends rounded, distinct scar at base, acropleurogenous, 60-175 X 4-6 µm.

On the living leaves of Pentas lanceolata (Forsk.) K. Schum., College garden, Jabalpur, January 1978, Leg. R. C.

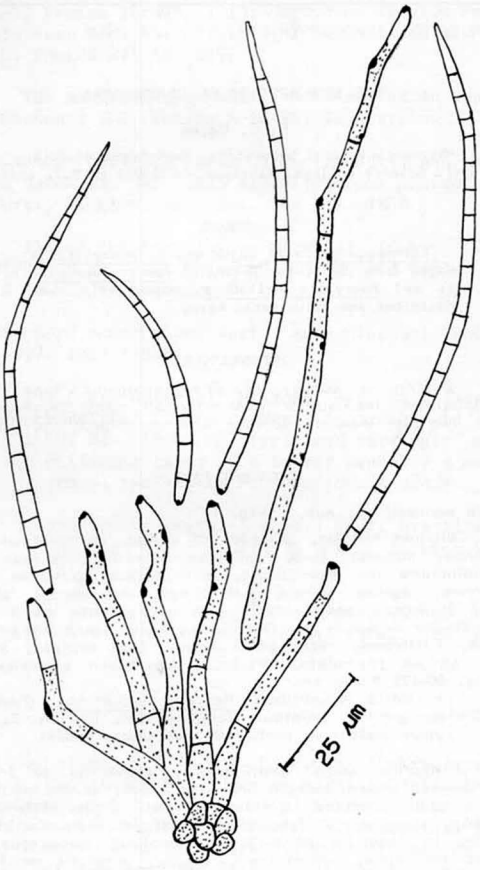


FIGURE 1. Cercospora pentasii. Conidia and conidiophores.

Rajak.

The type specimen has been deposited in the herbarium IMI No. 225291.

There is no report of any Cercospora parasitizing Pentas. It is, therefore, being described here as a new species, C. pentasii, named after the host plant.

Cercospora amaryllicola sp. nov. (Fig. 2)

Coloniae effusae, griseo nigrae, amphigenae. Hypostromata fusco brunnea vel griseo nigra, bulbiformae, pseudoparenchymatica, 64-112 µm lata. Conidiophora fasciculata, 6-15 conidiophora per fasciculata, multiseptata, olivacea brunnea vel brunnea, apicem versus pallidiores, nonramosa, simplicia, recta vel curvata, geniculata, cicatrice eminente ad antice vel conidiis, 224-640 X 5-7 µm. Conidia hyalina, latus infra-fastigiata sursum, filiformes, recta vel flexuosa, 6-25 septata, ad basim conicotruncata, apicem subacuta vel acuta, distincta ad basim cicatrice, acropleurogena, 72-450 X 4-6.5 µm.

In foliis viventibus Amarylli belladona Linn., Tagore garden, Jabalpur, January 1978, Leg. R. C. Rajak.

Typus positus in herb. IMI subnumero 225290.

Die-back of foliage was observed. Infection started from tips and extended downwards. Lesions olivaceous brown to greyish brown, halo not distinct.

Colonies effuse, greyish black, amphigenous. Stromata dark brown to greyish black, bulbous, pseudoparenchymatous, 64-112 µm wide. Conidiophores fasciculate, in fasciciles of 6-15,

64-112 µm wide. Conidiophores fasciculate, in fascicles of 6-15, multiseptate, olivaceous brown to brown, lighter at apex, simple, straight or flexuous, geniculate, with prominent scar of attachment to conidia, 224-640 X 5-7 µm. Conidia hyaline, broader below and tapering above, filiform, straight or curved, 6-25 septate, base conico-truncate, subacute to acute, distinct scar at the base, acropleurogenous, 72-450 X 4-6.5 µm.

On the living leaves of Amaryllis belladona Linn., Tagore garden, Jabalpur, January 1978, Leg. R. C. Rajak.

The type specimen has been deposited in the herbarium IMI No. 225290.

As far as known, there is no report of any Cercospora parasitizing Amaryllis. It is, therefore, being described here as a new species, C. amaryllicola, named after the host plant.

ACKNOWLEDGMENTS

I am grateful to Dr. G. P. Agarwal, Head, Department of Post-graduate Studies and Research in Botany, University of Jabalpur, for his kind interest and encouragement and to Mr. A. Johnston, Director, and Dr. B. C. Sutton, Commonwealth Mycological Institute, Kew, England, for their help in the identification of the species.

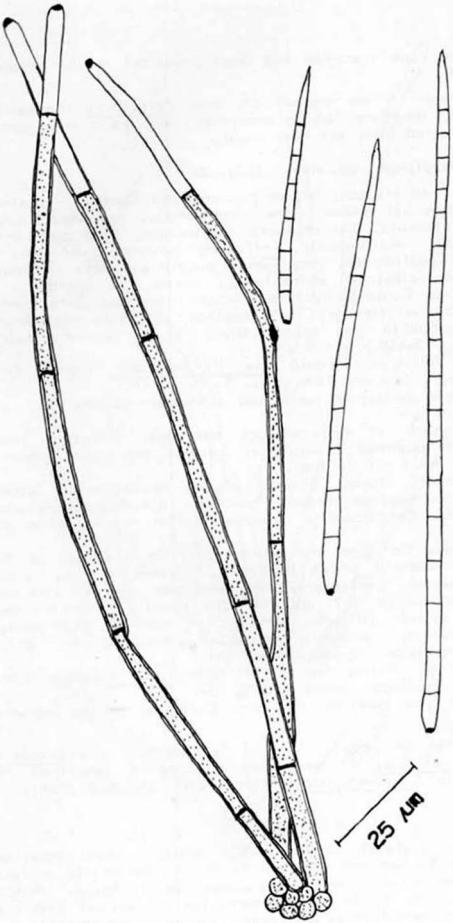


FIGURE 2. Cercospora amaryllicola. Conidia and conidiophores.

MYCOTAXON

Vol. 10, No. 2, pp. 459-472 January-March 1980

MOLLISIA IN MACARONESIA: AN EXERCISE IN FRUSTRATION

MARK A. GREENLEAF* and RICHARD P. KORF**

Plant Pathology Herbarium
Cornell University, Ithaca, NY 14853 USA

ABSTRACT

Twenty-seven taxa assumed to be of specific rank and referable to the genus Mollisia (Discomycetes: Helotiales, Dermateaceae) were delimited among collections from the Canary Islands and Madeira. Since there is no comprehensive monograph of the genus, an attempt at species identification was made by comparing sections of these Macaronesian collections with collections issued in European exsiccati. In no case was a match found with any of these previously identified, published collections. Comparisons were also made with 6 specimens collected and identified by Dennis from another Macaronesian island archipelago, the Azores. Three of our taxa appear to fit Dennis's concepts of described species. One of the collections from Madeira differs from any known species of the genus in having ascospores which are dextrinoid when mounted in iodine solutions; in culture it produces an anamorph close to Phialophora verrucosa, and the holomorph is described here as a new species, **Mollisia dextrinospora**. Illustrations of all 27 taxa are provided, 23 of which are merely cited as "taxonomic species" A, B, etc.

Species identification in genera of the Helotiales in which recent monographs are not available can be time-consuming and often unproductive work. One of the largest genera of the Helotiales lacking any kind of comprehensive treatment is Mollisia (Fr.) Karst., even in the sense that excludes the subiculate forms (Tapesia), the multiseptate-spored forms (Niptera), and the erumpent forms (Pyrenopeziza) that are only doubtfully worthy of recognition as separate genera. The junior author has (and suspects most of his colleagues who collect Discomycetes in earnest also have) hundreds of collections in his herbarium identified only to "Mollisia sp.," ever hopeful that a major monograph will appear that will allow identification of these collections to species.

* Undergraduate Research Student. Present address: 4306 Chesapeake St. NW, Washington, DC 20016.
** Professor of Mycology.

The junior author has in preparation a preliminary Discomycete Flora of Macaronesia, based on collections which he and colleagues have made in three, successive, month-long expeditions to the Canaries, the Madeiras, and the Azores, together with a study of all available collections which have formed literature reports from any of the Macaronesian islands. Other collections from colleagues who have collected in these island groups were also solicited and examined.

How to proceed with species identification of Macaronesian collections of Mollisia was given much thought. As a first step, all collections were examined under the light microscope (often using phase microscopy) from freezing-microtome sections (and squash mounts, where appropriate). Salient features of apothecial structure, including measurements of all appropriate micro-anatomical structures, were made. These studies permitted us to delimit 27 taxa which we feel may be worthy of species rank. Many of the taxa were represented by single collections, others by many collections. For each of the taxa the senior author prepared illustrations of the apothecium in median vertical section, and illustrations of the asci and ascospores (FIGS. 1-27). For one species, described below as new, and for which pure cultures had been obtained, illustrations were also prepared of its Phialophora anamorph (FIG. 1).

Sections were then made of all available published exsiccati of Mollisia from European sets in this herbarium (CUP) for comparison of these with our Macaronesian collections. These included what one might expect to be the commonest species one would encounter, Mollisia cinerea, M. melaleuca, M. melaleucoides, etc. Since several species of the genus had been reported by Dennis et al. (1977) from the Azores, six collections sent on loan from Kew were also sectioned and given comparative examination.

Our results were both unexpected and disheartening: not a single published exsiccatum matched any of our 27 purported species sufficiently to warrant assuming they represented the same taxon. While it is clear that the Macaronesian Discomycete flora may be expected to differ from the European flora which we sampled by choosing European exsiccati, we had expected to find some correlation at least. (The higher plant flora is said to have more than 50% of its species endemic in Macaronesia.) Our results with the 6 collections

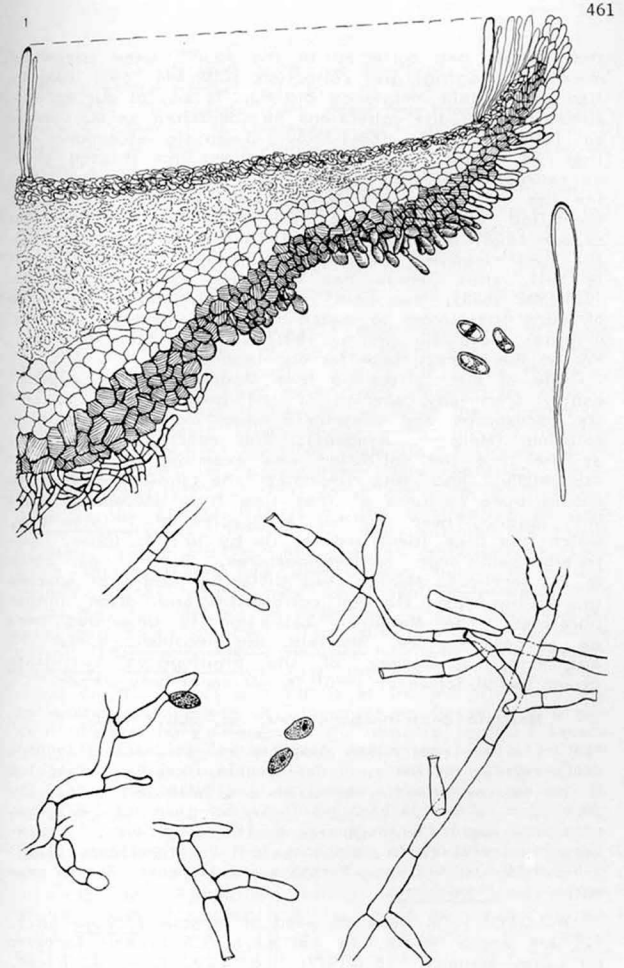


Fig. 1. Mollisia dextrinospora. Vertical section of apothecium × 500, 3 ascospores, ascus × 1000; phialides and phialoconidia of Phialophora in culture × 1000.

that Dennis had collected in the Azores were somewhat more encouraging. His collection (CUP-MM 1697) identified as Mollisia melaleuca did not fit any of our collections. Both of the collections he identified as M. ventosa (CUP-MM 1683, 1684) have 3-septate ascospores so that we would have excluded them and treated them as representatives of Niptera (but we do not feel that the two collections are conspecific). Dennis's collection identified as M. fallens (CUP-MM 1696) matches one of our taxa, and another identified as M. cinerea (CUP-MM 1695) matches another of our taxa. A third match is with what Dennis has identified as M. trabincola (CUP-MM 1698), but both his collection and the three of ours that seem to match differ so widely from the original diagnosis (Rehm, 1891) that we feel this cannot be the correct name for our taxon.

One of our collections from Madeira differs significantly from any species of the genus known to us: its ascospores are dextrinoid when mounted in iodine solution (Melzer's Reagent). The reaction was noted at the time the collection was examined in the field laboratory, and this prompted the junior author to obtain pure cultures at that time from ascospores shot onto agar. These yielded a species of Phialophora, which has been identified for us by Dr. W. Gams, Centraalbureau voor Schimmelcultures, Baarn, as close to P. verrucosa Medlar, but differing from that species in having less flaring collarettes and often longer phialides. The Madeiran collection is described here as a new species, Mollisia dextrinospora Korf. The anamorph, a member of the Phialophora fastigiata group (Schol-Schwarz, 1970) is not separately named.

Mollisia dextrinospora Korf, sp. nov. (FIG. 1)

Apothecia 0.3-1.0mm diam., dispersa vel gregaria, aliquando confluentia, applanata, translucentia, grisea. Excipulum e textura globulosa compositum, cellulis brunneis, 11-20µm diam. Asci 44-55×2.9-3.7(-4.4)µm, clavati, 8-spori, sine unco, poro J-. Ascosporae hyalinae, ovoideae, biseriatae, biguttulatae, in solutione iodi dextrinoideae, (3.7-)4.4-5.9(-6.6)×2.6-2.9µm. Paraphyses filiformes. Status anamorphosis: Phialophora.

HOLOTYPE: On decayed wood of mimosa (Acacia sp.), 1.5 km above Monte, at km mark 5.5 toward Terreiro da Luta, Madeira. 16.i.1977. Leg. R.P. Korf, R. Fogel, G.L. Hennebert & L.M. Kohn. CUP-MM 1557.

ISOTYPE: Ibid., TFC-MM 1557.

CULTURE: derived from the holotype on deposit in CBS, accession number 401.78.

NOTES: The ascus pore does not blue with iodine even if material is pretreated with 10% KOH (Kohn & Korf, 1975). The dextrinoid reaction of ascospores in Melzer's Reagent is intensely yellow-brown, and there is also a slight dextrinoid reaction in the subhymenium and medullary tissues. When sections are pretreated in 10% KOH the dextrinoid reactions of those tissues is essentially eliminated, and the spores are less intensely dextrinoid. The dextrinoid reaction is evident in maturing and mature ascospores, not in young ones.

Our studies have revealed that there are a large number of characters of the apothecia that may prove useful in delimiting species within the genus Moliisia, even though many have never been stressed by taxonomists. We have taken note not merely of the gross characters of apothecia (size, shape, colors of the hymenium and excipulum) and of hymenial features (sizes and shapes of asci, ascospores, spore septation, paraphyses, reactivity of the ascus pore to iodine) but also of the sterile tissues of the apothecium as seen in median section. Probably useful, but not taken into account in our studies, are the cell arrangements seen when the apothecia are viewed from below in squash mounts. Basal hyphae may be absent or present, and if so may or may not be embedded in gel; free hyphae may be present on the flanks, giving rise to hair-like outgrowths; excipular cells at the base vary greatly among collections in cell size and wall thickness, while those on the flanks and again at the margin may vary in shape and degree of pigmentation (from dark brown to hyaline); the thickness of the medulla, and its layering, also varies greatly among collections.

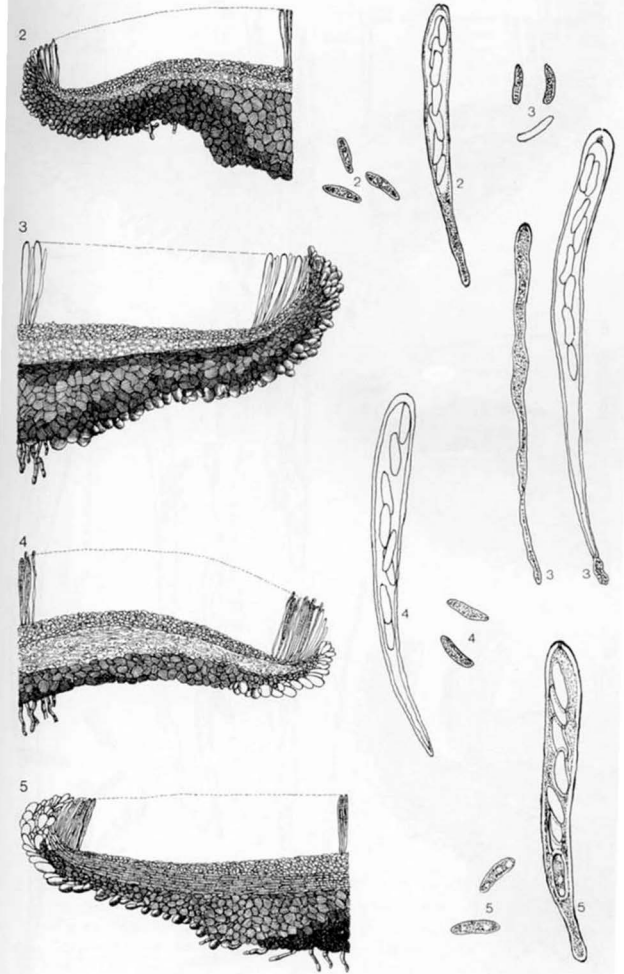
We are clearly not at a point where we can confidently assert that the taxa we have identified represent species rather than populations. They have the "feel" of being real species, but until someone undertakes monographic studies in this most complex genus, we prefer merely to record here our observations in a series of illustrations which will give some notion of the scope of variation to be found among our collections (FIGS. 1-27). Though an artificial key could easily be constructed to these "taxa," derived from our data, providing such a key would serve no real purpose: our intent is to point out how little, not how much, we know about Mollisia today. Monographic work

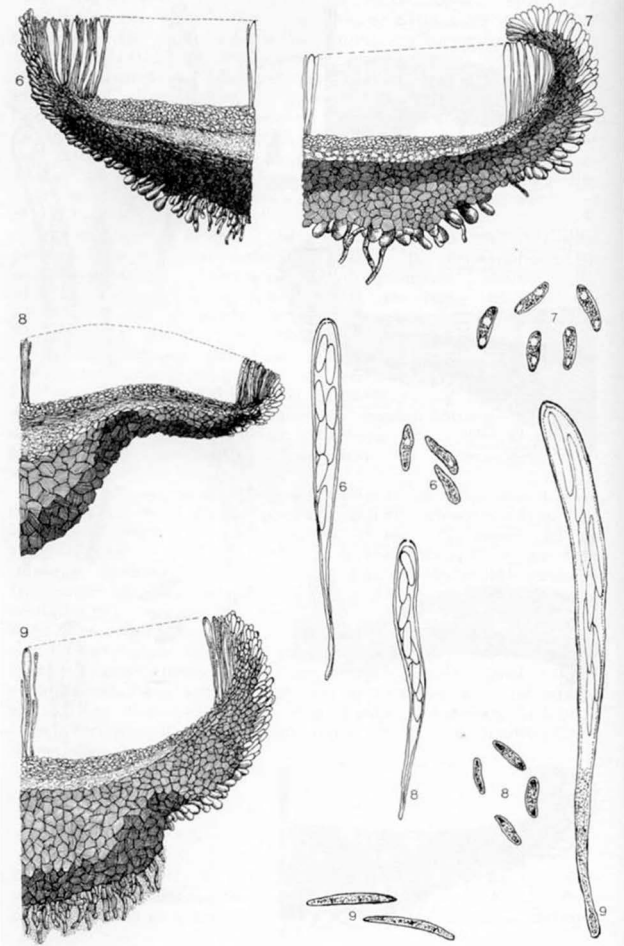
must necessarily involve much more work, and more sophisticated work, than we have attempted here. For example, in most cases no pure cultures were made of the species of this genus which were collected on the Macaronesian expeditions. Pure cultures are certain to yield much critical information, as has already been shown in the pioneering work by Le Gal & Mangenot (1956, 1958, 1960, 1961, 1966). Had it not been for our noting the peculiar dextrinoid reaction of the ascospores of M. dextrinospora in the field laboratory before drying, no cultures would have been obtained of it, either.

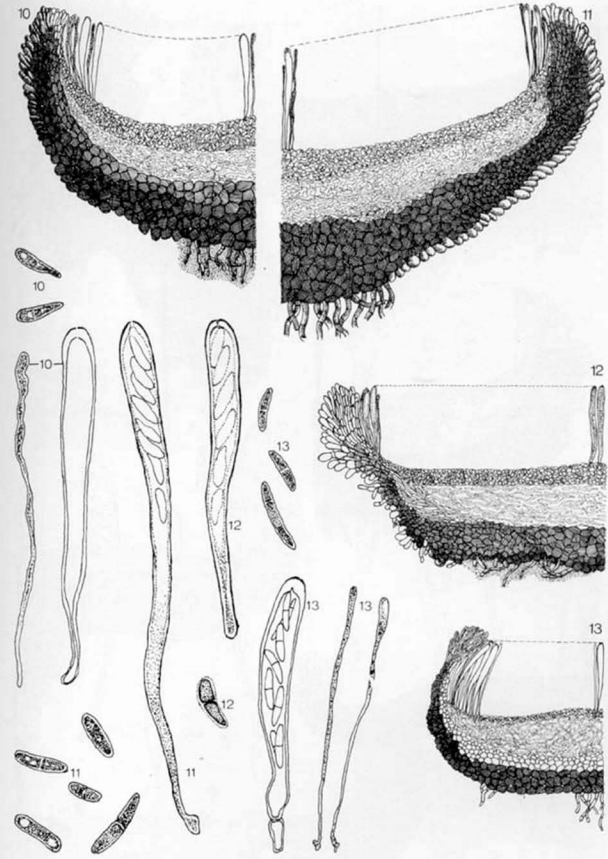
That many species of Mollisia and Mollisia-like genera yield anamorphs referable to Phialophora is well-established (Hennebert & Bellemère, 1979). If, as we believe, progress in the taxonomy of Mollisia will only be possible with concomitant study of the Phialophora anamorphs, the converse may be equally true: "I am sure that a study of Mollisia would be the only means of really advancing the knowledge of Phialophora" (W. Gams, pers. comm.). Is there a budding mycologist interested in monographing a large and important genus of Hyphomycetes (Phialophora) also willing to isolate from and do a monograph of Mollisia?

Some of the Macaronesian collections from the Canary Islands and Madeira were poorly preserved or so immature that we still cannot hazard a guess as to their identity beyond genus. A few taxa that we feel deserve species rank have not been illustrated because the material was too scanty. The 27 taxa that we fairconfidently recognize and which we have delimited here are represented by collections on deposit in CUP, with duplicates in some cases in O, OSC, or TFC. Collection data appears on the packet labels, and is not reproduced here except for an indication of the island on which the collection was taken. Numbers in bold face indicate the collection from which the illustrations were made.

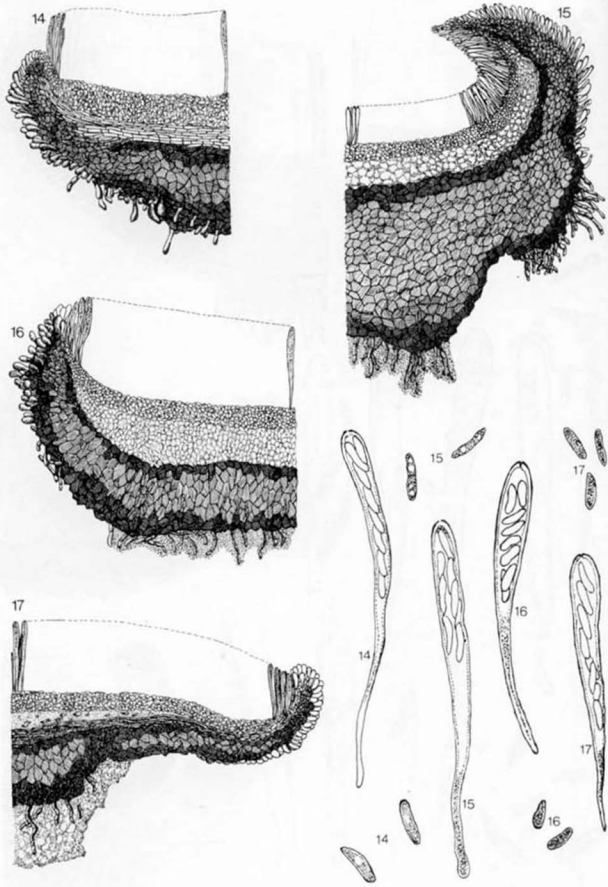
Figs. 2-5. Mollisia spp., apothecia x 250, asci, ascospores and paraphyses x 500. 2. Tax. sp. A. 3. Tax. sp. B. 4. Tax. sp. C. 5. M. trabincola sensu Dennis.


2
3
4
5
2
2
3
3
3
4
4
5
5

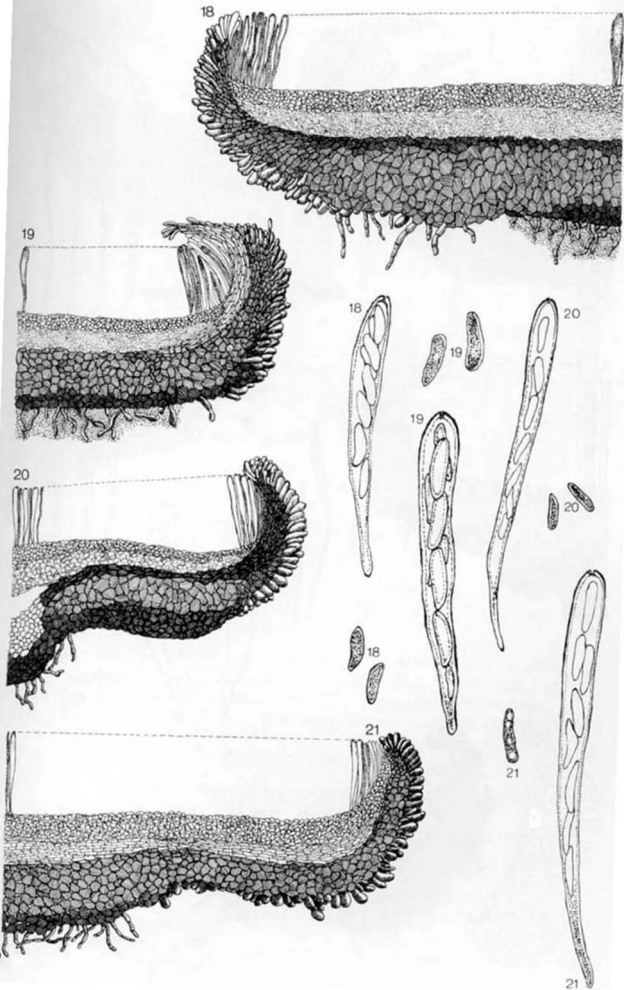

6
7
8
9
6
6
7
8
8
9
9

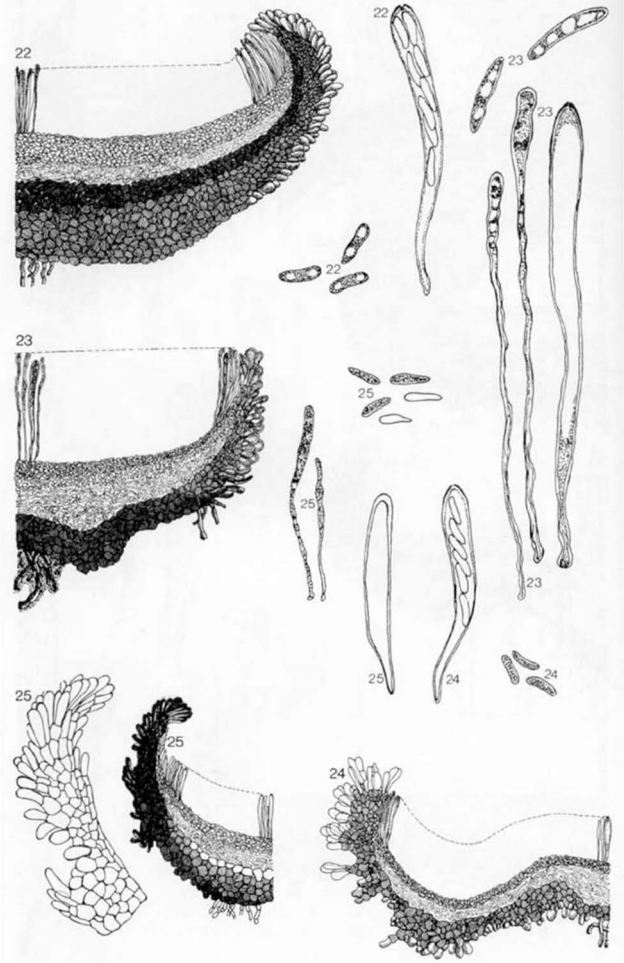


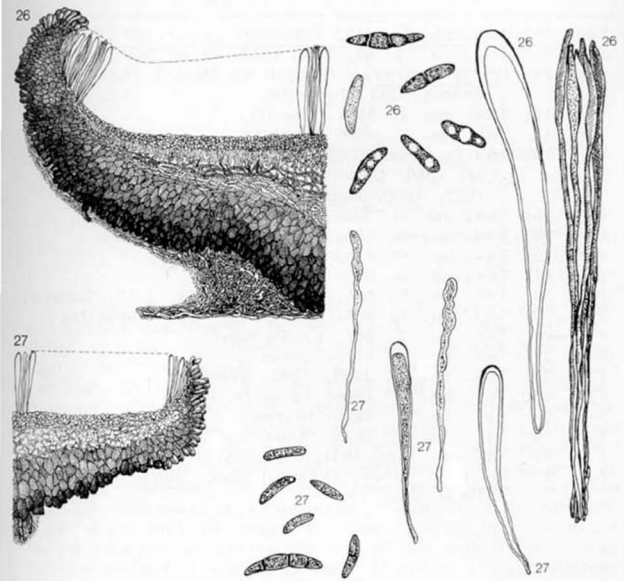
Figs. 6-13. Mollisia spp., apothecia x 250, asci, ascospores and paraphyses x 500. 6. Tax. sp. E (var.). 7. Tax. sp. E. 8. Tax. sp. F. 9. Tax. sp. G. 10. M. cinerea sensu Dennis. 11. Tax. sp. J. 12. Tax. sp. K. 13. Tax. sp. L.



Figs. 14-21. Mollisia spp., apothecia x 250, asci, ascospores and paraphyses x 500. 14. Tax. sp. M. 15. Tax. sp. N. 16. Tax. sp. P. 17. Tax. sp. Q. 18. Tax. sp. R. 19. Tax. sp. S. 20. Tax. sp. T. 21. Tax. sp. U.


18
19
20
21
18
19
20
18
19
20
21
21


22
22
22
23
23
23
23
23
25
25
25
25
24
24
24
25
25



† Figs. 26-27. Mollisia spp., apothecia x 250, asci ascospores and paraphyses x 500. 26. Tax. sp. AA. 27. M. fallens sensu Dennis.

+ Figs. 22-25. Mollisia spp. 22-24. Apothecia x 250, asci, ascospores, paraphyses x 500. 22. Tax. sp. W. 23. Tax. sp. X. 24. Tax. sp. Y. 25. Apothecium x 250, margin, ascus, ascospores, paraphyses x 500. Tax. sp. Z.

COLLECTION DATA

Fig. 1: Mollisia dextrinospora Korf. **1557:** Madeira.
Fig. 2: Taxonomic species A. **503:** Tenerife.
Fig. 3: Tax. sp. B. 89: Tenerife. **873:** La Palma.
Fig. 4: Tax. sp. C. 111, 1258: Tenerife. **667,** 1094: La
Fig. 5: Mollisia trabincola Rehm sensu Dennis. **220:** Tenerife. 1485, 1536, 1559: Madeira.
Fig. 6: Tax. sp. E (var.). **227:** Tenerife. 660, 899: La Palma.
Fig. 7: Tax. sp. E. **224,** 525, 605: Tenerife. 1344: Gomera.

Fig. 8: Tax. sp. F. **242**: Tenerife.
Fig. 9: Tax. sp. G. **95**, 249, 1259: Tenerife.
Fig. 10: Mollisia cinerea (Batsch ex Mérat) Karst. sensu Dennis. **303**: Tenerife.
Fig. 11: Tax. sp. J. **335**: Tenerife.
Fig. 12: Tax. sp. K. **490**: Tenerife.
Fig. 13: Tax. sp. L. 501, 513, 1109, 1229, **1328**: Tenerife. 1346: Gomera. 1488, 1493, 1603, 1620, 1622, 1640: Madeira.
Fig. 14: Tax. sp. M. **560**: Tenerife.
Fig. 15: Tax. sp. N. **606**, 1648: Tenerife.
Fig. 16: Tax. sp. P. **614**: Tenerife.
Fig. 17: Tax. sp. Q. **656**: La Palma.
Fig. 18: Tax. sp. R. **665**, 676: La Palma. 1342: Gomera.
Fig. 19: Tax. sp. S. **680**: La Palma. 1315: Tenerife.
Fig. 20: Tax. sp. T. **901**: La Palma.
Fig. 21: Tax. sp. U. **1174**: Gomera.
Fig. 22: Tax. sp. W. **1199**, 1293: Tenerife.
Fig. 23: Tax. sp. X. **1266**: Tenerife.
Fig. 24: Tax. sp. Y. **1428**: Hierro.
Fig. 25: Tax. sp. Z. **1625**: Madeira.
Fig. 26: Tax. sp. AA. **1631**: Madeira.
Fig. 27: Mollisia fallens (Karst.) Sacc. sensu Dennis. **1598**: Madeira.

ACKNOWLEDGEMENTS

The National Science Foundation, through grant DEB 75-23557, "Discomycete Flora of Macaronesia," sponsored not only three explorations, each a month in length and each by the junior author and three colleagues, but also provided financial support for two exceptionally able technicians, Susan Gruff (who sectioned most of the early collections) and Robert Dirig (the later ones, and who also gave technical assistance in preparing the illustrations for publication). The cooperation of the scientists at TFC and MADM was deeply appreciated and an essential to the programs. Dr. William Dress, BH, helped in checking the Latin diagnosis.

REFERENCES CITED

DENNIS, R.W.G., D.A. REID, & B. SPOONER. 1977. The fungi of the Azores. Kew Bull. **32**: 85-136.
HENNEBERT, G.L. & A. BELLEMERE. 1979. Les formes conidiennes des Discomycètes. Essai taxonomique. Rev. Mycol. (Paris) **43**: 259-315.
KOHN, L.M. & R.P. KORF. 1975. Variation in Ascomycete iodine reactions: KOH pretreatment explored. Mycotaxon **3**: 165-172.
LE GAL, M. & F. MANGENOT. 1956. Contribution à l'étude des Mollisiïdées. I. Note préliminaire: les formes conidiennes. Rev. Mycol. (Paris) **21**: 3-13.
____ & ____. 1958. Ibid., II (1re série). Rev. Mycol. (Paris) **23**: 28-86.
____ & ____. 1960. Ibid., III (2e série). Rev. Mycol. (Paris) **25**: 135-214.
____ & ____. 1961. Ibid., IV (3e série). Rev. Mycol. (Paris) **26**: 263-331.
____ & ____. 1966. Ibid., V (4e série). Rev. Mycol. (Paris) **31**: 3-44.
REHM, H. 1891. Ascomyceten: Hysteriaceen und Discomyceten. In Winter, G. & H. Rehm, Rabenhorst's Krypt.-Fl. Deutschl., ed. 2, 1(3)[Lief. 35]: 465-528.
SCHOL-SCHWARZ, M.B. 1970. Revision of the genus Phialophora (Moniliales). Persoonia **6**: 59-94.

MYCOTAXON

Vol. 10, No. 2, pp. 473-478 January-March 1980

CYTOSPORA VS. CYTISPORA: WHICH IS CORRECT?

LINDA J. SPIELMAN

Plant Pathology Herbarium, Cornell University
Ithaca, New York 14853 USA

A recent listing of diseases of apple and their associated pathogens in Phytopathology News (Parker 1979) aroused my interest with the statement that Cytispora is the correct spelling, rather than the more familiar Cytospora, for the agent of a common canker disease of apple. Since the genus includes several other pathogens of worldwide importance on cultivated and forest trees, there may be quite a few researchers wondering what those troublesome taxonomists are up to now. Because the "correct" spelling was indicated without reference or explanation, readers of Phytopathology News had no way of understanding the rationale for a change or of the making of an intelligent choice in the matter. I am at present involved in a taxonomic study of the genus, and therefore felt it worthwhile to investigate the question further, in the hope that I might help to clarify it for others as well.

The name Cytospora is a pre-starting point name, published by Ehrenberg (1818). The derivation of the name was not given in the original publication, but it is evidently a combination of the Greek words cytos (receptacle, cavity) and spora (seed) as mentioned by Saccardo (1884). Fries (1823) validated the name in the "Systema Mycologicum," referring to Ehrenberg's description, but spelling it Cytispora, giving no reason for the alteration. Dr. Kevin Clinton of the Classics Department of Cornell University has informed me that cytis is the diminutive form of cytos, and that while both are permissible, the combination 'Cytospora' is more acceptable. Therefore Fries's choice of Cytispora was apparently not based on linguistic correctness. He either preferred the spelling Cytispora or persisted in an unintentional orthographic change, since he employed it in the "Elenchus Fungorum" (1828) and the "Summa vegetabilium Scandinaviae" (1849) as well.

The history of both spellings from 1818 to the present is summarized in Table 1. From this we can see that in works immediately following Fries the spelling Cytispora was used, but Saccardo's (1884) revival of the original spelling in the "Sylloge Fungorum" was adhered to by nearly every subsequent author. Three authors (Saccardo, Lambotte, Feltgen) employed Cytispora in early works but adopted Cytospora in later works or supplements. Nowhere did the reverse occur.

Inquiries into the source of the statement in Phytopathology News revealed that Dr. F.A. Uecker, a USDA mycologist at Beltsville, had changed the spelling in Parker's (1979) list in the process of a routine taxonomic check required by the editors of the newsletter. The alteration was not applied consistently, however, appearing only in Parker's list; in the lists for peach and rose in the same and succeeding issues (Clayton 1979, Gill 1979) the generic name is spelled Cytospora. In support of his position Dr. Ueker has supplied me with a reference to an article by Jørstad (1962) in which a footnote reads: "Cytispora is the correct spelling, validated by Fries in Syst. Myc., 2 p. 540, 1823. Cytospora is due to Ehrenberg in Sylvae Myc. Berol. p. 28, 1818." In the absence of any further explanation I assume that Jørstad was referring to what is now Art. 13.1(f) of the International Code of Botanical Nomenclature (Stafleu 1978) which gives preferential status to the names published in Fries's "Systema Mycologicum" for this group of fungi. Additionally, Art. 73.1 and 73.2 direct that the original spelling in the validating publication be retained, except for the correction of typographic or orthographic errors. The crucial question is, does Fries's altered spelling constitute either a typographic or an orthographic error? The Code does not help to resolve this question, so I searched instead for precedents which might indicate how the problem had been handled in the past. There are at least two cases in which similar discrepancies in spelling have occurred.

1. Dacryomyces vs. Dacrymyces
   Both the pre-strating point spelling Dacryomyces (Nees von Esenbeck 1817) and Fries's (1821) spelling Dacrymyces are and have been in common use. Donk (1958) considered them orthographic variants, but preferred Fries's version.

2. Helmisporium vs. Helminthosporium
   Link (1809) published the name Helmisporium, which

TABLE 1: History of the use of Cytispora and Cytospora

CYTOSPORA	CYTISPORA
Ehrenberg (1818)	
	Fries (1823)
	Brongniart (1824)
	Fries (1828, 1849)
	Bonorden (1851)
	Nees & Henry (1858)
	Streinz (1862)
	Fuckel (1870)
	*Karsten (1873)
	Saccardo (1879)
	Lambotte (1880)
Saccardo (1884)	
Lindau (1889)	
Lambotte (1890)	
	*Ellis & Everhart (1892)
Schroeter (1894)	
Allescher (1898)	
	Feltgen (1899)
Feltgen (1903, 1905)	
Clements (1909)	
Diedicke (1912)	
Migula (1913)	
von Höhnel (1928)	
Clements & Shear (1931)	
*Défago (1935)	
Grove (1935)	
Gutner (1935)	
*Kern (1955)	
*Munk (1957)	
*Hubbes (1960)	
	Jørstad (1962)
Sutton (1973)	
von Arx (1974)	
*Wehmeyer (1975)	
Sutton (1977)	
*Barr (1978)	
*Dennis (1978)	

* These authors mentioned the anamorphic genus in the context of a work dealing principally with the teleomorphic genera Valsa and Leucostoma.

was picked up and validated by Fries (1821) with the same spelling. Later Fries (1832) used Persoon's (1822) changed spelling, Helminthosporium, which is now more commonly encountered. Hughes (1958) wanted to abolish the priviledged status of Fries's "Systema" and adopted an 1801 starting point for Hyphomycetes, and restored the original spelling of Link. Because of the problems in indexing and the preponderance of the use of the later spelling, Donk (1964) proposed conservation of Helminthosporium Fries 1832 over Helmisporium Fries 1821; that conservation has now been effected and appears in the Code.

The examples described above illustrate two differing solutions to the problem of typographic and orthographic variants of names sanctioned by virtue of their use in Fries's "Systema Mycologicum." The first is a case in which Fries's version has been preferred over the original by many, but not all, authorities. In the second example Fries himself used both spellings, but the earlier one has enough weight, due to its priority and its identity with the original, prestarting point version, that it was felt necessary to conserve the later, more common spelling through action by a Botanical Congress. Examination of these precedents has shown us that the Code has been variously interpreted on the subject of typographic and orthographic corrections of the names sanctioned by Fries. In the case of Cytospora/Cytispora, Fries's spelling, although much used during the nineteenth century, has been let go since Saccardo, in favor of the original spelling of Ehrenberg. Donk (1964) treated Cytispora as an incorrect orthographic variant, a position which represents the unspoken consensus in the recent literature. Since the Code allows for orthographic corrections, and the spelling Cytospora conforms to the original spelling as well as being in common use, I feel that there is no justification for a change to Cytispora. The problems which would result from such a change are mind-boggling. Since the anamorph is the state most commonly found in the field, the phytopathological literature is generally found under the name Cytospora rather than the teleomorphic names Valsa and Leucostoma. Phytopathologists and mycologists who work with this very common and economically important group of organisms would have to adopt a spelling which differed from the one in use in all of the recent literature. Even the common name, 'Cytospora canker,'

would have to be changed to 'Cytispora canker,' as the editors of Phytopathology News already, unfortunately, have done (Parker 1979). Indices would have to be revised, and gaining access to the literature would become more time-consuming. Therefore, if it were held that Fries's change was an intentionally introduced orthographic variant (no such evidence has been put forward) and if we were thus forced to adopt the unfamiliar spelling Cytispora, I for one would immediately move to conserve Cytospora. I strongly recommend that my mycological and phytopathological colleagues relax and ignore the "advice" of Phytopathology News, and continue their use of the spelling Cytospora.

LITERATURE CITED

Allescher, A. 1898. Fungi imperfecti: Hyalin-sporige Sphaeroideen. In Rabenhorst, Krypt.-Fl. Deutschl., ed. 2, 1(6)[Lief. 59-63].

Arx, J.A., von. 1974. The genera of fungi sporulating in pure culture. Lehre.

Barr, M.E. 1978. The Diaporthales in North America. Mycologia Memoir No. 7. Lehre.

Bonorden, H.F. 1851. Handbuch der allgemeinen Mykologie. Stuttgart.

Brongniart, A. 1824. Mycologie. (Bot.) In Dict. Sci. Nat. 33: 492-588. [Unsigned.] Issued as a repaged reprint with new title and rewritten first page: Brongniart, A. 1825. Essai d'une classification naturelle des champignons. Paris.

Clayton, C.N. 1979. Common names of plant diseases. Peach (Prunus persica (L.) Batsch). Phytopath. News 13: 130.

Clements, F.E. 1909. The genera of fungi. Minneapolis.
____ & C.L. Shear. 1931. The genera of fungi. New York.

Défago, G. 1935. De quelques Valsées v.H., parasites des arbres à noyeau dépérissants. Beitr. Kryptogamenfl. Schweiz 8(3).

Dennis, R.W.G. 1978. British Ascomycetes, ed. 2. Vaduz.

Diedicke, H. 1912. Pilze VII. Sphaeropsideae, Melanconidieae. Krypt.-Fl. Mark Brandenburg 9(2).

Donk, M.A. 1958. The generic names proposed for hymenomycetes VIII. Auriculariaceae, Septobasidiaceae, Tremellaceae, Dacrymycetaceae. Taxon 7: 164-178.
____. 1964. Nomina conservanda proposita. I. Proposals in fungi. Deuteromycetes. Regnum Veg. 34: 7-15.

Ehrenberg, C.G. 1818. Sylvae mycologicae Berolinensis. Berlin.

Ellis, J.B. & B.M. Everhart. 1892. The North American pyrenomycetes. Newfield.

Feltgen, J. 1899. Vorstudien zu einer Pilz-Flora des Grossherzogthums Luxemburg. I Theil. Luxemburg.
____. 1903. Ibid., Nachträge III. Luxemburg.
____. 1905. Ibid., Nachträge IV. Luxemburg.

Fries, E.M. 1821. Systema mycologicum. 1. Lund.
____. 1823. Ibid., 2(2). Lund.
____. 1828. Elenchus fungorum. 2. Greifswald.
____. 1832. Systema mycologicum. 3(2). Greifswald.

____. 1849. Summa vegetabilium Scandinaviae. Sectio posterior. Uppsala.
Fuckel, L. 1870. Symbolae mycologicae. Jahrb. Nassauischen Vereins Naturk. **23-24**: 1-459.
Gill, D.L. 1979. Common names of plant diseases. Rose (Rosa spp.). Phytopath. News **13**: 139.
Grove, W.B. British stem- and leaf-fungi. I: Sphaeropsidales. Cambridge.
Gutner, L.S. 1935. Materialy k monografii roda Cytospora. Trudy Bot. Inst. Akad Nauk SSSR, Ser.2, Sporov. Rast. **2**: 411-484.
Höhnel, F., von. 1928. Über die für Europa beschreibenen Cytospora-Arten der Abietineen. Mitt. Bot. Inst. TH Wien **5**: 5-15.
Hubbes, M. 1960. Systematische und physiologische Untersuchungen an Valsaceen auf Wieden. Phytopath. Z. **39**: 65-93.
Hughes, S.J. 1958. Revisiones hyphomycetum aliquot cum appendice de nominibus rejiciendis. Canad. J. Bot. **36**: 727-836.
Jørstad, I. 1962. Icelandic parasitic fungi apart from Uredinales. Skr. Norske Vidensk.-Akad. Oslo, Mat.-Naturvidensk. Kl., n.s. **10**: 1-72.
Karsten, P.A. 1873. Mycologica Fennica. Pars secunda: Pyrenomycetes. Bidr. Kännedom Finlands Natur Folk **23**: 1-250.
Kern, H. 1955. Taxonomic studies in the genus Leucostoma. Pap. Michigan Acad. Sci. **40**: 9-22.
Lambotte, E. 1880. Flore mycologique Belge. **3**. Verviers.
____. 1890. La flore mycologique de la Belgique. Suppl. **2**. Bruxelles.
Lindau, G. 1889. Pilze. In Engler und Prantl, Die natürlichen Pflanzenfamilien, ed. 1, **1**(1**).
Link, H.F. 1809. Observationes in ordines plantarum naturales. Ges. Naturf. Freunde Berlin Mag. Neuesten Entdeck. Gesammten Naturk. **3**: 3-42.
Migula, W. 1913. Fungi imperfecti: Sphaeropsidales, Melanconiales. Thomé's Krypt.-Fl. Deutschl. **3**(4)[1].
Munk, A. 1957. Danish pyrenomycetes. A preliminary flora. Dansk Bot. Ark. **17**: 1-149.
Nees von Esenbeck, C.G. 1817. Das System der Pilze und Schwämme. Ein Versuch. Ueberblick des Systems der Pilze und Schwämme zur Erklarung der Kupfertafeln. Würzburg.
Nees von Esenbeck, T.F. & A. Henry. 1858. Das System der Pilze. Zweite Abteilung. Bonn.
Parker, K.G. 1979. Common names of plant diseases. Apple (Malus sylvestris Mill.). Phytopath. News **13**: 127-128.
Persoon, C.H. 1822. Mycologia europaea. **1**. Erlangen.
Saccardo, P.A. 1879. Fungi Gallici. Michelia 1: 500-538.
____. 1884. Sylloge fungorum. **3**. Padua.
Schroeter, J. 1894. Die Pilze Schlesiens. In Cohn, Krypt.-Fl. Schlesien. **3**(2)[Lief. 2].
Stafleu, F.A. [ed.] 1978. International Code of Botanical Nomenclature adopted by the twelfth International Botanical Congress, Leningrad, July 1975. Regnum Veg. **97**: 1-457.
Streinz, W.M. 1862. Nomenclator fungorum. Vienna.
Sutton, B.C. 1973. Coelomycetes. In Ainsworth, Sparrow & Sutton [eds.], The fungi **4A**: 513-582.
____. 1977. Coelomycetes VI. Nomenclature of generic names proposed for Coelomycetes. Mycol. Pap. **141**: 1-253.
Wehmeyer, L.E. 1975. The pyrenomycetous fungi. Mycologia Memoir No. 6. Lehre.

MYCOTAXON

Vol. X, No. 2, pp. 479-501 January-March 1980

SYNOPSIS OF WOOD ROTTING-FUNGI ON SPRUCE IN NORTH AMERICA: III[1]

K. J. Martin

Arizona Commission of Agriculture and Horticulture
Phoenix, Arizona 85007

R. L. Gilbertson

Department of Plant Pathology
University of Arizona, Tucson 85721

SUMMARY

One hundred and fourteen species of wood-rotting basidiomycetes in the orders Tremellales, Agaricales, and Aphyllophorales (Polyporaceae and Corticiaceae excluded) are reported to occur on 8 species of North American spruces.

This is the last of a three-part synopsis of wood-rotting basidiomycetes on spruce in North America. The first part (Martin and Gilbertson, 1977) included keys to orders and to families of Aphyllophorales, and a synopsis of the family Corticiaceae. Part II (Martin and Gilbertson, 1978) was a synopsis of the family Polyporaceae sensu stricto. Part III includes keys to families, genera, and species of the order Tremellales; keys to families, genera and species of the order Agaricales; and keys to genera and species of the families Clavariaceae, Coniophoraceae, Echinodontiaceae, Hericiaceae, Hymenochaetaceae, Lachnocladiaceae, Punctulariaceae, Sparassidaceae, Steccherinaceae, Stereaceae, and Thelephoraceae of the order Aphyllophorales.

Species of spruce are denoted by numbers as follows: 1, *Picea breweriana;* 2, *P. engelmannii;* 3, *P. glauca;* 4, *P. mariana;* 5, *P. pungens;* 6, *P. rubens;* 7, *P. sitchensis;* 8, *P. chihuahuana;* 9, *Picea* sp.

Abbreviations designating geographical localities are AK, Alaska; AZ, Arizona; AT, Alberta; BC, British Columbia; CA, California; CO, Colorado; CH, Chihuahua; CT, Connecticut; ID, Idaho; MA, Massachusetts; MB, Manitoba; ME, Maine; MI, Michigan; MN, Minnesota; MT, Montana; NB, New Brunswick; NC, North Carolina; NF, Newfoundland; NH, New Hampshire; NJ, New Jersey; NM, New Mexico; NWT, Northwest Territories; NS, Nova Scotia; NY, New York; OR, Oregon; OT, Ontario; PA, Pennsylvania; PEI, Prince Edward Island; QB, Quebec; SK, Saskatchewan; SD, South Dakota; TN, Tennessee; UT, Utah; VT, Vermont; WA, Washington; WS, Wisconsin; WY, Wyoming; YT, Yukon Territory.

1/ University of Arizona Agricultural Experiment Station Journal Article No. 3091.

Order Tremellales

Key to families

1. Basidia septate 2
1. Basidia not septate 3
   2. Basidia elongated, transversely septate . . AURICULARIACEAE
   2. Basidia subglobose to pyriform, longitudinally septate . . . . . TREMELLACEAE
3. Basidia bifurcate . . . . . DACRYMYCETACEAE
3. Basidia with four large, swollen epibasidia . . . TULASNELLACEAE

Family AURICULARIACEAE

Key to genera

1. Basidiocarps corticioid; basidia slightly coiled or circinate . . . . . *Helicobasidium* Pat.

Helicobasidium corticioides Bandoni. Basidiocarps white to cream colored; hyphae simple-septate; basidia usually 4-celled; basidiospores broadly ellipsoid with a large, blunt apiculus, 14-22.5 x 6.5-12.5 µm. Brown cubical pocket rot of 2 in CO; 9 in AT.

1. Basidiocarps pileate, ear-like; basidia straight . . . . . *Auricularia* Pers.

Auricularia auricularis (S. F. Gray) G. W. Martin. Basidiocarps grayish to brownish with a brown hymenial surface; interior hyphae thin-walled, with clamps; hyphae on abhymenial surface thick-walled, aseptate; basidia imbedded, difficult to discern; basidiospores allantoid, 13-17 x 5-6 µm. White rot of 2 in ID, UT; 3 in AT, BC, MN, NB; 6 in CT, ME, NH, NY; 9 in CO, MN.

Family DACRYMYCETACEAE

Key to genera

1. Basidiocarps pulvinate or discoid; lacking thick-walled sterile cells on lower surface . . . . . *Dacrymyces* Fr.
1. Basidiocarps conical, attached by a narrow base; thick-walled sterile cells present on lower surface . . . . *Heterotextus* Lloyd

Heterotextus alpinus (Tracy et Earle) G. W. Martin. Basidiocarps bright yellowish orange, on wood buried in snow; hymenial surface concave; hyphae with clamps; basidiospores allantoid, 2-4 septate, 12-16 x 4-5 µm. On 2 in CO, ID, MT, OR, UT, WY.

Key to species of *Dacrymyces*

1. Basidiocarps cerebriform, bright orange 2
1. Basidiocarps discoid or turbinate, pale yellow to pale orange or dark reddish orange to reddish brown 3
2. Mature basidiospores 4-celled

Dacrymyces ellisii Coker. Hyphae simple-septate; basidiospores cylindric, curved, 12-15 x 5.5-7 µm. On 9 in QB.

2. Mature basidiospores 7-9 celled

Dacrymyces palmatus (Schw.) Bres. apud Hoehn. Hyphae mostly simple-septate, infrequent clamps sometimes present; basidiospores cylindric, curved, with large, blunt apiculus, 17-22 x 5-6.5 µm. On 2 in AZ; 3 in BC; 4 in AT.

3. Basidiocarps discoid; basidiospores 1-3 celled

Dacrymyces punctiformis Neuhoff. Basidiocarps dark reddish orange to reddish brown, with a shallow central depression; hyphae mostly with clamps, some thin-walled, others thick-walled with a narrow lumen; basidiospores cylindric, curved, 11-15 x 3-4 µm. On 2 in MT.

3. Basidiocarps turbinate; basidiospores 4-9 celled

Dacrymyces abietinus (Pers.) Schroet. Basidiocarps pale yellow to pale orange; hyphae mostly with clamps; basidiospores cylindric or allantoid, 16-20 x 6-8 µm. On 2 in CO.

Family TREMELLACEAE

Key to genera

1. Basidiocarps resupinate, arid or waxy. 2
1. Basidiocarps substipitate or cerebriform, gelatinous 3
2. Gloeocystidia absent. .*Exidiopsis* (Joh. - Ols. ex Bref.) Moll.
2. Gloeocystidia present. . . *Bourdotia* (Bres.) Bres. et Torrend

Bourdotia eyrei (Wakef.) Bourd. et Galz. Basidiocarps light gray or light ochre-yellow to reddish brown; gloeocystidia cylindric to almost clavate or fusiform, with yellowish contents; basidiospores subglobose to globose, 4-7 µm in diam. On 5 in CO.

3. Basidiocarps laterally substipitate; hymenial surface with well developed pendent spines . . . . . *Pseudohydnum* Karst.

Pseudohydnum gelatinosum (Fr.) Karst. Basidiocarps white, semi-transparent or with yellowish gray to grayish brown upper surface and white spines; hyphae with clamps; basidiospores subglobose to globose, 5-7 µm in diam. On 2 in CO.

3. Basidiocarps cerebriform; hymenial surface lacking spines . . . . . *Tremella* Fr.

Tremella mesenterica (S. F. Gray) Pers. Basidiocarps golden yellow to orange; hyphae with occasional clamps; basidiospores subglobose, 6-10 µm in diam. On 3 in BC.

Key to species of *Exidiopsis*

1. Basidiocarps resupinate, arid; basidiospores 15-22 x 6-9 µm.

Exidiopsis calcea (Pers.) Wells. Basidiocarps white or grayish white; hyphae with clamps; basidiospores cylindric to allantoid,

12-20 x 5-7.5 µm. White rot of 2 in AZ, MT; 3 in AK, BC, YT; 4 in MN, NS; 9 in MB, NS, PEI.

2. Basidiocarps resupinate to reflexed in drying, arid, coriaceous; basidiospores 10-15 x 5-7.5 µm.

Exidiopeis macrospora (Ell. et Everh.) Wells. Probasidia becoming obovate to subglobose, 15-22 x 8-14 µm. On 3 in BC.

Family TULASNELLACEAE

Key to species of *Tulasnella* Schroet.

1. Basidiospores subglobose

Tulasnella violea (Quél.) Bourd. et Galz. Basidiocarps thin, gelatinous, lilac to reddish gray; hyphae simple-septate; basidiospores 5-9 x 4-7 µm. On 5 in CO.

1. Basidiospores cylindric-ellipsoid

Tulasnella prunosa Bourd. et Galz. Basidiocarps thin, cobwebby to membranous, white to pinkish lilac, occasionally with a greenish tinge; hyphae simple-septate; basidiospores 4-7 x 3-4 µm. On 2 in MT.

Family CLAVARIACEAE

Clavariadelphus Donk

Clavariadelphus ligula (Fr.) Donk. Basidiocarps occurring in groups or singly, narrowly clavate to flattened, salmon color to orange-buff, with a white, downy base; interior tissue white; basidiospores elliptical, 12-15 x 3-4.5 µm. On 2 in AZ, MT; 3 in BC.

Family CONIOPHORACEAE

Key to genera

1. Hymenophore smooth or tuberculate 2
1. Hymenophore irregularly folded or toothed . . . *Serpula* S. F. Gray

Serpula himantioides (Fr. ex Fr.) Karst. Hymenial surface merulioid, light brown to raw umber; margin cream colored; hyphae with clamps; basidiospores narrowly ellipsoid, dextrinoid in Melzer's reagent, 10-14 x 5-6 µm. Brown rot of 2 in AZ, CO; 3 in AT, BC, MB, NB, OT; 4 in OT, QB.

2. Large, septate cystidia abundant 3
2. Cystidia absent or if present, small and aseptate . . . . . *Coniophora* DC. ex Mérat
3. Basidia barrel shaped to obovate . . . . . *Suillosporium* Pouz.

Suillosporium cystidiatum (Rogers) Pouz. Basidiocarps whitish with a faint yellowish tinge; hyphae with clamps; cystidia cylindric,

tapering to the apex; basidiospores cylindric to fusiform, slightly curved, 11-14 x 4-5 µm. On 9 in OT, QB.

3. Basidia cylindric-clavate . . . . . *Coniophorella* Karst.

Coniophorella olivacea (Fr. ex Fr.) Karst. Basidiocarps olivaceous to brownish; margin whitish or concolorous; hyphae simple-septate; cystidia cylindric, coarsely incrusted; basidiospores ovate to ellipsoid, strongly dextrinoid in Melzer's reagent, 8-13 x 4-5 µm. Brown rot of 2 in CO, MT; 3 in BC; 4 in AT; 9 in AT, CO, MB, MN.

Key to species of *Coniophora*

1. Subicular hyphae simple-septate or with some single, double, or multiple clamps; basidiospores dextrinoid in Melzer's reagent 2
1. Subicular hyphae with abundant single clamps; basidiospores negative in Melzer's reagent

Coniophora corrugis Burt. Hymenial surface pale brownish, shallowly merulioid; margin whitish; basidiospores broadly ellipsoid, 7-10 x 5-7 µm. White rot of 2 in AZ, CO, ID, UT, WY; 5 in AZ.

2. Basidiospores ellipsoid, 10-16 µm long 3
2. Basidiospores fusiform, 16-22 µm long

Coniophora fusispora (Cke. et Ellis) Cke. Basidiocarps pale buff; basidiospores 16-22 x 6-7.5 µm. On 9 in NS.

3. Basidiocarps becoming thick, fleshy, readily separable from substratum

Coniophora puteana (Schum. ex Fr.) Karst. Hymenial surface olive brown; margin cream colored; some hyphae with single, double, or multiple clamps; basidiospores 11-16 x 7-9 µm. Brown rot of 2 in AT, AZ, BC, CO, MB, MT; 3 in AK, AT, BC, MB, NB, OT; 4 in AT, MB, NB, OT, QB; 9 in CO, MB.

3. Basidiocarps thin, arid, not readily separable from substratum

Coniophora arida (Fr.) Karst. Hymenial surface light brown to olive brown; margin whitish to yellowish brown; hyphae simple-septate; basidiospores 10-14 x 5-8 µm. Brown rot of 2 in AZ, CO, ID, MT; 9 in MB, QB.

Family ECHINODONTIACEAE

Key to genera

1. Basidiocarps thick, sessile, ungulate; interior tissue brick red; hymenial surface strongly hydnaceous . . *Echinodontium* Ell. et Ev.

Echinodontium tinctorium (Ell. et Ev.) Ell. et Ev. Upper surface becoming blackish, rough, and rimose; hymenial surface pale olive buff; hyphal system dimitic; generative hyphae with clamps;

basidiospores ellipsoid, minutely echinulate to smooth, 6-8 x 5-6 µm. Brownish stringy heartrot of 2 in AZ, BC, ID, MT, NM; 3 in BC; 7 in BC.

1. Basidiocarps thin, effused-reflexed to resupinate; context pinkish buff; hymenial surface tuberculate to smooth . . . *Laurilia* Pouz.

Laurilia sulcata (Burt) Pouz. Upper surface pale to dark brownish, tomentose, becoming blackish, sulcate; hymenial surface pinkish buff to ochraceous; hyphal system trimitic; generative hyphae with clamps; basidiospores subglobose to globose, amyloid, echinulate, 5-6.5 x 4.5-6 µm. White pocket rot of 2 in AT, CO, ID, MT; 3 in AK, AT, BC; 5 in CO; 9 in AT, ID.

Family HERICIACEAE

Key to genera

1. Basidiocarps coralloid, intricately branched
Hericium Pers. ex S. F. Gray

Hericium abietis (Weir ex Hubert) K. Harrison. Basidiocarps large, densely or loosely branched from a solid tubercle, white to cream colored; spines up to 1 cm long; hyphae thick-walled, with clamps, often ampullate, amyloid in Melzer's reagent; cystidia and gloeocystidia present; basidiospores subglobose, minutely rough to smooth, 4.5-6 x 4-5 µm. White rot of 2 in ID, MT, WA; 7 in AK, BC.

1. Basidiocarps consisting of individual spines arising directly from substratum; no subiculum present . . . . . *Mucronella* Fr.

Mucronella aggregata Fr. Individual spines simple or branched, cream colored to pinkish buff, up to 1.5 mm long; hyphae thin-walled, with simple septa and clamps, some swollen or contorted; basidiospores ellipsoid, smooth, 4-6 x 2.5-3.5 µm. White rot of 2 in AZ, BC, CO.

Family HYMENOCHAETACEAE

Key to genera

1. Stellately branched setal hyphae not present in basidiocarps. . 2
1. Stellately branched setal hyphae abundant in subiculum and hymenium . . . . . *Asterodon* Pat.

Asterodon ferruginosus Pat. Basidiocarps resupinate, soft and cottony; hymenial surface hydnaceous, cinnamon brown to reddish brown; margin with brown rhizomorphs; basidiospores hyaline, ovoid to broadly ellipsoid, 5-7.5 x 3-4 µm. White rot of 3 in AK, BC, YT; 6 in CT, ME, NH, NY.

2. Hymenophore consisting of united tubes. 3
2. Hymenophore smooth . . . . . *Hymenochaete* Lév.
3. Basidiocarps perennial. . . . . *Phellinus* Quél.
3. Basidiocarps annual . . . . . *Inonotus* Karst.

Key to species of *Hymenochaete*

1. Setigerous layer next to substratum 2
1. Setigerous layer separated from substratum by a hyphal layer lacking setae 3
2. Setae 36-45 x 5-7 µm

Hymenochaete tenuis Pk. Basidiocarps resupinate; hymenial surface smooth, cracking; basidiospores cylindric-ellipsoid, 4.5-5.5 x 2-3 µm. White rot of 3 in AK.

2. Setae 60-75 x 8-9 µm

Hymenochaete fuliginosa (Pers.) Lév. Basidiocarps resupinate; hymenial surface colliculose; basidiospores ovoid, 4-5 x 2-3 µm. White rot of 3 in BC.

3. Several setigerous layers present in subiculum

Hymenochaete cinnamomea (Pers.) Bres. Basidiocarps resupinate; setae 60-90 x 5-6 µm; basidiospores 4.5-6 x 2-2.5 µm. White rot of 3 in YT; 9 in BC.

3. Single setigerous layer present in hymenial region

Hymenochaete tabacina (Sow. ex Fr.) Lév. Basidiocarps resupinate to effused-reflexed; hymenial surface cracking radially; setae 75-100 x 7.5-10 µm; basidiospores short-cylindric, 4-4.5 x 1.5-2 µm. White rot of 2 in AT; 6 in CT, ME, NH, NY; 9 in NS.

Key to species of *Inonotus*

1. Hymenial setae hooked; pileus usually over 2 cm thick 2
1. Hymenial setae straight; pileus usually less than 1 cm thick

Inonotus tomentosus (Fr.) Gilbn. Basidiocarps circular to flabelliform, centrally to laterally stipitate, often developing in large numbers; setae 50-70 (-140) x 7-11 µm; basidiospores ellipsoid, 5-6 x 3-4 µm. White pocket root and butt rot of 2 in AZ, BC, CO, ID, OR, WA; 3 in AK, AT, BC, MB, NB, OT, SK; 4 in AT, MB, NB, OT, QB; 6 in NS; 7 in BC, OR; also pathogenic on spruce in Canada, causing a root rot called stand opening disease.

2. Setae subulate; basidiospores ellipsoid; context duplex

Inonotus circinatus (Fr.) Gilbn. Basidiocarps circular to dimidiate, usually laterally substipitate or sessile on the base of trees, sometimes centrally stipitate, usually single; setae 50-80 x 12-20 µm; basidiospores 5-6.5 x 3-4 µm. White pocket root and butt rot of 2 in AT, AZ, CO, ID, NM, UT; 3 in BC, MN, NB, OT, SK; 4 in MN, OT; 6 in NB, NS; 7 in BC; 9 in ID, NY.

2. Setae ventricose; basidiospores subglobose; context not duplex

Inonotus dryadeus (Pers. ex Fr.) Murr. Basidiocarps up to 35 cm wide and 15 cm thick, sessile at base of trees; pore surface often

exuding amber colored droplets; context mottled; setae 25-40 x 9-16 µm; basidiospores dextrinoid in Melzer's reagent, 6-8 x 5-7 µm. White root and butt rot of 2 in CO, ID, MT, OR, WA; 7 in CA, WA.

Key to species of *Phellinus*

1. Setal hyphae present in tramal tissue and projecting beyond hymenium. 2
1. Setal hyphae not present in tramal tissue 3
2. Projecting ends of setal hyphae curved; basidiospores allantoid

Phellinus ferrugineofuscus (Karst.) Bourd. Basidiocarps resupinate; pore surface purplish brown; margin yellowish brown to white; setal hyphae 5-7 µm in diam; basidiospores 4-5.5 x 1.5-2 µm. White laminated and mottled rot of 2 in AZ, CO, MT, UT; 3 in BC, OT, NWT; 9 in AT.

2. Projecting ends of setal hyphae straight; basidiospores ovoid to subglobose

Phellinus weirii (Murr.) Gilbn. Basidiocarps resupinate; pore surface and margin yellowish brown; setal hyphae 6-10 µm in diam; basidiospores 4-5.5 x 3-4.5 µm. Yellow laminated root and butt rot of 2 in BC; 7 in BC.

3. Basidiospores cylindric, straight or allantoid 4
3. Basidiospores ellipsoid to subglobose or globose 7
4. Setal hyphae not present in subiculum and martinal tissue. . 5
4. Setal hyphae present in subiculum and marginal tissue

Phellinus ferruginosus (Schrad. ex Fr.) Bourd. et Galz. Basidiocarps resupinate; pores variable in size, 2-8 per mm; hymenial setae subulate, 40-150 x 6-10 mm; basidiospores 4.5-7 x 2.5-3 µm White rot of 3 in BC; 9 in AT.

5. Pores 4-7 per mm; setae not over 40 µm long 6
5. Pores 2-4 per mm; setae up to 80 µm long

Phellinus viticola (Schw.) Donk. Basidiocarps sessile, effused-reflexed, or resupinate; pilei dimidiate to elongate, up to 1.5 cm wide; setae subulate; basidiospores cylindric, straight to slightly curved, 5.5-8 x 1.5-2 µm. White rot of 2 in CO, BC, ID, MT; 3 in YT.

6. Black lines present in context

Phellinus nigrolimitatus (Rom.) Bourd. et Galz. Basidiocarps sessile, effused-reflexed, or resupinate; upper surface soft and spongy at first; setae subulate to ventricose, 25-37 x 6.5-8.5 µm; basidiospores straight, tapering to the apex and appearing carrot shaped, 7-10 x 2-2.5 µm. Large white pocket rot of 2 in AZ, CO, ID, MT, UT; 3 in AK, BC, YT; 7 in AK, BC, OR; 9 in AK, BC.

6. Black lines not present in context

Phellinus ferreus (Pers.) Bourd. et Galz. Basidiocarps resupinate; pore surface yellowish brown; setae subulate to slightly ventricose, 22-30 x 6-7 µm; basidiospores straight, 5-7.5 x 2-2.5 µm. White rot of 3 in BC.

7. Pores 1-4 per mm; setae abundant 8
7. Pores 4-10 per mm; setae rare 9
   8. Basidiocarps thin, usually occurring in clusters; upper surface hirsute

Phellinus chrysoloma (Fr.) Donk. Basidiocarps short-lived, sometimes annual; pilei usually less than 2 cm thick; setae subulate to ventricose, 30-60 x 10-14 µm; basidiospores ovoid to subglobose, 4.5-6 x 3.5-4.5 µm. White pocket rot of 2 in AZ, UT; 4 in AK.

   8. Basidiocarps thick, usually occurring singly under branch stubs on living trees; upper surface glabrous, crustose

Phellinus pini (Thore. ex Fr.) Pilát. Basidiocarps sessile, perennial for several years; pilei usually more than 5 cm thick on older specimens; setae subulate to ventricose, 40-50 x 10-14 µm; basidiospores ovoid, 4.5-7 x 3.5-5 µm, becoming yellowish in older specimens. White pocket trunk rot of 1 in OR; 2 in AT, BC, MB, NB, NS, OT, QB, SK, VT; 4 in AK, AT, MB, NB, NS, NWT, OT, QB, SK, YT; 5 in CO; 6 in CT, ME, NB, NC, NH, NS, NY, QB; 7 in AK, BC, CA, OR, WA; 9 in AK, MB, NB, NS, PEI.

9. Basidiospores subglobose, 5-8 µm in diam, dextrinoid in Melzer's reagent

Phellinus robustus (Karst.) Bourd. et Galz. Basidiocarps resupinate, effused-reflexed, or sessile; upper surface black and rimose with age; context bright yellowish brown; setae absent or extremely rare. White rot of 9 (listed in Overholts, 1953).

9. Basidiospores broadly ellipsoid to subglobose, 4-5.5 x 3-4.5 µm, negative in Melzer's reagent

Phellinus repandus (Overh.) Gilbn. Basidiocarps usually resupinate, rarely reflexed or sessile; pore surface grayish brown when fresh, drying reddish brown, rough to the touch; context yellowish brown, soft and spongy to corky; setae rare, subulate to ventricose, 20-25 x 6-7 µm. White pocket rot of 2 in MT.

Family LACHNOCLADIACEAE

Key to genera

1. Asterohyphidia present. . . . . *Asterostroma* Massee
1. Asterohyphidia absent, dichohyphidia or dendrohyphidia present 2
   2. Dichohyphidia present, with distinct dichotomous branching . . . . . *Vararia* Karst.
   2. Dendrohyphidia present, not distinctly dichotomously branched . . . . . .*Scytinostroma* Donk

Key to species of *Asterostroma*

1. Basidiospores smooth; rays of asterohyphidia rarely branched

Asterostroma andinum Pat. Basidiocarps soft, byssoid to arachnoid; hyphae simple-septate; asterosetae present in subiculum and hymenium; basidiospores amyloid, globose to subglobose, 5-6 µm in diam. White rot of 9, reported by Seymour (1929).

1. Basidiospores tuberculate; rays of asterohyphidia commonly branched

Asterostroma cervicolor (Berk. et Curt.) Massee. Basidiocarps soft; hymenial surface pale brownish; hyphae simple-septate; asterosetae present in subiculum and hymenium; gloeocystidia present; basidiospores amyloid, sparsely tuberculate, globose to subglobose, 4-7 x 3-6 µm. White rot of 3 and 9, reported by Seymour (1929).

Key to species of *Scytinostroma*

1. Basidiospores echinulate, amyloid

Scytinostroma arachnoideum (Pk.) Gilbn. Basidiocarps resupinate, soft-cottony, cream color to pale buff; hymenial surface smooth to papillate or strongly hydnaceous; margin rhizomorphic; hyphae of two types, some thick-walled, aseptate, dextrinoid in Melzer's reagent; gloeocystidia cylindric or with irregular constrictions and swellings; basidiospores ovoid to subglobose, 3.5-4.5 x 2.5-3.5 µm. White rot of 2 in AZ; 6 in NH; 7 in WA.

1. Basidiospores smooth, not amyloid

Scytinostroma galactinum (Fr.) Donk. Basidiocarps resupinate, becoming widely effused; hymenial surface cream colored to pale buff, smooth to papillate; dendrohyphidia densely interwoven, strongly dextrinoid in Melzer's reagent; generative hyphae with clamps; gloeocystidia imbedded or projecting; basidiospores short-cylindric to ellipsoid, 4-5.5 x 2-2.5 µm. White rot of 2 in BC, OR, WA; 3 in BC, NB, OT; 4 in MB, NB, OT, QB; 6 in CT, ME, NH, QB; 9 in AT, NS, NY.

Key to species of *Vararia*

1. Basidiospores cylindric to fusiform, negative in Melzer's reagent. 2
1. Basidiospores ellipsoid, amyloid

Vararia granulosa (Fr.) M. Laur. Basidiocarps resupinate; hymenial surface pinkish buff to pale buff, smooth to grandinioid; dichohyphidia abundant, strongly dextrinoid; generative hyphae with clamps; gloeocystidia weakly positive in sulfuric benzaldehyde; basidiospores with darker amyloid surface granules when mature, 5-5.5 x 3-3.5 µm. White rot of 2 in BC; 3 in BC.

2. Basidiospores fusiform; dichohyphidia loosely branched;

gloeocystidia thin-walled 3

2. Basidiospores cylindric; dichohyphidia in small, densely branched clusters; cystidia thick-walled

Vararia racemosa (Burt) Rogers et Jacks. Basidiocarps resupinate; hymenial surface pale buff, smooth; dichohyphidia abundant, strongly dextrinoid; generative hyphae simple-septate; cystidia often mucronate, with the wall thinning out at the narrowed apex; basidiospores 5-7 x 2-2.5 µm. White rot on 2 in AZ, CO, MT, UT.

3. Gloeocystidia positive in sulfuric benzaldehyde; basidiospores tear shaped.

Vararia athabascensis Gilbn. Basidiocarps resupinate; hymenial surface pale ochraceous buff to pinkish buff, smooth; dichohyphidia strongly dextrinoid; generative hyphae with clamps; gloeocystidia often mammillate; basidiospores 11-16 µm long, 3-5 µm wide at the distal end. White rot on 2 in AZ.

3. Gloeocystidia negative in sulfuric benzaldehyde; basidiospores swollen in the middle and tapered to both ends, often with sterigma remaining attached

Vararia investiens (Schw.) Karst. Basidiocarps resupinate; hymenial surface light buff to bright yellow; dichohyphidia slightly to distinctly dextrinoid; generative hyphae with clamps; gloeocystidia cylindric; basidiospores 7-8.5 x 3-3.5 µm. White rot of 5 in CO; 9 in QB.

Family PUNCTULARIACEAE

Punctularia Pat.

Punctularia strigosozonata (Schw.) Talbot. Basidiocarps resupinate to effused-reflexed; upper surface dark brown; hymenial surface bright reddish purple to dark brownish purple, with folds and ridges in radiating patterns; hyphae with clamps; dendrohyphidia in hymenium; basidiospores broadly cylindric to ellipsoid, 7.5-9 x 3-4 µm. White rot of 9 in QB.

Family SPARASSIDACEAE

Sparassis Fr.

Sparassis radicata Weir. Basidiocarps annual, arising from a perennial, elongated, underground pseudosclerotium as a rounded cluster of many anastomosing and subdivided petaloid lobes with thin, wavy margins, cream colored to yellowish tan; hyphae irregularly inflated, mostly with clamps, some simple septa present; aseptate gloeoplerous hyphae present; basidiospores ellipsoid, 5-7 x 3-5 µm. Brown cubical root and butt rot of 2 in ID, MT, OR, WA. Evidently conspecific with *Sparassis crispa* Fr. of Europe (Martin and Gilbertson, 1976).

Family STECCHERINACEAE

Key to genera

1. Heavily incrusted skeletocystidia present . . . . . *Steccherinum* S. F. Gray

Steccherinum ciliolatum (Berk. et Curt.) Gilbn. Basidiocarps resupinate; hymenial surface hydnaceous, white to pale buff; margin often with white rhizomorphs; generative hyphae with clamps; basidiospores short-cylindric to oblong, 3.5-5 x 2-2.5 µm. White rot of 9 in QB.

1. Cystidia lightly incrusted or not incrusted. 2

2. Vesicular cystidia present throughout subiculum . . . . . *Cystostereum* Pouz.
2. Cystidia fusoid, projecting from hymenium . . . . . *Fibricium* J. Erikss.

Fibricium rude (Karst.) Jülich. Basidiocarps resupinate; hymenial surface smooth, white to cream colored; generative hyphae with clamps; cystidia 55-85 x 5-7 µm, projecting to 50 µm; basidiospores short-cylindric, 4-5.5 x 2-2.5 µm. White rot of 2 in AZ; 7 in AK.

Key to species of *Cystostereum*

1. Vesicular gloeocystidia thick-walled, up to 25 µm in diam; hymenial surface coarsely tuberculate.

Cystostereum murrayi (Berk. et Curt.) Pouz. Basidiocarps perennial, resupinate to effused-reflexed; upper surface becoming black, crustose; hymenial surface olivaceous buff to cinereous; generative hyphae with clamps; basidiospores cylindric-ellipsoid to ovoid, 4-5 x 2.5-3 µm. White rot of 9 in QB.

1. Vesicular gloeocystidia thin-walled, up to 10 µm in diam; hymenial surface grandinioid

Cystostereum piceinum (Overh.) Linds. et Gilbn. Basidiocarps annual, resupinate; hymenial surface gray to pinkish buff; generative hyphae with clamps; basidiospores subglobose, 3.5-4 x 3-3.5 µm. White rot of 6 in NH.

Family STEREACEAE

Key to genera

1. Hymenial surface and inner tissue of basidiocarps brown 2
1. Hymenial surface and inner tissue of basidiocarps not brown . . .4
2. Cystidia thick-walled, not incrusted, wall thinning to apex; hymenial surface glaucous with fine, needle like crystals . . . . . *Columnocystis* Pouz.
2. Cystidia lightly to heavily incrusted, with uniformly thin or thick walls; hymenial surface not glaucous 3

3. Basidiospores amyloid in Melzer's reagent; cystidia thick-walled, heavily incrusted, 3.5-6 µm in diam . . . . . *Amylostereum* Boid.

Amylostereum chailletii (Pers. ex Fr.) Boid. Basidiocarps resupinate to narrowly reflexed; hymenial surface light brown, smooth to tuberculate, cracking into small angular blocks; hyphal system dimitic; generative hyphae with clamps; cystidia brown, with a basal clamp; basidiospores cylindric, 6-8.5 x 2-3 µm. White rot of 2 in CO, AT, OR, WA; 3 in BC, OT, AK; 4 in QB; 6 in NS, NB; 7 in BC; 9 in AT, NY, WA.

3. Basidiospores negative in Melzer's reagent; cystidia thin-walled, lightly incrusted, 2-4 µm in diam . . . . . *Boreostereum* Parm.

Boreostereum radiatum (Pk.) Parm. Basidiocarps resupinate to effused-reflexed; hymenial surface rusty brown, often turning blackish, with radially arranged ridges; hyphal system dimitic; generative hyphae simple-septate; basidiospores cylindric, 7.5-10 x 3-3.5 µm. White rot of 3 in MN; 4 in BC, MN; 9 in ID, MT.

4. Basidiospores negative in Melzer's reagent; hymenial surface of fresh specimens not staining red 5
4. Basidiospores amyloid in Melzer's reagent; hymenial surface of fresh specimens bruising red . . . . . *Haematostereum* Pouz.

Haematostereum sanguinolentum (Alb. et Schw. ex Fr.) Pouz. Basidiospores resupinate to effused-reflexed; upper surface tomentose, buff to gray; hymenial surface smooth, light buff to purplish gray; vesicular hyphae and pseudocystidia with brownish, granular contents; generative hyphae simple-septate; basidiospores cylindric, usually 5-8 x 2-3 µm but in some specimens with 2-sterigmate basidia 8-14 x 3-5 µm. White rot of 2 in AZ, CO, OR, WA; 3 in AK, AT, BC, MB, NB, NS, OT, YT; 4 in MB, NB, OT, QB; 6 in CT, ME, NB, NH, NS, NY, QB; 7 in AK, BC; 9 in MB, NB, NS, PEI.

5. Cystidia globose, thin-walled, present in context and hymenium . . . . . *Chondrostereum* Pouz.

Chondrostereum purpureum (Pers. ex Fr.) Pouz. Basidiocarps resupinate to effused-reflexed; upper surface tomentose, light to dark buff; hymenial surface violaceous buff to reddish purple, smooth to tuberculate; hyphal system dimitic; generative hyphae with clamps; cystidia up to 20 µm in diam; basidiospores cylindric, 6-8 x 2.5-3 µm. White rot of 3 in BC.

5. Cystidia fusoid, thick-walled with wall thinning at apex, in hymenium only. . . . . *Stereum* Pers. ex S. F. Gray emend. Pouz.

Stereum hirsutum (Fr.) S. F. Gray. Basidiocarps resupinate to effused-reflexed; upper surface hirsute, gray to buff; hymenial surface orange-buff to cinereous, smooth; hyphal system dimitic; generative hyphae simple-septate; cystidia up to 6 µm in diam; basidiospores cylindric, 5-8 x 2-3.5 µm. White rot of 7 in AK.

Key to species of *Columnocystis*

1. Generative hyphae with clamps; cystidia not incrusted

Columnocystis abietina (Pers. ex Fr.) Pouz. Basidiocarps resupinate to effused-reflexed or sessile; upper surface tomentose, pale to dark brown; hymenial surface grayish brown, smooth; cystidia 85-120 x 8-9 µm; basidiospores cylindric, 10-15 x 4-5.5 µm. Brown cubical pocket rot of 2 in AK, CO, UT, WY; 3 in AK, YT; 4 in AK, NY; 7 in AK, BC; 9 in NY, OR.

1. Generative hyphae simple-septate; cystidia lightly incrusted

Columnocystis ambigua (Pk.) Pouz. Basidiocarps resupinate to effused-reflexed; upper surface tomentose, dark brown; hymenial surface grayish brown to dark reddish brown, smooth; cystidia 150-250 x 8-14 µm; basidiospores cylindric, 12-16 x 3.5-4 µm. Brown cubical rot of 6 in ME, NC; 9 in NC, NY, TN.

Family THELEPHORACEAE

Key to genera

1. Basidiocarps entirely resupinate 2
1. Basidiocarps becoming pileate . . . . . *Thelephora* Fr.

Thelephora terrestris Ehrh. ex Fr. Basidiocarps effused-reflexed or caespitose with imbricate pilei; hymenial surface grayish brown; hyphae of two types, some contorted and irregular, others uniform in diam, with clamps and simple septa; basidiospores brown, coarsely warted, subglobose to irregular, 6-9 x 5-8 µm. On 2 in ID; 4 in MN; 9 in PA.

2. Cystidia if present not thick-walled and septate; hyphal system monomitic or dimitic 3
2. Cystidia thick-walled, septate, in fascicles; hyphal system dimitic . . . . . *Tomentellina* Hoehn. et Litsch.

Tomentellina fibrosa (Berk. et Curt.) M. J. Larsen. Hymenial surface ferrugineus, smooth to hydnaceous; generative hyphae simple-septate; cordons present; cystidia 4-7 µm in diam and projecting to 100 µm; basidiospores globose, brown, warted, with warts sometimes bifurcate, 7-9 µm in diam. On 3 in AK, YT.

3. Subicular hyphae simple-septate, dark colored; basidiocarps often incrusting organic debris and plant parts and approaching a terrestrial habit; fruiting surface often becoming negatively geotropic. . . . . .*Tomentellastrum* Svrček

Tomentellastrum floridanum (Ell. et Ev.) M. J. Larsen. Hymenial surface dark purplish brown or reddish brown, smooth; basidiospores globose to subglobose, pale brownish, echinulate to aculeolate, 8.5-10 µm in diam. On 3 in YT.

3. Not with the above combination of characters 4
4. Subicular hyphae simple-septate or with clamps; young basidia

napiform; basidiospores with coarse, often bifurcate warts . . . . . *Pseudotomentella* Svrček

4. Subicular hyphae with clamps or simple-septate; young basidia clavate, basidiospores mostly echinulate, rarely with bifurcate warts . . . . . *Tomentella* Pat.

Key to species of *Pseudotomentella*

1. Subicular hyphae simple-septate, clamps lacking 2
1. Subicular hyphae with clamp connections and some simple septa

Pseudotomentella humicola M. J. Larsen. Hymenial surface ferrugineus to pale brown, crustose to pelliculose, smooth; tissue black in KOH; hyphal system monomitic; basidiospores globose to irregular, pale yellowish, 6-9 µm in diam. On 4 in OT.

2. Basidiospores pale yellowish to hyaline; hyphal system dimitic 3
2. Basidiospores brownish; hyphal system monomitic

Pseudotomentella umbrina (Fr.) M. J. Larsen. Basidiocarps becoming widely effused, usually becoming crustose; fertile areas discontinuous at first, dark brown to blackish purple; basidiospores globose, 7-9 µm in diam. On 6 in NY.

3. Subiculum dark blue or violaceous black

Pseudotomentella nigra (Hoehn. et Litsch.) Svrček. Basidiocarps curling away from substratum at edges; fertile areas continuous, forming a distinct pellicle over the subiculum; cordons present; basidiospores globose to irregular, 8-12 µm in diam. On 9 in CO.

3. Subiculum pale brown

Pseudotomentella mucidula (Karst.) Svrček. Basidiocarps with hymenial surface tomentose, rarely pelliculose; fertile areas pale lavender brown to tan; cordons present; basidiospores globose, 8-12 µm in diam. On 9 in WA.

Key to species of *Tomentella*

1. Hyphal system monomitic 2
1. Hyphal system dimitic

Tomentella calcicola (Bourd. et Galz.) M. J. Larsen. Basidiocarps tawny to dark brown; hymenial surface smooth to hydnaceous; generative hyphae yellowish brown, mostly with clamps, some simple-septate; cordons present, composed of generative hyphae; basidiospores globose to subglobose, verrucose, 5-6 µm in diam. On 9 in AT.

2. Basidiospores echinulate or aculeate, usually larger than 4-6 µm in diam 3
2. Basidiospores globose, aculeolate, 4-6 µm in diam

Tomentella chlorina (Massee) G. H. Cunn. Basidiocarps soft and

fragile, arachnoid; hymenial surface yellowish green, smooth to hydnaceous; hyphae with clamps; cordons present; basidiospores purplish in KOH, slightly amyloid in Melzer's reagent. On 2 in AZ.

3. Basidia up to 20 µm in diam, narrowed sharply below 4
3. Basidia not as above 5
   4. Basidiospores 5-6.5 µm in diam; fertile areas dark brown to purplish brown

Tomentella terrestris (Berk. et Curt.) M. J. Larsen. Basidiocarps adherent, compact, up to 0.5 mm thick; hyphae with clamps and abundant clavate to pyriform vesicles up to 20 µm in diam; cordons present, infrequent; basidiospores irregular to subglobose, echinulate. On 2 in MT.

   4. Basidiospores 7-10 µm in diam; fertile areas pale yellowish brown

Tomentella nitellina Bourd. et Galz. Hymenial surface minutely punctate or granulose; hyphae mostly with clamps, some with simple septa; basidiospores pale brown, irregularly globose, echinulate. On 7 in WA.

5. Basidiocarps adherent; hymenial surface granulose to colliculose; cordons infrequent to absent; subicular hyphae mostly less than 5 µm in diam, thin-walled, not heavily pigmented 6
5. Basidiocarps not with combination of characters as above . . . 7
   6. Hymenial surface vinaceous brown; basidiospores distinctly lobed

Tomentella subvinosa (Burt) Bourd. et Galz. Basidiocarps becoming hypochnoid; hyphae with clamps; cordons rare; basidiospores 3-4 lobed, echinulate, 6-8 µm in diam. On 2 in AZ.

   6. Hymenial surface bright to dull reddish cinnamon; basidiospores globose to irregularly globose, rarely distinctly lobed

Tomentella lateritia Pat. Basidiocarps consisting of small coalescing patches; hymenial surface smooth to granulose; hyphae with clamps; globose to pyriform vesicles present in subhymenial region; basidiospores 6-8 µm in diam. On 9 in CO.

7. Basidiocarps arachnoid to byssoid, usually separable; cordons forming a conspicuous part of the subiculum 8
7. Basidiocarps not with combination of characters given above. . 10
   8. Hymenial surface normally reddish purple or rusty brown; margin honey colored to golden brown 9
   8. Hymenial surface gray to pale buff; margin whitish

Tomentella cinerascens (Karst.) Hoehn. et Litsch. Tissue blackish in KOH; hymenial surface colliculose; hyphae mostly with clamps, some simple septa present; basidiospores subglobose to globose, aculeolate to echinulate, 5-6.5 µm in diam. On 9 in MT.

9. Hymenial surface reddish purple; basidiospores pale tan to subhyaline in KOH

Tomentella atrorubra (Pk.) Bourd. et Galz. Basidiocarps turning dark bluish green or green in KOH; hyphae with clamps and some simple septa; basidiospores 4-lobed to irregular or becoming subglobose, echinulate, 6-8 µm in diam. On 9 in NY.

9. Hymenial surface red to rusty brown; basidiospores yellow to pale brown in KOH

Tomentella rubiginosa (Bres.) R. Maire. Hymenial surface granulose to colliculose; hyphae with clamps and some simple septa; dark brown cordons abundant; basidiospores irregular to lobed, echinulate, 6-9 µm in diam. On 3 in MB.

10. Basidiospores normally globose to subglobose, sometimes irregular or lobed; hyphae medium to dark brown or olive brown; hymenial surface some shade of brown or red . . . 11
10. Basidiospores frequently elongated along one axis, sometimes subglobose; hyphae pale to medium brown; hymenial surface some shade of gray, brown, or green 15

11. Hymenial surface some shade of red or orange

Tomentella bryophila (Pers.) M. J. Larsen. Hyphae with clamps, with frequent right angle branching, 6-10 µm in diam; basidiospores globose to subglobose, aculeate, 7-11 µm in diam. On 2 in AZ; 9 in MB.

11. Hymenial surface not some shade of red or orange 12
12. Subicular hyphae not incrusted or spinulose 13
12. Subicular hyphae incrusted, frequently appearing spinulose

Tomentella violaceofusca (Sacc.) M. J. Larsen. Hymenial surface grayish brown to darker brown, smooth to granulose or colliculose; hyphae with clamps, some thick-walled; basidiospores aculeate to echinulate, 6.5 µm in diam. On 3 in MN; 9 in MB.

13. Walls of subicular and subhymenial hyphae not swelling conspicuously in 10% KOH 14
13. Walls of subicular and subhymenial hyphae swelling conspicuously in 10% KOH

Tomentella ruttneri Litsch. Hymenial surface dark brown, smooth to finely punctate; hyphae with clamps, some becoming thick-walled in subiculum; basidiospores aculeate to echinulate, 7-11 µm in diam. On 9 in NY, MI.

14. Basidiospores usually 10-12 µm in diam

Tomentella bresadolae (Brinkm. in Bres.) Bourd. et Galz. Hymenial surface pale brown, smooth to finely granulose; hyphae with clamps; basidiospores globose, strongly aculeate. On 9 in NY.

14. Basidiospores usually 7-9 µm in diam

Tomentella ramosissima (Berk. et Curt.) Wakef. Hymenial surface dark brown to blackish brown; hyphae with clamps; basidiospores mostly irregular, rarely subglobose, aculeate to echinulate. On 2 in MT; 4 in NF; 9 in NF, OT, QB.

15. Hymenial surface medium to dark brown, gray, or green 16
15. Hymenial surface avellaneous, pale tan or buff

Tomentella avellanea (Burt) Bourd. et Galz. Basidiocarps sometimes cracking and becoming deeply fissured; small and inconspicuous cordons present; hyphae with clamps and some simple septa; basidiospores echinulate, 7-10 x 5-6 µm. On 9 in WA.

16. Hymenial surface some shade of brown 17
16. Hymenial surface green to olive brown

Tomentella olivascens (Berk. et Curt.) Bourd. et Galz. Basidiocarps occurring in small patches or becoming confluent and widely effused; hyphae with clamps, some thick-walled; basidiospores irregularly globose, echinulate to aculeate, 7-9 µm in diam. On 9 in NY.

17. Cordons usually present and conspicuous

Tomentella ochracea (Sacc.) M. J. Larsen. Hymenial surface vinaceous brown to buff, smooth; hyphae with clamps, often ampullate; some hyphae and basidia greenish in KOH; basidiospores subglobose or elongated, aculeolate to echinulate, 7-9 µm wide. On 2 in AZ; 9 in AZ, NJ, NY.

17. Cordons absent

Tomentella sublilacina (Ell. et Holw.) Wakef. Hymenial surface vinaceous brown to wood brown, smooth; hyphae with clamps, some ampullate, others becoming thick-walled; basidia and sterigmata often with transverse septa; basidiospores irregularly globose to lobed, echinulate, 7.5 µm wide. On 4 in NF; 9 in MI, NY, OT.

Order Agaricales

Key to Families

1. Spore print white, cream colored, or vinaceous . TRICHOLOMATACEAE
1. Spore print pink to dark purplish brown 2
2. Spore print salmon to pink . . . . . VOLVARIACEAE
2. Spore print some shade of brown 3
3. Spore print yellowish brown to rusty brown . . . . CORTINARIACEAE
3. Spore print dark purplish brown . . . . . .STROPHARIACEAE

Family CORTINARIACEAE

Key to Genera

1. Basidiocarps centrally to eccentrically stipitate . . . . . *Pholiota* (Fr.) Kummer
1. Basidiocarps sessile . . . . . *Crepidotus* (Fr.) Staude

Crepidotus ramosus Hesler et A. H. Smith. Basidiocarps 8-15 mm broad; upper surface buff; gills brown; cheilocystidia irregularly branched or contorted; basidiospores ellipsoid to subovoid, punctate-echinulate, 6.5-8 x 5.5-6 µm. On 9 in CO.

Key to species of *Pholiota*

1. Pileus surface viscid to glutinous. 2
1. Pileus surface not viscid 5
   2. Pileus surface bright yellow or orange 3
   2. Pileus surface pale brown to ferruginous. 4
3. Basidiospores 7-9.5 x 4.5-6 µm

Pholiota aurivella (Fr.) Kummer. Pileus surface scaly; stipe scaly; pleurocystidia thin-walled, fusoid, some lobet at apex; basidiospores slightly dextrinoid in Melzer's reagent. White rot of 2 and 3 in BC.

3. Basidiospores 6-7.5 x 4-5 µm

Pholiota limonella (Pk.) Sacc. Pileus surface scaly; stipe scaly; pleurocystidia thin-walled, clavate; basidiospores negative in Melzer's reagent. White rot of 9 in BC.

4. Pileus surface pale brown, some pleurocystidia thick-walled at apex; chrysocystidia absent.

Pholiota decorata (Murr.) A. H. Smith et Hesler. Pileus surface fibrillose to scaly; stipe scaly; basidiospores 6-9 x 3.5-4.5 µm, negative in Melzer's reagent. White rot of 2 in AZ.

4. Pileus surface ferruginous brown; pleurocystidia thin-walled; chrysocystidia present.

Pholiota adiposa (Fr.) Kummer. Pileus surface with concentric scales; stipe viscid, scaly; basidiospores 5-6 x 3-4 µm, negative in Melzer's reagent. White rot of 2 in BC, CO; 3 in BC.

5. Pleurocystidia and cheilocystidia present.

Pholiota bakerensis A. H. Smith et Hesler. Pileus surface fibrillose; pleurocystidia abundant, with slightly thickened walls at base, ventricose; basidiospores 7-9 x 4-5 µm, negative in Melzer's reagent. White rot of 2 in AZ.

5. Pleurocystidia absent, cheilocystidia present.

Pholiota alnicola (Fr.) Singer. Pileus surface fibrillose to scaly; stipe fibrillose; basidiospores 8-10 x 4-5.5 µm, slightly dextrinoid in Melzer's reagent. White rot of 3 in AT, BC, MB; 4 in OT; 9 in SK.

Family TRICHOLOMATACEAE

Key to genera

1. Lamellae with serrate edges. 2
1. Lamellae with edges not serrate. 3
   2. Basidiospores echinulate, amyloid in Melzer's reagent . . . . . *Lentinellus* Karst.
   2. Basidiospores smooth, negative in Melzer's reagent . . . . . *Lentinus* Fr.
3. Basidiocarps sessile. 4
3. Basidiocarps stipitate to substipitate to subsessile with a narrowed base. 5
   4. Lamellae not split lengthwise . . . . . *Panellus* Karst.
   4. Lamellae split lengthwise, edges curled back . . . . . *Schizophyllum* Fr.

Schizophyllum commune Fr. Pileus surface tomentose, grayish-white; hyphae with clamps; cystidia lacking; basidiospores cylindric, negative in Melzer's reagent. 7-11 x 2.5-3.5 µm. White rot of 3 in NB; 6 in CT, ME, NH, NS, NY; 9 in NS, PA, PEI.

5. Basidiocarps centrally stipitate. 6
5. Basidiocarps eccentrically or laterally stipitate or substipitate . . . . . *Pleurotus* (Fr.) Kummer

Pleurotus ostreatus Jacq. ex Fr. Basidiocarps centrally to laterally substipitate to almost sessile; pileus surface dull tan to mousy gray, glabrous; gills decurrent; hyphae with clamps; cystidia none; basidiospores cylindric, negative in Melzer's reagent, 6-10 x 3-4 µm, spore print cream colored. White rot of 3 in BC; 4 in NWT; 9 in CO.

6. Basidiospores not amyloid; basidiocarps typically larger than 2 cm wide. 7
6. Basidiospores amyloid; basidiocarps small, up to 2 cm wide . . . . . *Xeromphalina* Kühner et Maire

Xeromphalina campanella (Batsch ex Fr.) Kühner et Maire. Basidiocarps in dense clusters; pileus surface yellowish brown; gills decurrent; stipe dark brown, horny; pleurocystidia thin-walled, ventricose; basidiospores ellipsoid, smooth, 6.5-8 x 3.5-4 µm. On well rotted stumps and logs of 2 in AT, CO; 3 in AT, BC, NB, OT; 4 in AT, OT, QB; 6 in NB, NS; 7 in BC.

7. Basidiocarps caespitose or in dense clusters. 8
7. Basidiocarps occurring singly or in small groups . . . . . *Tricholomopsis* Sing.
   8. Annulus absent; pileus surface moist to viscid, stipe not fibrillose or scaly. 9
   8. Annulus present; pileus surface fibrillose-scaly; stipe fibrillose to scaly . . . . . *Armillariella* Karst.

Armillariella mellea (Vahl ex Fr.) Karst. Basidiocarps honey-brown, upper surface not viscid; gills decurrent; cystidia none; basidiospores ellipsoid, 7-13 x 4.5-7 µm. White root and butt

rot of 2 in AT, AZ, CO, NM, UT; 3 in AT, BC, MB, OT, SK, NB; 4 in OT, 5 in MB; 6 in CT, ME, NB, NH, NS, NY; 7 in BC, OR, WA; 9 in AZ, CO, NB, NM, WA.

9. Stipe dark brown, velvety . . . . . *Flammulina* Karst.

Flammulina velutipes (Curt. ex Fr.) Sing. Pileus surface buff to orange-brown; gills adnexed; pilocystidia and caulocystidia present; basidiospores ellipsoid, 7-8 x 3-4 µm. White rot of 2 in CO.

9. Stipe reddish brown, not velvety; pileus surface moist, glabrous, not viscid . . . . . .*Collybia* Fr. Kummer

Collybia acervata (Fr.) Kummer. Basidiocarps caespitose; pileus surface glabrous, pale chestnut brown; gills adnexed; basidiospores ellipsoid, 5-7 x 2-3 µm. White rot of 3 in BC.

Key to species of *Lentinellus*

1. Basidiocarps sessile; single or in umbricate clusters; pleurocystidia fusiform, 26-39 x 5-7 µm.

Lentinellus montanus O. K. Miller. Basidiocarps developing on logs in or near snow; pileus surface woolly; tramal tissue nonamyloid; basidiospores ovoid to subglobose, 4.5-6.5 x 4.5 µm. White rot of 2 in CO.

1. Basidiocarps centrally to eccentrically stipitate, usually caespitose; pleurocystidia fusiform, 30-50 x 6-8 µm.

Lentinellus omphalodes (Fr.) Karst. Pileus surface glabrous; tramal tissue nonamyloid; basidiospores ellipsoid to subglobose, 5-7.5 x 4-5 µm. White rot reported on 2 by Miller and Stewart (1971).

Key to species of *Lentinus*

1. Pileus surface becoming glabrous, pinkish-buff to dull tan; gills finely serrate, veil absent.

Lentinus kauffmanii A. H. Smith. Basidiocarps centrally to laterally stipitate; pleurocystidia abundant, cylindric to ventricose, 60-100 x 7-12 µm; basidiospores cylindric to slightly curved, 5-6 x 2-2 µm. Brown cubical pocket rot of 7 in AK, BC, CA, OR, WA.

1. Pileus surface cream to buff with darker scales; gills coarsely serrate, veil present at first.

Lentinus lepideus Fr. Basidiocarps centrally to laterally stipitate; pleurocystidia fusoid, not projecting, 40-60 x 3-5 µm; basidiospores cylindric, 9-11 x 3.35 µm. Brown cubical rot of 2 in AZ; 6 in CT, ME, NH, and NY.

Key to species of *Panellus*

1. Basidiocarps eccentrically to laterally stipitate; pileus surface

tan, pubescent.

Panellus stipticus (Bull. ex Fr.) Karst. Gills luminescent; pleurocystidia fusiform to bifurcate, 20-40 x 3-4.5 µm, basidiospores ellipsoid or slightly curved, smooth, amyloid in Melzer's reagent. White rot of 6 in CT, ME, NH, NY.

1. Basidiocarps sessile; pileus surface viscid, brown to greenish or olivaceous.

Panellus serotinus (Pers. ex Fr.) Kühner. Pleurocystidia abundant, fusiform to clavate, 35-65 x 6-11 µm; elongated, clavate pileocystidia in cuticle; basidiospores cylindric to allantoid, amyloid in Melzer's reagent, 4-5.5 x 1-5 µm. White rot of 3 in BC.

Key to species of *Tricholomopsis*

1. Pileus surface yellow with yellow or grayish scales. 2
1. Pileus surface with purplish red scales.

Tricholomopsis rutilans (Fr.) Singer. Basidiocarps up to 15 µm wide; gills yellow; stipe with red fibrils; pleurocystidia 35-60 x 6-9 µm; cheilocystidia abundant; basidiospores ellipsoid, 8-10 x 6-7 µm. White rot of 7 in AK; 9 in NH.

2. Pileus surface with grayish scales; stipe with grayish fibrils; gills yellow.

Tricholomopsis decora (Fr.) Singer. Basidiocarps up to 8 cm wide; pleurocystidia rare, barely projecting, 30-40 x 5-8 µm; basidiospores ellipsoid, 6-7.5 x 4.5-5 µm. White rot of 3 in BC.

2. Pileus surface and stipe bright yellow; gills pinkish.

Tricholomopsis streetsii Gilbertson. Basidiocarps mostly 1-2.5 cm wide; hyphae of surface tomentum thick-walled, closely nodose-septate; pleurocystidia abundant, narrowly clavate with a capitate apex, 90-125 x 10-13 µm; basidiospores lemon-shaped, 10.5-12.5 x 8-9 µm. White rot of 2 in AZ.

Family STROPHARIACEAE

Naematoloma Karst.

Naematoloma capnoides (Fr.) Karst. Basidiocarps centrally stipitate, caespitose or gregarious; upper surface of pileus pale reddish orange to cinnamon; gills grayish-white at first, becoming purplish-brown, adnate; pleurocystidia clavate, usually mucronate, contents highly refractive in KOH; basidiospores ellipsoid, yellowish-brown in KOH, appearing truncate due to apical pore, 6-7.5 x 3.5-4.5 µm. White rot of 3 in BC.

Family VOLVARIACEAE

Pluteus Fr.

Pluteus cervinus (Fr.) Quél. Basidiocarps centrally stipitate, usually single; upper surface of pileus pinkish-brown to gray; gills pinkish, free; annulus lacking; pleurocystidia abundant, with 1-4 apical horn-like projections; basidiospores ellipsoid, hyaline, pinkish-brown in mass, 7-9 x 5-6 m. White rot of 2 in AZ.

ACKNOWLEDGMENTS

This work was supported by McIntire-Stennis funds in the University of Arizona Agricultural Experiment Station. Field work by Gilbertson in spruce forests of the Southwest in 1968 and in Alaska and Yukon Territory in 1969 was supported by NSF grant no. GB7120.

LITERATURE CITED

Martin, K. J. and R. L. Gilbertson. 1977. Synopsis of wood-rotting fungi on spruce in North America: I. Mycotaxon 6(1):43-77.

Martin, K. J. and R. L. Gilbertson. 1978. Decay of Douglas-Fir by *Sparassis radicata* in Arizona. Phytopathology 68:149-154.

Martin, K. J. and R. L. Gilbertson. 1978. Synopsis of wood-rotting fungi on spruce in North America: II. Mycotaxon 7(2):337-356.

Miller, O. K., Jr. and L. Stewart. 1971. The genus *Lentinellus*. Mycologia 63:333-369.

Overholts, L. O. 1953. The Polyporaceae of the United States, Alaska, and Canada. University of Michigan Press, Ann Arbor. 466 p.

Seymour, A. B. 1929. Host index of the fungi of North America. Harvard Univ. Press, Cambridge, Mass. 718 p.

MYCOTAXON

Vol. 10. No. 2, p. 502 January-March 1980

NOTICES

SECOND INTERNATIONAL CONGRESS OF SYSTEMATIC AND EVOLUTIONARY BIOLOGY

This congress will be held in Vancouver, British Columbia, Canada from July 17 to July 24, 1980. Information may be obtained from Dr. G.G.E. Scudder, Chairman, Local Organizing Committee ICSEB-II, Department of Zoology, University of British Columbia, Vancouver, B.C. Canada V6T 1W5.

XIII INTERNATIONAL BOTANICAL CONGRESS

The First Circular, dated July, 1979, has been distributed to all botanists who have indicated an interest in attending the Thirteenth International Botanical Congress to be held in Sydney, Australia. The Nomenclature Section will meet August 17-20, 1981, prior to regular sessions. Other sections will meet August 21-28, 1981. Both pre-Congress and post-Congress field trips are announced. For further information contact Dr. W. J. Cram, Executive Secretary, 13th International Biological Congress, University of Sydney, N.S.W. 2006, Australia.

BOTANICAL LATIN

Botanical descriptions or diagnoses of new taxa will be rendered into Latin by a Latinist-botanist for a small fee. Contact P. M. Eckel, 43 Crescent Avenue, Buffalo, NY 14214 USA.

MYCOTAXON

Vol. X, No. 2, pp. 503-512 January-March 1980

REVISIONARY STUDIES IN THE HYALOSCYPHEAE. I. ON GENERA WITH "GLASSY" HAIRS

RICHARD P. KORF*

Institut for Sporeplanter, Københavns Universitet
Ø. Farimagsgade 2D, 1353 København K, Denmark

and

LINDA M. KOHN

Department of Botany, Clemson University, Clemson SC 29631

ABSTRACT

The "glassy-haired" members of the Hyaloscypheae (Discomycetes: Helotiales, Hyaloscyphaceae) all have either solid, refractive apices to the hairs, or thick-walled hairs with a fine lumen extending to or nearly to the apex. The glassy character derives from at least two substances: (1) glassiness disappears following aqueous KOH pretreatment, (2) glassiness retained after KOH exposure. For group (1) the generic name Urceolella Boud. is accepted, and two subgenera are recognized, U. subg. Urceolella and U. subg. **Hyalacrotes** subg. nov. Two genera are accepted in group (2): Mollisina Höhn. for species with delicate, branched, solid excipular "processes," and Hyalopeziza Fuckel, in a greatly modified sense. This genus is now conceived as containing four subgenera, the type subgenus, Hyalopeziza subg. Hyalopeziza, and three subgenera based on previously recognized generic names: Unguicularia Höhn., Unguiculariopsis Rehm, and Unguiculella Höhn. In two of these subgenera the hair walls give a reddish-brown (dextrinoid) reaction in Melzer's Reagent in some species, but not in others.

*Present address: Plant Pathology Herbarium, Cornell University, Ithaca, NY 14853, where this work was completed.

In the process of studying a series of Inoperculate Discomycetes collected in Greenland by Dr. Peter Milan Petersen, of Copenhagen University, the senior author encountered a tiny, sessile, clear-yellow (when dry) species on a twig of Salix sp. (host identification by Hans Tybjerg and Jette Dahl Møller, Copenhagen University), which proved to be a rarely collected species, Unguiculella rehmii E. Müller (= Mollisia hamulata Rehm), known previously primarily from alpine sites on herbaceous stems. The swollen, solid, "glassy" apices of both hairs and paraphyses are provided with more or less tubular, mostly hooked or crisped, delicate "processes," much longer on the hairs than on the paraphyses (FIG. 1). Three previously unreported characteristics of the species caught our attention: (1) the glassiness of the thickened apices and "processes" of both the excipular hairs and paraphyses was lost if the material was pretreated in 10% aqueous KOH, (2) the ascus pore did not blue in Melzer's Reagent without KOH-pretreatment [previously discussed in other Ascomycetes (Kohn & Korf 1975; Nannfeldt 1976)], and (3) some of the paraphyses are typically filiform, thus lacking the thickened apices and the tubular hooks that led von Höhnel [1918, as U. hamulata (Rehm) Höhn., a later homonym of the type species], Müller (1968) and Raitviir (1970) to place the species in Unguiculella. We have begun a monographic reinvestigation of that genus, together with a study of several other, apparently closely related, genera.

KOH-PRETREATMENT AND "GLASSINESS"

Glassiness in the hairs of members of the family Hyaloscyphaceae, tribe Hyaloscypheae, has been a generic characteristic recognized by Dennis (1949, 1960, 1968, 1978) for Unguicularia, Hyalotricha, Urceolella, and Hyalopeziza, by Raitviir (1970) in Hyalopeziza and Unguiculella, and by Korf (1973) in Urceolella and Unguiculariopsis. None of these treatments can be said to be at all exhaustive, though Raitviir's much broadened concept of Hyalopeziza provided a major advance. A particularly important paper dealing primarily with the glassy-haired genera and species has been published only recently (Raschle 1977). Three glassy-haired genera are scarcely more than mentioned in his key (Mollisina, Unguiculella, and Unguiculariopsis), but three are treated in depth (Hyalopeziza, Unguicularia, and Urceolella). Until we studied his paper

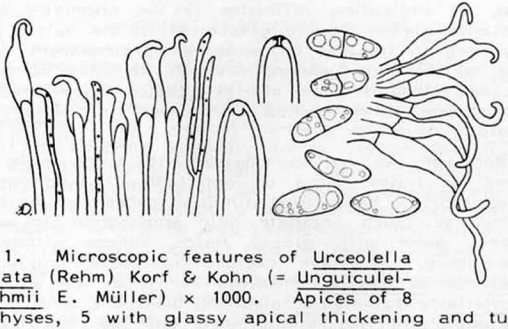


FIG. 1. Microscopic features of Urceolella hamulata (Rehm) Korf & Kohn (= Unguiculella rehmii E. Müller) × 1000. Apices of 8 paraphyses, 5 with glassy apical thickening and tubular "processes;" 2 ascus apices mounted in Melzer's Reagent, lower from water rehydrated section, upper from 10% aqueous KOH rehydrated section; 6 ascospores; 6 hairs with glassy apices and tubular "processes" from apothecial flanks. CUP **59475**. Drawn by R.P.K.

---

we were unaware that Raschle had earlier noted and emphasized the loss of glassiness in KOH-pretreated material. He reported it, and used it as a generic character, for only one genus, Urceolella. Our studies have confirmed his observations and confirmed the usefulness of this character in delimiting an apparently natural taxon.

Presence of refractive, uncinate paraphyses, similar to those of the excipular hairs, was von Höhnel's (1906) primary criterion for segregating Unguiculella Höhn. from Unguicularia Höhnel (1905). Some of the species von Höhnel transferred to his new genus lack description of such paraphysis apices, however, as noted by Raschle (1977); other authors (Bøhler 1974; Dennis 1950, 1955; Svrček 1978) have also added species without hooked paraphysis apices. Our studies on Unguiculella show that the type species of the genus, U. hamulata (Feltg.) Höhn., and most others do not lose glassiness of the hairs or paraphyses after KOH-pretreatment. This is in contrast to the situation in U. rehmii and in an as yet unpublished new species referred to the genus (Arendholz 1979) which we have had the opportunity to examine. Of far greater importance than the presence of hooked paraphysis apices, to our

mind, in indicating affinities is the chemistry of the substance giving rise to glassiness in the hairs, resulting here in its loss following KOH-pretreatment. Urceolella is the only genus in which we know of such a reaction, though none of its species have the solid hair apices and hooked "processes" of Unguiculella rehmii.

Moreover, we are unimpressed with such single characters as hairs being or not being hooked apically as appropriate bases to distinguish genera in the Hyaloscyphaceae. Such uncinate hair ends occur in several genera, some with glassy hairs, others without. In consequence, we have decided to place Unguiculella rehmii in Urceolella, creating for it a new subgenus, Urceolella subg. Hyalacrotes. At least one other species [Arendholz's (1979) unpublished one mentioned above] can be referred to the new subgenus. In Urceolella subg. Urceolella the hairs are not solid apically, but are thick-walled with a fine lumen that often expands again near the tip to form a thin-walled apex, and the two subgenera should be easily distinguished.

The manner in which glassiness develops in the hairs of this group of the Hyaloscyphaceae has never been adequately studied. Raschle (1977: 180) has noted that in Hyalopeziza millepunctata (Lib.) Raitv. [as Unguicularia millepunctata (Lib.) Dennis] one finds young apothecia with "hyphigen Haaren, an denen erst an der Haarspitze eine kleine, glasartige Kappe gebildet ist." We are able to confirm his observations that the hair thickening proceeds from the apex backwards in that species and in several others (at least one of which is undescribed, from our Macaronesian collections). The hairs are thin-walled when young, and at maturity there is cell lumen visible only at the very base. The glassiness thus appears to consist of secondary wall thickening.

We have not been able to confirm that a similar ontogeny accounts for the glassy "processes" found in Mollisina rubi Höhn., the type species of Mollisina Höhnel (1926). If so, these "processes" should better be considered branched, true "hairs" with the lumen completely replaced by secondary wall thickening; such an interpretation is wholly consistent with our studies, but may have to be resolved by use of the electron microscope.

REACTIONS IN MELZER'S REAGENT

In some species referred by Raschle (1977) to Hyalopeziza and to Unguicularia, but not in others, the hair walls and/or contents give a dextrinoid reaction (yellow-brown to reddish brown or even purplish brown) in Melzer's Reagent. Korf's (1973: 298) suggestion that this reaction might be useful at the generic rank is not confirmed by our studies; Raschle appears to be correct in accepting such a character only at the species level. No explanation for the differences in reactivity among species has yet been advanced.

We also concur with Raschle's (1977) treatment in not placing any emphasis at the generic level in the tribe Hyaloscypheae on whether or not the ascus pore mechanism blues in iodine (Melzer's Reagent). Raschle routinely pretreated with KOH to determine whether or not the pore blues; he did not report on whether such pretreatment changed any of the reactions he observed. We have found that pretreatment with KOH is necessary to observe the J+ reaction in Unguiculella rehmii (which we now treat as Urceolella hamulata, see below), but does not prove to be necessary in Arendholz's (1979) unpublished species that we would also refer to Urceolella subg. Hyalacrotes.

CONCLUSION

For glassy-haired Hyaloscypheae many generic names are available, but we are now convinced that according generic rank to taxa delimited by slight differences in wall thickening or degree of curvature of the hairs, or by whether or not the fungi occur as mycoparasites, obscures rather than elucidates relationships. We propose to reduce three generic names to subgeneric rank, not fully convinced that these subgenera delimit natural groups, but at least offering some leads back to the older literature where species we will include have been given generic rank in previous treatments. The following key will serve to distinguish the three genera that we accept, and their included subgenera.

Following the key we provide the full citations to the accepted genera and subgenera, and to their types.

KEY TO THE GENERA AND SUBGENERA OF GLASSY-HAIRED HYALOSCYPHEAE

1. Hairs losing glassiness when pretreated with KOH, hair walls not dextrinoid in Melzer's Reagent. **Urceolella** 2

2. Hairs with thick walls and a thin, continuous lumen (rarely lacking in some hairs) that often expands again at the hair apex; paraphyses without glassy apices. **Urceolella** subg. **Urceolella**

2'. Hairs and at least some paraphyses with solid apices and tubular, hooked or sinuous "processes" without a lumen. **Urceolella** subg. **Hyalacrotes**

1'. Hairs retaining glassiness after KOH pretreatment, dextrinoid or not. 3

3. Glassiness confined to delicate, mostly 1.0-1.5µm wide, usually branched "processes" from the excipular cells, not dextrinoid. **Mollisina**

3'. Glassiness in distinct (only very rarely branched) hairs at least 2.0µm broad, dextrinoid or not. **Hyalopeziza** 4

4. Paraphyses without hooked apices. 5

5. Hairs with thick walls, with a narrow lumen nearly to the apex, with or without thin septa, dextrinoid in some of the species. **Hyalopeziza** subg. **Hyalopeziza**

5'. Hairs with a solid apex and lumen only at the base. 6

6. Hairs uncinate, walls not dextrinoid; on fungi. **Hyalopeziza** subg. **Unguiculariopsis**

6'. Hairs straight or slightly crooked, walls dextrinoid or not; usually on plant debris. **Hyalopeziza** subg. **Unguicularia**

4'. Paraphyses and hairs with thickened, hooked, glassy apices, neither dextrinoid. **Hyalopeziza** subg. **Unguiculella**

ACCEPTED GENERA AND SUBGENERA AND THEIR TYPES

1. HYALOPEZIZA Fuckel, Jahrb. Nassauischen Vereins Naturk. **23-24**: 297. 1870, **char. emend.**

   Lectotype: Hyalopeziza ciliata Fuckel, loc. cit., p. 298.

1a. HYALOPEZIZA Fuckel subg. **HYALOPEZIZA**

   Lectotype: Hyalopeziza ciliata Fuckel, loc. cit.

1b. HYALOPEZIZA Fuckel subg. **UNGUICULARIA** (Höhn.) Korf & Kohn, **comb. et stat. nov.**

   Basionym: Unguicularia Höhn. [ut gen.], Ann. Mycol. **3**: 404. 1905.

   Holotype: **Hyalopeziza unguiculata** (Höhn.) Korf & Kohn, **comb. nov.** = Unguicularia unguiculata Höhn., loc. cit.

1c. HYALOPEZIZA Fuckel subg. **UNGUICULARIOPSIS** (Rehm) Korf & Kohn, **comb. et stat. nov.**

   Basionym: Unguiculariopsis Rehm [ut gen.], Ann. Mycol. **7**: 401. 1909.

   Holotype: **Hyalopeziza ilicincola** (Berk. & Br.) Korf & Kohn, **comb. nov.** = Peziza ilicincola Berk. & Br., Ann. Mag. Nat. Hist., Ser. 3, **7**: 457. 1861.

1d. HYALOPEZIZA Fuckel subg. **UNGUICULELLA** (Höhn.) Korf & Kohn, **comb. et stat. nov.**

   Basionym: Unguiculella Höhn. [ut gen.], Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, **115**: 1281. 1906.

   Holotype: **Hyalopeziza hamulata** (Feltg.) Korf & Kohn, **comb. nov.** = Pezizella hamulata Feltg., Vorst. Pilz-Fl. Luxembourg, Nachträge **3**: 51. 1903.

2. MOLLISINA Höhn., Mitt. Bot. Inst. TH Wien **3**: 67. 1926.

   Holotype: Mollisina rubi Höhn. [ut "(Rehm) Höhnel n. sp."], loc. cit.

3. URCEOLELLA Boudier, Bull. Soc. Mycol. France **1**: 119. 1885, **char. emend.**

Lectotype: Urceolella crispula (Karst.) Boud., Hist. classific. discomyc. Europe 130. 1907.

3a. URCEOLELLA Boudier subg. **URCEOLELLA**

Lectotype: Urceolella crispula (Karst.) Boud., loc. cit.

3b. URCEOLELLA Boudier subg. **HYALACROTES** Korf & Kohn, **subg. nov.**

Holotype: **Urceolella hamulata** (Rehm) Korf & Kohn, **comb. nov.** = Mollisia hamulata Rehm in Rabenh., Krypt.-Fl. Deutschl., ed. 2, **1**(3)[Lief. 36]: 534. 1891. = Unguiculella rehmii E. Müller, Sydowia **21**: 148. 1968 ('1967'). = Unguiculella rehmii Raitv., Scripta Mycol. **1**: 38. 1970 [nom. superfl.]

Apothecia minuta, pruinosa, hymenio leviter pruinoso. Excipulum ectale hyalinum, ad basin ex textura angulari compositum, marginem versus hyphas habens; excipulum medullare ex textura intricata compositum. Pili hyalini, ab basi ad marginem apothecii procurrentes, apice plano mitra sublanceolata refractiva solida proboscem apicalem vel subapicalem hamatam vel crispatam habente praedito, mitra una cum probosce, refractivitate materiae siccae KOH soluto madefactae evanescente. Asci clavati. Ascosporae hyalinae. Paraphyses hyalinae, dimorphae: paraphyses non capitatae ascos aequantes vel parum excedentes, raro sympodialiter ramificantes, apice aliquando plus minusve flexo vel deformi; paraphyses capitatae similares sed ascos parum excedentes, apice clavato mitra sublanceolata refractiva solida plerumque proboscem apicalem vel subapicalem saepe hamatam habente praedito, refractivitate materiae siccae KOH soluto madefacte evanescente.

Etymology: from the Greek, **Hyalos** = glass + **Acrotes** = tip.

ACKNOWLEDGEMENTS

The authors acknowledge financial assistance of National Science Foundation grant DEB75-23557, "Discomycete Flora of Macaronesia," technical assistance of Mr. Robert Dirig, who inked the drawing, and assistance with the Latin diagnosis by Dr. William Dress (BH). We particularly wish to thank Dr. Donald H. Pfister (FH) for the loan of type materials from the von Höhnel collections, Dr. Emil Müller (ZT) for collections of Urceolella hamulata, and Dr. W.-R. Arendholz, Hamburg, for loan of a specimen of the unpublished new species referred in his thesis to Unguiculella. Dr. John M. Haines (NYS) provided much help in reviewing an early draft of this paper.

The senior author expresses particular thanks to Dr. Henry Dissing of the University of Copenhagen, and the staff of their Institut for Sporeplanter, for inviting him to spend over two months as Adjunktvikar during 1978, when this study was initiated. Their cordial reception and encouragement will long be remembered and treasured. A special word of thanks is due Dr. Peter Milan Petersen, whose exciting collections from Greenland stimulated these studies.

The junior author expresses her appreciation to the Department of Botany, Clemson University, for financial assistance in completing this study.

LITERATURE CITED

ARENDHOLZ, W.-R. 1979. Morphologisch-taxonomische Untersuchungen an Blattbewohnenden Ascomyceten aus der Ordnung der Helotiales. Ph.D. thesis, Universität Hamburg. 115 p., 16 pl.

BØHLER. H.C. 1974. Taxonomical studies on some Norwegian Helotiales (Ascomycetes) on fern remains. Norwegian J. Botany **21**: 79-100.

DENNIS, R.W.G. 1949. A revision of the British Hyaloscyphaceae with notes on related European species. Mycol. Pap. **32**: 1-97.

____. 1950. New fungi. Kew Bull. **1950**: 170.

____. 1955. An overlooked species of Unguiculella. Kew Bull. **1955**: 136.

____. 1960. British Cup Fungi and their Allies. Ray Society, London.

____. 1968. British Ascomycetes. Cramer, Lehre.

____. 1978. British Ascomycetes, ed. 2. Cramer, Vaduz.

HÖHNEL, F. von. 1905. Mykologische Fragmente. Ann. Mycol. **3**: 402-409.

____. 1906. Revision von 292 der von J. Feltgen aufgestellten Ascomycetenformen auf Grund der Originalexemplare. Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, **115**: 1189-1327

____. 1918. Fragmente zur Mykologie. (XXII. Mitteilung, Nr. 1092 bis 1153). Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, **127**: 549-634.

____. 1926. Über die Gattung Pezizella Fuckel. Mitt. Bot. Inst. TH Wien **3**: 54-80.

KOHN, L.M. and R.P. KORF. 1975. Variation in Ascomycete iodine reactions: KOH-pretreatment explored. Mycotaxon **3**: 165-172.

KORF, R.P. 1973. Discomycetes and Tuberales. In Ainsworth, G.C., F.K. Sparrow & A.S. Sussman [eds.], The Fungi: an Advanced Treatise **4A**: 249-319.

MÜLLER, E. 1968. Neufunde von Hyaloscyphaceae aus den Alpen. Sydowia **21**: 143-153. '1967.'

NANNFELDT, J.A. 1976. Iodine reactions in ascus plugs and their taxonomic significance. Trans. Brit. Mycol. Soc. **67**: 283-287.

RAITVIIR, A. 1970. Synopsis of the Hyaloscyphaceae. Scripta Mycol. **1**: 1-115.

RASCHLE, P. 1977. Taxonomische Untersuchungen an Ascomyceten aus der Familie der Hyaloscyphaceae Nannfeldt. Sydowia **29**: 170-236. '1976.'

SVRČEK, M. 1978. New or less known Discomycetes. IX. Česká Mykol. **32**: 202-204.

AUTHOR INDEX, VOLUME TEN

REVIEWERS

The Co-Editors express their appreciation to the following individuals who have reviewed one or more of the papers in this volume prior to publication.

C.J. ALEXOPOULOS
R.J. BANDONI
H.H. BURDSALL, JR.
W.J. CAIRNEY
E.R. CANFIELD
J.L. CRANE
B.A. DANIELS
F. DI COSMO
J. ERIKSSON
J.H. GINNS
R.D. GOOS
J.M. HAINES
M.E. HALE, JR.
R.T. HANLIN
J.F. HENNEN
I. HO
S.J. HUGHES
R.A. HUMBER
E.G. JORDAN
W.B. KENDRICK
J.W. KIMBROUGH
L.M. KOHN
J.C. KRUG
H.H. KUEHN
K.J. KWON-CHUNG
A.E. LIBERTA
J.P. LINDSEY
D. MALLOCH
S.J. MAZZER
G. MORGAN-JONES
T.R. NAG RAJ
G.F. ORR
R.H. PETERSEN
D.H. PFISTER
K.A. PIROZYNSKI
C.T. ROGERSON
A.Y. ROSSMAN
M.A.A. SCHIPPER
L. SHANOR
R.A. SHOEMAKER
A.H. SMITH
L.J. SPIELMAN
A. STRID
B.C. SUTTON
H.D. THIERS
J.M. TRAPPE
S.-I. UDAGAWA
C. WALKER
K. WELLS

PUBLICATION DATES FOR MYCOTAXON

Volume 9, No. 2: July 19, 1979*
Volume 10, No. 1: October 19, 1979

*[the date given on the cover of Vol. 10, No. 1 is *incorrect*]

INDEX TO FUNGOUS AND LICHEN TAXA, VOLUME TEN

This index includes genera, infrageneric taxa, species, and infraspecific taxa. New taxa are in **boldface** as are the pages where they are published. The Solheim Exsiccata paper (pp. 49-92) is itself a pair of indices, reference to which is indicated by the notation "see."

ERRATA, VOLUME NINE

Page 370, line 8: *for* delim- *read* delimit

ERRATA, VOLUME TEN

10(1) *Cover*, line 57: *for* July 13, *read* July 19,

Page 7, line 3: for *sonorica* read *sonoriea* v. *sonoriea*
29 29-30: *for* kuehnii) (Kuehn) *read* kuehnii
50 46: *for* ANTHROCOIDEA *read* ANTHRACOIDEA
108 34: for *H.* read *Hygrophorus*
120 16: *for* var. *conicus* (Rav. *apud* B. & C.) Wolfe. *read* (Rav. *apud* B. & C.) Wolfe var. *conicus*.
122 37: for *B. violaceiporus* read *Boletellus violaceiporus*
126 13: for *B. violacei-* read *Boletellus violacei-*
140 31: for *A. tuberculatum* read *Arthroderma tuberculatum*
178 28-29: *for* 285-579. *read* 499.
185 17: for *Amanit* read *Amanita*
189 3: *for* f. *inodora* (Coker) Murrill *read* (Coker) Murrill f. *inodora* Murrill
193 23: for *Amanits* read *Amanita*
202 23: for *Hyphochicium* read *Hypochnicium*
204 9: for *A. amylacea* read *Amyloathelia amylacea*
207 35: *for* characteristica *read* characteristics
234 37-39: *substitute* Figure 1: A-F B. musae IMI 235790 A) Synnema B) terminal ornamentations C) lateral ornamentations D) conidia E) lateral phialide with developing conidium F) terminal phialides
236 13: *insert* 174318 *between* material *and* in
243 43: for *gaminum* read *graminum*
290 18: for *P.* read *Pocillopycnis*
370 35: for *Gliosporium* read *Gloeosporium*
392 10: for *chrysosperma* read *chrysospermum*
408 20: for *Cladosporium fulva* read *Cladosporium fulvum*
423 39: for *S.* read *Sclerotinia*
428 13: *for* eight *read* nine
14: after *(6)*, insert *Rogersella (1)*,
430 47: for HUILCA read HIULCA
433 9: for *P.* read *Peniophora*
436 32: for *cremea* read *cremeum*

CO-EDITORS OF MYCOTAXON

G. L. HENNEBERT
FRENCH LANGUAGE EDITOR
& BOOK REVIEW EDITOR
UCL, Place Croix du Sud 3
B-1348 Louvain-la-Neuve, Belgium

RICHARD P. KORF
ENGLISH LANGUAGE EDITOR
& MANAGING EDITOR
P.O. Box 264
Ithaca, NY 14850, USA

MYCOTAXON is a quarterly journal devoted to all phases of mycological and lichenological taxonomy and nomenclature. It seeks to publish all papers within 4 months of acceptance, using photo-offset lithography. All articles are reviewed by specialists prior to acceptance. Publication is open to all persons. Papers may be in French or English, summaries in any language.

SUBSCRIPTION INFORMATION

Each issue of MYCOTAXON may vary in number of pages. Each volume, beginning with volume 3, consists of at least 512 pages, and consists of an irregular number of quarterly issues depending only upon the amount of copy received from authors. Subscriptions are on a **per volume** basis, **not** on an annual basis. If only one bill during each year is a requirement, please pay for 2 volumes, which will normally cover one year's issues. Personal subscriptions are available at a substantially reduced subscription rate for **individuals** who agree not to deposit their copies in another library than their own within three years of receipt. Prices for each volume, beginning with volume 3, are:

	Paid by June 30, 1980	Paid after June 30, 1980
REGULAR (multiuser)	$32.00	$40.00
PERSONAL (individual)	$14.00	$17.50

(Vols. 1 and 2 are available at **half** the above rates per volume)

(**Complete runs,** vols. 1 through the latest complete volume, are subject to a 10% discount)

MYCOTAXON is also available in **microform** (microfiche, microfilm) from University Microfilms, 300 North Zeeb Road, Ann Arbor, MI 48106, from whom prices may be obtained.

MYCOTAXON may also be obtained on a journal exchange basis. This may be arranged with journals, institutions, or individuals who have difficulty in obtaining foreign currencies. For details and journal exchange forms, write to a Co-Editor.

EDITORIAL SERVICES AND INFORMATION FOR PROSPECTIVE AUTHORS

Authors prepare their own **camera-ready** copy after having received comments from pre-submission reviewers. Detailed **Instructions to Authors** appeared in MYCOTAXON **1**: 3-12. 1974, and **6**: 370. 1977. A copy of each will be sent upon request to one of the Co-Editors.

We are able to provide prospective authors with two aids to publication. Both are sold at our cost, and are shipped postpaid from MYCOTAXON, LTD., P.O. Box 264, Ithaca, NY 14850 USA.

SPECIAL MANUSCRIPT PAPER is available in packages of 50 sheets, and is ruled in blue, non-photoreproducing ink for each of the two sizes of typeface called for in the Instructions to authors (elite, pica). It is a convenience to typists, but certainly not an essential, since the appropriate size rectangles can be prepared on any paper using a non-photoreproducing blue pencil. Each package of 50 sheets is sent **postpaid** for $1.75.

BIOPLATE is a special sheet of transfer letters for the use of authors in the preparation of plates and graphs for publication. It is manufactured specifically for us by Prestype, and is available in either black or white. Each sheet is approximately 30 x 39 cm., with a wide assortment of numbers, letters (including important Greek characters), symbols, etc. These are sent **postpaid** for $3.75 (black will be shipped unless white is specified.)