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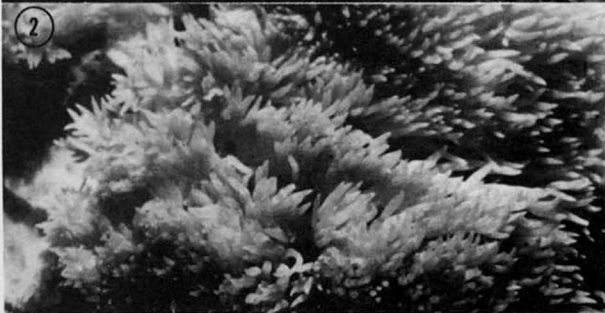
MORPHOLOGICAL AND MATING SYSTEM STUDIES OF
A NEW TAXON OF *HERICIUM* (APHYLLOPHORALES,
HERICIACEAE) FROM THE SOUTHERN APPALACHIANSH. H. Burdsall, Jr., O. K. Miller, Jr.
and K. A. Nishijima

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SUMMARY

A new subspecies, *Hericium erinaceum* ssp. *erinaceo-abietis*, is described and illustrated. It is interfertile with *H. erinaceum* and *H. abietis*.

Recently, a collection (OKM 15159) of an unusual (seemingly aborted) hydneous basidiocarp was found in the mountains of central Virginia. The morphological characters of the specimen indicate it represents a member of the genus *Hericium* Pers. per S. F. Gray but unlike any with which we are acquainted. The four North American species recognized by Harrison (1973) are *H. abietis* (Wier ex Hubert) K. Harrison, *H. erinaceum* (Bull. per Fr.) Pers., *H. coralloides* (Scop. per Fr.) S. F. Gray, and *H. ramosum* (Bull. per Mérat) Letellier. Our comparison of this "aborted" specimen with the descriptions of these indicated that it was different macroscopically from all of them. It is most like *H. erinaceum* in micromorphology and habitat. Basidiocarps of *H. erinaceum* are generally large, white, densely hirsute, oval to irregularly shaped masses of fungal tissue with pendent teeth up to 3 cm long, but the unusual specimen recently found (Fig. 1) is smaller, irregularly swollen, and has minute teeth (Fig. 2) covering the irregularly shaped basidiocarp.



Polyspore cultures were obtained from specimen OKM 15159, and single spore isolates were obtained when this isolate fruited in culture. The mating system is tetrapolar and multiple allelic as in *Hericium* species, with the four mating types distributed as follows:

A ₁ B ₁	1,4,10,11,14,17,18,48,50,53
A ₂ B ₂	2,3,5,12,13,15,16,51
A ₁ B ₂	6,8,9,20,46,49,52
A ₂ B ₁	7,19,47

To determine if any of the four North American species (none of which are interfertile according to our studies) are interfertile with OKM 15159, single spore isolates were paired with those derived from at least two different basidiocarps of each of the four species, often from different parts of the U.S.A. Such pairings between OKM 15159 and *H. ramosum* and OKM 15159 and *H. coralloides* indicated that the isolates were incompatible because clamp connections were not formed.

The pairings between OKM 15159 single spore isolates and those of *H. erinaceum* [from Maryland (OKM 4950) and Arizona (JPL 317)] were totally compatible. Similar pairings between OKM 15159 single spore isolates and those from three different collections of *H. abietis* (a species found only in the northwestern U.S. and western Canada), however, showed partial, but not complete, compatibility as expressed by clamp connection formation. The possibility that OKM 15159 was a hybrid of *H. erinaceum* x *H. abietis* was considered but in no case were clamp connections formed when single spore isolates of these two species were paired. We have not yet, however, attempted pairings between single spore isolates of *H. abietis* and those from *H. erinaceum* specimens from the Northwest. Such studies will be carried out when isolates of the northwestern *H. erinaceum* specimens are available.

Nuclear staining (using the method of Morgan-Jones and Hulton, 1974) was then conducted to determine whether clamp connection formation in the crosses between OKM 15159 and *H. erinaceum* and between OKM 15159 and *H. abietis* resulted

Figs. 1-2. *H. erinaceum* subsp. *erinaceo-abietis*
basidiocarp, OKM 15159, Fig. 1, x 1. Fig. 2, x 3.

in dikaryon formation. In pairings where clamp connections were formed the dikaryon condition was established and maintained.

Available distribution data indicate that the geographic isolation of OKM 15159 (from eastern U.S.A.) from *H. abietis* (from western U.S.A.) is complete. The isolation of OKM 15159 from *H. erinaceum* is apparently lacking. The Virginia specimen is obviously very closely related to both species but maintains a degree of distinctness as indicated by the morphology, growth in culture, and mating interactions.

Because of the differences in morphological, cultural, and mating interactions found in OKM 15159, we erect here a new subspecies of *H. erinaceum*.

Hericium erinaceum (Bull. per Fr.) Pers. subsp.
erinaceo-abietis subsp. nov. Figs 1-10.

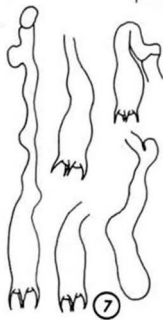
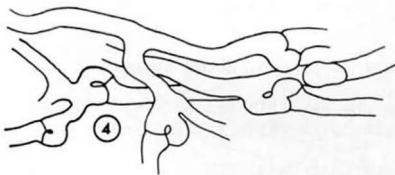
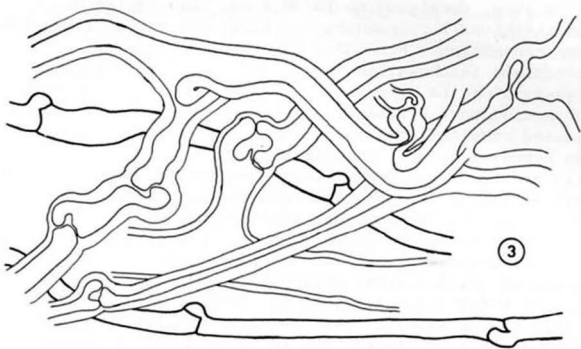
A *Hericio erinaceo* typica basidiocarpis similiter sed irregularis nodulosis; dentibus usque ad 3 mm longos; hyphis trama clentibus tunicatis tenuibus; tetrapolaribus; interfertilibus *H. erinaceo* et *H. abieti*.

Holotypus-OKM 15159, on living *Quercus* sp. (oak), Carvins Cove, Hollins, Roanoke County, Virginia, U.S.A., October 4, 1975, Coll. Joseph Deutsch. In herb. CFMR conservatum. Isotypus in herb. VPI conservatum.

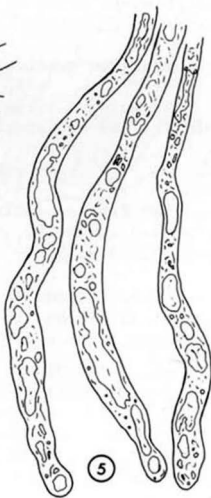
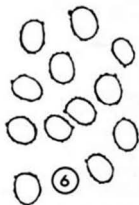
Basidiocarp (Figs. 1 and 2) up to 12 x 10 x 5 cm, irregularly shaped masses of tissue with swellings forming a nodulose surface, white, firm to tough; teeth covering surface, white; 3(-4) mm long, 0.5 mm thick, subulate; context white, spore print white.

Hyphal system monomitic; contextual hyphae (Fig. 3) 5-9 μ m diam, hyaline, thick-walled (walls up to 3 μ m thick), smooth, septate with clamp connections, regularly branched, rarely with only slight wall thickening, these densely staining in phloxine, walls blue in Melzer's reagent;

Figs. 3-7. Line drawings of microscopic structures in basidiocarp of *H. erinaceum* subsp. *erinaceo-abietis* (OKM 15159) 3. contextual hyphae. 4. hyphae of tooth trama. 5. cystidia with globular and granular content. 6. basidiospores. 7. basidia.



10 μ m



tooth trama a textura porrecta, hyphae (Fig. 4) mostly 3-4 μm diam, rarely up to 10 μm diam, thin-walled or with slight wall thickening, hyaline, smooth, septate with clamp connections, branching regularly, scattered intercalary thick-walled (walls up to 1 μm thick) cells present, ovoid to irregularly elongate, hyaline, smooth; subhymenium poorly delimited, composed mainly of cystidia oriented parallel to axis of tooth, these turn outward into hymenial layer; cystidia (Fig. 5) 75-150 x 6-9 μm , cylindrical, thin-walled, clavate or moniliform, often with small apical bead or papilla, smooth, with dense granular and/or globular content, not reacting with sulfuric benzaldehyde; basidia (Fig. 7) rare, difficult to observe, of variable length, up to 60 x 5-6 μm , hyaline, thin-walled, clamped at basal septum, mostly 4 spored, basidiospores (Fig. 6) 6-7.5 x 4.5-5.5 (-6) μm , broadly ovoid, hyaline to pale yellow under microscope, with thickened walls (walls up to 1 μm thick), smooth to slightly granulose, dark blue to black in Melzer's reagent, no color change in lactophenol aniline blue.

Specimen examined: Holotype, noted above.

Etymology: From the specific epithets *erinaceum* and *abietis*, the two species with which it is interfertile.

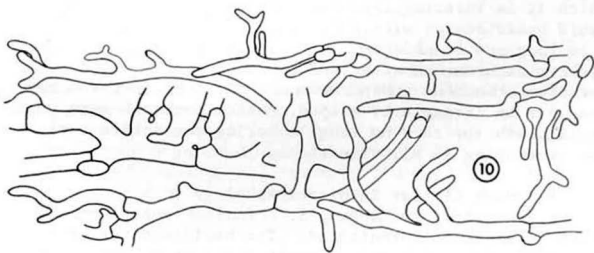
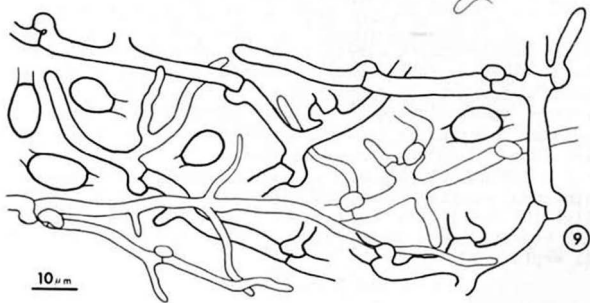
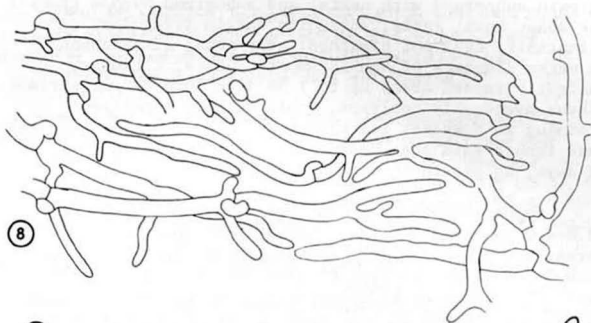
CULTURAL CHARACTERS

Key Pattern (using Davidson et al. (1942) method).
A-P-S-1-2-10-14-16. ^{1/}Species Code (using Nobles (1965) method). 2.3.15.27-.34.36.38.44.45.48.54.60.

Growth Characteristics: Growth on 1.5% malt extract agar at 25 C slow, 18-25 mm radius in 14 days; mat white, appressed, with sparse woolly aerial white threads, most

^{1/} Nobles (1965) left numbers 27-33 of her species code system available for future characters. We are using 27 to indicate the presence of normal cylindrical thick-walled hyphae with clamp connections at septa. None of the numbers presently used indicate the presence of such hyphae.

Figs. 8-10. Line drawings of microscope structures in cultures of *H. erinaceum* subsp. *erinaceo-abietis* (OKM 15159). 8. hyphae of margin. 9. aerial hyphae with occasional intercalary and terminal thick-walled swollen cells. 10. submerged hyphae.



growth submerged with aerial and submerged hyphae growing at about equal rates, advancing margin irregular, fimbriate; agar not bleached; odor none; after about 2 weeks clusters of small, smooth, white, circular, slightly raised areas up to 1 mm diam form on mat surface, these eventually coalesce, fruiting body sometimes forming in 6 weeks; reaction zone on both gallic acid agar and tannic acid agar weak to strong, up to 15 mm diam in 7 days, no growth on either medium.

Hyphal Characteristics: Margin hyphae (Fig. 8) 2.0-4.0 μm diam, hyaline, thin-walled, smooth, much branched, clamped at all septa; aerial hyphae (Fig. 9) 2.0-5.5 μm diam, hyaline to pale yellow, smooth, thin-walled or walls up to slightly less than 1 μm thick, much branched, clamped at all septa; in crustose areas hyphae like those in other areas but densely encrusted with yellow needle-shaped crystals which form large irregularly shaped clusters, these dissolve in 2% KOH, stable in Melzer's reagent; in older cultures (> 3 weeks) cystidia develop, these clavate to slightly moniliform, with globular to granular content; terminal or intercalary cells also form (chlamydospores) of Davidson et al., 1942), 9-15 x 7-9 μm , thick-walled, hyaline, septate at one or both ends, lacking clamps on these septa; submerged hyphae (Fig. 10) 2-3 (-4.5) μm diam, thin-walled, hyaline, smooth, much branched into finger-like terminal cells, clamped at all septa.

DISCUSSION

Macroscopically, *H. erinaceum* subsp. *erinaceo-abietis* would not be confused with either of the species with which it is interfertile. *Hericium erinaceum* has large ovoid basidiocarps with densely crowded pendent teeth up to 3 cm long and *H. abietis* basidiocarps are loosely organized systems of branches with less crowded pendent teeth. *Hericium erinaceum* subsp. *erinaceo-abietis*, on the other hand, is an irregularly shaped, solid, nodulose mass with small teeth (up to 3 mm long) covering the entire surface and protruding in all directions.

Although similar in micromorphology to both *H. abietis* and *H. erinaceum*, *H. erinaceum* subsp. *erinaceo-abietis* can be differentiated. The basidiospores of *H. abietis* are 5-6 x 4-5 μm while those of *H. erinaceum* subsp. *erinaceo-abietis* are 6-7.5 x 4.5-6 μm . The two also differ in structure of tooth trama. *Hericium erinaceum*

subsp. *erinaceo-abietis* lacks the broad (up to 15 μ m diam) thick-walled hyphae (walls up to 5 μ m thick) which are found in *H. erinaceum* and the inflated cells (up to 15 μ m diam) that have little wall thickening.

In culture, *H. erinaceum* subsp. *erinaceo-abietis* grows about half as fast as *H. erinaceum* on malt extract agar at 25 C and about twice as fast at 32 C. The new subspecies and *H. abietis* grow equally well at 25 C on malt extract agar but *H. abietis* does not grow at 32 C while the new subspecies does.

LITERATURE CITED

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TAXONOMY OF PHANEROCHAETE CHRYSORHIZON

AND HYDNUM OMNIVORUM

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During type studies leading toward a monograph of *Phanerochaete* Karst., the type specimen of *Hydnum chrysorhizon* Torrey in Eaton (1822, p. 309) [\equiv *Phanerochaete chrysorhizon* (Torr. in Eaton) Budington et. Gilbn.] and the type specimens of its facultative (taxonomic) synonyms were studied. Among these synonyms was the name *Hydnum omnivorum* Shear (1925). This name was applied to a species that Shear felt was probably the perfect state of *Phymatotrichum omnivorum* (Shear) Duggar (1916) [\equiv *Phymatotrichopsis omnivorum* (Shear) Hennebert (1973, p. 199)]. These two species are probably not, as Shear supposed, different states of the same organism but to date this has not been demonstrated unequivocally.

When he published the name *Hydnum omnivorum*, Shear indicated (1925, p. 477) the "type" to be his number 5267, on *Maclura aurantiaca* [\equiv *Maclura pomifera* (Ref.) Schmeid.], near Paris, Texas, September 1903, and provided a painting

^{1/} Present address Center for Forest Mycology Research.

of the specimen. In BPI^{2/} a specimen with the same collection data was found (cited by Gilbertson 1964, p. 22). Further indication that it is the same specimen referred to by Shear is the fact that it matches exactly the painting accompanying the description provided by Shear. The twigs and thorns of the twigs branch at the same angle and are located in the same place relative to each other as they are in the painting. There is no doubt that this is the type specimen for *H. omnivorum* Shear.

The use of the name *Hydnium omnivorum* has been challenged recently by Hennebert (1973, p. 199), who states that the name refers to a Basidiomycete but is based on a type specimen that is a member of the Fungi Imperfecti. His studies of the type specimen apparently revealed neither basidia nor basidiospores, and he, therefore, considers the name illegitimate.

However, our studies of the type specimen revealed the presence of a basidiomycetous hymenium with cystidia, holobasidia, and basidiospores. Shear reported seeing none of these structures but was not in doubt as to the specimen's being a Basidiomycete, as indicated by his text and the name he provided for it.

The epithet *omnivorum*, although probably an unfortunate choice since it is probably not the perfect state of *P. omnivorum*, fulfills the requirements for both legitimate and valid publication.

The recent use of the epithet *chrysothizon* also deserves discussion. Gilbertson (1964, p. 23) treated *H. omnivorum* as a synonym of *H. chrysothizon*. The two were also considered conspecific by Gilbertson, et al. (1974, 1976), Lindsey and Gilbertson (1975), and Burdsall (1976). In all four publications the name *Phanerochaete chrysothizon* was used to encompass both species. More recent studies, however, indicate that *H. omnivorum* is a distinct species, differing from *H. chrysothizon* in basidiocarp color, basidiospore size, cystidium characters, and distribution.

^{2/} Herbarium abbreviations are those of Holmgren and Keuken (1974).

Parmasto (1967, p. 384) proposed the genus *Hydnophlebia* Parm. for *H. chrysorhizon*. If this genus is recognized, then *Hydnum omnivorum* should be included. However, we do not feel that the hydneous basidiocarp, which is the only character by which these species differ from members of *Phanerochaete*, warrants this segregation. We recognize both as members of the genus *Phanerochaete*.

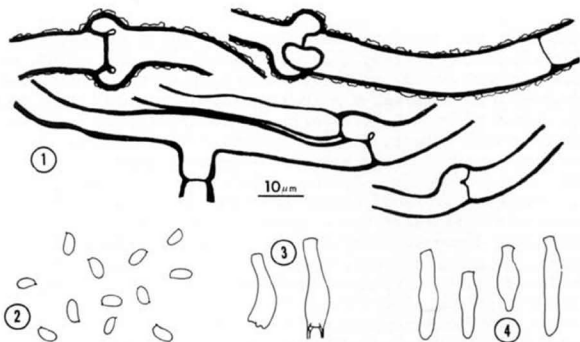
A description of the basidiocarp characters and culture characters of each species is offered. The specimens marked with an * are those from which cultures were studied. All specimens and cultures cited are on deposit at CFMR unless otherwise indicated.

- Phanerochaete chrysorhizon* (Torr. in Eaton) Budington et Gilbn. Southwest Nat. 17:417. 1973. Figs. 1-9.
 ≡ *Hydnum chrysorhizon* Torr. in Eaton. Manual Bot., Ed. 3, p. 309, 1822.
 ≡ *Oxydontia chrysorhiza* (Torr. in Eaton) Rogers et G. W. Martin. Mycologia 50:308. 1958.
 ≡ *Mycocacia chrysorhiza* (Torr. in Eaton) Aoshima et Furukawa. Trans. Mycol. Soc. Japan. 7:135. 1966.
 ≡ *Hydnophlebia chrysorhiza* (Torr. in Eaton) Parm. Eest. Nsv. Tead. Akad. Toim. 16:384. 1967.

Basidiocarp broadly effused, extending up to 20 x 10 cm, thin, membranous, easily separable, reddish orange (7A8)^{3/} to deep orange (near 5A8), hydneous, teeth widely spaced to dense, up to 1.5 mm long, cylindrical or tapered to rounded apex, orange white (5A2) to pale orange (5A3); margin fimbriate to rhizomorphic, up to 1 mm diam, reddish orange (near 7A8).

Hyphal system monomitic; subiculum not differentiated from abhymenial surface, 250-500 μm thick (excluding teeth), a textura intricata to textura porrecta; hyphae (Fig. 1) 4-7 (-9) μm diam, hyaline to pale yellow, thick-walled (walls up to 2 μm thick) or with only slight thickening, usually densely encrusted with hyaline crystals, septa widely spaced, lacking clamps at most septa, some septa clamped, rarely with several clamps at one septum,

^{3/} Color notations are those of Kornerup and Wanscher (1967). The notation indicates plate number, vertical column, and horizontal columns, respectively.



Figs. 1-4.--*P. chrysorhizon* (type). Line drawings of microscopic structures from basidiocarps. 1. subicular hyphae. 2. basidiospores. 3. basidia. 4. cystidia.

branching frequent, mostly at nearly right angles; tooth trama a compact textura porrecta oriented perpendicular to substrate, hyphae like those of subiculum; subhymenium a compact textura porrecta, short-celled, hyaline, thin-walled, lacking clamps, smooth, or lightly coated with pale yellow granules; cystidia (Fig. 4) ventricose, smooth, thin-walled, hyaline, 18-40 x 4.5-6 μ m, lacking clamps at basal septa; basidia (Fig. 3) clavate to broadly clavate, 15-20 x 4.5-6 μ m, hyaline, thin-walled, lacking clamps at basal septa, 4-sterigmate, sterigmata 3-3.5 μ m long; basidiospores (Fig. 2) 4-5 x 2-2.5 μ m, ovoid to narrowly ovoid, slightly flattened adaxially, hyaline, thin-walled, smooth, negative in Melzer's reagent, acyanophilous.

Specimens Examined: FLORIDA--HHB 4720, HHB 4733, and HHB 6372, on *Quercus* sp. (oak), behind Mall, State Route 441; HHB 6452, on oak, University of Florida Horticulture Unit; HHB 6468, on *Liquidambar styraciflua* L. (sweetgum); and HHB 6478*, on *Carpinus caroliniana* Walt. (American hornbeam), Hogtown Creek Basin, NW 8th Street; all from Gainesville, Alachua County; HHB 7202, on *Nectandra coriacea* (Sw.) Griseb. (Jamaica nectandra), Gumbo Limbo Trail, Everglades National Park, Dade County. MARYLAND--

HHB 622*, on oak, Patuxent Wildlife Research Refuge, Laurel, Prince Georges County. MISSISSIPPI--HHB 8870*, on oak, and HHB 8871*, on *Pinus taeda* L. (loblolly pine), both 5 miles W of Wiggins, S of Red Creek, Stone County; HHB 8917, on *Cornus florida* L. (flowering dogwood), Hammock, Harrison Experimental Forest, Harrison County. NEW YORK--RLG 5507*, on *Populus grandidentata* Michx. (bigtooth aspen), Otisco Rd., Otisco, Onondaga County. NORTH CAROLINA--HHB 2652, on *Fraxinus* sp. (ash), Scaly School-Dryman Chapel Rd., Nantahala National Forest, Macon County; HHB 4352, on flowering dogwood, along Kephart Prong, Great Smoky Mountains National Park, Swain County. SOUTH CAROLINA--Curtis 2608, on oak, April 1849, Society Hill, Darlington County, isotype of *Hydnum fragillissimum* Berk. et Curt., (FH). TENNESSEE--HHB 3012*, on *Juglans* sp. (walnut), near Cable Mill, Cades Cove, Blount County, and HHB 4134, on *Acer* sp. (maple), Snake Den Trail, Cocke County, both from Great Smoky Mountains National Park. WISCONSIN--HHB 9375, on *Populus tremuloides* Michx. (quaking aspen), Blue Mounds State Park, Iowa County.



Fig. 5.--Cultures of *P. chrysorhizon* (on right showing no growth) and *H. omnivorum* (on left) grown at 36 C on malt extract agar for 14 days.

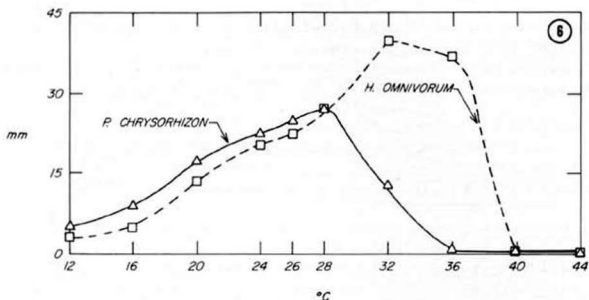


Fig. 6.--Graph showing growth of *P. chrysorhizon* and *H. omnivorum* at 10 constant temperatures on malt extract agar after 7 days.

Culture description

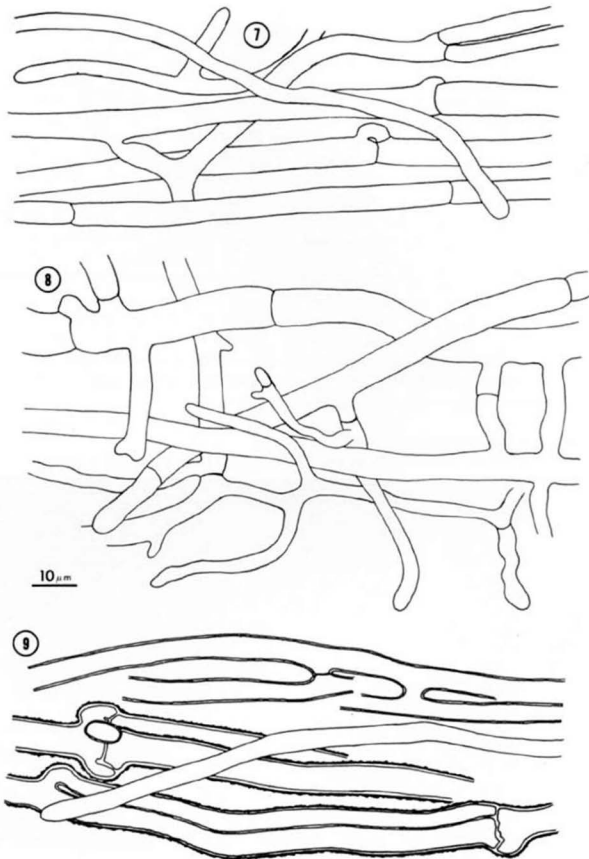
Species Code: 2.5.16.32.37.40.42.-43.54.55 (using Nobles (1965) system).

Key Pattern: B-P-I-1-10-14 (using Davidson et al. (1942) system).

Growth on 1.5% malt extract agar at 25 C moderate, 25-35 mm radius/wk, optimum growth at 28 C, trace of growth at 36 C (Figs. 5, 6); mat thin, appressed, white, becoming slightly orange, some isolates eventually with zones of orange wooly aerial hyphae, hyphae near inoculum orange; margin indistinct, even; reverse bleached; odor mild; not fruiting in 6 wk.

On gallic acid agar after 1 wk at 25 C diffusion zone up to 35 mm diam, light reaction, trace of growth; on tannic acid agar diffusion zone up to 20 mm diam, light reaction, no growth.

Marginal hyphae (Fig. 7) 2.5-7 μ m diam, hyaline, thin-walled, with occasional branching, especially on narrower hyphae, mostly simple septate, with rare single or multiple clamps; aerial hyphae (Fig. 9) (2.5-) 4-7 μ m diam, hyaline to pale yellow, with slightly thickened to thick walls, often aggregated to form orange cordons, usually covered



Figs. 7-9.--*P. chrysorhizon* (HHB 8871). Line drawings of microscopic structures from culture. 7. hyphae of margin. 8. submerged hyphae. 9. aerial hyphae.

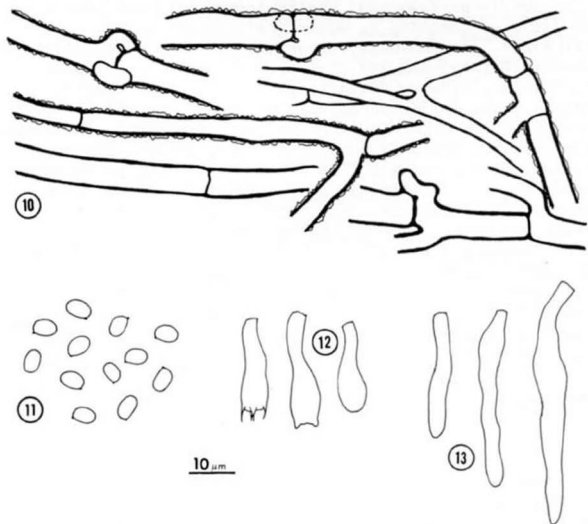
with yellow granules, mostly simple septate with rare single or multiple clamps; submerged hyphae (Fig. 8) 5-7 μm diam, hyaline, thin-walled, with rare clamps, broad hyphae with infrequent branching usually producing narrow much branched hyphae.

Phanerochaete omnivorum (Shear) *comb. nov.*

Figs. 5, 6, 10-16.

\equiv *Hydnium omnivorum* Shear, J. Agric. Res. 30:476. 1925.

Basidiocarps effused in small often poorly developed patches, thin, membraneous, creamy yellow, adnate to somewhat separable, hydnceous; teeth up to 1 mm long, tapered to apex; subiculum white, fibrous to byssoid; margin white, thick, fibrillose and irregular in outline or rhizomorphic; rhizomorphs white, usually poorly developed, occasionally well developed and up to 0.25 mm diam.



Figs. 10-13.--*H. omnivorum* (type). Line drawings of microscopic structures from basidiocarps. 10. subicular hyphae. 11. basidiospores. 12. basidia. 13. cystidia.

Hyphal system monomitic; subiculum a texture intricata, hyphae (Fig. 10) 5-9 (-12) μm diam, with slight wall thickening, hyaline, with clamps at some septa, sometimes multiple clamps present, with dense encrustation on some hyphae, branching at near right angles; subhymenium a compact textura porrecta, hyphae 3.5-4.5 μm diam, some areas with irregular swellings up to 6 μm becoming a textura epidermoidea, hyaline, thin-walled, much branched, smooth or with scattered hyaline granules; hymenium with cystidia and basidia; cystidia (Fig. 13) poorly developed, hyphoid, thin-walled, hyaline, of irregular length, up to 4 μm diam, protruding up to 20 μm beyond basidia; basidia (Fig. 12) (15-) 20-25 (-27) x (5.5-) 6-7 μm , clavate, hyaline, thin-walled, lacking clamps at base, 4-sterigmate, sterigmata up to 4 μm long; basidiospores (Fig. 11) 5-6 x 3-3.5 μm , nearly ovoid, slightly flattened adaxially, hyaline, thin-walled, smooth, negative in Melzer's reagent, acyanophilous.

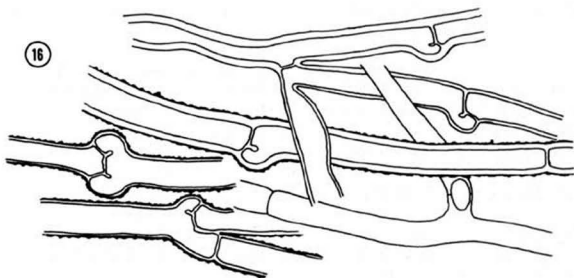
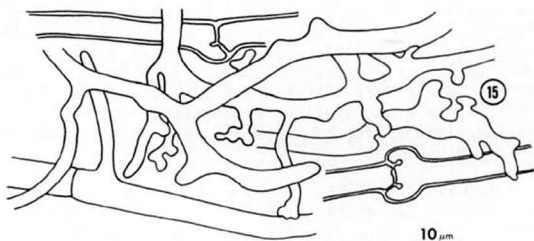
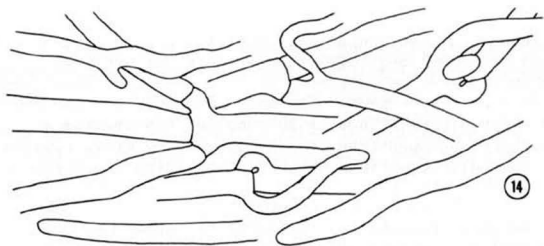
Specimens Examined: ARIZONA--HHB 6218 and HHB 6227, on *Platanus wrightii* S. Wats. (Arizona sycamore), and HHB 6228*, on *Acacia* sp. (acacia), all from Peloncillo Mts., Cochise County; KKN 187 on *Fouquieria splendens* Engelm. (ocotillo), highway 90, milepost 299, Cochise County (ARIZ). HHB 5969*, on Arizona sycamore, and HHB 5972, on *Chilopsis linearis* (Cav.) Sweet (desert willow), Redington, Pima County; HHB 8426, on *Baccharis* sp. (desert broom), Tucson, Pima County; RLG 10887 and RLG 10888, on *Prosopis juliflora* (Sw.) DC (mesquite), Santa Catalina Mts., Pima County (ARIZ); JPL 72, on *Carnegia gigantea* (Engelm.) Britt. et Rose (saguaro), Saguaro Nat. Monument--West Unit, Pima County (ARIZ); KKN 90, KKN 102, KKN 112*, and KKN 113, on ocotillo, Santa Rita Expt. Range, Pima County (ARIZ); RLG 10857, on ocotillo, Santa Catalina Mts., Pima County (ARIZ); RLG 10391, on mesquite, Galliuro Mts., Pinal County (ARIZ); RLG 10507, on mesquite, Baboquivari Mts., Santa Cruz County (ARIZ).

Culture description

Species Code: 2.5.16.20.24.32.37.40.42.-43.54.

Key Pattern: B-P-M-1-9-11-14-16.

Growth on 1.5% malt extract agar at 25 C moderate, 25-35 mm radius/wk, optimum growth at 32 C, rapid growth at 36 C (Figs. 5, 6); mat thin, wispy downy to woolly cottony, white, becoming yellow orange near inoculum, eventually



Figs. 14-16.--*H. omnivorum* (HHB 6228). Line drawings of microscopic structures from culture. 14. hyphae of margin. 15. submerged hyphae. 16. aerial hyphae.

spreading over plate and developing cordons; margin appressed, even; reverse bleached; odor mild; not fruiting in 6 wk.

On gallic acid agar after 1 wk at 25 C diffusion zone 15-20 mm diam, very light reaction, no growth; on tannic acid agar diffusion zone 35-40 mm, very light reaction, no growth.

Marginal hyphae (Fig. 14) 3.5-7 μm diam, hyaline, thin-walled, frequently branched, mostly simple septate with rare single or multiple clamps; aerial hyphae (Fig. 16) 4-7 μm diam, hyaline to pale yellow, thin- to thick-walled, often aggregated to form cordons, usually encrusted with yellow granules, simple septate with rare single or multiple clamps; submerged hyphae (Fig. 15) of two types: (a) similar to aerial hyphae but lacking encrustations; (b) 1.5-5 μm diam, hyaline, thin-walled, septa rare, clamps lacking, irregularly branched and contorted, nonstaining in KOH-phloxine mounts.

Remarks: Macroscopically *P. chrysothizon* and *P. omnivorum* are distinguished on the basis of basidiocarp color and rhizomorph development. *Phanerochaete chrysothizon* is bright orange with well developed orange rhizomorphs and somewhat paler spines; *P. omnivorum* is yellow or cream (including spines) with a white fimbriate to slightly rhizomorphic margin.

Microscopically *P. omnivorum* can be separated from *P. chrysothizon* because of its broader spores, usually fewer cystidia, and a tendency toward thinner-walled hyphae (walls usually 1 μm thick while those of *P. chrysothizon* are often 2-3 μm thick).

In culture the two species can be separated readily when grown at 36 C (Figs. 5, 6). *Phanerochaete chrysothizon* grows only 1-2 mm in 2 wk while *P. omnivorum* nearly covers the plate in that time. At 25 C the two are not readily distinguishable.

Ecologically these species occupy vastly different niches. *Phanerochaete omnivorum* occurs on desert hardwood shrubs and trees, while *P. chrysothizon* inhabits hardwoods

(rarely conifers) in more moist areas. The specimens examined indicate that *P. omnivorum* occurs in the southwestern United States and east into Texas while *P. chrysorhizon* occurs throughout the eastern United States and west into Mississippi. An overlapping distribution in Texas is to be expected because there the dry and moist regions meet.

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A STUDY OF AMANITA TYPES
I. TAXA DESCRIBED BY C. H. PECK

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The immense influence that C. H. Peck exerted on American mycology is a well accepted and documented fact (Lloyd, 1912; Bessey, 1914; Atkinson, 1918; Burnham, 1919). Throughout his 48 year tenure with the State Museum of New York at Albany his untiring observation and analysis of the flora of New York resulted in a herbarium of many thousands of specimens, over 2700 of which were fungi (Gilbertson, 1962). Included among these were 36 taxa of the genus *Amanita* described as new.

During the period from 1867 to 1915 when Peck published his mycological studies many nomenclatural rules that are observed today were not in existence or were little used. Such was the case of the recognition of nomenclatural types. Rules governing the designation of nomenclatural types were not adopted by American mycologists until 1904 and international acceptance was not gained until 1930.

Even though Peck published new taxa after the adoption of the American Code in 1904, he still did not designate type specimens. Usually, however, he would cite one or more specimens. According to the International Code of Botanical Nomenclature (Art. 7, note 3; Guide for the Determination of Types), if more than one specimen is cited in the original description and one of these, i.e., preferably a collection by the author, can be adequately associated with an extant herbarium specimen it should be designated as a lectotype. This procedure has been followed with several of Peck's taxa.

It was not uncommon for Peck to cite only one specimen in the original description. The information contained in this citation frequently did not completely match that of any herbarium specimen. Ordinarily this might necessitate the designation of a neotype (Art. 7, note 3, International Code of Botanical Nomenclature). It has recently been noted that Peck rarely accessioned into the herbarium more than one collection of a particular organism from the same location. Any subsequent collections of this organism from that same location were usually made by someone else (Personal communication, Dr. John H. Haines, State Museum of New York). After examining many of the specimens from Peck's herbarium this practice appears to have been the case. The incongruence between the original citation and the information with the herbarium specimen appears, therefore, to be of little consequence, thus, allowing the specimen in question to be implicitly designated as

the holotype. There will be no discussion for those taxa with an implicit holotype.

It is the purpose of this publication to designate and describe the type specimens for the taxa of the genus *Amanita* named by C. H. Peck. Of these 36 taxa, descriptions are provided for 30. At present five of the remaining taxa do not have representative specimens in the State Herbarium, a fifth specimen was determined not to be an *Amanita*, and *Amanita frostiana* is a nomenclatural synonym of *Agaricus muscarius* var. *minor*.

The descriptions contain macroscopic characters obtained from observations of the dried type specimens, with one exception being the color citations from the original description (in italics). Extensive microscopic observations are included when adequate reinflation of pertinent tissues permitted analysis. These studies were made on a Wild M20 bright-field, phase contrast microscope with a Nikon EFM camera attachment allowing magnifications up to 3250x. Tissues were prepared for study using techniques similar to those described by Bas (1969).

Descriptions for several types have been previously published (Jenkins, 1977), but are included here to provide a single source of reference.

TYPES STUDIED

1. *Amanita abrupta* Peck. 1897. Torr. Bot. Club Bull. 24: 138. Holotype (Implicit: *des. mihi*): Alabama, vii. 1896, L. M. Underwood s.n.(NYS).

PILEUS: approximately 7 cm broad, plano-convex, margin slightly inrolled, faintly striate, *white*; volval remnants sparse, randomly distributed, irregular to pyramidal warts. LAMELLAE: crowded, free or just reaching stem, *white*. STIPE: 9 x 0.7 cm, tapering upward, solid, basal bulb abrupt, subglobose, *white*; annulus superior, submembranous; volval remnants as a few, irregular warts at base of stipe.

PILEIPELLIS: filamentous hyphae densely interwoven to subradial, slightly gelatinized. PILEUS TRAMA: undifferentiated filamentous hyphae and elongate, inflated cells. LAMELLA TRAMA: bilateral. SUBHYMENIUM: hyphae subcellular to cellular, clamped. BASIDIA: up to 52 x 4-10 μm , 4-sterigmate, clamped. VOLVA: filamentous hyphae on pileus extremely sparse, moderately branched, up to 8 μm diam; inflated cells predominant type, mostly globose, subglobose, and broadly elliptic, up to 37.6 x 31.3 μm , with fewer oblong-elliptic to clavate, up to 59.5 x 18.8 μm , terminal or short, terminal chains; volval material at base of stipe very similar to that above. STIPE TRAMA: filamentous hyphae sparsely branched, up to 9 μm diam, occasionally clamped; inflated cells terminal, clavate, longitudinally oriented, up to 160 x 20 μm . PARTIAL VEIL: filamentous hyphae sparsely branched, up to 7 μm diam, rarely clamped; inflated cells terminal, mostly clavate, up to 78 x 15.7 μm , with a few subglobose to pyriform, up to 21.9 x 15.6 μm .

SPORES: 7.8-9.4 x 5.5-7.0 μm ($\underline{E} = 1.24-1.71$; $\underline{E}^m = 1.46$), broadly elliptic to elongate, often adaxially flattened, hyaline, amyloid, thin

walled; contents guttulate, apiculus sublateral, cylindrical to truncate-conic.

2. *Amanita bivolvata* Peck. 1909. Torr. Bot. Club Bull. 36: 329. Holotype (Implicit: *des. mihi*): Claremont, California, i. 1909, C. F. Baker s.n. (NYS).

PILEUS: 7-10 cm broad, plano-convex, margin shallowly striate, white with brownish stains toward center. LAMELLAE: free, crowded, white; lamellulae numerous. STIPE: 13-15 x 1.6-2.5 cm, equal, flocculose, white, basal bulb ovoid; annulus superior, narrow, white, soon disappearing; volva 3-5 x 4.6 cm, lobed, with an inner margin surrounding the stipe, white.

PILEIPELLIS: filamentous hyphae densely interwoven, gelatinized. PILEUS TRAMA: undifferentiated, filamentous hyphae, moderately branched, up to 8 μm diam, and elongate, inflated cells, terminal and short, terminal chains. LAMELLA TRAMA: bilateral; filamentous hyphae up to 8 μm diam, moderately branched, no clamps; inflated cells elongate, terminal or short, terminal chains. SUBHYMENIUM: hyphae distinctly ramose, no clamps. BASIDIA: up to 55 x 4-11.7 μm , 4-sterigmate, thin walled, no clamps. VOLVA: filamentous hyphae at base of stipe predominant, sparsely to moderately branched, up to 14 μm diam, no clamps; inflated cells few, elongate, clavate to fusiform, up to 156.5 x 37 μm , terminal. STIPE TRAMA: filamentous hyphae undifferentiated and inconspicuous; inflated cells terminal or rarely short, terminal chains, oblong-elliptic to clavate, longitudinally oriented, up to 188 x 46.9 μm . PARTIAL VEIL: filamentous hyphae up to 7 μm diam, moderately branched, no clamps observed, few gloeoplerous segments; no inflated cells.

SPORES: 8.6-10.2 x 7.0-7.8 μm ($\underline{E} = 1.10-1.34$; $\underline{E}^m = 1.25$), subglobose to broadly elliptic, often adaxially flattened, hyaline, amyloid, thin walled; contents guttulate; apiculus sublateral, cylindrical.

3. *Amanita calyptrata* var. *albescens* Peck. 1900. Rep. N. Y. St. Mus. 53: 840, pl. A, fig. 1-5. Holotype (Implicit: *des. mihi*): Gansevoort, vii., C. H. Peck s.n. (NYS).

PILEUS: approximately 6 cm broad, plane to plano-convex, margin distinctly striate, whitish; volval remnant as a large, membranous patch, white, covering a major portion of the pileus. LAMELLAE: free, crowded, edges even. STIPE: approximately 12 x 1.3 cm, tapering slightly upward, hollow, lumen large, no basal bulb; only a few remnants of a membranous annulus remaining; volva large, thick, membranous, lobed, usually not adhering to stipe.

PILEIPELLIS: densely interwoven, gelatinized, filamentous hyphae. PILEUS TRAMA: undifferentiated, filamentous hyphae, up to 8 μm diam, moderately branched, and elongate, inflated cells. LAMELLA TRAMA: bilateral; filamentous hyphae up to 7 μm diam, moderately branched, rarely clamped; inflated cells elongate, terminal or in short, terminal

chains. SUBHYMENIUM: hyphae ramose, no clamps observed. BASIDIA: up to $50 \times 4-11 \mu\text{m}$, 4-sterigmate, thin walled, no clamps. VOLVA: outer layer composed primarily of filamentous hyphae, moderately branched, up to $8 \mu\text{m}$ diam, no clamps; inflated cells mostly subglobose to elliptic, up to $80 \times 62.6 \mu\text{m}$, terminal or occasional short, terminal chains; inner layer very similar, but with a larger number of inflated cells: volva on pileus very similar to that on base of stipe. STIPE TRAMA: filamentous hyphae fairly conspicuous, sparsely branched; inflated cells terminal, clavate, longitudinally oriented, up to $278 \times 37.6 \mu\text{m}$. PARTIAL VEIL: almost exclusively filamentous hyphae, sparsely branched, up to $7 \mu\text{m}$ diam, rarely clamped, only an occasional, small, inflated cell, usually elliptic.

SPORES: $12.5-13 \times 9.0-10 \mu\text{m}$ ($\bar{E} = 1.30-1.38$; $\bar{E}^m = 1.31$), elliptic, often adaxially flattened, hyaline, nonamyloid, thin walled; contents guttulate; apiculus sublateral, cylindrical.

4. *Amanita calyptrotoides* Peck. 1909. Torr. Bot. Club Bull. 36: 329. Lectotype (*des. mihi*): Claremont, California, i. 1909, C. F. Baker s.n.(NYS).

PILEUS: 4-8 cm broad, convex to plano-convex, margin shallowly striate, lead colored, darker toward center; volval remnant as a large, irregular but unbroken, white, membranous patch covering a large portion of the pileus. LAMELLAE: deeply sinuate, white, crowded. STIPE: white, minutely pulverulent striate, 8-12 \times 0.8-1.75 cm, tapering upward, hollow, annulus evanescent, adhering to lamellae in young specimens; volva up to 2 cm deep, irregularly lobed, white, frequently adhering to the stipe.

PILEIPELLIS: densely interwoven, gelatinized, filamentous hyphae. PILEUS TRAMA: undifferentiated, filamentous hyphae and elongate, inflated cells. LAMELLA TRAMA: bilateral; filamentous hyphae up to $7 \mu\text{m}$ diam, moderately branched, no clamps; inflated cells elongate, terminal or short, terminal chains. SUBHYMENIUM: hyphae ramose, no clamps. BASIDIA: up to $77 \times 3.9-11.7 \mu\text{m}$, 4-sterigmate, thin walled, no clamps. VOLVA: filamentous hyphae dominant, moderately branched, irregularly interwoven, up to $8 \mu\text{m}$ diam, no clamps; inflated cells few, mostly broadly elliptic to elliptic, up to $87.6 \times 78.3 \mu\text{m}$: tissue at base of stipe very similar to that on pileus. STIPE TRAMA: filamentous hyphae undifferentiated and inconspicuous, no clamps; inflated cells terminal, clavate to oblong-elliptic, longitudinally oriented, up to $359.4 \times 68.9 \mu\text{m}$.

SPORES: $11.7-14.8 \times (6.2)7.0-8.6 \mu\text{m}$ ($\bar{E} = 1.50-2.27$; $\bar{E}^m = 1.66$), elliptic to cylindrical, often adaxially flattened, hyaline, nonamyloid, thin walled; contents guttulate; apiculus sublateral, cylindrical to truncate-conic.

Typification. Although there is apparently only one collection cited in the original description, an implicit holotype cannot be designated. In the herbarium box labeled "type" from Peck's herbarium there were two separate collections from C. F. Baker, numbers 5100 and 5115. Both were collected under Oak trees in Claremont, CA, the citation in the original publication. Examination of the specimens shows

them to be the same organism. It would appear that Peck had two separate collections at his disposal when delimiting this taxon. Since this possibility exists neither can be considered the holotype. Instead a lectotype must be chosen from these two collections (Art. 7, note 3, International Code of Botanical Nomenclature). Analysis of the descriptions accompanying these specimens reveals much similarity in wording between the description of collection 5115 and that used by Peck in the original description. Based upon this similarity and the presence of four fruit bodies in 5115 vs. one fruit body in 5110, I have chosen collection 5115 as the lectotype.

5. *Amanita candida* Peck. 1897. Torr. Bot. Club Bull. 24: 137-138. Holotype (Implicit: *des. mihi*): Alabama, x., F. S. Earle s.n.(NYS).

PILEUS: approximately 10.4 cm broad, plane, margin not striate, white; volval remnants as a thin pulverulence with a few, randomly scattered warts near the center. LAMELLAE: just reaching stipe, moderately broad, crowded; lamellulae attenuate. STIPE: approximately 12 x 1.5 cm, cylindrical or tapering slightly upward, solid, covered with a slight flocculence, basal bulb abruptly enlarged, subglobose to broadly elliptic, up to 4.5 x 4 cm; no annular remnants; volva as a dense flocculence or rings of small, irregular chunks.

PILEUS TRAMA: undifferentiated, filamentous hyphae, up to 8 μ m diam, moderately branched and elongate, inflated cells. LAMELLA TRAMA: bilateral; filamentous hyphae up to 9 μ m diam, moderately branched, no clamps observed; inflated cells elongate, terminal. SUBHYMENIUM: hyphae inflated ramose, no clamps observed. BASIDIA: up to 46 x 3-12.3 μ m, 4-sterigmate, thin walled, no clamps observed. VOLVA: filamentous hyphae on pileus relatively inconspicuous, moderately branched, up to 8 μ m diam, no clamps observed, inflated cells dominant, globose, broadly elliptic to broadly clavate and oblong-elliptic, 30-60 x 15-33 μ m, usually as short, terminal chains: remnants on base of stipe very similar to that on pileus. STIPE TRAMA: filamentous hyphae rather abundant, up to 9 μ m diam, sparsely branched; inflated cells terminal, clavate, longitudinally oriented, up to 245 x 29 μ m.

SPORES: 11-12.5 x 5.9-7.0 μ m ($E = 1.56-2.0$; $E^m = 1.80$), elliptic to elongate, often adaxially flattened, hyaline, amyloid, thin walled; contents guttulate; apiculus sublateral, cylindrical.

6. *Agaricus chlorinosmus* Peck in Austin. 1878. Torr. Bot. Club Bull. 6: 278.

= *Amanita chlorinosma* (Peck) Lloyd. 1898. Volvae: 7, 15. Holotype (Implicit: *des. mihi*): New York - Closter, viii. 1877, C. F. Austin s.n.(NYS).

PILEUS: up to 15 cm broad, plano-convex, margin slightly in-rolled, not striate, white; volval remnants as randomly distributed, irregular warts and pulverulence, more dense on disc, with a scarcely discernible yellow tint. LAMELLAE: crowded, just reaching stem. STIPE: up to 13 x 2 cm, cylindrical, solid, basal bulb clavate; no annular material remaining; volval remnants as an occasional, randomly distributed wart.

PILEIPELLIS: a thin layer of densely interwoven, filamentous hyphae, gelatinous nearer the surface. PILEUS TRAMA: undifferentiated, filamentous hyphae and elongate, inflated cells. LAMELLA TRAMA: bilateral; filamentous hyphae up to 9 μm diam, moderately branched, clamped; inflated cells elongate, terminal or short, terminal chains. SUBHYMENIUM: hyphae inflated ramose to subcellular, clamped. BASIDIA: up to 57 x 3.9-9.4 μm , 4-sterigmate, thin walled, clamped. VOLVA: filamentous hyphae on pileus moderately branched, up to 8 μm diam, occasionally clamped; inflated cells mostly subglobose to broadly elliptic, up to 50 x 40 μm , with fewer oblong-elliptic to clavate, up to 45 x 10 μm , terminal or short, terminal chains: volval remnants at base of stipe very similar to that above. STIPE TRAMA: filamentous hyphae quite conspicuous, sparsely branched, up to 8 μm diam, rarely clamped; inflated cells terminal, elongate, longitudinally oriented, up to 200 x 25 μm .

SPORES: 8.2-9.4 x 5.4-5.9 μm ($\underline{E} = 1.49-1.71$; $\underline{E}^m = 1.61$), elliptic to elongate, often adaxially flattened, hyaline, amyloid, thin walled; contents guttulate; apiculus sublateral, cylindrical.

7. *Amanita crenulata* Peck. 1900. Torr. Bot. Club Bull. 27: 15. Holotype (Implicit: *des. mihi*): Massachusetts, near Boston, 1899, Mrs. E. Blackford s.n.(NYS).

PILEUS: up to 4 cm broad, becoming convex or nearly plane, thin, margin striate, *whitish or grayish, sometimes tinged with yellow*; volval remnants as thin, *whitish*, floccose patches or slight warts. LAMELLAE: crowded, with floccose-crenulate edges, reaching stipe, *white*; lamellulae truncate. STIPE: up to 4.5 x 0.4-0.8 cm, tapering upward, stuffed, *white*, basal bulb globose to subglobose; no annular material remaining; volva remaining only as floccose-mealy remnants at apex of bulb.

PILEIPELLIS: densely interwoven or subradial, gelatinized, filamentous hyphae. PILEUS TRAMA: filamentous hyphae undifferentiated and inconspicuous; inflated cells approximately up to 160 x 64 μm , clavate to irregularly elongate, terminal. LAMELLA TRAMA: bilateral; filamentous hyphae undifferentiated. SUBHYMENIUM: hyphae ramose, clamps not observed. BASIDIA: 35-42 x 4-9.4 μm , 4-sterigmate, clamps not observed. VOLVA: filamentous hyphae on pileus 2-6.5 μm diam, sparsely to moderately branched, without clamps; gloeoplerous hyphae moderately abundant; inflated cells up to 75 x 51 μm , subglobose, ovoid, broadly elliptic, elliptic, fusiform, clavate, arranged mostly as randomly oriented, terminal chains, the terminal element usually broadly elliptic to ovoid: volva remnants at base very similar to those on pileus. STIPE TRAMA: filamentous hyphae undifferentiated and inconspicuous with terminal, clavate, longitudinally oriented cells, up to 200 x 32 μm .

SPORES: 7.9-8.7 x 7.0-8.7 μm ($\underline{E} = 1.0-1.13$; $\underline{E}^m = 1.04$), globose to subglobose, smooth, hyaline, thin walled, nonamyloid; contents guttulate; apiculus sublateral, cylindrical to truncate-conic.

Typification. In the introduction an explanation was given for the designation of implicit holotypes for several of Peck's taxa.

Additional explanation is required for this taxon, however. In a previous publication (Jenkins, 1977) a lectotype was designated for *A. crenulata*. This designation was in error and should be disregarded.

As a result of specimen analysis during this study, as well as that of the previously cited publication, I have now studied all of the specimens of *A. crenulata* in the Peck herbarium. A reevaluation of the type specimen in question now requires me to accept it as an implicit holotype.

8. *Amanita elongata* Peck. 1909. Bull. N. Y. St. Mus. 131: 33. Holotype (Implicit: *des. mihi*): Pennsylvania, vii. 1907, E. B. Sterling s.n.(NYS).

PILEUS: approximately 4.5 cm broad, plano-convex, margin striate, flesh moderately thick on disc, *yellow or orange, sometimes more deeply colored in the center*; volval remnants as randomly distributed, floccose patches. LAMELLAE: free, crowded, *white*; lamellulae attenuate. STIPE: approximately 11 x 0.4-0.8 cm, tapering upward, glabrous, slightly pruinose above annulus, stuffed, *white or whitish at the top, pallid below*, basal bulb elliptic, up to 2 x 1.3 cm; annulus superior, very thin, membranous, *pale yellow*, collapsing on stem or remaining attached to gills; volval remnants sparse, as slight rim or loose, floccose patches.

PILEIPELLIS: densely interwoven, gelatinized, filamentous hyphae. PILEUS TRAMA: undifferentiated, filamentous hyphae, moderately branched, no clamps, up to 8 μm diam; inflated cells elongate, terminal or in short, terminal chains. SUBHYMENIUM: hyphae ramose to inflated ramose, no clamps. BASIDIA: up to 40 x 4.5-9.4 μm , 4-sterigmate, thin walled, no clamps. VOLVA: filamentous hyphae on pileus moderately branched, up to 8 μm diam, no clamps; inflated cells mostly globose to elliptic, up to 93.9 x 62.6 μm , with a few elongate, up to 94 x 31.3 μm , terminal or short, terminal chains: volval material at base of stipe very similar to that on pileus, but with a larger number of filamentous hyphae. STIPE TRAMA: filamentous hyphae sparsely branched, up to 8 μm diam, no clamps; inflated cells terminal, clavate, longitudinally oriented, up to 281 x 37 μm . PARTIAL VEIL: composed primarily of filamentous hyphae, moderately branched, up to 7 μm diam, no clamps, with a few variform, terminal, inflated cells, up to 60 x 30 μm .

SPORES: 7.8-9.4 x 5.5-6.2 μm ($E = 1.42-1.71$; $E^m = 1.51$) elliptic to elongate, often adaxially flattened, hyaline, amyloid, thin walled; contents guttulate; apiculus sublateral, truncate-conic.

9. *Amanita frostiana* (Pk.) Sacc. (See *Agaricus muscarius* var. *minor*).

10. *Amanita frostiana* var. *pallidipes* Peck. 1899. Rep. N. Y. St. Mus. 53: 855.

Neotype (*des. mihi*): New York - Port Jefferson, Suffolk Co., vii., C. H. Peck s.n.(NYS); mixed collection, specimens annotated.

PILEUS: approximately 2.5-4 cm broad, convex to plane, margin faintly striate, *whitish to pale yellow*; volval remnants as floccose patches or flattened warts. LAMELLAE: free, crowded; lamellulae truncate. STIPE: approximately 3.5-6 x 0.3-0.6 cm, tapering slightly upward, *white*, basal bulb ovoid; annulus fragmentary, 1.5-2 cm from apex of stipe, *white*; volva often extending above apex of bulb as slight, free margin.

PILEIPELLIS: densely interwoven or subradial, gelatinized, filamentous hyphae. PILEUS TRAMA: composed of undifferentiated, filamentous hyphae and inflated, elongate cells. LAMELLA TRAMA: bilateral; filamentous hyphae undifferentiated; inflated cells variform. SUBHYMENIUM: hyphae ramose, clamps occasional. BASIDIA: 41-50 x 5-11.5 μm , 4-sterigmate, rarely clamped. VOLVA: filamentous hyphae on pileus up to 8 μm diam, moderately branched, rarely clamped; inflated cells up to 100 x 51 μm , ovoid, broadly elliptic, subglobose, elongate, elliptic, clavate, or fusiform, often as single, terminal cells or irregularly disposed to apico-basal chains of cells: filamentous hyphae of volva at base of stipe up to 7 μm diam, moderately branched, rarely clamped; inflated cells up to 100 x 40 μm , shapes similar to those on pileus but with a larger proportion of elongate cells. STIPE TRAMA: filamentous hyphae undifferentiated and relatively inconspicuous; inflated cells terminal, clavate, longitudinally oriented, up to 318 x 45 μm . PARTIAL VEIL: filamentous hyphae up to 7 μm diam, moderately branched, rarely clamped; inflated cells rare, elongate, terminal, not exceeding 50 x 10 μm .

SPORES: (7.3)7.9-10.2 x (5.8)6.3-7.9(8.4) μm (\bar{E} = 1.13-1.46; \bar{E}^m = 1.27), subglobose, elliptic, adaxially flattened, smooth, hyaline, thin walled, nonamyloid; contents guttulate; apiculus sublateral, cylindrical to slightly truncate-conic.

Typification. There were no specimens originally cited, requiring designation of a neotype. The collection chosen is mixed, but includes fruit bodies exhibiting the characters of the original description. The two taxa can be separated on amyloidity of spores, those of the type fruit bodies of *Amanita frostiana* var. *pallidipes* exhibiting a negative reaction, the others reacting positively. Fruit bodies have been annotated appropriately.

11. *Amanita glabriceps* Peck. 1909. Bull. N. Y. St. Mus. 131: 18-19, pl. u., fig. 1-4.

Lectotype (*des. mihi*): New York - Coopers Plains, Steuben Co., vii., C. H. Peck s.n.(NYS).

PILEUS: approximately 7 cm broad, plano-convex to slightly depressed, thin, margin striate, *white or yellowish white, sometimes slightly brownish in the center*; no volval remnants on pileus. LAMELLAE: free, crowded, *white*; lamellulae truncate. STIPE: up to 14 x 0.9 cm, tapering upward, stuffed, floccose-squamulose, *white*, base clavate; annulus fragmentary, median; volva appressed with a slight, free ring of volval material above the free, margined collar.

PILEIPELLIS: moderately dense, interwoven to subradial gelatinized, filamentous hyphae. PILEUS TRAMA: composed primarily of clavate

to irregularly elongate, inflated cells; filamentous hyphae undifferentiated with clamps. LAMELLA TRAMA: bilateral; filamentous hyphae undifferentiated; inflated cells elongate. SUBHYMENIUM: hyphae ramose, occasionally clamped. BASIDIA: 39-50 x 4.5-9.4 μm , 4-sterigmate, no clamps observed. VOLVA: filamentous hyphae at base of stipe 2-6 μm diam, moderately branched, without clamps; inflated cells subglobose, broadly elliptic, ovoid, oblong-elliptic, elliptic, clavate, up to 64 x 45 μm . STIPE TRAMA: filamentous hyphae 3-8 μm diam, sparsely branched, rarely clamped; inflated cells terminal, clavate, longitudinally oriented, up to 240 x 35 μm . PARTIAL VEIL: filamentous hyphae 3-6 μm diam, moderately branched, rarely clamped; inflated cells terminal, clavate, up to 180 x 25 μm .

SPORES: 7.9-9.4 x 6.3-7.9 μm ($E = 1.19-1.38$; $E^m = 1.28$), broadly elliptic to elliptic, adaxially flattened, smooth, hyaline, nonamyloid; contents guttulate; apiculus sublateral, cylindrical to truncate-conic.

Typification. In Peck's original description only two syntypes were cited, making mandatory the selection of a lectotype. Although both specimens cited were of comparable condition, the one collected by Peck was given preference.

12. *Amanita magnivelaris* Peck. 1897. Rep. N. Y. St. Mus. 50: 96. Holotype (Implicit: *des. mihi*): Port Jefferson, Suffolk Co., vii., s.n.(NYS).

PILEUS: approximately 8 cm broad, plane to plano-convex, margin not striate, *white or yellowish-white*; volval remnants a single, membranous patch on disc. LAMELLAE: crowded, free, *white*; lamellulae numerous. STIPE: approximately 9 x 0.7-1.2 cm, tapering upward, apex slightly expanded, *white*, basal bulb elliptic, approximately 2.5 x 2 cm; annulus superior, pendant, ample, submembranous, *white*; volva at base of stipe sheathing, membranous, lobed.

PILEIPELLIS: densely interwoven, filamentous hyphae, slightly gelatinized. PILEUS TRAMA: undifferentiated, filamentous hyphae and inflated, elongate cells. LAMELLA TRAMA: bilateral. SUBHYMENIUM: hyphae ramose, no clamps observed. BASIDIA: up to 45 x 4-11.7 μm , 4-sterigmate, no clamps. VOLVA: filamentous hyphae on pileus abundant, moderately branched, up to 8 μm diam; inflated cells abundant, subglobose, broadly elliptic, elliptic, to clavate, up to 109.9 x 46.9 μm , usually terminal, with occasional terminal chains: volval material at base of stipe predominantly filamentous hyphae, up to 8 μm diam, with a small number of cells similar to those of pileus volva, in addition, an extensive gelatinous layer, representative of the pileipellis. STIPE TRAMA: filamentous hyphae sparsely branched, up to 7 μm diam, no clamps; inflated cells terminal, clavate, longitudinally oriented, up to 250.5 x 31 μm . PARTIAL VEIL: entirely filamentous hyphae, up to 8 μm diam, moderately branched, no clamps; no inflated cells.

SPORES: 8.6-10.9 x 5.5-7.8 μm ($E = 1.34-1.56$; $E^m = 1.47$), elliptic, often adaxially flattened, hyaline, amyloid, thin walled; contents guttulate, apiculus sublateral, cylindrical.

13. *Amanita morrisii* Peck. 1910. Bull. N. Y. St. Mus. 139: 42. Holotype (Implicit: *des. mihi*): Massachusetts - Natick, ix. - x. 1909, G. E. Morris s.n.(NYS).

PILEUS: approximately 9 cm broad, plano-convex, glabrous, flesh moderately thin, margin not striate, *dark grayish brown to blackish brown*; volval remnants as small, sparse, floccose patches. LAMELLAE: free, crowded, edges smooth, *white*; lamellulae attenuate. STIPE: approximately 15 x 1 cm, tapering slightly upward, apex expanded, very slightly floccose, stuffed, *sometimes grayish and striate at the top, usually white*, basal bulb subglobose to ovoid, up to 2.5 x 2 cm; annulus superior, up to 3 cm from apex, membranous, double-edged, *whitish buff beneath*; volva as occasional, small, floccose patches.

PILEIPELLIS: densely interwoven to subradial, gelatinized, filamentous hyphae. PILEUS TRAMA: undifferentiated, filamentous hyphae and elongate, inflated cells. LAMELLA TRAMA: bilateral; filamentous hyphae up to 8 μ m diam, moderately branched, no clamps observed; inflated cells elongate, terminal or short terminal chains. SUBHYMENIUM: hyphae inflated ramose, no clamps observed. BASIDIA: up to 43 x 4.9-8.6 μ m, 4-sterigmate, thin walled, no clamps observed. VOLVA: filamentous hyphae on pileus inconspicuous, sparsely branched, up to 8 μ m diam, no clamps observed; inflated cells dominant, globose, subglobose, broadly elliptic, with a few small, elongate, up to 62.6 x 26.6 μ m, terminal or short, terminal chains, the subtending cells being usually elongate. STIPE TRAMA: filamentous hyphae inconspicuous, sparsely branched, up to 7 μ m diam, no clamps observed; inflated cells terminal, or occasional short, terminal chains, clavate to oblong-elliptic, longitudinally oriented, up to 187 x 31.3 μ m. PARTIAL VEIL: predominantly filamentous hyphae, moderately branched, up to 7 μ m diam, no clamps observed; a significant number of inflated cells, cylindrical, up to 125 x 9.5 μ m, rarely exceeding that diameter.

SPORES: 7.0-7.8 x 5.5-6.3 μ m ($E = 1.24-1.42$; $E^m = 1.27$), broadly elliptic to elliptic, often adaxially flattened, hyaline, amyloid, thin walled; contents guttulate; apiculus sublateral, cylindrical.

14. *Amanita multisquamosa* Peck. 1900. Rep. N. Y. St. Mus. 53: 840, pl. B, fig. 1-7. Lectotype (*des. mihi*): New York - Amagansett, Suffolk Co., vii., C. H. Peck s.n.(NYS).

PILEUS: approximately 4 cm broad, convex to plane, margin slightly striate, *white or white with a brown or brownish center*; volval remnants as numerous, angular, erect warts, more closely spaced toward disc. LAMELLAE: free, crowded, *white*; lamellulae truncate. STIPE: approximately 5 x 0.3-0.6 cm, tapering slightly upward, stuffed, *white*, basal bulb ovoid; annulus fragmentary, approximately 2 cm from apex of stipe, *white*; volva as slight, free margin at apex of bulb, not inrolled.

PILEIPELLIS: gelatinous layer with relatively little hyphal structure remaining. PILEUS TRAMA: composed of undifferentiated, filamentous hyphae and inflated, elongate cells. LAMELLA TRAMA: bilateral. SUBHYMENIUM: hyphae ramose. BASIDIA: 40-47 x 4.5-11 μ m, 4-sterigmate,

no clamps observed. VOLVA: filamentous hyphae on pileus approximately 2-8 μm diam, moderately branched, occasionally clamped, with a significant number of gloeoplerous hyphae; inflated cells up to 76 x 51 μm , subglobose, broadly elliptic, ovoid, elliptic, oblong-elliptic, clavate, usually arranged in terminal, randomly oriented to apico-basal chains: filamentous hyphae of volva at base of stipe approximately 3-7 μm diam, moderately branched, with occasional clamps; inflated cells similar to those on pileus with a larger number of broadly shaped cells. STIPE TRAMA: filamentous hyphae up to 7 μm diam, moderately branched, clamped; inflated cells terminal, clavate, longitudinally oriented, up to 255 x 38 μm . PARTIAL VEIL: filamentous hyphae up to 3-7 μm diam, moderately branched, clamped; inflated cells sparse, terminal, clavate, up to 130 x 20 μm .

SPORES: 8.7-11 x 7.0 8.7 μm ($E = 1.10-1.39$; $E^m = 1.22$), subglobose to elliptic, often adaxially flattened, smooth, hyaline, non-amyloid, thin walled; contents guttulate; apiculus sublateral, truncate-conic.

Typification. Peck's original description contained no citation of specimens, but only three counties in which collections were made. The lectotype is from one of these, and has been chosen based on morphological similarities with the original description and in agreement with Bas (annotated specimen).

15. *Agaricus muscarius* var. *albus* Peck. 1880. Rep. N. Y. St. Mus. 33: 44.

\equiv *Amanita muscaria* var. *alba* (Pk.) Peck. 1893. Rep. N. Y. St. Mus. 46: 53.

Neotype (*des. mihi*): New York - Albany and Delmar, x., C. H. Peck s.n.(NYS).

PILEUS: approximately 4-9 cm broad, convex to plano-convex, relatively thin, margin striate, *white*; volval remnants as thin, floccose patches or small, angular warts, arranged in nearly concentric rings. LAMELLAE: free to approximate, crowded; lamellulae truncate. STIPE: up to 8 x 0.9 cm, tapering slightly upward, stuffed to hollow, basal bulb ovoid, up to 2.5 x 2 cm; annulus fragmentary; volva as irregular, floccose ringlets at apex of bulb and lower stipe.

PILEIPELLIS: densely interwoven, gelatinized, filamentous hyphae. PILEUS TRAMA: composed of undifferentiated, filamentous hyphae, 3-9 μm diam; inflated cells elongate. LAMELLA TRAMA: bilateral; filamentous hyphae undifferentiated; inflated cells elongate. SUBHYMENIUM: hyphae ramose, occasionally clamped. BASIDIA: 41-50 x 4-11.5 μm , usually 4-sterigmate, occasionally clamped. VOLVA: filamentous hyphae on pileus up to 8 μm diam, moderately branched, clamps occasional; inflated cells globose, subglobose, broadly elliptic, ovoid, elliptic, clavate, fusiform, up to 138 x 51 μm , arranged as random to apico-basal, terminal chains: filamentous hyphae of volva at base of stipe up to 8.5 μm diam, moderately branched, occasionally clamped; inflated cells very similar to those on pileus. STIPE TRAMA: filamentous hyphae undifferentiated and relatively inconspicuous with terminal, clavate, longitudinally oriented cells, up to 225 x 25 μm .

SPORES: 9.4-11.2 x 7.0-8.4 μm ($\underline{E} = 1.29-1.45$; $\overline{E}^m = 1.36$), broadly elliptic to elliptic, adaxially flattened, smooth, hyaline, nonamyloid; contents guttulate; apiculus sublateral, cylindrical.

Typification. Peck cited no specimens in the original description, thus requiring the designation of a neotype. The specimen above was chosen because of its proximity to Peck's primary collecting area, its acceptable condition, and the exhibition of morphological characteristics associated with the *A. muscarius* complex.

16. *Agaricus muscarius* var. *major* Peck. 1872. Rep. N. Y. St. Cab. 23: 69.

Holotype (Implicit: *des. mihi*): Catskill Mountains, x., C. H. Peck s.n.(NYS).

PILEUS: approximately 8 cm broad, plano-convex, surface glabrous, margin striate, flesh moderately thin; volval remnants as irregular to pyramidal warts, randomly disposed, frequently becoming thinner toward margin. LAMELLAE: moderately broad. STIPE: approximately 9 x 1.6 cm, tapering upward, stuffed, quite fibrillose on surface, basal bulb elliptic, up to 2.5 x 2 cm; annulus superior, floccose-membranous; no volval remnants remaining at base of stipe.

PILEIPELLIS: densely interwoven to subradial, gelatinized, filamentous hyphae. PILEUS TRAMA: undifferentiated, filamentous hyphae and elongate, inflated cells. LAMELLA TRAMA: bilateral; filamentous hyphae up to 7 μm diam, moderately branched, occasionally clamped; inflated cells elongate, terminal or in short, terminal chains. SUBHYMENIUM: hyphae ramose, occasionally clamped. BASIDIA: up to 62 x 4-11.8 μm , 4-sterigmate, walls thin, clamps not observed. VOLVA: remnants on pileus a dense to loose tissue of irregularly disposed to apico-basal, terminal chains of inflated cells and single, terminal cells; cells globose, subglobose, broadly elliptic, elliptic, oblong-elliptic, fusiform to clavate, up to 138 x 69 μm ; filamentous hyphae up to 8 μm diam, abundant, moderately branched, occasionally clamped, with abundant gloeoplerous segments: remnants at base of stipe very similar to that on pileus, but with a smaller number of inflated cells. STIPE TRAMA: filamentous hyphae up to 9 μm diam, sparsely branched, clamped; inflated cells up to 376 x 45 μm , clavate to oblong-elliptic, terminal, longitudinally oriented. PARTIAL VEIL: composed primarily of moderately branched, occasionally clamped, filamentous hyphae, up to 8 μm diam, with a significant number of inflated cells, clavate, terminal, up to 74 x 18 μm .

SPORES: 8.9-10.2 x 5.9-7.6 μm ($\underline{E} = 1.17-1.59$; $\overline{E}^m = 1.38$), broadly elliptic to elongate, adaxially flattened, thin walled, hyaline, nonamyloid; contents guttulate to subgranular; apiculus sublateral, cylindrical to truncate-conic.

17. *Agaricus muscarius* var. *minor* Peck. 1869. Rep. N. Y. St. Mus. 23: 69.

= *Amanita frostiana* (Pk.) Sacc. 1887. Syll. Fung. 5: 14.
Neotype (*des. mihi*): New York - Croghan, Lewis Co., no date, C. H. Peck s.n.(NYS).

PILEUS: approximately 3 cm broad, convex or expanded, margin striate, *bright orange*; volval remnants as small patches to small warts, more numerous over disc. LAMELLAE: free, crowded, *tinged with yellow*; lamellulae truncate. STIPE: approximately 5 x 0.3-0.5 cm, tapering slightly upward, stuffed, *yellow*, bulbous at base; annulus fragmentary, approximately 1.5 cm from stipe apex; volva extending above bulb as slight margin, with narrow, ascending rings of floccose material below margin of bulb.

PILEIPELLIS: densely interwoven to subradial, gelatinized, filamentous hyphae. PILEUS TRAMA: undifferentiated, filamentous hyphae with inflated cells, mostly elongate. LAMELLA TRAMA: bilateral; filamentous hyphae undifferentiated; inflated cells elongate. SUBHYMENIUM: hyphae ramose, clamps not observed. BASIDIA: 40-50 x 4.5-11 μm , 4-sterigmate, clamps rare. VOLVA: filamentous hyphae on pileus 3-7 μm diam, scarcely to moderately branched, clamped; inflated cells globose, subglobose, broadly elliptic, ovoid, up to 76 x 57 μm , with clavate, fusiform, oblong-elliptic, astringo-elliptic, up to 160 x 38 μm , arranged as irregular to apico-basal, terminal chains: filamentous hyphae of volva at base of stipe 3-9 μm diam, moderately branched, frequently clamped; inflated cells very similar to those above. STIPE TRAMA: filamentous hyphae undifferentiated and inconspicuous with terminal, oblong-elliptic to clavate, longitudinally oriented, inflated cells up to 240 x 35 μm . PARTIAL VEIL: filamentous hyphae 3-8 μm diam, moderately branched, clamped, with occasional, terminal, inflated cells up to 160 x 20 μm .

SPORES: 7.9-8.7 x 7.9-8.7 μm ($E = 1.0-1.01$; $E^m = 1.01$), globose to subglobose, smooth, hyaline, nonamyloid, thin walled; contents guttulate; apiculus sublateral, truncate-conic.

Typification. Peck did not cite any specimens in the original description, forcing the selection of a neotype. The collection chosen as type is mixed, containing fruit bodies of two morphologically similar taxa. When Peck changed the rank of the taxon he emended the original description by adding the character of globose spore shape. This enables division of this collection into fruit bodies with globose spores (*A. frostiana*) and those with elliptic spores (presumably *A. flavoconia*). In addition the globose spores of *A. frostiana* are nonamyloid while those of the elliptic spored specimen are amyloid.

18. *Agaricus nivalis* Peck. 1880. Rep. N. Y. St. Mus. 33: 48.

= *Amanita nivalis* (Pk.) Lloyd. 1898. Volvae: 9, 16.

Neotype (*des. mihi*): New York - Worcester, Otsego Co., no date, C. H. Peck s.n. (NYS).

PILEUS: approximately 4.5-5 cm broad, plane, thin, *white*, sometimes tinged with yellow or ochraceous on the disk, margin striate; no volval remnants on pileus. LAMELLAE: barely free, crowded, *white*; lamellulae truncate. STIPE: approximately 10 x 0.6 cm, tapering slightly upward, *white*, base subglobose to ovoid; annulus absent; volva delicate, floccose, at apex of bulb forming a fragile, rim-like structure or leaving fragments on lower stipe.

PILEIPELLIS: a layer of interwoven, gelatinized, filamentous

hyphae. PILEUS TRAMA: filamentous hyphae relatively slender and moderately branched; inflated cells clavate to irregularly elongate, up to $130 \times 32 \mu\text{m}$. LAMELLA TRAMA: bilateral; filamentous hyphae undifferentiated; inflated cells oblong-elliptic to clavate, up to $110 \times 24 \mu\text{m}$, terminal or in very short, terminal chains. SUBHYMENIUM: hyphae ramose, rarely clamped. BASIDIA: $40\text{-}47 \times 4.7\text{-}11 \mu\text{m}$, 4-sterigmate, rarely clamped. VOLVA: filamentous hyphae at base of stipe up to $7 \mu\text{m}$ diam, sparsely branched, without clamps; inflated cells up to $125 \times 25 \mu\text{m}$, subglobose, broadly elliptic, ovoid, oblong-elliptic, clavate, usually as irregularly disposed, terminal chains. STIPE TRAMA: filamentous hyphae up to $6 \mu\text{m}$ diam, sparsely branched, without clamps; inflated cells terminal, clavate, longitudinally oriented, up to $380 \times 32 \mu\text{m}$.

SPORES: $7.0\text{-}9.4 \times 6.3\text{-}7.9 \mu\text{m}$ ($\underline{E} = 1.11\text{-}1.38$; $\underline{E}^m = 1.20$), subglobose to elliptic, often adaxially flattened, smooth, hyaline, thin walled, nonamyloid; contents guttulate; apiculus sublateral, cylindrical.

Typification. In the original description Peck cited no specimens, thereby forcing the selection of a neotype. He did, however, mention in his discussion three counties in which he had collected the fungus. Based on the similarity of morphological characters of these specimens to the original description, the neotype has been selected as a collection from one of these locations.

19. *Amanitopsis parvicolvata* Peck. 1900. Torr. Bot. Club Bull. 27(12): 610.

= *Amanita parvicolvata* (Pk.) Gilb. 1941. Iconogr. Mycol. 27(2): 226.

Lectotype (*des. mihi*): North Carolina - Skyland, Henderson Co., vii., Miss Mary L. Wilson s.n.(NYS).

PILEUS: approximately 3 cm broad, convex to plane, flesh thin, margin striate, orange or yellow, sometimes orange in the center and yellow or whitish on the margin; no volval remnants remaining. LAMELLAE: free, crowded, pale yellow; lamellulae truncate. STIPE: approximately $3 \times 0.2\text{-}0.4$ cm, tapering slightly upward, stuffed, pale yellow, rarely fading to white, base ovoid; volval remnants as sparse, very fine floccose material at top of basal bulb, white.

PILEIPELLIS: densely interwoven, gelatinized, filamentous hyphae. PILEUS TRAMA: undifferentiated, filamentous hyphae and elongate, inflated cells. LAMELLA TRAMA: bilateral; filamentous hyphae approximately $3\text{-}6 \mu\text{m}$ diam, moderately branched, clamped; inflated cells up to $100 \times 25 \mu\text{m}$, elongate, terminal or as short, terminal chains. SUBHYMENIUM: hyphae ramose, clamped. BASIDIA: $40\text{-}47 \times 4.5\text{-}12.6 \mu\text{m}$, 4-sterigmate, clamps not observed. VOLVA: filamentous hyphae at base of stipe very sparse, approximately $2\text{-}6 \mu\text{m}$ diam, moderately branched, rarely clamped; inflated cells up to $70 \times 64 \mu\text{m}$, globose, subglobose, ovoid, broadly elliptic, elliptic, clavate, usually arranged as terminal, randomly oriented chains. STIPE TRAMA: filamentous hyphae undifferentiated and inconspicuous; inflated cells terminal, clavate to oblong-elliptic, longitudinally oriented, $222 \times 64 \mu\text{m}$.

SPORES: $11\text{-}11.8 \times 6.3\text{-}7.9 \mu\text{m}$ ($\underline{E} = 1.39\text{-}1.75$; $\underline{E}^m = 1.52$);

elliptic to elongate, often adaxially flattened, hyaline, nonamyloid, thin walled; contents guttulate; apiculus sublateral, cylindrical to truncate-conic.

Typification. In the original description two syntypes were cited. Although a lectotype should ideally be a specimen collected by the author, neither of the syntypes was collected by Peck. The specimen in the best condition was, therefore, selected.

20. *Amanita peckiana* Kauff. in Peck. 1913. Mycologia 5: 67. Holotype (Implicit: *des. mihi*): Michigan - New Richmond, ix. 1912, C. H. Kauffman s.n.(NYS).

PILEUS: approximately 6 cm broad, plano-convex, margin not striate, slightly inrolled, white; no volval remnants remaining. LAMELLAE: free or just reaching stem, moderately crowded, white; lamellulae attenuate. STIPE: up to 5.5 x 0.8-1.0 cm, tapering slightly upward, base slightly enlarged; annulus remaining attached to lamellae and margin of pileus; volva thick, membranous, saccate, lobed, up to 1 cm deep.

PILEIPELLIS: a layer of interwoven, gelatinized, filamentous hyphae. PILEUS TRAMA: filamentous hyphae up to 8 μm diam; inflated cells clavate to elongate. LAMELLA TRAMA: bilateral; filamentous hyphae undifferentiated; inflated cells oblong-elliptic to elongate, terminal or in very short, terminal chains. SUBHYMENIUM: hyphae ramose to inflated ramose, not clamped. BASIDIA: 39-46 x 4-12 μm , 4-sterigmate, no clamps. VOLVA: filamentous hyphae at base of stipe abundant, up to 8 μm diam, moderately branched, no clamps; inflated cells mostly globose to broadly elliptic, up to 78 x 78 μm , with fewer elongate cells, up to 93.9 x 31.3 μm , disposed as terminal chains. STIPE TRAMA: filamentous hyphae up to 8 μm diam, sparsely branched, without clamps; inflated cells terminal, clavate, longitudinally oriented, up to 234.7 x 37 μm . PARTIAL VEIL: filamentous hyphae up to 7 μm diam, moderately branched, no clamps, with very occasional, terminal, inflated cells, up to 45 x 15 μm .

SPORES: 12.5-14.8 x 4.9-5.9 μm ($\bar{E} = 2.27-3.02$; $\bar{E}^m = 2.60$), cylindrical, smooth, hyaline, amyloid, thin walled; contents guttulate; apiculus sublateral, cylindrical.

Observation. This taxon is included with the taxa described as new by C. H. Peck only because it appeared in one of his publications. Primary credit should go to C. H. Kauffman who first collected and described the specimens. Accompanying the type specimen is a letter and a description from Kauffman to Peck. In this letter Kauffman emphasized the necessity of designating this organism as a new species. In addition, the included description is almost word for word the same as the published description. In accordance with Recommendation 46D, International Code of Botanical Nomenclature, C. H. Kauffman should be primarily associated with the publication of this name.

21. *Amanita phalloides* var. *striatula* Peck. 1902. Bull. N. Y. St. Mus. 54: 961.

Holotype (Implicit: *des. mihl*): Bolton, no date, C. H. Peck s.n.(NYS).

PILEUS: approximately 4 cm broad, plano-convex, thin margin, very faintly striate, *white*; no volval remnants remaining on pileus. LAMELLAE: just reaching stipe, crowded, edges slightly floccose; lamellulae attenuate. STIPE: approximately 7.5 x 0.6 cm, tapering upward, stuffed, basal bulb globose to subglobose; annulus superior, thin, membranous, delicate, collapsing; volva membranous, moderately thick, shallow.

PILEIPELLIS: densely interwoven, gelatinized, filamentous hyphae. PILEUS TRAMA: undifferentiated, filamentous hyphae, up to 8 μm diam, and elongate, inflated cells, up to 150 x 25 μm . LAMELLA TRAMA: bilateral; filamentous hyphae up to 7 μm diam, moderately branched, no clamps; inflated cells elongate, terminal or short, terminal chains. SUBHYMENIUM: hyphae cellular, no clamps. BASIDIA: up to 39 x 3.9-10.2 μm , 4-sterigmate, thin walled, no clamps. VOLVA: filamentous hyphae, moderately branched, up to 10 μm diam, no clamps. with few inflated cells, mostly broadly elliptic, usually terminal, up to 93 x 78 μm . STIPE TRAMA: filamentous hyphae inconspicuous, sparsely branched, up to 8 μm diam; inflated cells terminal, clavate to oblong-elliptic, longitudinally oriented, up to 271 x 25 μm .

SPORES: 7.8-10.2 x 7.0-10.2 μm ($\bar{E} = 1.0-1.10$; $\bar{E}^m = 1.04$), globose to subglobose, hyaline, amyloid, thin walled; contents guttulate; apiculus sublateral, cylindrical.

22. *Amanita prairiicola* Peck. 1897. Torr. Bot. Club Bull. 24: 138. Holotype (Implicit: cf. *des. Bas*, 1969): Kansas, Rooks Co., 17. ix. 1896, E. Bartholomew s.n.(NYS).

PILEUS: approximately 6 cm broad, plano-convex, margin slightly appendiculate, not striate, *white, more or less tinged with yellow*; volval remnants as subpyramidal to pyramidal warts, fairly small, randomly distributed, becoming fewer toward margin. LAMELLAE: moderately crowded, just reaching stem, *white*. STIPE: up to 7 x 0.7 cm, tapering slightly upward, expanded at apex, apparently solid, basal bulb very slight, *white or whitish*; annulus superior, membranous, narrow; no volval remnants remaining on base of stipe.

PILEIPELLIS: densely interwoven, gelatinized, filamentous hyphae. PILEUS TRAMA: undifferentiated, filamentous hyphae and elongate, inflated cells. LAMELLA TRAMA: bilateral; filamentous hyphae up to 8 μm diam, moderately branched, clamps rare; inflated cells elongate, terminal or short, terminal chains. SUBHYMENIUM: hyphae ramose to subcellular, clamped. BASIDIA: up to 54 x 5.5-14.8 μm , 4-sterigmate, abundantly clamped. VOLVA: filamentous hyphae on pileus sparsely to moderately branched, up to 9 μm diam, occasionally clamped; inflated cells mostly elliptic, oblong-elliptic to fusiform, up to 110 x 37 μm , terminal or short, terminal chains. STIPE TRAMA: filamentous hyphae sparsely branched, up to 8 μm diam, clamped; inflated cells terminal, mostly clavate, longitudinally oriented, up to 249 x 31 μm .

SPORES: 11.7-14.1 x 8.6-10.9 μm ($\bar{E} = 1.24-1.45$; $\bar{E}^m = 1.33$), broadly elliptic to elliptic, often adaxially flattened, hyaline,

amyloid, thin walled; contents guttulate; apiculus sublateral, cylindrical.

23. *Amanitopsis pulverulenta* Peck. 1907. Bull. N. Y. St. Mus. 116: 17.

= *Amanita limbatula* Bas. 1969. Persoonia 5(4): 530.

Holotype (Implicit: cf. *des.* Bas, 1969): Port Jefferson, Suffolk Co., 18. viii. 1906, C. H. Peck s.n.(NYS).

PILEUS: approximately 3.5 cm broad, plano-convex, margin even, white or creamy white; volval remnants as a thin pulverulent layer and occasional floccose patches. LAMELLAE: free or just touching stipe, moderately broad, crowded, white. STIPE: approximately 3 x 0.6 cm, tapering slightly to apex, occasional slight flocculence, white, basal bulb elliptic to broadly elliptic; volva as a very slight, membranous limb on upper portion of bulb.

PILEIPELLIS: densely interwoven, gelatinized filamentous hyphae. PILEUS TRAMA: undifferentiated hyphae and elongate, inflated cells. LAMELLA TRAMA: bilateral; filamentous hyphae moderately branched, clamped; inflated cells elongate, usually terminal. SUBHYMENIUM: hyphae ramose to slightly inflated ramose, clamped. BASIDIA: up to 50 x 4-11 μm , 4-sterigmate, thin walled, clamped. VOLVA: remnants on pileus composed of filamentous hyphae and inflated cells; hyphae moderately branched, up to 8 μm diam, occasionally clamped; inflated cells globose to elliptic, up to 55 x 30 μm , with a few elongate, up to 80 x 35 μm , terminal or in short, terminal chains: volval material at base of stipe very similar to that on pileus. STIPE TRAMA: filamentous hyphae abundant, sparsely branched, and clamped; inflated cells terminal, clavate, longitudinally oriented, up to 330 x 37 μm .

SPORES: 8.6-10.2 x 3.9-5.5 μm ($\underline{E} = 1.83-2.21$; $\underline{E}^m = 1.93$), elongate to cylindrical, often adaxially flattened, hyaline, amyloid, thin walled; contents guttulate; apiculus sublateral, truncate-conic.

24. *Amanita pusilla* Peck. 1897. Rep. N. Y. St. Mus. 50: 96.

non [*Amanita pusilla* Per. 1799. Obs. Myc. 2: 36].

Holotype (Implicit: *des. mihi*): New York - Gouverneur, St. Lawrence Co., 4. xi. 1896, Mrs. E. C. Anthony s.n.(NYS).

PILEUS: approximately 2.0-2.5 cm broad, plano-convex with slight umbo, rimose-areolate, margin not striate, pale brown. LAMELLAE: free, crowded, becoming brownish. STIPE: approximately 2 x 0.2-0.3 cm, tapering slightly upward, basal bulb subglobose to ovoid; slight membranous volva at apex of basal bulb.

Observation. This does not appear to be a member of the genus *Amanita*. Analysis of two characters indicates this: 1) the lamella trama is interwoven and not bilateral, and 2) the stipe trama does not have the "typical *Amanita* structure" (Hoffman, 1861: 11; Boudier, 1886: pl. 1, fig. 8; Bas, 1969: 328). Since there is a definite volval structure present, this might easily be a *Volvariella*. The identity could not be determined at this time due to the condition of the specimen and the lack of notes.

25. *Amanita radicata* Peck. 1900. Torr. Bot. Club Bull. 27: 609-610.
 ≡ *Amanita rhopalopus* Bas. 1969. Persoonia 5(4): 416-417.
 Lectotype (cf. *des.* Bas, 1969): New Jersey, 26. vii. 1899, E. B. Sterling 114, s.n.(NYS).

PILEUS: approximately 5 cm broad, convex, margin even, inrolled, white; volval remnants as irregularly shaped, adnate warts densely covering pileus. LAMELLAE: free crowded, rather narrow. STIPE: approximately 6 x 1.6 cm, tapering upward, floccose-scaly, solid, white, basal bulb cylindrical to oblong-elliptic; annular remains thick, floccose-membranous, remaining attached to pileus margin; volval remnants as a few floccose patches on basal bulb.

PILEIPELLIS: densely interwoven to subradial, gelatinized, filamentous hyphae. PILEUS TRAMA: undifferentiated, filamentous hyphae and elongate, inflated cells. LAMELLA TRAMA: bilateral; filamentous hyphae up to 8 μm diam, moderately branched, occasionally clamped; inflated cells elongate, terminal or short, terminal chains. SUBHYMENIUM: hyphae ramose to inflated ramose, occasionally clamped. BASIDIA: up to 55 x 4-11 μm , 4-sterigmate, thin walled, occasionally clamped. VOLVA: filamentous hyphae on pileus moderately branched, up to 9 μm diam, occasionally clamped; inflated cells subglobose to broadly elliptic, up to 71.9 x 46.9 μm and oblong-elliptic to clavate, up to 110 x 37.6 μm , terminal or short, terminal chains: volval remnants at base of stipe very similar to above, but with a greater number of filamentous hyphae. STIPE TRAMA: filamentous hyphae moderately branched, up to 7 μm diam, occasionally clamped; inflated cells terminal, clavate, longitudinally oriented, up to 210 x 18 μm .

SPORES: 8.5-10.5 x 5.0-7.0 μm ($\bar{E} = 1.35-1.80$; $\bar{E}^m = 1.55$), elliptic to elongate, often adaxially flattened, hyaline, amyloid, thin walled; contents guttulate; apiculus sublateral, truncate-conic.

Typification. cf. Bas, 1969.

26. *Agaricus russuloides* Peck. 1873. Bull. Buff. Soc. Nat. Sci. 1(2): 41.
 ≡ *Amanita russuloides* (Pk.) Sacc. 1887. Syll. Fung. 5: 13.
 Holotype (Implicit: *des. mihi*): New York - Greenbush, Rensselaer Co., no date, C. H. Peck s.n.(NYS).

PILEUS: approximately 3.5 cm broad, convex to plano-convex, margin striate, pale yellow or straw color; volval remnants as a few widely scattered, floccose patches. LAMELLAE: crowded, free but connected to stipe by a floccose line, white; lamellulae truncate. STIPE: approximately 3.5 x 0.2-0.5 cm, tapering slightly upward, stuffed, smooth, bulbous at base; no annulus; volva as a slight, free limb at the apex of the bulb with occasional floccose patches on lower stem.

PILEIPELLIS: densely interwoven to subradial, gelatinized, filamentous hyphae. LAMELLA TRAMA: bilateral; filamentous hyphae 3-8 μm diam, moderately branched, clamps not observed; inflated cells up to 130 x 25 μm , mostly clavate and irregularly elongate. SUBHYMENIUM: hyphae ramose, clamps not observed. BASIDIA: 39-50 x 4.1-12 μm , 4-sterigmate, clamps rarely observed. VOLVA: on pileus a loose to

fairly dense tissue of apico-basal to irregularly disposed, terminal chains of clavate, elliptic, oblong-elliptic, astringo-cylindric inflated cells; cells up to $110 \times 32 \mu\text{m}$, with broadly elliptic and ovoid cells up to $64 \times 40 \mu\text{m}$; filamentous hyphae of volva $4-8 \mu\text{m}$ diam, moderately branched, clamps not observed: inflated cells of basal volva very similar to those on pileus with elliptic and ovoid cells larger, usually arranged in irregularly disposed, terminal chains; filamentous hyphae $3-8 \mu\text{m}$ diam, moderately branched, rarely clamped. STIPE TRAMA: filamentous hyphae up to $8 \mu\text{m}$ diam, sparsely branched, clamps rare; inflated cells up to $255 \times 32 \mu\text{m}$, clavate, terminal, longitudinally oriented.

SPORES: $8.7-10.2 \times 6.3-7.0 \mu\text{m}$ ($E = 1.24-1.49$; $E^m = 1.40$), broadly elliptic to elliptic, adaxially flattened, thin walled, smooth, hyaline, nonamyloid; contents guttulate; apiculus sublateral, cylindrical.

Typification. The specimen citation in the original description is very incomplete, and under ordinary circumstances would not suffice in type selection. However, this taxon appears to be rare, and Peck (1905) later stated that he had made no additional collections at Greenbush. Under these conditions I feel that the citation justifies the matching packet at NYS as the holotype (Lanjouw, 1966; Guide for the Determination of Types).

27. *Agaricus spretus* Peck. 1879. Rep. N. Y. St. Mus. 32: 24.
 \equiv *Amanita spreta* (Pk.) Sacc. 1887. Syll. Fung. 5: 12.
 Holotype (Implicit: *des. mihi*): Sandlake, 1878, C. H. Peck s.n. (NYS).

PILEUS: approximately 10 cm broad, plano-convex to plane, flesh thin, margin strongly striate, *whitish or pale brown*; no volval remnants on pileus surface. LAMELLAE: free to just reaching stipe, moderately crowded, *white*; lamellulae truncate. STIPE: approximately 20×1.5 cm, tapering slightly upward, expanded at apex, stuffed, *white*, basal bulb not inflated; annulus superior, submembranous, fragmentary; volva thin, membranous, saccate, up to 3.5 cm deep, often adhering to stipe.

PILEIPELLIS: densely interwoven, gelatinized, filamentous hyphae. PILEUS TRAMA: undifferentiated, filamentous hyphae and elongate, inflated cells. LAMELLA TRAMA: bilateral; filamentous hyphae approximately $7 \mu\text{m}$ diam, moderately branched, occasionally clamped; inflated cells elongate, terminal or short, terminal chains. SUBHYMENIUM: hyphae ramose, clamped. BASIDIA: up to $49 \times 4-14 \mu\text{m}$, 4-sterigmate, walls thin, frequently clamped. VOLVA: layered at the base of the stipe; outer layer almost exclusively filamentous hyphae, moderately branched, up to $8 \mu\text{m}$ diam, no clamps; inflated cells rare, broadly elliptic to oblong-elliptic, terminal; inner layer very similar but with a larger number of inflated cells. STIPE TRAMA: filamentous hyphae undifferentiated and inconspicuous, sparsely branched, no clamps seen; inflated cells longitudinally oriented, clavate, terminal, up to $469 \times 62.6 \mu\text{m}$. PARTIAL VEIL: filamentous hyphae up to $7 \mu\text{m}$ diam, moderately branched, clamped; inflated cells rare.

SPORES: $10.2-13.3 \times 5.5-7.0 \mu\text{m}$ ($E = 1.62-2.11$; $E^m = 1.86$), elongate to cylindrical, often adaxially flattened, hyaline, nonamyloid, thin

walled; contents guttulate; apiculus sublateral, cylindric.

28. *Amanita submaculata* Peck. 1900. Torr. Bot. Club Bull. 27: 609. Holotype (Implicit: *des. mihl*): North Carolina, vii. 1899, Miss M. L. Wilson s.n.(NYS).

PILEUS: approximately 7 cm broad, plano-convex, margin very slightly striate, dark brown, more or less marked by whitish stripes or spots; volval remnants as a single, floccose patch. LAMELLAE: moderately close, just reaching stipe, white. STIPE: approximately 6 x 0.6 cm, tapering slightly upward, expanded at apex, solid, white, basal bulb ovoid; annulus large, flaring membranous, very thin, white; no volval remnants remaining.

PILEIPELLIS: densely interwoven, gelatinized, filamentous hyphae. PILEUS TRAMA: undifferentiated, filamentous hyphae and elongate, inflated cells. LAMELLA TRAMA: bilateral; filamentous hyphae moderately branched, no clamps seen; inflated cells elongate, terminal or in short, terminal chains. BASIDIA: up to 60 x 5-14 μm , 4-sterigmate, thin walled, clamps not observed. VOLVA: filamentous hyphae on pileus relatively inconspicuous, sparsely branched, up to 7 μm diam, no clamps observed; inflated cells abundant, primarily subglobose to broadly elliptic, with a few oblong-elliptic, mostly terminal chains. STIPE TRAMA: filamentous hyphae sparsely branched, up to 7 μm diam, no clamps observed; inflated cells terminal, clavate, longitudinally oriented, up to 281 x 31 μm .

SPORES: 7.0-8.6 x 4.7-6.4 μm ($E = 1.22-1.83$; $E^{\text{III}} = 1.59$), broadly elliptic to elongate, often adaxially flattened, hyaline, amyloid, thin walled; contents guttulate; apiculus sublateral, cylindric.

29. *Amanitopsis velosa* Peck. 1895. Torr. Bot. Club Bull. 22: 485. \equiv *Amanita velosa* (Pk.) Lloyd. 1898. Volvae: 9,15. Holotype (Implicit: *des. mihl*): California - Pasadena, under Oak trees, iv. 1895, A. J. McClatchie s.n.(NYS).

PILEUS: approximately 5 cm broad, plane to plano-convex, margin slightly inrolled, striate, buff or orange-buff; volval remnants as large, whitish, felty patches, randomly distributed and frequently covering a large portion of the pileus. LAMELLAE: crowded, just reaching the stipe, pale cream color; lamellulae truncate. STIPE: approximately 9 x 0.6 cm, tapering upward, slightly at apex, stuffed, white or whitish, basal bulb not distinct; no annular remains; volva very thick and membranous-felty, remote or adhering to stipe.

PILEIPELLIS: densely interwoven, gelatinized, filamentous hyphae. PILEUS TRAMA: undifferentiated, filamentous hyphae and variform, inflated cells, terminal or short, terminal chains. LAMELLA TRAMA: bilateral; filamentous hyphae up to 8 μm diam, moderately branched, no clamps; inflated cells mostly elongate, terminal or short, terminal chains. SUBHYMENIUM: hyphae ramose to slightly inflated ramose, no clamps. BASIDIA: up to 62 x 5.6-15 μm , 4-sterigmate, walls thin, no clamps. VOLVA: on pileus composed primarily of filamentous hyphae, irregularly disposed, moderately branched, up to 8 μm diam, no clamps;

inflated cells usually elliptic, up to $78.3 \times 46.9 \mu\text{m}$, terminal: tissue of volva at the stipe base very similar to that of pileus, but with a slightly larger number of inflated cells. STIPE TRAMA: filamentous hyphae undifferentiated and quite abundant, sparsely branched, up to $7 \mu\text{m}$ diam, no clamps; inflated cells terminal, clavate, longitudinally oriented, up to $343 \times 43 \mu\text{m}$.

SPORES: $9.4\text{--}10.9 \times 7.8\text{--}9.4 \mu\text{m}$ ($\underline{E} = 1.09\text{--}1.27$; $\underline{E}^{\text{m}} = 1.16$), subglobose to broadly elliptic, often adaxially flattened, hyaline, non-amyloid, thin walled; contents guttulate; apiculus sublateral, truncate-conic.

30. *Agaricus volvatus* Peck. 1872. Rep. N. Y. St. Mus. 24: 59.

= *Amanita volvata* (Pk.) Lloyd. 1898. Volvae: 9, 15.

Holotype (Implicit: *des. mihi*): Greenbush, no date, C. H. Peck s.n. (NYS).

PILEUS: approximately 4.7 cm broad, plano-convex, flesh moderately thick, margin faintly striate, *whitish, the disk pale brown*; volval remnants as thin, floccose patches, randomly distributed, but concentrated on disc. LAMELLAE: free, crowded, *white*. STIPE: approximately 6×0.7 cm, tapering upward, slightly expanded at apex, stuffed, *whitish*; no annulus; volva saccate, thick membranous, margin lobed, up to 3.5 cm deep.

PILEIPELLIS: densely interwoven, slightly gelatinized, filamentous hyphae. PILEUS TRAMA: undifferentiated, filamentous hyphae, up to $9 \mu\text{m}$ diam, and elongate, inflated cells. LAMELLA TRAMA: bilateral; filamentous hyphae up to $7 \mu\text{m}$ diam, moderately branched, no clamps observed; inflated cells elongate, terminal or short, terminal chains. BASIDIA: up to $46 \times 4\text{--}11 \mu\text{m}$, 4-sterigmate, thin walled, no clamps observed. VOLVA: at base of stipe layered; outer layer composed primarily of filamentous hyphae, up to $9 \mu\text{m}$ diam, moderately branched, no clamps observed; inflated cells few, broadly elliptic up to $72 \times 59.5 \mu\text{m}$, and elongate up to $78.3 \times 21.9 \mu\text{m}$, terminal; inner layer very similar, but with a greater number of inflated cells: volval material on pileus very similar to that on the inside layer of the basal volva. STIPE TRAMA: filamentous hyphae inconspicuous, sparsely branched, up to $7 \mu\text{m}$ diam, no clamps observed; inflated cells terminal, clavate, longitudinally oriented, up to $218 \times 21 \mu\text{m}$.

SPORES: $8.6\text{--}10.2 \times 5.5\text{--}7.0 \mu\text{m}$ ($\underline{E} = 1.34\text{--}1.58$; $\underline{E}^{\text{m}} = 1.48$), elliptic, often adaxially flattened, hyaline, amyloid, thin walled; contents guttulate; apiculus sublateral, cylindrical.

31. *Amanitopsis volvata* var. *elongata* Peck. 1900. Rep. N. Y. St. Mus. 53: 856, pl. A, fig. 6-10.

Holotype (Implicit: *des. mihi*): Claryville, no date, C. H. Peck s.n. (NYS).

PILEUS: approximately 6.3 cm broad, plano-convex to plane, *white*, margin slightly striate, glabrous, flesh moderately thin; no volval remnants remaining. LAMELLAE: free, moderately crowded. STIPE: approximately 10×0.7 cm, tapering slightly upward, slightly

floccose-mealy; basal bulb elliptic; no annular remains; volva saccate, membranous, moderately thick, lobed, up to 2 cm deep.

PILEIPELLIS: densely interwoven, gelatinized, filamentous hyphae. PILEUS TRAMA: undifferentiated, filamentous hyphae, up to 8 μm diam, moderately branched and elongate, inflated cells. LAMELLA TRAMA: bilateral; filamentous hyphae up to 8 μm diam, moderately branched, no clamps; inflated cells elongate, terminal or short, terminal chains. SUBHYMENIUM: hyphae ramose to inflated ramose, no clamps observed. BASIDIA: up to 47 x 4-7.8 μm , 4-sterigmate, thin walled, clamps not observed. VOLVA: filamentous hyphae at base of stipe moderately branched, up to 8 μm diam, clamps not observed; inflated cells elliptic to clavate, terminal, up to 93.9 x 31.3 μm , with a very few, small, subglobose to elliptic. STIPE TRAMA: filamentous hyphae sparsely branched, up to 9 μm diam, no clamps seen; inflated cells terminal, clavate, longitudinally oriented, up to 249 x 21.9 μm .

SPORES: 10.2-11.7 x 4.7-6.2 μm ($\bar{E} = 1.85-2.32$; $\bar{E}^m = 2.02$), elongate to cylindrical, often adaxially flattened, hyaline, amyloid, thin walled; contents guttulate; apiculus sublateral, cylindrical to truncate-conic.

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A NEW STATUS FOR THE BROWN *PARMELIAE*

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Generic concepts in lichens have been undergoing extremely rapid change recently, especially in large and ubiquitous families like the Parmeliaceae. In his work with the large and heterogeneous genus *Parmelia*, Hale (1974 a, b, c, d; 1976) has created eight new segregate genera just since 1974. Recently (Esslinger, 1977), I published a revision of the brown species of *Parmelia* in which three major infrageneric taxa, the subgenera *Allantoparmelia*, *Melanoparmelia*, and *Neofusca*, were recognized. At the time of the original research and writing of that paper, I wavered between treating the three taxa as independent genera or as subgenera, deciding finally to follow the more conservative path of recognition as subgenera. The time span between writing the paper and its final publication proved to be rather long, however, and well before it appeared in print, I was convinced that recognition at the level of genus would have been more natural and more indicative of the remote relationships between the three taxa involved. The descriptions and/or new combinations necessitated by recognition at the level of genus are presented below. The evidence supporting the recognition of three independent taxa are presented in my original paper and will not be repeated here.

The following key outlines the major distinctions between the three genera to be recognized. As with most genera, there is no single character that will distinguish between any two of the three. Rare exceptions to almost all character differences do occur, hence the relative complexity of the key.

-Lower surface erhizinate and the upper cortex HNO_3 -; foliose to subcrustose species characteristic of rock (or rarely soil) substrates in boreal or arctic-alpine areas..... *Allantoparmelia*

-Lower surface rhizinate or the upper cortex HNO_3^+ blue-green or both

-Upper cortex HNO_3^+ blue-green or rarely violet (in one North American species and one South African species); foliose to commonly subcrustose or subfruticose species characteristic of rock or soil substrates primarily in temperate areas.....

..... *Neofuscelia*

-Upper cortex HNO_3^- (rarely HNO_3^+ violet in two eurasian species); foliose species of diverse substrates (including rock), most common in north temperate to boreal or arctic-alpine areas.....

..... *Melanelia*

ALLANTOPARMELIA (Vain.) Essl., stat. nov.

Basionym: *Parmelia* subgenus *Allantoparmelia* Vain.,
Ark. Bot. 8(4): 32. 1909.

Type species: *Allantoparmelia alpicola* (Th. Fr.) Essl.

Allantoparmelia almquistii (Vain.) Essl., comb. nov.

Basionym: *Parmelia almquistii* Vain., Ark. Bot. 8(4):
32. 1909.

Allantoparmelia alpicola (Th. Fr.) Essl., comb. nov.

Basionym: *Parmelia alpicola* Th. Fr., Lichenes Arctoi:
57. 1860.

Allantoparmelia sibirica (Zahlbr.) Essl., comb. nov.

Basionym: *Parmelia sibirica* Zahlbr., Catalog. Lichen.
Univers. 6: 47. 1930. (as nom. nov. for *P. nigra*
Vain., Ark. Bot. 8(4): 31. 1909).

MELANELIA Essl., gen. nov.

Thallus foliosus, laxis vel modice adnatus, lobis 0.4-1.1 mm latis, brevibus et rotundatis vel elongatis, plus minusve planis. Superne vulgo sorediatus isidiatus vel pseudocyphellatus, HNO_3 non reagens vel raro HNO_3^+ violaceus. Subtus modice vel sparse rhizinosus.

Type species: *Melanelia stygia* (L.) Essl.

Synonym: *Parmelia* subgenus *Melanoparmelia* (Hue) Essl.,
J. Hattori Bot. Lab. 42: 46. 1977.

subgenus *MELANELIA*

Melanelia disjuncta (Erichs.) Essl., comb. nov. Basionym:
Parmelia disjuncta Erichs., Ann. Mycol. 37: 78. 1939.
(as nom. nov. for *P. sorediata* var. *coralloidea* Lynge,
Lichens from Novaya Zemlya: 200. 1928).

Melanelia panniformis (Nyl.) Essl., comb. nov. Basionym:
Parmelia prolixa f. *panniformis* Nyl., Synop. Method.
Lichen.: 397. 1860.

- Melanelia predisjuncta* (Essl.) Essl., comb. nov. Basionym:
Parmelia predisjuncta Essl., J. Hattori Bot. Lab. 42:
50. 1977.
- Melanelia sorediosa* (Almb.) Essl., comb. nov. Basionym:
Parmelia sorediosa Almb. in Krok & Almquist, Svensk
Flora for Skolor 2, Kryptogamer, ed. 6: 134. 1947.
(as nom. nov. for *P. sorediata* (Ach.) Th. Fr., Lichenes
Arctoi: 56. 1860. Basionym: *Parmelia stygia* β. *P.*
sorediata Ach., Lichenogr. Univers.: 471. 1810).
- Melanelia stygia* (L.) Essl., comb. nov. Basionym: *Lichen*
stygius L., Spec. Pl. 2: 1143. 1753.
- Melanelia substygia* (Räs.) Essl., comb. nov. Basionym:
Parmelia substygia Räs., Lichenes Fenniae Exs. 51.
1935.
- subgenus *OLIVASCENTES* (Harm.) Essl., stat. nov. Basionym:
Parmelia sect. *Amphigymnia* A. *Olivascentes* Harm.,
Lichens de France 4: 571. 1909. Type species:
Melanelia acetabulum (Neck.) Essl.
- Melanelia acetabulum* (Neck.) Essl., comb. nov. Basionym:
Lichen acetabulum Neck., Delic. Gallo-Belgic. Silvestr.
2: 506. 1768.
- Melanelia koflerae* (Clauzade & Poelt) Essl., comb. nov.
Basionym: *Parmelia koflerae* Clauzade & Poelt, Nova
Hedwigia 3: 368. 1961.
- subgenus *VAINIOËLLAE* (Gyeln.) Essl., stat. nov. Basionym:
Parmelia subgenus *Euparmelia* sect. *Vainioëllae* Gyeln.,
Repert. Spec. Nov. Regni Veg. 30: 220. 1932. Type
species: *Melanelia glabra* (Schaer.) Essl.
- Melanelia albertana* (Ahti) Essl., comb. nov. Basionym:
Parmelia albertana Ahti, Bryologist 72: 236. 1969.
- Melanelia calva* (Essl.) Essl., comb. nov. Basionym: *Par-*
melia calva Essl., J. Hattori Bot. Lab. 42: 60. 1977.
- Melanelia elegantula* (Zahlbr.) Essl., comb. nov. Basionym:
Parmelia olivacea * *P. aspidota* var. *elegantula* Zahlbr.,
Verh. Vereins Natur- und Heilk. Pressburg 8: 39.
1894.
- Melanelia exasperata* (De Not.) Essl., comb. nov. Basionym:
Parmelia exasperata De Not., Giorn. Bot. Ital. 2: 193.
1847.
- Melanelia exasperatula* (Nyl.) Essl., comb. nov. Basionym:
Parmelia exasperatula Nyl., Flora 56: 299. 1873.
- Melanelia fuscosediata* (Essl.) Essl., comb. nov. Basionym:
Parmelia fuscosediata Essl., J. Hattori Bot. Lab. 42:
68. 1977.
- Melanelia glabrata* (Lamy) Essl., comb. nov. Basionym:

Parmelia olivacea a *corticola* a *glabra* Schaer., Lichenum Helveticorum Spicilegium: 466. 1840.

Melanelia glabratula (Lamy) Essl., comb. nov. Basionym: *Parmelia fuliginosa* * *P. glabratula* Lamy, Bull. Soc. Bot. France 30: 353. 1883.

Melanelia glabratuloides (Essl.) Essl., comb. nov. Basionym: *Parmelia glabratuloides* Essl., J. Hattori Bot. Lab. 42: 72. 1977.

Melanelia glabroides (Essl.) Essl., comb. nov. Basionym: *Parmelia glabroides* Essl., J. Hattori Bot. Lab. 42: 72. 1977.

Melanelia halei (Ahti) Essl., comb. nov. Basionym: *Parmelia halei* Ahti, Acta Bot. Fenn. 70: 38. 1966.

Melanelia huei (Asah.) Essl., comb. nov. Basionym: *Parmelia huei* Asah., J. Jap. Bot. 26: 194. 1951.

Melanelia infumata (Nyl.) Essl., comb. nov. Basionym: *Parmelia infumata* Nyl., Flora 58: 359. 1875.

Melanelia laciniatula (Flag. ex Oliv.) Essl. comb. nov. Basionym: *Parmelia exasperatula* var. *laciniatula* Flag. ex Oliv., Rev. Bot. Bull. Mens. 12: 69. 1894.

Melanelia multispora (Schneid.) Essl., comb. nov. Basionym: *Parmelia multispora* Schneid., A Guide to the Study of Lichens: 154. 1898.

Melanelia olivacea (L.) Essl., comb. nov. Basionym: *Lichen olivaceus* L., Spec. Pl.: 1143. 1753.

Melanelia olivaceoides (Krog) Essl., comb. nov. Basionym: *Parmelia olivaceoides* Krog, Norsk Polarinst. Skr. 144: 109. 1968.

Melanelia piliferella (Essl.) Essl., comb. nov. Basionym: *Parmelia piliferella* Essl., J. Hattori Bot. Lab. 42: 83. 1977.

Melanelia pseudoglabra (Essl.) Essl., comb. nov. Basionym: *Parmelia pseudoglabra* Essl., J. Hattori Bot. Lab. 42: 84. 1977.

Melanelia septentrionalis (Lynge) Essl., comb. nov. Basionym: *Parmelia olivacea* var. *septentrionalis* Lynge, Bergens Mus. Arbok 1912(10): 4. 1912.

Melanelia subargentifera (Nyl.) Essl., comb. nov. Basionym: *Parmelia subargentifera* Nyl., Flora 58: 359. 1875.

Melanelia subaurifera (Nyl.) Essl., comb. nov. Basionym: *Parmelia subaurifera* Nyl., Flora 56: 22. 1873.

Melanelia subelegantula (Essl.) Essl., comb. nov. Basionym: *Parmelia subelegantula* Essl., J. Hattori Bot. Lab. 42: 89. 1977.

Melanelia subglabra (Ras.) Essl., comb. nov. Basionym: *Parmelia subaurifera* var. *subglabra* Ras., Ann. Bot. Soc. Zool.-Bot. Fenn. "Vanamo" 2: 19. 1932.

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Parmelia subolivacea Nyl. in Hasse, Bull. Torrey Bot.
Club 24: 445. 1897.
- Melanelia trabeculata* (Ahti) Essl., comb. nov. Basionym:
Parmelia trabeculata Ahti, Acta Bot. Fenn. 70: 54.
1966.
- Melanelia ushuaiensis* (Zahlbr.) Essl., comb. nov. Basio-
nym: *Parmelia ushuaiensis* Zahlbr., Kungl. Svenska
Vetenskapsakad. Handl. 57: 42. 1917.
- Melanelia villosella* (Essl.) Essl., comb. nov. Basionym:
Parmelia villosella Essl., J. Hattori Bot. Lab. 42:
95. 1977.
- Melanelia zopheroa* (Essl.) Essl., comb. nov. Basionym:
Parmelia zopheroa Essl., J. Hattori Bot. Lab. 42: 96.
1977.

NEOFUSCELIA Essl., gen. nov.

Thallus foliosus vel interdum subcrustus vel sub-
fruticosus, laxis vel arctis adnatis, lobis 0.1-5 mm latis,
brevibus et rotundatis vel lineari-elongatis, plus minusve
planis vel convexis. Superne sorediis pseudocyphellisque
destitutis, vulgo isidiatis; persaepe HNO_3 + aeruginosus vel
atrovirens, raro HNO_3 + violaceus vel non reagans. Subtus
plerumque rhizinosus.

Type species: *Neofuscelia pulla* (Ach.) Essl.

Synonym: *Parmelia* subgenus *Neofusca* (Gyeln.) Essl.,
J. Hattori Bot. Lab. 42: 97. 1977.

subgenus **NEOFUSCELIA**

- Neofuscelia adpicta* (Zahlbr.) Essl., comb. nov. Basionym:
Parmelia adpicta Zahlbr., Akad. Wiss. Math.-Naturwiss.
Kl., Denkschr. 104: 351. 1941.
- Neofuscelia ahtii* (Essl.) Essl., comb. nov. Basionym: *Par-*
melia ahtii Essl., J. Hattori Bot. Lab. 42: 99.
1977.
- Neofuscelia applicata* (Stizenb.) Essl., comb. nov. Basio-
nym: *Parmelia prolixa* var. *applicata* Stizenb., Ber.
Thatigk. St. Gall. Naturwiss. Ges. 1887-88: 163.
1889.
- Neofuscelia attica* (Leuckert et al.) Essl., comb. nov.
Basionym: *Parmelia prolixa* var. *attica* Leuckert et
al. in Vězda, Lich. Sel. Exs. 1069. 1972.
- Neofuscelia atticoides* (Essl.) Essl., comb. nov. Basionym:
Parmelia atticoides Essl., J. Hattori Bot. Lab. 42:
101. 1977.
- Neofuscelia brattii* (Essl.) Essl., comb. nov. Basionym:
Parmelia brattii Essl. in C. F. Culb. & Essl., Bryolo-
gist 79: 42. 1976.

- Neofuscelia brunella* (Essl.) Essl., comb. nov. Basionym: *Parmelia brunella* Essl., J. Hattori Bot. Lab. 42: 103. 1977.
- Neofuscelia cafferensis* (Essl.) Essl., comb. nov. Basionym: *Parmelia cafferensis* Essl., J. Hattori Bot. Lab. 42: 104. 1977.
- Neofuscelia caliginosa* (Essl.) Essl., comb. nov. Basionym: *Parmelia caliginosa* Essl., J. Hattori Bot. Lab. 42: 105. 1977.
- Neofuscelia conturbata* (Müll. Arg.) Essl., comb. nov. Basionym: *Parmelia conturbata* Müll. Arg., Flora 71: 9. 1888.
- Neofuscelia crustulosa* (Essl.) Essl., comb. nov. Basionym: *Parmelia crustulosa* Essl., J. Hattori Bot. Lab. 42: 106. 1977.
- Neofuscelia delisei* (Duby) Essl., comb. nov. Basionym: *Parmelia olivacea* var. *delisei* Duby, Botan. Gall. 2: 602. 1830.
- Neofuscelia dregeana* (Hampe) Essl., comb. nov. Basionym: *Parmelia dregeana* Hampe in Nyl., Syn. Method. Lichen.: 398. 1858-60.
- Neofuscelia ephoboides* (Zahlbr.) Essl., comb. nov. Basionym: *Parmelia ephoboides* Zahlbr., Akad. Wiss. Wien. Math.-Naturwiss. Kl., Denkschr. 104: 353. 1941.
- Neofuscelia erythrocardia* (Müll. Arg.) Essl., comb. nov. Basionym: *Parmelia prolixa* var. *erythrocardia* Müll. Arg., Flora 62: 290. 1879.
- Neofuscelia fissurina* (Zahlbr.) Essl., comb. nov. Basionym: *Parmelia fissurina* Zahlbr., Ann. Mycol. 34: 172. 1936.
- Neofuscelia foveolata* (Essl.) Essl., comb. nov. Basionym: *Parmelia foveolata* Essl., J. Hattori Bot. Lab. 42: 111. 1977.
- Neofuscelia glabrans* (Nyl.) Essl., comb. nov. Basionym: *Parmelia glabrans* Nyl., Flora 58: 15. 1875.
- Neofuscelia imitatrix* (Tayl.) Essl., comb. nov. Basionym: *Parmelia imitatrix* Tayl., Lond. J. Bot. 63: 161. 1847.
- Neofuscelia incantata* (Essl.) Essl., comb. nov. Basionym: *Parmelia incantata* Essl., J. Hattori Bot. Lab. 42: 115. 1977.
- Neofuscelia incomposita* (Essl.) Essl., comb. nov. Basionym: *Parmelia incomposita* Essl., J. Hattori Bot. Lab. 42: 116. 1977.
- Neofuscelia infrapallida* (Essl.) Essl., comb. nov. Basionym: *Parmelia infrapallida* Essl., J. Hattori Bot. Lab. 42: 116. 1977.

- Neofuscelia kenyana* (Essl.) Essl., comb. nov. Basionym:
Parmelia kenyana Essl., J. Hattori Bot. Lab. 42: 117.
1977.
- Neofuscelia lichinoidea* (Nyl. ex Crombie) Essl., comb. nov.
Basionym: *Parmelia lichinoidea* Nyl. ex Crombie, J.
Bot. 14: 19. 1876.
- Neofuscelia lineella* (Essl.) Essl., comb. nov. Basionym:
Parmelia lineella Essl., J. Hattori Bot. Lab. 42: 118.
1977.
- Neofuscelia loriloba* (Essl.) Essl., comb. nov. Basionym:
Parmelia loriloba Essl., J. Hattori Bot. Lab. 42: 119.
1977.
- Neofuscelia loxodella* (Essl.) Essl., comb. nov. Basionym:
Parmelia loxodella Essl. in C.F. Culb. & Essl., Bryol-
ogist 79: 43. 1976.
- Neofuscelia loxodes* (Nyl.) Essl., comb. nov. Basionym:
Parmelia loxodes Nyl., Flora 55: 426. 1872.
- Neofuscelia luteonotata* (J. Stein.) Essl., comb. nov. Bas-
ionym: *Parmelia luteonotata* J. Stein., Verh. K. K.
Zool.-Bot. Ges. Wien 12: 472. 1902.
- Neofuscelia martinii* (Essl.) Essl., comb. nov. Basionym:
Parmelia martinii Essl., J. Hattori Bot. Lab. 42:
123. 1977.
- Neofuscelia melancholica* (J. Stein. & Zahlbr.) Essl., comb.
nov. Basionym: *Parmelia melancholica* J. Stein. &
Zahlbr. in Zahlbr., Bot. Jahrb. Syst. 60: 507. 1926.
- Neofuscelia melanobarbatica* (Essl.) Essl., comb. nov. Bas-
ionym: *Parmelia melanobarbatica* Essl., J. Hattori Bot.
Lab. 42: 124. 1977.
- Neofuscelia minuta* (Essl.) Essl., comb. nov. Basionym:
Parmelia minuta Essl., J. Hattori Bot. Lab. 42: 125.
1977.
- Neofuscelia nakuruensis* (Essl.) Essl. comb. nov. Basionym:
Parmelia nakuruensis Essl., J. Hattori Bot. Lab. 42:
126. 1977.
- Neofuscelia namaënsis* (J. Stein. & Zahlbr.) Essl., comb.
nov. Basionym: *Parmelia namaënsis* J. Stein. & Zahlbr.
in Zahlbr. Bot. Jahrb. Syst. 60: 508. 1926.
- Neofuscelia occidentalis* (Essl.) Essl., comb. nov. Basio-
nym: *Parmelia occidentalis* Essl., J. Hattori Bot. Lab.
42: 128. 1977.
- Neofuscelia parviloba* (Essl.) Essl., comb. nov. Basionym:
Parmelia parviloba Essl., J. Hattori Bot. Lab. 42: 129.
1977.
- Neofuscelia peloloba* (Essl.) Essl., comb. nov. Basionym:
Parmelia peloloba Essl., J. Hattori Bot. Lab. 42: 129.
1977.

- Neofuscelia petriseda* (Zahlbr.) Essl., comb. nov. Basionym: *Parmelia petriseda* (Zahlbr., Akad. Wiss. Wien., Math.-Naturwiss. Kl., Denkschr. 104: 352. 1941.
- Neofuscelia pictada* (Essl.) Essl., comb. nov. Basionym: *Parmelia pictada* Essl. in C. F. Culb. et al., Bryologist 80: 131. 1977.
- Neofuscelia plana* (Essl.) Essl., comb. nov. Basionym: *Parmelia plana* Essl., J. Hattori Bot. Lab. 42: 132. 1977.
- Neofuscelia pokornyi* (Essl.) Essl., comb. nov. Basionym: *Imbricaria pokornyi* Korb. in Pokorny, Verh. K.-K. Zool.-Bot. Ges. Wien 10: 285. 1860.
- Neofuscelia prolixula* (Nyl. ex Crombie) Essl., comb. nov. Basionym: *Parmelia prolixula* Nyl. ex Crombie, J. Bot. 14: 19. 1876.
- Neofuscelia pulla* (Ach.) Essl. comb. nov. Basionym: *Parmelia pulla* Ach., Synop. Method. Lichen.: 206. 1814.
- Neofuscelia pulloides* (Essl.) Essl., comb. nov. Basionym: *Parmelia pulloides* Essl., J. Hattori Bot. Lab. 42: 138. 1977.
- Neofuscelia pustulosa* (Essl.) Essl. comb. nov. Basionym: *Parmelia pustulosa* Essl., J. Hattori Bot. Lab. 42: 139. 1977.
- Neofuscelia pyrenaica* (Essl.) Essl., comb. nov. Basionym: *Parmelia pyrenaica* Essl., J. Hattori Bot. Lab. 42: 140. 1977.
- Neofuscelia ryssolea* (Ach.) Essl., comb. nov. Basionym: *Dufourea ryssolea* Ach., Lichenogr. Univers.: 525. 1810.
- Neofuscelia scabrella* (Essl.) Essl., comb. nov. Basionym: *Parmelia scabrella* Essl. in C. F. Culb. et al., Bryologist 80: 134. 1977.
- Neofuscelia serpulina* (Essl.) Essl., comb. nov. Basionym: *Parmelia serpulina* Essl., J. Hattori Bot. Lab. 42: 143. 1977.
- Neofuscelia spesica* (Essl.) Essl., comb. nov. Basionym: *Parmelia spesica* Essl., J. Hattori Bot. Lab. 42: 143. 1977.
- Neofuscelia squamans* (Stizenb.) Essl., comb. nov. Basionym: *Parmelia squamans* Stizenb., Ber. Thatigk. St. Gall. Naturwiss. Ges. 1887-88: 164. 1889.
- Neofuscelia squamariata* (Nyl. ex Crombie) Essl., comb. nov. Basionym: *Parmelia squamariata* Nyl. ex Crombie, J. Bot. 14: 19. 1876.
- Neofuscelia stygiodes* (Nyl. ex Crombie) Essl., comb. nov. Basionym: *Parmelia stygiodes* Nyl. ex Crombie, J. Bot. 13: 333. 1875.
- Neofuscelia subhosseana* (Essl.) Essl., comb. nov. Basionym: *Parmelia subhosseana* Essl., J. Hattori Bot. Lab. 42: 148. 1977.

- Neofuscelia subimitatrix* (Essl.) Essl., comb. nov. Basionym: *Parmelia subimitatrix* Essl., J. Hattori Bot. Lab. 42: 149. 1977.
- Neofuscelia subincerta* (Essl.) Essl., comb. nov. Basionym: *Parmelia subincerta* Essl., J. Hattori Bot. Lab. 42: 150. 1977.
- Neofuscelia subverrucella* (Essl.) Essl., comb. nov. Basionym: *Parmelia subverrucella* Essl. in C. F. Culb. et al., Bryologist 80: 133. 1977.
- Neofuscelia tatimirix* (Essl.) Essl., comb. nov. Basionym: *Parmelia tatimirix* Essl., J. Hattori Bot. Lab. 42: 151. 1977.
- Neofuscelia tentaculina* (Essl.) Essl., comb. nov. Basionym: *Parmelia tentaculina* Essl., J. Hattori Bot. Lab. 42: 151. 1977.
- Neofuscelia trachythallina* (Essl.) Essl., comb. nov. Basionym: *Parmelia trachythallina* Essl., J. Hattori Bot. Lab. 42: 152. 1977.
- Neofuscelia verisidiosa* (Essl.) Essl., comb. nov. Basionym: *Parmelia verisidiosa* Essl., J. Hattori Bot. Lab. 42: 153. 1977.
- Neofuscelia verrucella* (Essl.) Essl., comb. nov. Basionym: *Parmelia verrucella* Essl. in C. F. Culb. et al., Bryologist 42: 154. 1977.
- Neofuscelia verruculifera* (Nyl.) Essl., comb. nov. Basionym: *Parmelia verruculifera* Nyl., Flora 61: 247. 1878.
- Neofuscelia waiporiensis* (Hillm.) Essl., comb. nov. Basionym: *Parmelia waiporiensis* Hillm., Repert. Spec. Nov. Regni Veg. 45: 173. 1938.
- subgenus *ATROVIRIDIS* (Essl.) Essl., stat. nov. Basionym: *Parmelia* subgenus *Neofusca* section *Atroviridis* Essl., J. Hattori Bot. Lab. 42: 157. 1977. Type species: *Neofuscelia atroviridis* (Essl.) Essl.
- Neofuscelia atroviridis* (Essl.) Essl., comb. nov. Basionym: *Parmelia atroviridis* Essl., J. Hattori Bot. Lab. 42: 157. 1977.
- Neofuscelia chiricahuensis* (R. Anderson & W. Web.) Essl., comb. Basionym: *Parmelia chiricahuensis* R. Anderson & W. Web., Bryologist 65: 234. 1962.

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A NEW MEXICAN SPECIES IN THE LICHEN GENUS
EVERNIASTRUM HALE (PARMELIACEAE)

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Hale (1976) established the lichen genus *Everniastrum* to include species previously grouped in *Parmelia* subgenus *Everniiformes* (Hue) Hale & Wirth (Hale & Wirth, 1971). Hale's (1976) synopsis of *Everniastrum* included 21 species of which 12 are known from Mexico. This paper describes a new species, *Everniastrum mexicanum* Egan, the thirteenth Mexican taxon.

EVERNIASTRUM MEXICANUM Egan, sp. nov.

Thallus (Fig. 1) ut in *Everniastrum neocirrhatum* (Hale & Wirth) Hale sed differt acidum protocetraricum continente.

Thallus subfruticose, to 15 cm broad, mineral gray above; lobes linear, 1-2 mm wide, elongate, channeled, with a pored epicortex (Fig. 3), lacking soredia and isidia; margins of lobes sparsely short ciliate (Fig. 4); lower surface smooth and very sparsely rhizinate, colored white to tan near the ends of the lobes, turning brown to black toward the center of the thallus; apothecia frequent, up to 8 mm in diameter, imperforate, subterminal; pycnidia common; white maculae inconspicuous or lacking; asci globose; spores hyaline, non-septate, ellipsoid or kidney bean-shaped, 8 per ascus, 7-10 x 14-18 μ m.

Chemistry: cortex K+ yellow, medulla K-, C-, KC-, P+ orange-red, atranorin and protocetraric acid.

Holotype: MEXICO. Jalisco: Municipio de Jalpa, Cumbre del Tejamanil, pine-oak forest, 2200 m, on trees, R. Gonzáles, 25 October 1971 (US; isotypes at Texas A&M University-Biology Department Herbarium, and MIN). Since

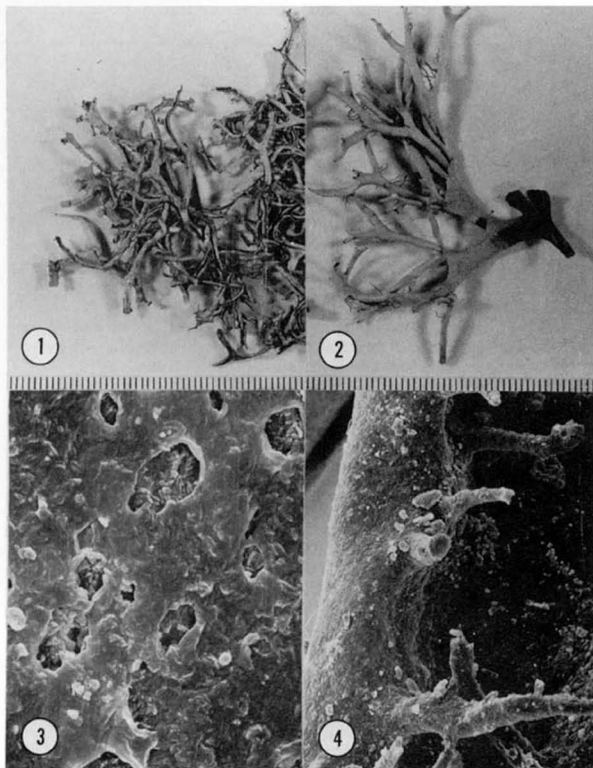


Figure 1: *Everniastrum mexicanum*, portion of the holotype (US). Scale in mm. Figure 2: *E. pachydermum*, portion of *B. Rambo 102* from Porto Alegre, Brazil (US). Scale in mm. Figure 3: *E. mexicanum*, SEM photograph of upper surface showing pored epicortex (X 2000). Figure 4: *E. mexicanum*, SEM photograph of a single lobe showing marginal cilia and rhizines (X 160).

material upon which this species is based was sent in exchange from Dr. Gastón Guzmán in Mexico City, I assume that an additional isotype may also be located at ENCB. The material I received was abundant in the packet and chemically uniform.

As in several other *Everniastrum* species, *E. mexicanum* is morphologically indistinguishable from *E. neocirrhatum* (Hale & Wirth) Hale, the most widespread and abundant *Everniastrum* species in Mexico (Hale, 1976). Chemically it is identical to *E. limaeforme* (Tayl.) Hale (Hale, pers. comm.), *E. arsenei* (Hale & Wirth) Hale, and *E. pachydermum* (Hue) Hale, all producing the medullary depsidone protocetraric acid. However, *E. limaeforme* is isidiate, *E. arsenei* is very densely rhizinate below, and *E. pachydermum* is a more robust, coriaceous plant with broader lobes, longer and more abundant cilia and rhizines, a black lower surface, and distinct white maculae on the upper surface (Fig. 2). It grows on rocks and soil in southern Brazil, Argentina, and Uruguay (Hale, 1976). *E. neocirrhatum*, although morphologically identical, produces norstictic, salazinic, and protolichesterinic acids.

I thank Dr. Mason E. Hale, Jr. (US) for the loan of material of *E. pachydermum* for comparison and for his critical comments on the manuscript. I thank Dr. Gastón Guzmán (ENCB) for sending the material of this new species.

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PEZIZA UMBILICATA KARSTEN, AN OLDER
BUT UNAVAILABLE NAME FOR PEZIZA OSTRACODERMA,
APOTHECIAL PEAT MOULD

HENRY DISSING

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For many years the junior author avoided proposing a new species in the genus *Peziza* for what he considered to be an undescribed species with the peculiar anamorphic state now known as *Chromelosporium fulvum* (Link) McGinty, Hennebert & Korf in Hennebert & Korf, or as *C. ollare* (Pers.) Hennebert. This is the common "peat mould" of greenhouses, mushroom beds and firesites known also under a variety of misapplied names (Hennebert & Korf, 1975). When the apothecial (teleomorphic) state was described as a new species, *Plicaria fulva* Schneider (1954), the junior author was unable to transfer that epithet to *Peziza* because of an earlier homonym, *P. fulva* Micheli ex Persoon (1822), and he thus proposed a new name for Schneider's discomycete, *Peziza ostracoderma* Korf (1961).

One additional name was later found (Hennebert & Korf, 1975) for the apothecial state, *Discina cinerophila* Sturgis in Ellis & Everhart, published in 1896, but without a description and hence not validly published and unusable.

The senior author has recently discovered that P. A. Karsten described this species from Scandinavia a century ago as *Peziza umbilicata* Karsten (1868), with a description on the label of his Fungi Fenniae Exsiccati #729. We have both compared Karsten's exsiccati with recent collections of *Peziza ostracoderma*, and there is no doubt that they are synonyms. Cooke (1877) failed to illustrate the reticulum (FIG. 1) on the ascospores, which were shown as warted; Schneider (1954)



FIG. 1. *Photomicrographs of ascospores from Karsten, F. Fenn. Exs. 729(K), ×2000. Photos by H.D.*

made the same error in interpretation of the spore ornamentation, corrected by Korf (1961). We have chosen the Kew Herbarium specimen of Karsten, *Fungi Fenniae Exsiccati* #729 as the LECTOTYPE for this name; other portions of this collection in other herbaria become ISOLECTOTYPES of *P. umbilicata*.

Unfortunately, Karsten's name cannot be applied to the apothecial state of peat mould when it is treated in *Peziza* since it is a later homonym of the much earlier *P. umbilicata* Persoon (1822). [A still later homonym, *P. umbilicata* Berk. & Curt. *in* Berkeley (1875), does not affect Karsten's name.] Karsten's name is surely worthy of note in that it provides the earliest available epithet which can and should be used if the apothecial state of peat mould is treated in another genus (though in the process it will lose direct reference to Karsten). As a later homonym, Karsten's name is illegitimate [Art. 64, International Code of Botanical Nomenclature (Stafleu, 1972)]. But when Saccardo (1889) catalogued Karsten's species as "*Discina umbilicata* Karst.," the epithet took on new life since there was no earlier homonym of it in that genus; the correct author citation for it is *D. umbilicata* Sacc., not *D. umbilicata* (Karst.) Sacc. as one might normally assume (Art. 72, Note, ICBN). Since some authors do not circumscribe *Peziza* in the way we do, but would prefer to range the species in *Galactinia*, *Plicaria*, or some other genus, Saccardo's epithet should be used there in a new combination, not Schneider's (1954) nor Korf's (1961). The type specimen of Saccardo's name is automatically Karsten's type specimen, designated above.

Hennebert & Korf (1975) provided a full synonymy of both the anamorphic and the teleomorphic states of peat mould. The apothecial (teleomorphic) synonymy should be expanded from that given by them:

- PEZIZA OSTRACODERMA Korf in *Mycologia* 52: 650. 1961 ('1960'), a name change.
- ≡ *Plicaria fulva* Schneider in *Zentralbl. Bakteriolog. Hyg.* 2 Abt. 108: 153. 1954, non *Peziza fulva* [Mich.] Pers. 1822.
- = *Peziza umbilicata* Karst., *Fungi Fenn. Exs.* 729. 1868, nom illegit. (later homonym), nec *P. umbilicata* Pers. 1822 nec *P. umbilicata* Berk. & Curt. in Berk. 1875.
- ≡ *Discina umbilicata* Sacc., *Syll. Fung.* 8: 100. 1889 (ut "Karst.").
- = [*Discina cinerophila* Sturgis in Ellis & Everh., *North Am. Fungi* 3500. 1896, nomen nudum.]

ACKNOWLEDGEMENTS

We wish to thank the Director of the Royal Botanic Gardens, Kew, for the opportunity to examine the Karsten exsiccati specimen, Professor Donald H. Pfister, Farlow Herbarium, Harvard University for bibliographic assistance, and Prof. Pfister and Miss Linda M. Kohn, Cornell University, for editorial suggestions. The junior author acknowledges financial assistance from National Science Foundation Grant DEB75-23557.

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- PERSOON, C.H. 1822. *Mycologia europaea* 1: 1-356. Erlangae.
- SACCARDO, P.A. 1889. *Sylloge fungorum* 8: 1-1143. Patavii.
- SCHNEIDER, R. 1954. *Plicaria fulva* n. sp., ein bisher nicht bekannter Gewächshausbewohner. *Zentralbl. Bakteriolog. Hyg.*, 2 Abt. 108: 147-153.
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THE USE OF PIGMENTS AS A TAXONOMIC CHARACTER
TO DISTINGUISH SPECIES
OF THE TRICHIACEAE (MYXOMYCETES)

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INTRODUCTION

For several decades taxonomists studying many groups of organisms have been redefining old terms and defining new ones in order to express the principles of the "New Systematics." It appears that the emphasis has been rightly shifted from merely naming static forms to understanding the interactions of individuals within populations and the relationships between one population and the next.

When one compares the taxonomy of the Myxomycetes to the taxonomy of many other groups it appears to be far behind. Intrinsic features of the group which make it difficult to proceed beyond this alpha taxonomic level and to apply methods of biosystematics include:

- 1) Large series of specimens are lacking for many species.
- 2) The sporophore of the Myxomycetes is morphologically simple so that even when a few additional plasmodial characters can be used, the total number of characters is still small, and the range of variation due to environmental or genetic differences is not well known nor statistically analyzed.
- 3) The fact that myxomycete spores are wind disseminated over wide areas and the absence of quantifiable characters adds to the difficulty of interpreting any information on populations in nature.

4) Because of their small size, it is difficult to obtain enough field collected material for use of biochemical techniques.

5) Although cultural techniques can overcome some of these problems by providing readily available material, only about 70 of 450 species have been grown from spore to spore in agar culture (Clark and Collins, 1977).

Needless to say, myxomycete taxonomy is bound by a rigid type concept, and although herbarium studies are necessary, other approaches are possible and should be used. This experimental method has been emphasized by Alexopoulos (1969). The present report is a result of a search for additional characters which might be useful in assessing interspecific and intraspecific variation in the Trichiaceae.

Pigment analysis has been of great benefit to systematists of a number of groups of organisms (Arpin and Fiasson, 1971; Harborne *et al*, 1973). This technique has been applied to four species of the Trichiaceae and is reliable in distinguishing them along established morphological lines. In addition, intraspecific variation found in three of the species may be useful as a populational marker or an environmental indicator depending upon whether these variations are genetically or environmentally controlled. It is significant that this technique provides an additional taxonomic character from small amounts of herbarium material of organisms that we have not been able to grow in culture.

MATERIALS AND METHODS

Specimens from the University of Texas Myxomycete Collection (UTMC), a personal collection (MB), and the University of Michigan Herbarium (MICH) used in this study are listed below. Identification of all specimens was made or verified using the keys of Martin and Alexopoulos (1969).

Pigments of two to four entire sporangia from each collection were extracted in 95% ethanol for one half hour at room temperature. The extracts were spotted on Bakerflex Silica Gel 1B thin layer chromatography plates (Baker Chemical Co., Phillipsburg, N. J.) and developed in a solvent designed for pteridine pigments containing 2% ammonium acetate:n-propanol (1:1) and 0.25% mercaptoethanol for up

to ten hours (Descimon and Barial, 1966). Even minor temperature or humidity fluctuations affect the results and care must be taken so that comparisons may be made of plates developed at different times. On some occasions basic fuschin was used as a reference standard. Developed chromatographs were examined under UV light.

Specimens:

Hemitrichia calyculata (Speg.) Farr

- UTMC 265 - Iowa, 13 VI 1959, C. J. Alexopoulos
 UTMC 384 - Pennsylvania, 26 VI 1957, C. J. Alexopoulos,
 Pa-30
 UTMC 477 - Texas, VI 1964, C. D. Therrien
 UTMC 891 - Jamaica, 21 I 1966, C. J. Alexopoulos, Jam-62
 UTMC 921 - Guadeloupe, 24 XII 1965, C. J. Alexopoulos
 UTMC 1091 - Dominica, 10 I 1966, M. L. Farr, 2121
 UTMC 1325 - Virginia, 14 VII 1967, C. J. Alexopoulos
 UTMC 1426 - Costa Rica, 1 VI 1963, J. A. Sáenz, UCR-31
 UTMC 1429 - Costa Rica, 24 IX 1964, J. A. Sáenz, UCR-203
 UTMC 1610 - Thailand, 19 VIII 1967, D. Reynolds, 1202
 UTMC 1851 - Florida, 15 VII 1961, D. Creager, 388

Hemitrichia clavata (Pers.) Rost.

- UTMC 259 - Iowa, 25 IX 1958, C. J. Alexopoulos, Ia-60
 UTMC 574 - Arkansas, 1 I 1965, T. E. Brooks, 2733
 UTMC 658 - Washington, XII 1912, T. H. Macbride
 UTMC 1961 - Texas, 30 III 1969, H. Henney, Jr.
 MICH (4) - Michigan, 1 X 1956, V. Potter, 11627
 MICH (5) - Michigan, 23 IX 1956, V. Potter, 11580

Hemitrichia serpula (Scop.) Rost.

- UTMC 17 - Mexico, B. Lowy, M85
 UTMC 225 - InterAmerican Hwy. Km 135, 13 IX 1964,
 G. C. Carroll
 UTMC 1281 - Tennessee, 21 III 1967, R. H. Petersen
 UTMC 1418 - Costa Rica, 20 V 1963, J. A. Sáenz, UCR20
 UTMC 1419 - Costa Rica, 29 VII 1963, J. A. Sáenz, UCR102
 UTMC 1420 - Costa Rica, 30 VIII 1963, J. A. Sáenz,
 UCR108
 UTMC 1998 - Costa Rica, 22 III 1966, E. F. Morris, 982

Metatrichia vesparium (Batsch.) Nann.-Brem.

MB (1) - Virginia (?), Goldman

MB (2) - Virginia (?), E. W. Elliott

MB (3) - Virginia (?), 1949, R. E. Carrigan

MICH (6) - Michigan, 27 IX 1956, V. Potter, 11617

MICH (7) - Michigan, 12 VIII 1956, V. Potter, 11063

MICH (8) - Michigan, 8 IX 1931, E. B. Mains, 31-171

MICH (9) - Massachusetts, 1902, B. M. Davis

MICH (10) - New Hampshire, 1910, W. G. Farlow

MICH (11) - California, 29 XII 1942, P. and M. Rea

MICH (12) - Michigan, X 1890, V. M. Spaulding

MICH (13) - Michigan, 16 VII 1946, T. E. Brooks, 1154

MICH (14) - Michigan, 29 X 1931, E. B. Mains, 31-511

MICH (15) - Michigan, 1 VIII 1956, V. Potter, 10962

OBSERVATIONS

Chromatographic data from entire sporangia of four species of trichiaceous Myxomycetes are presented in Table 1. In visible light the spots appear pale yellow or orange; color of UV fluorescence is shown in Table 1. Although all of the specimens examined exhibit certain common spots, there are interspecific differences in the total patterns. Spots 2 and 4 (Table 1) are present in all four of the species. *Hemitrichia calyculata* is easily detectable because it has spot 9 which has a greater R_f value than any of the other spots and fluoresces purple in UV light. The chromatograms of the other species lack spot 9. *Hemitrichia serpula* and *Metatrichia vesparium* are different from *H. clavata* and *H. calyculata* by the lack of spot 1. *Metatrichia vesparium* has spot 8, but unlike spot 7 of other species which has the same R_f value, it does not fluoresce in UV light.

Intraspecific differences are evident. They cannot be correlated with collection locality, known habitat differences, or specimen age and treatment. Even specimens which appeared faded gave chromatographic results recognizable for the species; in these cases since less pigment was available more alcoholic extract had to be applied to the chromatographic plate.

DISCUSSION

Plasmodial pigments in some physaraceous slime molds may act as photoreceptors in presporulation events (Daniel, 1966; Rakoczy, 1963; Wormington and Weaver, 1977) and are retained in the sporangia. The fact that none of these pigments is yet chemically characterized points to the complexity of the components. Less is known of the pigments present in the sporangia of triacheaceous species; even plasmodial color is not known for some of these species, nor is it known whether these pigments act as photoreceptors during sporulation.

Although the species tested appear to contain common pigment components, until the chemical nature of these pigments, their possible function, and the environmental and genetic influences upon them are known this character is of no phylogenetic use. But, in the species observed, differences in pigment profiles do correlate with morphological species and provide an additional character at this level.

Variation within morphological species may indicate environmental or genetic variation. During routine culture of species of *Physarum*, differences in sporangial pigmentation may sometimes be correlated with lighting conditions. This phenomenon was experimentally studied by Brandza (1926a, 1926b) who placed pieces of the same plasmodia in conditions of shade and direct sunlight and found that color (intensity) varied in the sporangia which developed. On the other hand, the extreme differences in plasmodial color of certain isolates of *Didymium iridis* (Ditmar) Fries have been shown to be genetically determined (Collins and Clark, 1966; Collins, 1966).

We are continuing this survey of trichiaceous species to see if others can be characterized on the basis of pigment components and are looking at laboratory cultured specimens of physaraceous species in order to determine if infraspecific differences are environmentally or genetically controlled.

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A CHECKLIST OF THE OPERCULATE CUP-FUNGI (PEZIZALES)
OF NORTH AMERICA WEST OF THE GREAT PLAINS

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This checklist is based upon published records and upon specimens in several, but by no means all, major North American Herbaria. Those Herbaria which have been searched with some thoroughness are those at Bureau of Plant Industry, Beltsville (BPI); Cornell Univ. (CUP); Oregon State Univ. (OSC); San Francisco State Univ. (SFS); Univ. of British Columbia (UBC); Univ. of Washington (WTU); and Washington State Univ. (WSP). Herbarium abbreviations are after Lanjouw and Staffleu (34) with the following two additions. (RMD) represents the private herbarium of Dr. R. M. Danielson of the Dept. of Biology, Univ. of Calgary, Calgary, Alberta. (W-K) represents the private herbarium of Virginia Wells and Phyllis Kempton in Anchorage, Alaska.

The list consists of 231 species arranged in seven families. The families and, with rare exceptions, the genera are those recognized by Korf (31). The inclusion of some names and the exclusion of others has involved a series of arbitrary decisions by the authors. Where a recent monograph is available (e.g. ref. no. 3) the species concepts and synonymies of its authors have been followed. The references which follow each species include descriptions of the species. Commonly used synonyms are given for species only where the correct species epithet differs from that used in the references cited. Those species for which occurrence records have not yet been verified by either author or by recent monographers are marked with an asterisk, and additional species of dubious record are cited by name only at the end of the checklist.

Appended to the list are eight additional species whose previous generic placement is unsatisfactory according to current discomycete taxonomy. Most of these are species for which transfers should be made in the near future.

Order PEZIZALES

Suborder SARCOSCYPHINEAE

Family SARCOSOMATACEAE

Nannfeldtiella aggregata Eckblad

Distr: ALB.
 Herb: OSC, R. P. Korf (?), (RMD)
 Refs: 11

Neournula pouchetii (Berthet & Rioussat) Paden

Distr: B.C., ID, OR, WA
 Herb: ID, OSC, UBC, WSP
 Refs: 46, 47

Plectania melastoma (Sow. ex Fr.) Fuckel

Distr: B.C., CA, CO, ID, OR, WA
 Herb: BPI, CUP, OSC, SFS, UBC, WSP
 Refs: 9, 56

Plectania milleri Paden & Tylutki

Distr: ID, OR
 Herb: ID, OSC, WSP
 Refs: 48

Plectania nannfeldtii Korf

Distr: ALB., B.C., CO, ID, OR, WA
 Herb: OSC, (RMD), SFS, WSP
 Refs: 30, 42

Pseudoplectania melaena (Fr.) Boud.

Distr: B.C., ID, OR, WA
 Herb: ID, NY, OSC, UBC, WSP
 Refs: 56

Pseudoplectania nigrella (Pers. ex Fr.) Fuckel

Distr: B.C., CA, CO, ID, OR, UT, WA, WY
 Herb: CUP, OSC, SFS, UBC, WSP, WTU
 Refs: 9, 56

Sarcosoma latahensis Paden & Tylutki

Distr: ID, OR, WA
 Herb: OSC, WSP
 Refs: 48

Sarcosoma mexicana (Ellis & Holway) Paden & Tylutki

Distr: B.C., ID, OR, WA
 Herb: OSC, UBC, WSP, WTU
 Refs: 48

Urnula hiemalis Nannf.

Distr: AK, ALB.
 Herb: (RMD), (W-K)
 Refs: 21

Family SARCOSCYPHACEAE

Desmazierella acicola Lib.

Distr: OR
 Herb: OSC
 Refs: 9

Microstoma protracta (Fr.) Kanouse

Distr: ALB., CO
 Herb: CUP, NY, OSC, (RMD)
 Refs: 15

Pithya cupressina (Fr.) Fuckel

Distr: B.C., CA, ID, OR, WA
 Herb: NY, OSC, SFS, UBC, WSP, WTU
 Refs: 56

Pithya vulgaris Fuckel

Distr: B.C., CA, ID, OR, WA
 Herb: NY, OSC, SFS, UBC, WSP
 Refs: 56

Pseudopithyella minuscula (Boud. & Torrend) Se

Distr: CA, OR
 Herb: NY, OSC
 Refs: 56

Sarcoscypha coccinea (Jacq. ex Gray) Lambotte

Distr: B.C., CA, OR, WA
 Herb: BPI, CUP, NY, OSC, SFS, UBC
 Refs: 56

Suborder PEZIZINAE

Family ASCOBOLACEAE

Ascobolus albidus Crouan

Distr: AK, WA, WY
 Herb: OSC, TRTC, WSP
 Refs: 3

*Ascobolus boudieri Qué!.

Distr: WA
 Herb: WTU
 Refs: 3

Ascobolus brassicae Crouan

Distr: CA
 Herb: FH
 Refs: 3

Ascobolus carbonarius Karst.

Distr: ALB., B.C., CA, OR
 Herb: NY, OSC, SFS, UBC, WTU
 Refs: 3

*Ascobolus crenulatus Karst.

Distr: ID
 Herb: WSP
 Refs: 3

Ascobolus denudatus Fr.

Distr: CA
 Herb: BPI
 Refs: 3

Ascobolus doliiformis Kobayasi

Distr: AK
 Herb: BPI
 Refs: 26

- Ascobolus foliicola Berk. & Br.
 Distr: CA, CO, OR
 Herb: BPI, NY, OSC
 Refs: 3
- Ascobolus furfuraceus Pers. ex Pers.
 Distr: B.C., CA, CO, ID, OR, WA
 Herb: CUP, NY, OSC, WSP
 Refs: 3
- Ascobolus geophilus Seaver
 Distr: CO, ID, OR
 Herb: BPI, NY
 Refs: 3
- Ascobolus immersus Pers. ex Pers.
 Distr: AZ, B.C., CO
 Herb: NY, UBC
 Refs: 3
- Ascobolus lignatilis Alb. & Schw. ex Pers.
 Distr: OR
 Herb: OSC
 Refs: 3
- Ascobolus michaudii Boud.
 Distr: B.C.
 Herb: CUP, DOAM, UVIC
 Refs: 3
- Ascobolus nodulosporus van Brumm.
 Distr: CA
 Herb: FH
 Refs: 3
- Ascobolus sacciferus van Brumm.
 Distr: B.C., CA, WA
 Herb: CUP, UC, UVIC
 Refs: 3
- Ascobolus scatigenus (Berk.) van Brumm.
 Distr: CA
 Herb: S
 Refs: 3
- Ascobolus viridis Currey
 Distr: OR
 Herb: OSC
 Refs: 3
- Ascobolus xylophilus Seaver
 Distr: CO
 Herb: NY
 Refs: 3
- Iodophanus carneus (Pers.) Korf
 Distr: CA, CO, ID, WA
 Herb: NY, OSC, WSP
 Refs: 25, 55, 56
- Iodophanus testaceus (Moug. in Fr.) Korf
 Distr: OR, WA
 Herb: OSC, WTU
 Refs: 25, 56
- Saccobolus depauperatus (Berk. & Br.) Hansen
 Distr: AK, CO, ID, OR
 Herb: BPI, NY, WSP
 Refs: 3, 27

- Saccobolus glaber (Pers.) Lambotte
 Distr: CO
 Herb: BPI, NY
 Refs: 3
- Saccobolus versicolor (Karst.) Karst.
 Distr: CA, CO, ID, OR
 Herb: BPI, CUP, NY, OSC, WSP
 Refs: 3
- *Sphaerosoma hesperium (Setch.) Seaver
 Distr: CA
 Herb: NY
 Refs: 56, 58
- Thecotheus agranulosus Kimbr.
 Distr: OR, YUKON
 Herb: MICH, OSC
 Refs: 23, 56
- Thecotheus apiculatus Kimbr.
 Distr: OR
 Herb: NY
 Refs: 23
- Thecotheus cinereus (Crouan & H. Crouan) Chenantais
 Distr: CA, CO, ID, OR, UT
 Herb: NY, WSP
 Refs: 23
- *Thecotheus pelletieri (Crouan) Boud.
 Distr: OR, WA
 Herb: NY, WTU
 Refs: 23, 56

Family PEZIZACEAE

- Pachyella adnata (Berk. & Curt.) Pfister
 Distr: MT, WA, WY
 Herb: BPI, CUP-D, NY, R. P. Korf, WTU
 Refs: 49, 51
- Pachyella babingtonii (Berk.) Boud.
 Distr: CO, ID, MT, OR, WA
 Herb: CUP, MICH, NY, OSC
 Refs: 49, 51
- Pachyella clypeata (Schw.) LeGal
 Distr: CA, OR
 Herb: BPI, NY, OSC
 Refs: 49, 51
- Peziza alaskana Cash
 Distr: AK
 Herb: BPI (?), WSP
 Refs: 5
- Peziza ammophila Dur. & Mont.
 Distr: CA, OR
 Herb: NY, OSC
 Refs: 9
- Peziza ampliata Pers.
 Distr: AZ, OR
 Herb: OSC
 Refs: 9

Peziza apiculata Cooke

Distr: AZ
 Herb: OSC
 Refs: 56

Peziza arvernensis Boud.

Distr: ALB., ID, OR, UT
 Herb: OSC, (RMD), WSP
 Refs: 9, 36

Peziza badia Pers. ex Mérat

Distr: AK, ALB., B.C., CA, CO, ID, NM, OR, WA
 Herb: BPI, CUP, DOAM, NY, OSC, SFS, UBC, WSP, WTU
 Refs: 9, 12, 56

Peziza badiocfusca Korf

Distr: B.C., CA, ID, MACK. DIST., OR, UT, WA
 Herb: DOAM, NY, OSC, WSP
 Refs: 9, 12, 58, 61

Peziza badiofusca (Boud.) Dennis

Distr: WA
 Herb: WSP
 Refs: 9

Peziza brunneoatra Desm.

Distr: CA, CO, ID, OR, WA
 Herb: BPI, NY, OSC, WSP
 Refs: 9, 56

*Peziza brunneovinosa Clem.

Distr: OR
 Herb: OSC
 Refs: 56

Peziza cerea Sow. ex Mérat

Distr: NV, OR
 Herb: BPI, OSC
 Refs: 9

*Peziza concentrica Seaver

Distr: CA, OR
 Herb: NY
 Refs: 56

Peziza domiciliana Cooke

Distr: B.C., CA, OR, UT, WA
 Herb: BPI, NY, OSC, SFS, UBC, WSP, WTU
 Refs: 56

Peziza echinospora Karst.

Distr: AZ, CO, ID, NM, OR, UT
 Herb: OSC, WSP
 Refs: 9

Peziza emeleia Cooke

Distr: CA, CO, OR, UT
 Herb: BPI, OSC
 Refs: 9

Peziza fimeti (Fuckel) Seaver

Distr: CO, OR, UT, WA
 Herb: NY, OSC, SFS
 Refs: 56

*Peziza griseorosea Gerard

Distr: NM
 Herb: NY
 Refs: 56

Peziza limnaea Maas G.=P. limosa (Grelet) Nannf.

Distr: AK, OR, WA

Herb: OSC

Refs: 27, 36

Peziza michelii (Boud.) Dennis

Distr: OR

Herb: OSC

Refs: 9

Peziza micropus Pers.

Distr: CO

Herb: OSC

Refs: 9

Peziza ostracoderma Korf

Distr: OR, WA

Herb: OSC, WSP

Refs: 29

Peziza paludicola Boud.

Distr: OR

Herb: OSC

Refs: 9

Peziza petersii Berk. & Curt.

Distr: B.C., OR, WA

Herb: OSC

Refs: 9

Peziza praetervisa Bres.

Distr: ALB., CO, ID, OR

Herb: OSC, (RMD), WSP

Refs: 9, 61

Peziza proteana (Boud.) Seaver

Distr: CA, OR, WA

Herb: BPI, OSC, SFS, WTU

Refs: 9, 56, 62

*Peziza pustulata Pers.

Distr: CA, WA, WY

Herb: NY, SFS, WSP

Refs: 56

Peziza repanda Pers. ex Pers.

Distr: B.C., CA, CO, ID, MT, OR, WA, WY

Herb: BPI, CUP, NY, OSC, SFS, WSP

Refs: 9, 56

Peziza sepiatra Cooke

Distr: B.C., CO

Herb: BPI, OSC, UVIC

Refs: 9

*Peziza spissa Berk.

Distr: WA

Herb: NY

Refs: 56

Peziza succosa Berk.

Distr: B.C., CA, OR, WA

Herb: BPI, NY, OSC, UBC

Refs: 9, 56

Peziza sterigmatizans Phillips

Distr: OR, WA

Herb: OSC

Refs: 9

Peziza sylvestris (Boud.) Sacc. & Trott.

Distr: B.C., CA, ID, OR, UT, WA, WY

Herb: BPI, NY, OSC, SFS, UBC, WSP, WTU

Refs: 56, 57

Peziza varia (Hedwig) Fr.

Distr: ID

Herb: WSP

Refs: 9

Peziza vesiculosa Bull. ex Fr.

Distr: B.C., CA, CO, ID, OR, WA

Herb: BPI, CUP, NY, OSC, SFS, WSP, WTU

Refs: 9, 56

Peziza violacea Pers.

Distr: B.C., CA, CO, ID, OR, UT, WA

Herb: NY, OSC, SFS, UBC, WSP, WTU

Refs: 9, 56

Plicaria carbonaria (Fuckel) Fuckel= P. trachycarpa var. muricata Grelet

Distr: ALB., OR

Herb: OSC, (RMD)

Refs: 9, 60

Plicaria endocarpoides (Berk.) Rifai= P. leiocarpa (Currey) Boud.

Distr: B.C., CA, ID, MT, OR, WA

Herb: CUP, NY, OSC, UBC, WSP, WTU

Refs: 9, 56

Plicaria trachycarpa (Currey) Boud.

Distr: B.C., CO, ID, OR, WA

Herb: NY, UBC, WSP, WTU

Refs: 9, 56

Sarcosphaera crassa (Santi ex Steudl) Pouzar= S. coronaria (Jacq. ex Cooke) Boud.

Distr: ALB., AZ, B.C., CA, CO, ID, NM, OR, UT, WA

Herb: BPI, CUP, NY, OSC, (RMD), SFS, UBC, WSP

Refs: 9, 56

Family MORCHELLACEAE

Disciotis venosa (Pers. ex Fr.) Boud.

Distr: CA, CO, ID, NM, OR, UT

Herb: BPI, CUP, NY, OSC, SFS, WSP

Refs: 9, 56

Morchella angusticeps Peck

Distr: ALB., CA, CO, ID, UT, WA

Herb: OSC, (RMD), SFS, WSP

Refs: 56

*Morchella crassipes (Ventenat) Pers.

Distr: CA, ID, WY

Herb: SFS, WSP

Refs: 56

Morchella elata Fr.

Distr: B.C., CA, ID, OR, WA, WY
 Herb: CUP, NY, OSC, SFS, WSP, WTU
 Refs: 9, 56

Morchella esculenta Pers. ex St.-Amans

Distr: ALB., CA, CO, ID, MT, OR, UT, WA
 Herb: CUP, NY, OSC, (RMD), SFS, UBC, WSP, WTU
 Refs: 9, 56

Morchella semilibera DC. ex Fr.

Distr: ID, OR, WA
 Herb: NY, OSC, WSP
 Refs: 9, 56

Ptychoverpa bohemica (Krombholz) Boud.

Distr: AK, ALB., B.C., CA, ID, OR, WA
 Herb: CUP, NY, OSC, (RMD), SFS, UBC, WSP
 Refs: 9, 62

Verpa conica Swartz ex Pers.

Distr: ALB., B.C., CA, CO, ID, OR, WA
 Herb: NY, OSC, (RMD), SFS, UBC, WSP, WTU
 Refs: 9, 56

Family HELVELLACEAE

Discina apiculata McKnight

Distr: CA, ID, UT, WY
 Herb: BPI, BRY, FH, MICH
 Refs: 38

Discina larryi McKnight

Distr: UT
 Herb: BPI
 Refs: 41

Discina leucoxantha Bres.

Distr: ID, OR, UT
 Herb: BRY, OSC, WSP
 Refs: 38

Discina macrospora Bubák

Distr: B.C., OR
 Herb: CUP, FH
 Refs: 38

Discina melaleuca Bres.

Distr: CO, ID, OR, WA
 Herb: OSC, WSP
 Refs: 56

Discina olympiana Kanouse

Distr: WA, WY
 Herb: BPI, MICH
 Refs: 38

Discina perlata (Fr.) Fr.

Distr: AK, ALB., B.C., CA, CO, ID, MT, OR, UT, WA, WY
 Herb: BPI, BRY, CUP, FH, MICH, NY, OSC, (RMD), WSP,
 WTU
 Refs: 38

Gyromitra ambigua (Karst.) Harmaja

Distr: AK, ALB.
 Herb: (RMD)
 Refs: 20

Gyromitra californica (Phillips) Raitviir

Distr: B.C., CA, CO, ID, NV, OR, WA
 Herb: CUP, NY, OSC, SFS, UBC, WSP, WTU
 Refs: 56

Gyromitra caroliniana (Bosc ex Fr.) Fr.

Distr: B.C., CA, CO, OR, WA
 Herb: NY, OSC, UBC, WTU
 Refs: 14, 40

Gyromitra esculenta Fr.

Distr: ALB., B.C., CA, CO, ID, OR, WA, WY
 Herb: CUP, OSC, (RMD), SFS, UBC, WSP, WTU
 Refs: 9

Gyromitra fastigiata (Krombholz) Rehm

Distr: ALB
 Herb: (RMD)
 Refs: 42

Gyromitra gigas (Krombholz) Quél.

Distr: CA, CO, ID, OR, UT, WA
 Herb: OSC, SFS, WSP
 Refs: 56

Gyromitra infula (Schaeffer ex Fr.) Quél.

Distr: AK, ALB., AZ, B.C., CA, CO, ID, OR, UT, WA
 Herb: CUP, NY, OSC, (RMD), SFS, UBC, WSP
 Refs: 9

Helvella acetabulum (L. ex St.-Amans) Quél.

Distr: ALB., AZ, B.C., CA, CO, ID, OR, UT, WA
 Herb: CUP, NY, OSC, (RMD), S, SFS, WSP, WTU, UVIC
 Refs: 10, 61

Helvella albella Quél.

Distr: AK, CO
 Herb: MICH, (W-K)
 Refs: 19, 61

Helvella albipes Fuckel

Distr: ID
 Herb: NY
 Refs: 56

Helvella atra Holmskjöld

Distr: AK, MT, NM, WA
 Herb: NY, WTU, (W-K)
 Refs: 10, 19

*Helvella brevissima Peck

Distr: CA
 Herb: CUP, NY
 Refs: 56

Helvella connivens Dissing & Lange

Distr: OR, WA
 Herb: OSC
 Refs: 10

Helvella corium (Weberbauer) Masee

Distr: AK, ALB., AZ, B.C., CO, ID, OR, WA
 Herb: NY, OSC, (RMD), SFS, UBC, WSP, WTU, (W-K)
 Refs: 10, 19, 61

*Helvella costifera Nannf.

Distr: AK, CA
 Herb: SFS, (W-K)
 Refs: 10, 19

Helvella crispa Scop. ex Fr.

Distr: AK, ALB., AZ, B.C., CA, CO, ID, NM, OR, UT, WA
 Herb: CUP, K, NY, OSC, SFS, UBC, WTU, WSP, (W-K)
 Refs: 10, 19, 61

Helvella cupuliformis Dissing & Nannf.

Distr: AK, NM
 Herb: OSC, (W-K)
 Refs: 10, 19

Helvella elastica Bull. ex St.-Amans

Distr: AK, ALB., B.C., CA, CO, ID, NM, OR, UT, WA, WY
 Herb: CUP, NY, OSC, (RMD), SFS, UBC, WSP, WTU, (W-K)
 Refs: 10, 19, 61

Helvella ephippium Lév.

Distr: ALB., AZ, CA
 Herb: BPI, OSC, (RMD)
 Refs: 10, 61

Helvella fusca Gill. sensu Bres.

Distr: AK, OR
 Herb: OSC, (W-K)
 Refs: 10, 19

Helvella lacunosa Afz. ex Fr.

Distr: AK, AZ, B.C., CA, CO, ID, NM, OR, UT, WA
 Herb: BPI, CUP, K, NY, OSC, SFS, WSP, WTU, (W-K)
 Refs: 9, 10, 19, 61

Helvella leucomelaena (Pers.) Nannf. in Lundell & Nannf.

Distr: AK, ALB., CA, CO, ID, OR, UT, WA
 Herb: NY, OSC, (RMD), SFS, WSP, WTU, (W-K)
 Refs: 10, 19, 61

Helvella leucopus Pers.

Distr: CA, ID, OR
 Herb: CUP, L, NY, OSC, WSP
 Refs: 10

Helvella macropus (Pers. ex Fr.) Karst.

Distr: AK, AZ, B.C., CO, ID, OR
 Herb: BPI, NY, UBC, WSP, WTU, (W-K)
 Refs: 10, 19, 61

Helvella maculata Weber

Distr: ALB.
 Herb: (RMD)
 Refs: 61

Helvella pezizoides Afz. ex Fr.

Distr: CA, CO, NM, OR
 Herb: OSC
 Refs: 10, 61

Helvella philonotis Dissing

Distr: OR
 Herb: OSC
 Refs: 10

Helvella queletii Bres.

Distr: AK, ALB., B.C., CA, CO, ID, OR, WA, WY
 Herb: CUP, OSC, (RMD), S, WSP, (W-K)
 Refs: 10, 19, 61

Helvella solitaria (Karst.) Karst.

Distr: AK, UT
 Herb: OSC, (W-K)
 Refs: 10, 19

Helvella stevensii Peck

Distr: OR
 Herb: OSC
 Refs: 10, 61

Helvella villosa (Hedwig ex Kuntze) Dissing

Distr: AK, ALB., CA, ID, OR
 Herb: OSC, (RMD), (W-K)
 Refs: 10, 54, 61

Rhizina undulata Fr.

Distr: B.C., CA, ID, MT, OR, WA
 Herb: CUP, NY, OSC, SFS, UBC, WSP, WTU
 Refs: 9, 56

Wynnella silvicola (Beck ex Sacc.) Nannf.

=O. auricula (Schaeffer ex Cooke) Rehm
 Distr: AK, ALB., B.C., CO, ID, WA
 Herb: NY, OSC, (RMD), SFS, UVIC, WSP
 Refs: 16, 56

Family PYRONEMATACEAE

Aleuria aphanodictyon Kobayasi

Distr: AK
 Herb: BPI
 Refs: 27

Aleuria aurantia (Pers. ex Hook.) Fuckel

Distr: AZ, B.C., CA, ID, OR, WA
 Herb: CUP, NY, OSC, SFS, WSP, WTU
 Refs: 9, 56

Aleuria rhenana Fuckel

Distr: CA, WA
 Herb: NY, OSC, SFS
 Refs: 56

Anthracobia macrocystis (Cooke) Boud.

Distr: B.C., CA, ID, OR
 Herb: OSC, WSP
 Refs: 9, 35, 55

Anthracobia melaloma (Alb. & Schw. ex Fr.) Boud.

Distr: B.C., CA, CO, ID, OR, WA
 Herb: BPI, NY, OSC, WSP, WTU
 Refs: 9, 35, 55

Anthracobia muelleri (Berk.) Rifai

Distr: UT
 Herb: CUP, OSC
 Refs: 35, 55

Anthracobia nitida Boud.

Distr: ALB., WA
 Herb: OSC, (RMD), UPS
 Refs: 35

Byssonectria aggregata (Berk. & Br.) Rogerson & Korf

Distr: ALB.
 Herb: OSC, (RMD)
 Refs: 11

*Byssonectria tetraspora (Fuckel) Korf

Distr: AK
 Herb: BPI
 Refs: 27, 30

Caloscypha fulgens (Pers.) Boud.

Distr: ALB., B.C., CA, CO, ID, MT, OR, UT, WA, WY
 Herb: CUP, NY, OSC, (RMD), SFS, UBC, WSP, WTU
 Refs: 56

Cheilymenia coprinaria (Cooke) Boud.

Distr: B.C., CA, CO, ID, OR, UT, WA
 Herb: NY, OSC, SFS, UBC, WSP, WTU
 Refs: 8, 9, 56

Cheilymenia crucipila (Cooke & Phillips) LeGal

Distr: ID, WA
 Herb: NY, WSP
 Refs: 8, 9

*Cheilymenia pulcherrima (Crouan) Boud.

Distr: AZ, CA, WA
 Herb: BPI, NY, WSP, WTU
 Refs: 56

*Cheilymenia raripila (Phillips) Seaver

Distr: CA
 Herb: CUP, NY
 Refs: 56

Cheilymenia stercorea (Pers. ex Fr.) Boud.

Distr: B.C., CA, CO, ID, OR, NV, WA
 Herb: BPI, CUP, NY, OSC, UBC, WSP, WTU
 Refs: 8, 56

Cheilymenia theloboloides (Fr.) Boud.

Distr: ALB., CA, CO, ID, OR, WA, WY
 Herb: BPI, NY, OSC, (RMD), WSP
 Refs: 8, 9, 56

Coprotia granulata (Fr.) Boud.

Distr: CA, ID, OR, WA
 Herb: OSC, SFS, WSP, WTU
 Refs: 9

Coprotus aurora (Crouan & H. Crouan) Kimbr., Luck-Allen & Cain

Distr: ALB., WY
 Herb: TRTC
 Refs: 26

Coprotus breviascus (Velen.) Kimbr., Luck-Allen & Cain

Distr: WY
 Herb: TRTC
 Refs: 26

Coprotus dextrinoideus Kimbr., Luck-Allen & Cain

Distr: WY
 Herb: TRTC
 Refs: 26

Coprotus glaucellus (Rehm) Kimbr.

Distr: B.C., CO
 Herb: OSC, TRTC
 Refs: 26

Coprotus granuliformis (Crouan & H. Crouan) Kimbr.

Distr: CO, OR, WY
 Herb: NY, OSC, TRTC
 Refs: 26, 56

Coprotus leucopocillum Kimbr., Luck-Allen & Cain

Distr: CA, WY
 Herb: OSC, TRTC
 Refs: 26

Coprotus luteus Kimbr., Luck-Allen & Cain

Distr: MT, WY
 Herb: TRTC
 Refs: 26

Coprotus ochraceus (Crouan & H. Crouan) Kimbr.

Distr: CA, ID, OR
 Herb: MICH, NY, WSP
 Refs: 26

Coprotus sexdecimsporus (Crouan & H. Crouan) Kimbr.

Distr: CA, CO, WY
 Herb: NY, TRTC
 Refs: 24, 26, 56

Coprotus winteri (March.) Kimbr.

Distr: CO
 Herb: NY
 Refs: 26

Fimaria cervina (Phillips) van Brumm.

Distr: OR
 Herb: OSC
 Refs: 2

*Fimaria hepatica (Batsch ex Fr.) van Brumm.

Distr: CO, OR
 Herb: BPI, NY
 Refs: 2, 9

*Fimaria porcina Svrček & Kubička

Distr: AK
 Herb: BPI
 Refs: 27

*Geopora clausa (Tul. & Tul.) Burdsall

Distr: ALB.
 Herb: (RMD)
 Refs: 4

Geopora cooperi Harkn.

Distr: AK, ALB., CA, CO, ID, OR, TU, WA
 Herb: OSC, (RMD), VPI
 Refs: 4

Geopyxis carbonaria (Alb. & Schw. ex Pers.) Sacc.

Distr: ALB., B.C., CA, CO, ID, MT, OR, UT, WA
 Herb: CUP, OSC, (RMD), WSP, WTU
 Refs: 9, 55, 56

Geopyxis majalis (Fr.) Sacc.

Distr: CA, OR
 Herb: BPI, OSC, WSP
 Refs: 55

Geopyxis vulcanalis (Peck) Sacc.

Distr: ALB., B.C., CA, CO, ID, OR, UT, WA, WY
 Herb: BPI, CUP, NY, OSC, (RMD), SFS, UBC, WSP, WTU
 Refs: 56

Humaria hemisphaerica (Wigg. ex Fr.) Fuckel

Distr: AK, ALB., B.C., CA, ID, WA
 Herb: OSC, (RMD), SFS, UBC, WSP, WTU
 Refs: 9

Lamprospora crec'hqueraultii (Crouan) Boud.

Distr: CO, ID, OR
 Herb: NY, OSC, WSP
 Refs: 9, 56

- *Lamprospora crouani (Cooke) Seaver
 Distr: CO, WA
 Herb: NY, WTU
 Refs: 9, 56
- *Lamprospora polytrichina (Rehm) Seaver
 Distr: CO, WA
 Herb: NY, WTU
 Refs: 56
- *Lamprospora spinulosa Seaver
 Distr: ID, OR
 Herb: NY, WSP
 Refs: 56
- Lasiobolus ciliatus (Fr.) Boud.
 Distr: AK, CA, CO, ID, OR, UT, WA
 Herb: CUP, NY, OSC, SFS, WSP, WTU
 Refs: 9, 27
- Lasiobolus macrotrichus Rea
 Distr: OR
 Herb: OSC
 Refs: 9
- *Lasiobolus ruber (Quel.) Sacc.
 Distr: CO, OR
 Herb: NY, OSC
 Refs: 9, 56
- Leucoscypha hetieri (Boud.) Rifai
 Distr: B.C.
 Herb: OSC
 Refs: 55
- Leucoscypha rutilans (Fr.) Dennis & Rifai
 Distr: CA, CO, WA
 Herb: CUP, NY, OSC, SFS
 Refs: 9, 55, 56
- Melastiza chateri (W. G. Smith) Boud.
 Distr: ALB., B.C., CO, ID, OR, WA
 Herb: NY, OSC, (RMD), WSP, WTU
 Refs: 9, 56
- Melastiza rubra (Batra) Maas G.
 Distr: AZ
 Herb: OSC
 Refs: 1, 7
- Miladina lechithina (Cooke) Svrček
 Distr: ID, OR, UT
 Herb: OSC
 Refs: 53
- Mycoarctium ciliatum Jain & Cain
 Distr: CA, CO
 Herb: TRTC
 Refs: 33
- Octospora leucoloma Gray
 Distr: AK, CA, CO, ID, OR
 Herb: BPI, NY, OSC, UBC, WSP
 Refs: 9, 27, 55
- *Octospora rubens (Boud.) Moser
 Distr: CO, WA
 Herb: BPI, NY, WSP
 Refs: 44

- *Otidea abietina (Pers. ex Fr.) Fuckel
 Distr: AK, CO, OR, WA
 Herb: BPI, NY, OSC, WTU, (W-K)
 Refs: 16, 37, 45, 62
- Otidea alutacea (Pers.) Masee
 Distr: ALB., CA, ID, WA
 Herb: MICH, OSC, (RMD), SFS, WSP
 Refs: 9, 16
- *Otidea bufonia (Pers.) Boud.
 Distr: CA, WA
 Herb: WTU
 Refs: 9
- Otidea concinna (Pers.) Sacc.
 Distr: CA, ID, WA
 Herb: BPI, MICH, OSC, SFS, WSP, WTU
 Refs: 9, 16
- *Otidea grandis (Pers.) Rehm
 Distr: ID, WA
 Herb: BPI, MICH, NY, WSP
 Refs: 16, 56
- Otidea leporina (Batsch) S. F. Gray
 Distr: ALB., AZ, B.C., CA, CO, ID, OR, WA, WY
 Herb: CUP, MICH, NY, OSC, SFS, UBC, WSP, WTU
 Refs: 16, 56
- Otidea onotica (Pers.) Fuckel
 Distr: CA, CO, ID, OR, WA
 Herb: CUP, MICH, OSC, SFS, WSP, WTU
 Refs: 9, 16
- Otidea smithii Kanouse
 Distr: B.C., CA, ID, WA
 Herb: MICH, OSC, WSP
 Refs: 16
- Pseudocollema cartilagineum Kanouse & Smith
 Distr: ALB., CO, MT, WA
 Herb: MICH, OSC, (RMD), WSP
 Refs: 18
- *Psilopezia nummularia Berk.
 Distr: ID, WA
 Herb: BPI, WSP
 Refs: 9, 49, 50, 56
- Pulparia persoonia (Crouan) Korf, Pfister & Rogers
 Distr: AK
 Herb: WSP
 Refs: 9, 30
- Pulparia plachonis (Dun.) Korf, Pfister & Rogers
 Distr: WA
 Herb: WSP
 Refs: 30, 55, 56
- Pulvinula archeri (Berk. in Hook.) Rifai
 Distr: B.C., ID, OR, WA
 Herb: BPI, NY, OSC, WSP
 Refs: 52, 55
- Pulvinula carbonaria (Fuckel) Boud.
 Distr: CA, MT, OR
 Herb: BPI, NY, OSC
 Refs: 52, 55

Pulvinula convexula (Karst.) Pfister

=P. constellatio (Berk. & Br.) Rehm

Distr: AK, CO, MT, OR, CA

Herb: BPI, CUP, NY, OSC, WSP

Refs: 9, 52, 55

Pulvinula globifera (Berk. & Curt.) LeGal

Distr: AZ

Herb: OSC

Refs: 52

Pulvinula laeterubra (Rehm) Pfister

Distr: ALB., B.C.

Herb: OSC

Refs: 52

Pyronema omphalodes (Bull. ex St.-Amans) Fuckel

Distr: ALB., B.C., CA, ID, UT, WA

Herb: OSC, (RMD), UBC, WSP, WTU

Refs: 9, 43, 56

Scutellinia erinaceus (Schw.) Kuntze

Distr: ID, UT

Herb: OSC, WSP

Refs: 6

Scutellinia scutellata (L. ex Fr.) Lambotte

Distr: AK, ALB., B.C., CA, CO, ID, NM, OR, WA

Herb: CUP, NY, OSC, (RMD), SFS, UBC, WSP, WTU

Refs: 6, 9, 55, 56

*Scutellinia setosa (Nees) Seaver

Distr: B.C., CO, WA

Herb: CUP, NY, UBC, WSP

Refs: 56

*Scutellinia trechispora (Berk. & Br.) Lambotte

Distr: AK, CO

Herb: BPI, NY

Refs: 6, 27, 56

Scutellinia umbrarum (Fr.) Lambotte

Distr: AK, AZ, B.C., CA, CO, ID, NM, WA

Herb: NY, OSC, UBC, WSP, WTU

Refs: 6, 56

Scutellinia verrucipolaris Denison

Distr: WA

Herb: WSP

Refs: 6

Sepultaria arenicola (Lév.) Masee

Distr: CO

Herb: WSP

Refs: 9, 56

Sepultaria arenosa (Fuckel) Boud.

Distr: CO, OR

Herb: NY, OSC

Refs: 9, 56

*Sepultaria longii Seaver

Distr: WA

Herb: WTU

Refs: 56

- *Septularia pellita (Cooke & Peck) Seaver
 Distr: AK
 Herb: (W-K)
 Refs: 56, 62
- *Septularia semiimmersa (Karst.) Masee
 Distr: CA, OR, WA
 Herb: BPI, NY, OSC, WSP
 Refs: 56
- *Septularia sepulta (Fr.) Boud.
 Distr: CA, CO
 Herb: CUP
 Refs: 4, 56
- *Tarzetia bronca (Peck) Korf & Rogers
 Distr: CO
 Herb: NY
 Refs: 56
- Tarzetia catinus (Pers.) Korf & Rogers
 Distr: CA, CO, OR, WA
 Herb: OSC, SFS, WTU
 Refs: 9, 30
- Tarzetia cupularis (L. ex Fr.) Lambotte
 Distr: B.C., CA, CO, ID, OR, WA
 Herb: BPI, CUP, NY, OSC, SFS, UBC, WSP, WTU
 Refs: 9, 56
- *Thelebolus crustaceus (Fuckel) Kimbr.
 Distr: AK
 Herb: BPI
 Refs: 27
- *Thelebolus microsporus (Berk. & Br.) Kimbr.
 Distr: AK, CO
 Herb: BPI, NY
 Refs: 27
- *Thelebolus stercorius (Pers.) Fr.
 Distr: B.C., CA, WY
 Herb: CUP
 Refs: 22
- Tricharina gilva (Boud. in Cooke) Eckblad
 Distr: ID, OR
 Herb: OSC, WTU
 Refs: 11, 56
- Trichobolus octosporus Krug
 Distr: WY
 Herb: BPI, TRTC
 Refs: 32
- Trichobolus zukalii (Hermerl) Kimbr. & Korf
 Distr: B.C.
 Herb: CUP
 Refs: 22, 24
- Trichophaea abundans (Karst.) Boud.
 Distr: CA, CO, ID, OR
 Herb: BPI, CUP, OSC, SFS
 Refs: 17
- *Trichophaea boudierii Grelet
 Distr: ID
 Herb: WSP
 Refs: 13

Trichophaea brunnea (Alb. & Schw. ex Fr.) Batra & Batra

Distr: ALB.

Herb: OSC

Refs: 9, 55, 56

*Trichophaea bullata Kanouse

Distr: CO, OR, WA, WY

Herb: BPI, NY, OSC, WTU

Refs: 17

*Trichophaea gregaria (Rehm) Boud.

Distr: CO, OR, WY

Herb: BPI, MICH

Refs: 17

Trichophaea hemisphaerioides (Mont.) Graddon

Distr: OR

Herb: OSC

Refs: 9

Trichophaea woolhopiea (Cooke & Phillips) Boud.

Distr: CO

Herb: OSC

Refs: 9

QUESTIONABLE RECORDS

Family SARCOSOMATACEAE

Plectania rimosa Peck

Sarcosoma globosa Caspary

Urula craterium (Schw.) Fr.

Family ASCOBOLACEAE

Boudiera marginata Phillips & Harkn.

Saccobolus obscurus (Cooke) Phillips

Family PEZIZACEAE

Peziza atrovinosa Cooke

Peziza chlorophysa Sacc.

Peziza convoluta Peck

Peziza rubricosa Fr.

Peziza secreta Phillips

Family MORCHELLACEAE

Morchella smithii Cooke

Family HELVELLACEAE

Gyromitra brunnea L. ex Underwood

Helvella oregonensis Ellis & Everh.

Family PYRONEMATACEAE

Cubonia bulbifera Hotson

Humaria macrospora (Wallr.) Fuckel

Humaria saccardoii Cavara

Humaria turbinata Snyder

Humarina axillaris (Nees) Seaver

Humarina coccinea (Crouan) Seaver

QUESTIONABLE RECORDS: PYRONEMATACEAE (Cont'd.)

Humarina orthotricha (Cooke & Ellis) Seaver
Humarina purpurea Seaver
Lasiobolus pilosus (Fr.) Sacc.
Neotiopezis sclerothrix Clem.
Patella irregularis (Clem.) Seaver
Patella piliseta (Clem.) Seaver
Patella sequoiae (Phillips) Seaver
Ryparobius pachyascus Zukal
Scutellinia chaetoloma Clem.

ADDITIONAL SPECIES WITH UNSATISFACTORY NAMES

Pachyella-affinities

"Peziza" melaleucoides Seaver

Distr: B.C., ID, OR, WA

Herb: OSC, UVIC, WSP

Refs: 56

"Paxina" recurva Snyder

Distr: B.C., ID, MT, WA

Herb: CUP, NY, OSC, SFS, UVIC, WSP, WTU

Refs: 56, 59

Helvella-affinities

"Paxina" compressa Snyder

Distr: CA, OR, WA

Herb: NY, OSC, SFS, WTU

Refs: 56, 59

Leucoscypha-affinities

"Patella" maculosa (Phillips) Seaver

Distr: CA

Herb: CUP

Refs: 54, 56

"Humarina" ochroleuca (Clem.) Seaver

Distr: CO, OR

Herb: NY, OSC

Refs: 56

Tarzetta-affinities

"Pustularia" rosea Rea

Distr: B.C.

Herb: OSC

Refs: 9

Trichophaea-affinities

"Patella" contradicta Seaver

Distr: B.C.

Herb: OSC

Refs: 57

"Sphaerospora" hinnulea (Berk. & Br.) Masee

Distr: CA, OR, WA

Herb: BPI, WSP

Refs: 9, 55, 56

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A NEW SPECIES OF *MICROASCUS* AND ITS PECULIAR
CONIDIAL STATE

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During a taxonomical study of soil fungi in Thailand, a new ascomycete belonging to the genus *Microascus* was encountered. The conidial state of this species is characterized by short annellophores and dark, globose, thick-walled, catenate conidia with a germ slit, suggestive of the genus *Wardomyces*, from which it differs in several significant characteristics. It cannot be accommodated in any known genus, and is, besides the ascospore state, described here as new genus.

Microascus inopinatus Udagawa & Furuya, sp.nov. (Figs. 1, 2)

Status conidialis: *Wardomycopsis inopinata* Udagawa & Furuya, st.nov. (vide infra)

Coloniae in agar farina avenae mixto vel agar cum decocto tuberorum et carota restrictae, tenues et partim submersae, plus minusve floccosae; fructificationes conidiorum abunde efferentes, atrocinereae vel fere nigrae; ascocarpae tarde effectae; reversum valde brunneo-cinereum.

Ascocarpae dispersae vel irregulariter aggregatae, superficiales vel partim immersae, nigrae, opacae, subgloboseae, 160-350 μm diam, pilosae, postea longirostrae, ostiolatae; rostra atra, cylindracea, 550-1,000 μm longa, ad basim 18-25(-28) μm diam, pilosa, saepe distorta; peridium 20-40 μm crassum, valde olivaceo-brunneum, membranam vel carbonaceum, e usque 8 stratis cellularum composito. Pili ascocarparum (et collorum) numerosi, recti vel flexuosi, septati, laeves, olivaceo-brunnei, usque 130-250 μm longi, prope basin 3.0-3.5 μm diam, in fasciculis saepe dispositi. Asci octospori, globosi vel ovoidei, 6-9 \times 5-7 μm , tenues, nonstipitati, irregulariter dispositi, evanescentes. Ascosporae primum dextrinoideae, hyalinae vel dilute stramineae, triangulares vel reniformes, 3.0-3.5 \times 2.5-3.0 μm , laeves, poro germinationis basilari praeditae. Status conidialis *Wardomycopsis*.

Typus No. 2767, NHL, isolatus e solo in thailandensis.

Ety. Refers to the unexpected morphology of the conidial structures.

Colonies on oat-meal agar or potato-carrot agar grow-

ing restrictedly, thin, vegetative mycelium submerged, with more or less floccose surface; conidial structures abundantly produced, dark grey to nearly black (Leaden Grey to Black; Rayner, 1970); ascocarps later developed within aerial growth or into the agar; reverse dark brownish grey.

Ascocarps scattered or irregularly aggregated, superficial to semi-immersed, black, opaque, subglobose, 160-350 μm in diam, later with a long neck, hairy, ostiolate; necks dark-colored, cylindrical, 550-1,000 \times 18-25(-28) μm , hairy, often distorted; peridium 20-40 μm thick, dark olivaceous brown, membranaceous to carbonaceous, up to 8 cells deep in radial section, consisting of outer layers of thick-walled angular dark cells and inner layer of hyaline cells. Ascocarp hairs numerous, straight to flexuous, septate, smooth-walled, olivaceous brown, up to 130-250 μm long, 3.0-3.5 μm wide near the base, often adhering in fascicles, covering the exposed upper part of the ascocarp and the neck. Asci 8-spored, globose to ovoid, 6-9 \times 5-7 μm , thin-walled, non-stipitate, irregularly disposed, evanescent. Ascospores dextrinoid when young, hyaline to pale straw-colored, pale reddish brown in mass, triangular to reniform, 3.0-3.5 \times 2.5-3.0 μm , smooth-walled, with an indistinct germ pore at base. Conidial state present, Wardomyopsis.

Holotype - No. 2767, NHL, isolated from soil, Bangkhen near Bangkok, Thailand, February 25, 1974. Isotype - SANK 10777.

Wardomyopsis inopinata Udagawa & Furuya, gen. et sp. nov. (Figs. 1, 2)

Deuteromycotina, hyphomycetes. Coloniae restrictae, fuscae. Mycelium sparsum, partim superficiale, partim in substrato immersum, hyalinum vel dilute flavo-brunneum, ex hyphis vulgo flexuosis, ramosis, septatis, laevibus, 1.5-3.0 μm diam, saepe funiculosis compositum. Structurae conidicae simplices, annellophoris solitaris vel catervis annellophorum parvis acrogenis in conidiophoris brevibus. Conidiophora semi-macronemata, mononemata, septata, laevia, hyalina vel subhyalina, raro ramosa, 3.5-6.0(-12.0) \times 2.0-3.0(-4.0) μm . Cellulae conidiogenae monoblasticae, in conidiophoris incorporatae, terminales, sed interdum discretae, percurrentes, hyalinae vel leviter coloratae, simplices vel septatae, laeves, ampulliformes vel cylindricae, 3.5-5.0 \times 2.5-3.0 μm , saepe superne inflatae, cum anellationibus terminalibus distinctis. Conidia sicca, acrogena, basipetalia et breve catenulata, simplicia, primum pallida et pyriformia, deinde olivaceo-brunnea, in massa nigra, globosa vel subglobosa, 4.0-5.5 μm diam, parietibus crassis, laeves, cum fissura mediana (plerumque transversali).

Typus No. 2767, NHL, cum forma ascosporae (loc. cit.).

Etym. of generic name. Refers to position intermediate between Scopulariopsis and Wardomyces.

Colonies restricted, dark-colored. Mycelium sparse, superficial or immersed, hyaline to pale yellowish brown, composed of mostly flexuous, branched, septate, smooth-walled hyphae, 1.5-3.0 μm in diam, often forming funicles.

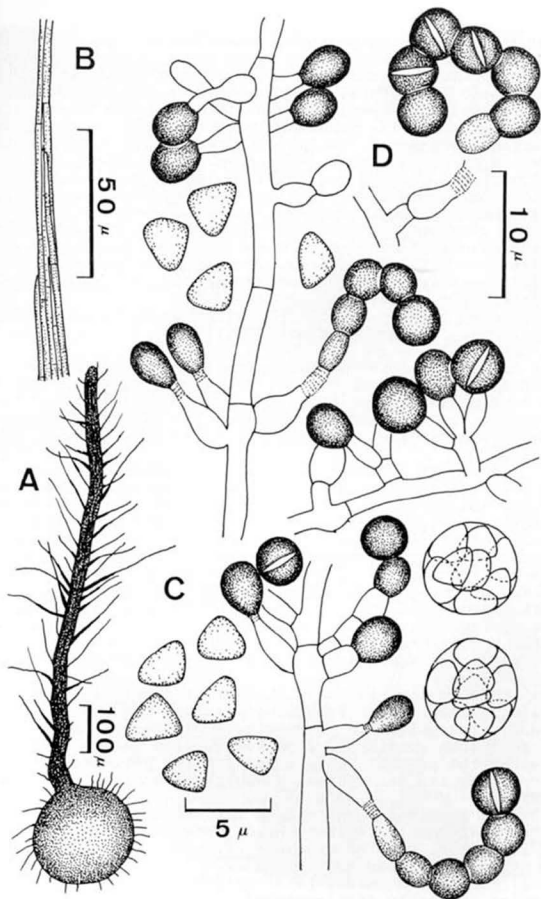


Fig. 1. *Microascus inopinatus* Udagawa & Furuya. A. Ascocarp. B. A portion of ascocarp hairs. C. Asci and ascospores. D. Conidial structures of *Wardomyopsis* state.

Conidial structures as annellophore borne singly along the aerial or prostrate hyphae, or in small divergent groups on short conidiophores. Conidiophores semi-macronematous, mononematous, septate, smooth-walled, hyaline to subhyaline, rarely branched, $3.5-6.0(-12.0) \times 2.0-3.0(-4.0) \mu\text{m}$. Conidiogenous cells monoblastic, integrated, terminal but sometimes separated, percurrent, hyaline to slightly colored, simple or septate, smooth-walled, flask-shaped to cylindrical, $3.5-5.0 \times 2.5-3.0 \mu\text{m}$, often swollen above, with distinct terminal annellations. Conidia dry, acrogenous, borne in basipetal succession as a curved short chain, 1-celled, pale-colored and pyriform when young, then becoming olivaceous brown, black in mass, globose to subglobose, $4.0-5.5 \mu\text{m}$ in diam, with walls thick and smooth, with a median germ slit running the entire length of one side (mostly transverse).

Holotype - No. 2767, NHL, with the ascosporic state (loc. cit.). Isotype - SANK 10777.

Specimens cited are deposited as follows: No. 2767 (holotype) in the Mycological Herbarium, National Institute of Hygienic Sciences (NHL), Tokyo, Japan, and No. 10777 (isotype) in the Mycological Herbarium, Fermentation Research Laboratories, Sankyo Co., Ltd. (SANK), Tokyo, Japan.

Upon most substrata containing vegetable extracts such as PDA, PCA or oat-meal agar, the ascocarps are produced fairly abundantly and ripen within about 1 month, and are usually cleistocarpic. Plate cultures are often not in good condition to show the ostiolate characteristic of the ascocarp. The long-beaked neck of the ascocarps is very slow to form and is ultimately seen on the agar slants after 18 months incubation. The development was so slow that it was difficult to establish the proper placement of the new species in the Microascaceae. When young the ascocarps are rather suggestive of Kernia (Malloch and Cain, 1971), but as these develop they assume a clearly different.

This species is somewhat similar to M. giganteus Malloch (1970) which is, among previous members of the genus, also unique in possessing a Wardomyces conidial state. Both species produce long-beaked setose ascocarps. However the present species has smaller perithecia, smaller and triangular ascospores, and globose conidia that are in chains.

The triangular pattern of the ascospores in M. inopinatus is strongly reminiscent of those seen in some species of the genus, viz. M. trigonosporus Emmons & B.O. Dodge and M. pyramidus Barron & Gilman (Arx, 1975; Barron et al., 1961; Morton and Smith, 1963; Udagawa, 1962). The new species is easily distinguished from these similar species in the above mentioned appearance of the ascocarps, as well as in association with a conidial state of the 'Wardomyopsis' type.

The Wardomyopsis state in this species is very characteristic. Although this state could not be identified

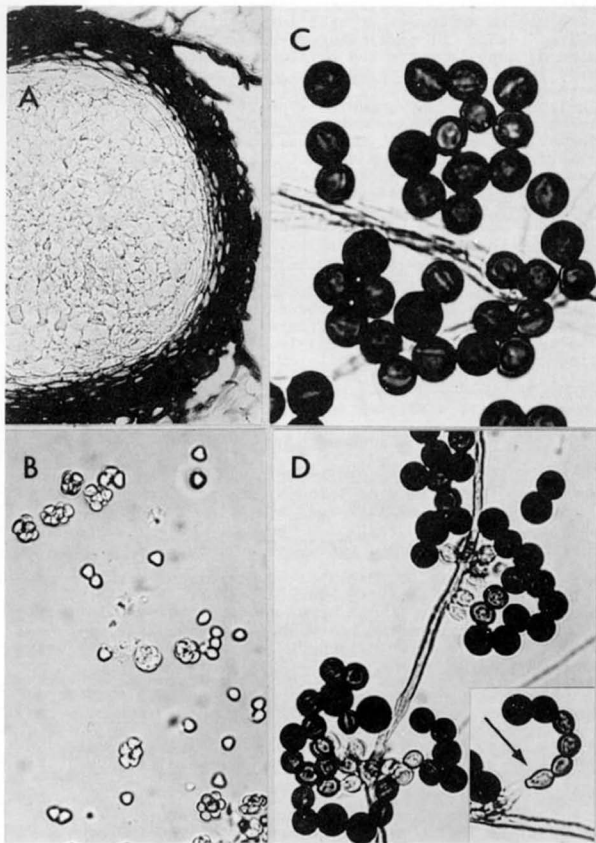


Fig. 2. *M. inopinatus*. A. Section of ascocarp. $\times 400$. B. Asci and ascospores. $\times 750$. C. Conidia. $\times 2,000$. D. Conidial structures (arrow: pyriform, young conidium). $\times 1,500$.

with any described genus, the ontogeny of conidial formation may be analogous to that in Scopulariopsis (Morton and Smith, 1963). Of particular resemblances are the production of annellophores and pyriform conidia with a truncate base (when young). Wardomyces belongs in the complex of several imperfect genera connected with the Microascaceae (Malloch, 1970) and occupies a position intermediate between Scopulariopsis and Wardomyces. It differs from the former in the globose, thick-walled conidia with a germ slit (when matured) and the latter in annellated conidigenous cells and catenate, globose conidia.

There are at least two Scopulariopsis species to be transferred to the new genus: Wardomyces humicola (Barron) Udagawa & Furuya comb. nov. (Syn. Scopulariopsis humicola Barron, Antonie van Leeuwenhoek 32: 294. 1966) and Wardomyces state (= Scopulariopsis state) of Microascus singularis (Sacc.) Malloch & Cain. A comparison of our organism with the type collection of S. humicola Barron (CBS 487.66 = ATCC 16691) showed them to be distinct from each other because of the difference in shape of conidia. The conidia of the additional two species are normally long-ovate to short-cylindric or elliptical-ovate. M. singularis also differs from this fungus in having nearly glabrous ascocarps and larger, heart-shaped ascospores (Barron et al., 1961; Malloch and Cain, 1971).

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TYPE STUDIES IN THE GENUS PEZIZA. II.
 OPERCULATE DISCOMYCETES DESCRIBED
 BY J. B. ELLIS AND CO-AUTHORS

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In my continuing study of the genus *Peziza* I have examined the species described by J. B. Ellis and his co-authors. My task was facilitated by the use of *A Record of the Fungi Named by J. B. Ellis* by Edith Cash (1953). Species of *Peziza* referred to genera of inoperculate Discomycetes by Cash are listed at the end of this article. More detailed comments on the operculate Discomycetes follow. Type specimens from the New York Botanical Garden have been examined where there have been no recently published comments.

Peziza aurantiopsis Ell., Bull. Torrey Bot. Club 9: 18. 1882.

≡ *Lachnea aurantiopsis* (Ell.) Sacc., Syll. Fung. 8: 180. 1889.

≡ *Wolfina aurantiopsis* (Ell.) Seav., Mycologia 29: 680. 1937.

This is the type species of *Wolfina* Seav. ex Eckblad. Eckblad (1968) provides an accurate description of this species. The genus is placed in the Sarcosomataceae of the Sarcoscyphineae by Korf (1972).

Peziza brachypus Ell. & Ev., J. Mycol. 4: 55. 1888.

≡ *Geopyxis brachypus* (Ell. & Ev.) Sacc., Syll. Fung. 8: 68. 1889.

The fungus should be referred to *Helvella* section *Macropodes*. Seaver (1928) treated the species as a synonym of *Parina subclavipes* (Phill. & Ell.) Seaver.

Peziza cestrica Ell. & Ev., J. Mycol. 7: 152. 1885.

≡ *Hymaria cestrica* (Ell. & Ev.) Sacc., Syll. Fung. 8: 133. 1889.

≡ *Aleuria cestrica* (Ell. & Ev.) Seav., North American cup-fungi (operculates) p. 28. 1928

The species is properly referred to *Aleuria* as was

done by Seaver.

Peziza chlamydospora Ell. & Ev., Bull. Torrey Bot. Club 10: 98. 1883.

Authentic material in the Farlow Herbarium general collection from the type locality, and the type collection (NY!), show this to be close to, if not identical with, *Peziza atrovinosa* Cooke. Seaver (1928) first listed this synonymy.

Peziza hainesii Ell., Bull. Torrey Bot. Club 8: 65. 1881; North American Fungi no. 562.

= *Lachnea hainesii* (Ell.) Sacc., Syll. Fung. 8: 186. 1889.

Seaver (1928) treated this as a synonym of *Paxina semitosta* (Berk. & Curt.) Seaver. Korf (1960) treated it as a synonym of *Jafnea semitosta* (Berk. & Curt.) Korf. My study of number 562 in *North American Fungi* (FH) bears out this opinion.

Peziza olivatra Ell. & Holw. in Arth. et al., Bull. Minnesota Geol. and Nat. Hist. Surv. 3: 36. 1887.

= *Humaria olivatra* (Ell. & Holw.) Sacc., Syll. Fung. 8: 148. 1889.

Seaver (1928) reported this as an inoperculate Disco-mycete. The species seems best referred to the Dermateaceae because of its dark ectal excipulum. The holotype (NY) has been studied.

Peziza orthotricha Cke. & Ell. Grevillea 6: 7. 1877.

= *Humaria orthotricha* (Cke. & Ell.) Sacc., Syll. Fung. 8: 119. 1889.

= *Humarina orthotricha* (Cke. & Ell.) Seav., North American cup-fungi (operculates) p. 127. 1928.

This fungus has large operculate asci, globose or subglobose warted ascospores, and occurs on a moss. It appears to develop cleistohyemially. It is a member of the genus *Octospora* and should be compared with *O. meslinii* (Le Gal) Svrček & Kubička which occurs on the same moss (Benkert 1976).

Peziza rhizomorphae Ell. & Ev., J. Mycol. 4: 98. 1888.

= *Plectania rhizomorphae* (Ell. & Ev.) Sacc., Syll. Fung. 8: 164. 1889.

= *Scutellinia rhizomorphae* (Ell. & Ev.) Kuntze, Rev. Gen. Pl. 3: 520. 1898.

This species, based on the specimens in NY, is *Plectania melastoma* (Sow. ex Fr.) Fuckel. This accords

with Seaver's (1928) synonymy.

Peziza scutelloides Ell., Bull. Torrey Bot. Club 9: 18. 1882; North American Fungi no. 838.

≡ *Sphaerospora scutelloides* (Ell.) Sacc., Syll. Fung. 8: 188. 1889.

Rifai (1968) suggested that this species is one of the synonyms of *Sphaerosporella hinnulea* (Berk. & Br.) Rifai. Certainly the description given by Ellis closely matches the concept Rifai presents. Ellis's specimen has a bright orange hymenium and occurs on soil. These features distinguish it from *S. brunnea*. There is confusion on several points over the distinction between *Sphaerosporella* and *Pyronemella*. Tewari and Pant (1968) would use the name *Pyronemella* for hairy spherical-spored Discomycetes on burned areas. This is essentially the circumscription of *Sphaerosporella*. A study of *P. arenosa* Speg., type species of the genus *Pyronemella*, might resolve the problem. Korf (1972) treated *Sphaerosporella* as a synonym of *Trichophaea*.

Peziza stephensoniana Ell. in Rehm, Ascom. Lojk. p.3. 1882. Invalid, published in synonymy.

≡ *Discina repanda* (Wahl. ex Fr.) Sacc. subsp. *stephensoniana* Ell. in Rehm ex Sacc., Syll. Fung. 8: 100. 1889.

Pfister (1973) gave a complete synonymy and indicated that the species was indistinguishable from *Peziza repanda*. As for Ellis's opinion on the taxon, it is apparent from studying specimens identified by him that he had no clear concept of it. Among those collections in the Farlow Herbarium identified by Ellis are specimens of *Peziza badiocfusca* Korf, *P. sylvestris* Boud., *P. ampliata* Pers. ex Fr., and an *Otidea*.

Peziza striispora Ell. & Ev., Bull. Iowa Lab. Nat. Hist. 4: 69. 1896.

≡ *Sarcoscypha striispora* (Ell. & Ev.) Sacc. & Syd., Syll. Fung. 14: 754. 1899.

The holotype of *Peziza striispora* is a specimen of *Cookeina tricholoma* (Mont.) Kunze. This was suggested by Seaver (1928).

Peziza trachyderma Ell. & Ev., Amer. Naturalist 31: 426. 1897.

≡ *Humaria trachyderma* (Ell. & Ev.) Sacc. & Syd., Syll. Fung. 14: 752. 1899.

≡ *Humarina trachyderma* (Ell. & Ev.) Seav., North American cup-fungi (operculates) p. 139. 1928.

This seems best referred to *Peziza vesiculosa* Bull. ex S. F. Gray. Among collections referred to *P. vesiculosa* this is one of the smallest. *Peziza vesiculosa* has predominantly globose cells in the ectal excipulum, large, smooth ascospores (up to 24 μ m long) and apothecia which always occur on dung or manured soil.

EXCLUDED SPECIES

The following species which were originally described in the genus *Peziza* are members of the Helotiales. For synonyms, the reader is referred to Cash (1953).

Peziza abdita Ell., *P. acerina* Cke. & Ell., *P. aquifoliae* Cke & Ell., *P. astericola* Cke. & Ell., *P. borealis* Ell. & Holw., *P. callochaetes* Ell. & Ev., *P. campanula* Ell., *P. carneorubra* Ell. in Cke., *P. cazenoviae* Ell. & Ev., *P. cenangioides* Ell., *P. clavigera* Ell. & Ev., *P. conorum* Ell., *P. cornuta* Ell., *P. craginiana* Ell. & Ev. in Cragin, *P. crinella* Ell. & Ev., *P. crossota* Ell., *P. culcitella* Cke. & Ell., *P. cyphelloides* Ell. & Ev., *P. dinemasporioides* Ell. & Ev., *P. doratophora* Ell. & Ev., *P. earina* Ell., *P. earliana* Ell. & Ev., *P. elongata* Ell. & Ev. in Rehm, *P. fairmanii* Ell. & Ev., *P. frondicola* Ell. & Ev., *P. fumigata* Ell. & Ev., *P. fumosella* Cke. & Ell., *P. fuscidula* Cke. & Ell., *P. fuscocarpa* Ell. & Holw., *P. gaultheriae* Ell. & Ev., *P. gelatinosa* Ell. & G. Martin, *P. glagosa* Ell. & Ev., *P. glenospora* Ell. & Ev., *P. heterocarpa* Ell., *P. heteromorpha* Ell. & Ev., *P. hypnicola* Ell., *P. hystriacula* Ell. & Ev., *P. incondita* Ell., *P. incrustata* Ell., *P. introviridis* Cke. & Ell., *P. latebrosa* Ell., *P. mauriata* Cke. & Ell., *P. meleagris* Ell., *P. miniopsis* Ell., *P. mycogena* Ell., *P. nyssaegena* Ell., *P. oenotherae* Cke. & Ell., *P. oleosa* Ell., *P. osmundae* Cke. & Ell., *P. paulopuncta* Cke. & Ell., *P. phlegmacea* Ell., *P. prinicola* Ell. & Ev., *P. prolifica* Ell., *P. regalis* Cke. & Ell., *P. rhabdocarpa* Ell., *P. raphidospora* Ell., *P. simulata* Ell., *P. soleniaeformis* Ell. & Ev., *P. solfatara* Cke. & Ell., *P. stictoidea* Cke. & Ell., *P. subgibbosa* Ell., *P. tenella* Cke. & Ell., *P. theioidea* Cke. & Ell., *P. venturioides* Ell. & Ev., *P. yogoensis* Ell. & Gall.

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ZYGOPLEURAGE, TRIPTEROSPORELLA AND PODOSPORA
(SORDARIACEAE: PYRENOAMYCETES) IN IRAQ

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SUMMARY

Fourteen species belonging to Zygopleurage, Tripterosporella and Podospora are discussed and diagnostic keys are composed for the species known from Iraq. Out of these, Z. multicaudata, Z. faiyumensis, T. coprophila, P. fimbriata, P. bicornis and P. miniglutinans are new records for Iraq.

Contributions to the study of coprophilous fungi from Iraq were made by Abdullah et al. (1976), Ahmed et al. (1970, 71) and Ismail and Ahmed (1970). A total of 48 species have been recorded so far. This paper records six more species from Iraq and their illustrated descriptions are provided. Diagnostic keys are provided for all known species of Zygopleurage and Podospora from Iraq. New distribution data and substratum relationships are added for the previously known species.

ZYGOPLEURAGE

Boed., *Persoonia* 2: 316. 1962.

This genus was proposed by Boedijn (1962) to accommodate Sordaria zygospora Speg. The chief basis was the morphology and development of ascospores. In the young asci, the ascospores are subhyaline, single-celled and more or less elongated. These may or may not be coiled around each other. During maturation two septa are laid down, forming three cells. The end cells develop thick walls and become strongly pigmented while the intermediate cell remains subhyaline and cylindrical. In the mature ascus the intermediate cell of the ascospore tends to collapse leaving separate end cells. Such asci apparently appear 16-spored but a careful search, especially of younger asci, reveals the remnants of the intermediate cells. The gelatinous caudae are present in all the known species and are best seen in fresh material.

Perithecia subglobose to pyriform with slender neck, ostiolate. Peridium membranous, 3-layered; outer layer pigmented and angular; middle layer of vertically elongated cells and inner layer of irregularly swollen, subhyaline cells. Asci clavate to subcylindrical, unitunicate, 8-spored. Ascospores subhyaline, single-celled and cylindrical when young but become three-celled at maturity. The end cells become strongly pigmented and thick walled while the middle cell remains subhyaline and thin walled. Gelatinous caudae present.

Type species: Zygopleurage zygospora (Speg.) Boed.

KEY TO THE SPECIES

- A. Gelatinous caudae present all around the ascospores (end cells as well as intercalary cell). . . B
- A. Gelatinous caudae confined to the end cells; end cells 28-33 x 17-20 μm , ellipsoid; intercalary cell 75-90 x 4-5 μm , cylindrical.
1. Z. multicaudata
- B. Intercalary cell 120-175 μm long, cylindrical; end cells 30-36 x 18-22 μm , ellipsoid, covered with 4 distinct gelatinous caudae.
2. Z. zygospora
- B. Intercalary cell 60-80 μm long, cylindrical but sometimes inflated in the middle; end cells 40-45 x 22-26 μm , ellipsoid, covered with irregular gelatinous sheath.
3. Z. faiyumensis

1. Zygopleurage multicaudata Mirza
in Mirza and Nasir, Nova Hedwigia 16: 286. 1968.

Perithecia scattered to partially immersed, pyriform, yellowish brown to light brown, 750-1000 x 450-650 μm , with a short cylindrical neck, often darker to almost brownish black in the neck area, covered all over with long (up to 25 μm long and 2-2.5 μm broad), flexuous, light brown, septate, thin to moderately thick walled hairs. Peridium translucent to somewhat opaque, thin and membranous, 3-layered; outer layer with angular to somewhat irregular cells (6-15 μm across); middle layer of vertically elongated cells and inner layer of irregularly globose, subhyaline cells. Paraphyses evanescent. Asci 240-280 x 45-55 μm , clavate to subcylindrical, 8-spored, the walls thin, subhyaline and often collapsing at maturity. Ascospores 2(4) seriate, 3-celled, end cells 28-33 x 17-20 μm , ellipsoid, greenish brown to dark brown; intercalary cell 75-90 x 4-5 μm ,

subhyaline, cylindrical but often collapsing in dry specimens and difficult to discern. Gelatinous caudae occurring as slender processes all around the end cells but absent on the intercalary cell.

COLLECTIONS EXAMINED: on cow dung, Basrah, Feb. 2, 1977, SKA 237; on buffalo dung, Basrah, Feb. 2, 1977, SKA 238.

This species was first noticed by Ahmed and Asad (1968) from Karachi (Pakistan) and they reported it under Z. zygo-spora as an abnormal specimen. Later, Mirza and Nasir (1968) again found it from Lyallpur (Pakistan) and described it as a new species. They also observed that the species seems to be widely distributed in West Pakistan. We have noticed two collections of this species from Iraq (Basrah area) and perhaps the species is widely distributed in this part of Asia. The Iraqi collections are typical of the species but the size of ascospores and asci appears slightly larger.

2. Zygopleurage zygospora (Speg.) Boed.
Persoonia 2: 316. 1962.

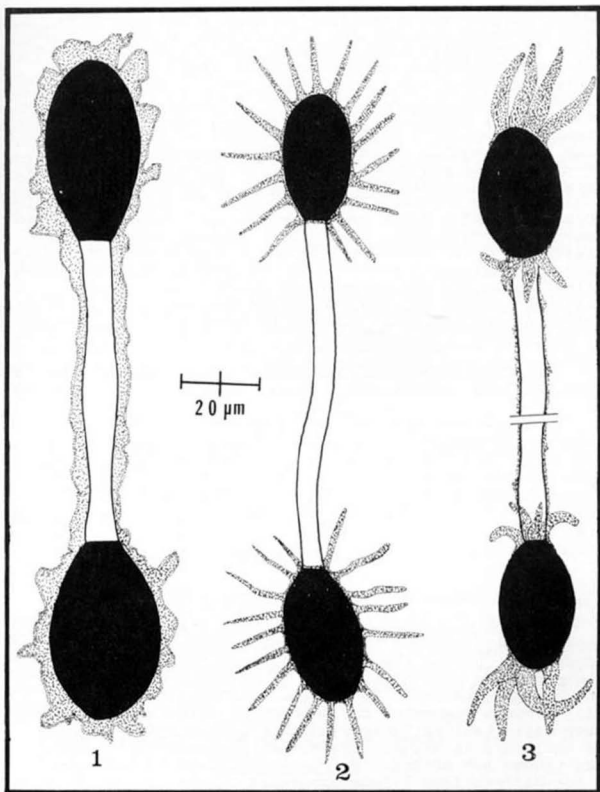
Perithecia scattered, semi-immersed, pyriform, olivaceous brown, 800-1000 x 500-800 μm ; neck cylindrical (300-400 x 150-200 μm) and usually covered with long flexuous hairs. Peridium thin, membranous, semi-translucent, 3-layered. Asci 250-350 x 45-55 μm , clavate, 8-spored, the walls thin, subhyaline and collapsing at maturity. Paraphyses evanescent. Ascospores biseriate, 3-celled; end cells ellipsoid, 30-36 x 18-22 μm , dark brown, with 4 distinct gelatinous processes; intercalary cell 120-175 μm long and 5-6 μm broad, cylindrical, subhyaline.

COLLECTIONS EXAMINED: on cow dung, Shaqlawa (Arbil), July 20, 1970, SKA 113; on cow dung, Sulaimania, July 20, 1970, SKA 117; on sheep droppings, Basrah, March 25, 1975, SKA 239; on sheep droppings, Nasriah, Sept. 1, 1974, SKA 240; on horse dung, Kerbala, Sept. 3, 1974, SKA 241.

This species is widely distributed and has been recorded from Europe, Asia and North America. From Iraq, it was first reported by Ahmed et al. (1971) on cow dung gathered from Shaqlawa (Arbil). Since then we have examined several collections of this species from various parts of Iraq.

3. Zygopleurage faiyumensis Lundq.
Bot. Not. 122: 354. 1969.

Perithecia scattered and few, semi-immersed to almost superficial, yellowish brown, 900-1200 x 600-850 μm , pyriform with a short cylindrical neck up to 200 μm long and



Figs. 1-3. Mature ascospores of *Zygopleurage faiyumensis* (fig. 1), *Z. multicaudata* (fig. 2) and *Z. zygospora* (fig. 3).

120-140 μm broad, neck darker to almost brownish black. Hairs occurring all over the perithecium, up to 2 μm wide, yellow to yellowish brown, thin walled, septate, flexuous. Peridium translucent to almost opaque, membranous, 3-layered; outer layer composed of angular to somewhat irregular cells, 4-7 μm across, with slightly thick and uneven walls; middle layer of vertically elongated cells appearing like short hyphae; inner layer of subhyaline, large and irregular cells. Paraphyses evanescent. Asci 250-400 x 50-60 μm , subcylindrical to clavate, unitunicate, the walls thin, hyaline and scarcely visible, 8-spored but some evidently 4-6 spored. Ascospores 2-4 seriate, 3-celled, end cells 40-45 x 22-26 μm , ellipsoid with rounded apex and somewhat truncate base, dark brown, smooth, uniguttulate; intercalary cell 60-80 μm long and 6-8 μm broad, cylindrical but occasionally inflated in the middle, hyaline, often collapsing in the mature asci and difficult to discern. Gelatinous caudae all over, covering the end cells as well as the intercalary cell uneven to drawn out in to irregular processes.

COLLECTIONS EXAMINED: on horse dung, Kerbala, Sept. 3, 1974, SKA 242; on cow dung, Basrah, April 2, 1972, SKA 243.

This species is known only from the type specimen which was collected from Faiyum in Egypt (Lundqvist, 1969). This is perhaps the second report of this species. The Iraqi collections are characteristic of the species but possess slightly smaller ascospores, however, these come well within the range of the species.

TRIPTEROSPORELLA

Subr. & Lodh., Curr. Sci. 37: 245. 1968.

This genus was proposed for a single species marked by nonostiolate ascocarps (cleistothecia) and the nature of ascospores. During the early stages of development the ascospores are subhyaline, long and cylindrical but soon become segmented in to two cells. The upper cell (head cell) becomes pigmented and develops a thick wall while the lower cell (tail cell) remains thin walled and subhyaline. The tail cell is always longer than the head cell. Gelatinous caudae are absent. *Tripterospora* Cain is very close to but differs from *Tripterosporella* in the shape of young ascospores which are ovoid to clavate. Moreover, in mature ascospores the tail cell is always shorter than the head cell.

Tripterosporella coprophila Subr. & Lodh.

Curr. Sci. 37: 245. 1968.

Cleistothecia scattered, superficial, subglobose, 275-350 μm across, brownish black to almost black, hairy. Hairs

long, flexuous, 2-3.5 μm wide, slightly thick walled, brown to almost subhyaline near the apices. Peridium semi-translucent to almost opaque, membranous. Paraphyses evanescent. Asci 165-225 x 16-20 μm , subcylindrical to clavate-cylindrical, 8-spored, iodine test negative, the walls thin, subhyaline and collapsing at maturity. Ascospores 2(3) seriate, occasionally uniseriate at maturity, 2-celled; head cell, 21-24 x 12-13.5 μm , ellipsoid to subglobose, the walls moderately thick, olivaceous brown, germ pore apical; basal cell (tail cell) 30-32 x 5-6 μm , subhyaline, cylindrical, straight to slightly curved near the base, thin walled.

COLLECTION EXAMINED: on horse dung, March 3, 1975, SKA 266.

This species was first reported on dung from India (Uttar Pradesh and Rajasthan) by Subramanian and Lodha (1968). It is marked by the morphology and development of the ascospores. The Iraqi collection is typical of the species and appears to be the second report for the species.

PODOSPORA

Cesati in Raben., Klotzsch Herb. Viv. Mycol. ed.2, No. 259. 1856.

It is a large and unnatural genus but recently it has been revised and circumscribed (Lundqvist, 1972; Mirza and Cain, 1969). As defined here it includes those species only which have pedicellate brown spores with or without gelatinous caudae at each end.

Perithecia nonstromatic, ostiolate. Peridium membranous to coriaceous, 3-4 layered, light brown to almost black. Asci 4 to multispored, clavate to cylindrical or saccate, unitunicate. Ascospores ellipsoid, dark brown to almost black; primary appendage basal, cylindrical to clavate, subhyaline; secondary appendage present or absent; germ pore apical.

Type species: Podospora fimicola Cesati

KEY TO THE SPECIES

A. Asci 4-spored. . . B

A. Asci 8-spored. . . C

B. Ascospores 19-22 x 10.5-12 μm , ellipsoid in face view but inaequilateral in side view with one side almost flat; primary appendage slender and fugacious; secondary appendage absent.

1. P. inaequalis

- B. Ascospores 33-39 x 18-20 μm , ellipsoid; primary appendage cylindrical, 24-28 x 4-4.5 μm ; secondary appendage 60-80 x 8 μm , lash-like. 2. P. anserina
- C. Ascospores comparatively small, 15-22 μm in length. ..D
- C. Ascospores medium sized, 25-35 μm in length. ..F
- C. Ascospores large sized, 35-45 (55) μm in length. ..H
- D. Primary appendage clavate; secondary appendage absent; ascospores 17-20 x 8.5-10 μm , boat-shaped with one side flat. 3. P. fimbriata
- D. Primary appendage cylindrical; secondary appendage present. ..E
- E. Perithecia with agglutinated hairs only; ascospores 17-21.6 x 11-14 μm , ellipsoid. 4. P. vesticola
- E. Perithecia with agglutinated as well as flexuous hairs also; ascospores 21-22.5 x 12-13.5 μm , broadly ellipsoid to ovoid. 5. P. miniglutinans
- F. Secondary appendages covered with a diffuse gelatinous sheath which may extend to cover the primary appendage as well; ascospores 27-30 x 16-18 μm , ellipsoid. 6. P. bicornis
- F. Secondary appendages not covered as above. ..G
- G. Ascospores 28-34 x 18.5-20 μm , ellipsoid; primary appendage 26-33 x 5-6 μm , cylindrical; secondary appendage short, crown-like, occurring near the apex of the ascospore as well as near the distal end of the primary appendage. 7. P. communis
- G. Ascospores 28-45 x 16-22 μm , ellipsoid; primary appendage 17-35 x 6-8 μm , cylindrical but swollen slightly in the middle and at the end; secondary appendage 20-40 x 5-9 μm , lash-like, present at the apex of the ascospore as well as

near the distal end of the primary appendage.

8. P. prethopodalis

- H. Ascospores 34-45 x 19.5-22.5 μm , ellipsoid; primary appendage 45-60 x 7-7.5 μm , cylindrical; secondary appendage 19-21 x 12-13 μm , cylindrical, occurring in a cluster or tuft near the junction of primary appendage and spore as well as at the apex of the spore.

9. P. decipiens

- H. Ascospores 39-50 x 20-27 μm , ellipsoid; primary appendage 28-40 x 6-7 μm , clavate; secondary appendages numerous, present all over the ascospores.

10. P. longicaudata

1. Podospora inaequalis (Cain) Cain
Can. J. Bot. 40: 460. 1962.

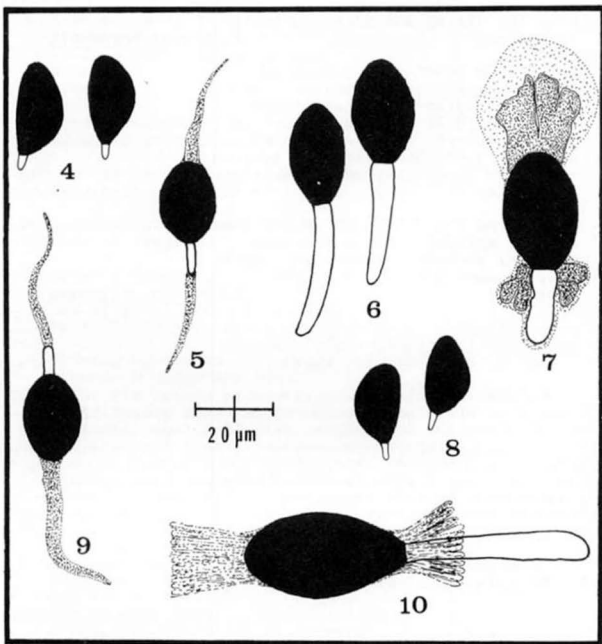
Perithecia scattered, pyriform to ovoid, 175-200 x 120-150 μm , dark brown to brownish black; neck absent or rudimentary. Peridium membranous, thin (5-7.5 μm thick), semi-translucent. Paraphyses evanescent. Asci 80-100 x 12-15 μm , cylindrical, 4-spored. Ascospores 19-22 x 10.5-12 μm , uniseriate, ellipsoid with flattened side and thus appear inaequilateral in side view, thin walled, smooth, brown; primary appendage clavate, 4-5 x 1-1.2 μm , subhyaline; secondary appendage not observed.

COLLECTION EXAMINED: on sheep droppings, Diwania, Jan. 15, 1974, SKA 210; SKA 211; SKA 212.

This species was reported earlier from Iraq by Abdullah et al. (1976). The chief diagnostic features are 4-spored asci, inaequilateral ascospores and presence of primary appendages.

2. Podospora anserina (Rabenh.) Niessl.
Hedwigia 22: 156. 1883.

Perithecia dark brown to almost black, 400-560 x 300-330 μm , pyriform to subglobose with a short, conical neck; usually covered with few tufts of hairs especially in the basal part; hairs up to 200 μm long and 2.5-3 μm broad, straight, nonseptate. Asci cylindrical to subcylindrical, 225-250 x 20-30 μm , 4-spored. Ascospores 33-39 x 18-20 μm , ellipsoid, uniseriate, thick walled, brownish black; primary appendage cylindrical, 24-28 x 4-4.5 μm , secondary appendage 60-80 x 8 μm , lash-like, upper one eccentrically attached to the apex of the spore while the lower one to the distal end of the primary appendage, sometimes two evanescent secondary appendages are also attached at the



Figs. 4-10. Mature ascospores of *Podospora inaequalis* (fig. 4), *P. miniglutinans* (fig. 5), *Tripterosporella coprophila* (fig. 6), *P. bicornis* (fig. 7), *P. fimbriata* (fig. 8), *P. vesticola* (fig. 9) and *P. decipiens* (fig. 10).

base of primary appendage.

COLLECTIONS EXAMINED: on cow dung, Shaqlawa (Arbil), July 4, 1970, SKA 91; on sheep droppings, Hilla, Jan. 15, 1974, SKA 244; on cow dung, Abu Ghraib (Baghdad), June 6, 1974, SKA 245; on camel dung, Al-Madain, June 6, 1974, SKA 246; on horse dung, Hilla, Jan. 12, 1974, SKA 247.

This species was recorded from Iraq by Ahmed et al. (1971) but since then we have noticed several collections

from different localities. It is marked by 4-spored asci large ascospores and presence of a lash-like secondary appendage.

3. Podospora fimbriata (Bayer) Cain
Can. J. Bot. 40: 459. 1962.

Perithecia scattered, partially immersed, dark brown to brownish black, 300-600 x 300-400 μm , pyriform to more less ovoid, with a short subconical neck; usually covered with agglutinated hairs especially in the apical half of the perithecium. Peridium semitranslucent to almost opaque, thin and membranous. Paraphyses filiform but usually collapsing at maturity. Asci 110-140 x 12-14 μm , cylindrical (spore bearing part) but usually with a long drawn out base, 8-spored, thin walled. Ascospores 17-20 x 8.5-10 μm , uniseriate with usually convex side facing each other, boat-shaped with one side almost flat, the walls thin, dark brown; primary appendage basal, 3-5 x 1-1.5 μm , clavate, hyaline. Secondary appendage absent. Germ pore apical.

COLLECTIONS EXAMINED: on cow dung, Basrah, March 3, 1975, SKA 267; on sheep droppings, Basrah, March 3, 1975, SKA 268.

This species is characterised by the presence of fimbriate hairs in the apical half of the perithecia and by the morphology of ascospores. P. inaequalis possesses similar ascospores but the asci in that species are 4-spored. Moreover, the ascospores are also slightly larger in size.

4. Podospora vesticola (Berk. & Br.) Cain & Mirza
ex Kobayasi in Kobayasi et al. Bull. Nat. Sci. Mus.
Tokyo 12: 332. 1969.

Perithecia 600-800 x 220-350 μm , light olivaceous brown, ovoid with a short papillate neck; sparsely covered with short agglutinated hairs. Asci cylindrical, 120-150 x 14-16 μm , 8-spored. Ascospores 17-21.6 x 11-14 μm , ellipsoid, uniseriate, thick walled, dark brown; primary appendage cylindrical, subhyaline, 6-8 μm long and up to 1.5 μm broad; secondary appendage lash-like, upper one slightly eccentric, lower one similar but attached to the distal end of the primary appendage.

COLLECTIONS EXAMINED: on cow dung, Shaqlawa (Arbil), July 20, 1970, SKA 94; on cow dung, Sulaimania, July 2, 1970, SKA 92; on cow dung, Zawita, April 13, 1977, SKA 248.

This species was recorded from Iraq by Ahmed et al. (1971). It comes very near P. miniglutinans but differs in lacking simple, flexuous hairs on the perithecia.

5. Podospora miniglutinans Mirza & Cain
 Can. J. Bot. 47: 230-231. 1969.

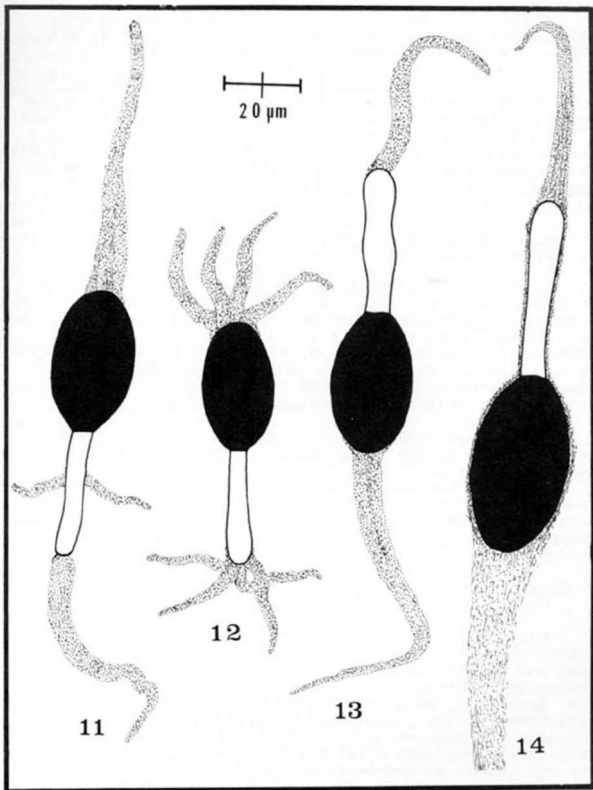
Perithecia scattered, superficial to partially immersed, dark brown to brownish black or almost black especially in the basal part, averaging 500 x 250 μm , pyriform to subconical with a short neck; usually covered with agglutinated hairs (especially in the apical half) as well as discreet, long flexuous brown hairs. These are often mixed with short tubercles each consisting of an elongated apical cell and few globose basal cells. Peridium membranous, semi-translucent. Paraphyses evanescent. Asci 200-225 x 17-19 μm , cylindrical to subclavate, 8-spored, thin-walled, amyloid test negative. Ascospores 21-22.5 x 12-13.5 μm , uniseriate but may become biseriate at maturity, broadly ellipsoid to ovoid, the walls moderately thick, greenish brown to brownish black; primary appendage 7-8 x 1.5-2 μm , cylindrical, attached to the base of ascospores, subhyaline. Upper secondary appendage ca. 20 x 5 μm , lash-like; lower secondary appendage narrower, lash-like and attached to the distal end of primary appendage; germ pore apical.

COLLECTIONS EXAMINED: on sheep droppings, Abu Ghraib (Baghdad), June 5, 1974, SKA 264; on cow dung, Zawita, April 13, 1977, SKA 265.

This species is marked by the presence of agglutinated as well as flexuous hairs interspersed with short tubercles, cylindrical primary appendage, lash-like secondary appendages and shape and size of ascospores. P. glutinans (Cain) Cain is very similar but has larger ascospores.

6. Podospora bicornis Lundq.
 Svensk Bot. Tidskr. 64: 412. 1970.

Perithecia usually aggregated in small groups, semi-immersed, greenish brown to almost brownish black, 500-600 x 400-450 μm , pyriform with a short cylindrical neck, usually covered with long, flexuous hairs. These may remain discreet or agglutinate forming tufts especially in the neck area. Peridium semi-translucent, membranous. Paraphyses evanescent. Asci 175-225 (275) x 28-32 μm , clavate, with a long tapering base and rounded apex, 8-spored, thin walled, amyloid test negative. Ascospores 27-30 x 16-18 μm , biseriate, ellipsoid, the walls moderately thick, dark brown or olivaceous brown, smooth; primary appendage 12-15 x 6-7 μm , clavate to cylindrical, subhyaline, basal; secondary appendage occurring as upper and lower caudae. Upper caudae 2, separate but more often fused and irregular, surrounded by a diffuse sheath visible in Indian ink mounts only. Lower caudae 3-5, usually fused and irregular, occurring at the junction of spore base and primary appendage, enveloped in a diffuse sheath which extends and covers the primary appendage as well.



Figs. 11-14. Mature ascospores of *Podospora anserina* (fig. 11), *P. communis* (fig. 12), *P. prethopodalis* (fig. 13) and *P. longicaudata* (fig. 14).

COLLECTIONS EXAMINED: on cow dung, Hilla, June 5, 1974, SKA 269; on horse dung, Hilla, June 5, 1974, SKA 270; on horse dung, Baghdad, June 4, 1974, SKA 271.

This species is marked by the nature of secondary appendages as well as shape and size of ascospores. Podospora caligata Khan & Cain (1972) appears very similar but differs in having slightly narrower (13-17 μm) ascospores and by the nature of secondary appendages. Lundqvist (1973) has suggested that perhaps P. caligata is a synonym of P. bicornis.

7. Podospora communis (Speg.) Niessl.
Hedwigia 22: 156. 1883.

Perithecia 700-900 x 350-450 μm , olivaceous brown to brownish black, pyriform with a conical to cylindrical neck; smooth or occasionally covered with long, flexuous and septate hairs. Asci 170-200 x 26-32 μm , clavate, 8-spored. Ascospores 28-34 x 18.5-20 μm , ellipsoid; primary appendage 26-33 x 5-6 μm , cylindrical; secondary appendage short, four, crown-like, occurring at the apex of the ascospore and near the distal end of primary appendage.

COLLECTIONS EXAMINED: on cow dung, Kirkuk, July 3, 1970, SKA 98; on cow dung, Baghdad, June 6, 1974, SKA 249.

This species was recorded by Ahmed et al. (1971) and since then we have examined another collection from Baghdad area. The chief diagnostic features are medium-sized ascospores and presence of crown-like secondary appendages.

8. Podospora prethopodalis Cain
Can. J. Bot. 40: 458-459. 1962.

Perithecia 500-800 x 300-400 μm , dark brown to almost black, subglobose to pyriform; neck short, papilliform to long and cylindrical; covered with brown, septate hairs occurring in tufts. Asci 180-250 x 40-45 μm , broadly clavate, 8-spored. Ascospores 28-45 x 16-22 μm , ellipsoid, dark brown; primary appendage 17-35 x 6-8 μm , cylindrical but slightly swollen in the middle and near the distal end; secondary appendages 20-40 x 5-9 μm , lish-like, present on one end of the ascospore as well as at the distal end of the primary appendage.

COLLECTIONS EXAMINED: on goat droppings, Hamdan (Basrah), Sept. 23, 1969, SKA 7; on sheep droppings, Brathaia (Basrah), Sept. 23, 1969, SKA 20; on sheep droppings, Hilla, Jan. 15, 1974, SKA 250; on sheep droppings, Diwania, Jan. 15, 1974, SKA 251; on cow dung, Basrah, Sept. 29, 1971, SKA 252; on goat droppings, Basrah, Sept. 29, 1971, SKA 253; on cow dung, Nasirah, Sept. 6, 1974, SKA 254; on sheep droppings, Kadisia, Jan. 15, 1974, SKA 255.

This species was recorded from Iraq by Ismail and Ahmed (1970) and since then we have recorded several collections from different localities. It comes very near P. communis but differs in the shape of primary and secondary appendages on ascospores.

9. Podospora decipiens (Winter) Niessl.
Hedwigia 22: 156. 1883.

Perithecia 600-780 x 330-420 μm , pyriform with a short neck, olivaceous brown to almost black; usually covered with flexuous septate and brown hairs especially in the basal part. Asci 190-225 x 40-50 μm , clavate, 8-spored. Ascospores biseriate, 34-45 x 19.5-22.5 μm , ellipsoid, dark brown; primary appendage subhyaline, cylindrical, 45-60 x 7-7.5 μm ; secondary appendages 19-21 x 12-13 μm , cylindrical, occurring in clusters or tufts near the junction of primary appendage and spore as well as at the apex of the spore.

COLLECTIONS EXAMINED: on cow dung, Sulaimania, July 3, 1970, SKA 99; on horse dung, Hilla, Jan. 15, 1974, SKA 256; on sheep droppings, Hilla, June 5, 1974, SKA 257; on cow dung, Diwania, Jan. 15, 1974, SKA 258; on donkey dung, Hilla, Jan. 15, 1974, SKA 259; on cow dung, Hilla, June 5, 1974, SKA 260; on horse dung, Baghdad, June 4, 1974, SKA 261; on cow dung, Diwania, Jan. 15, 1974, SKA 262; on horse dung, Hilla, Jan. 12, 1974, SKA 263.

This species was reported from Iraq by Ahmed et al. (1971) and since then we have examined several collections of this species from different parts of Iraq. It is marked by the large size of the ascospores and characteristic secondary appendages.

10. Podospora longicaudata (Griff.) Cain
Can. J. Bot. 40: 460. 1962.

Perithecia 600-800 x 470-600 μm , globose to pyriform with a small rudimentary neck, dark brown to olivaceous; semi-immersed, exposed part smooth (without hairs) but immersed part covered with dark brown septate, branched hairs or mycelium. Asci 270-290 x 35-40 μm , clavate, 8-spored. Ascospores uniseriate, ellipsoid, 39-50 x 20-27 μm , dark brown; primary appendage 28-40 x 6-7 μm , subhyaline, clavate; secondary appendages numerous, present all over the ascospores but very long and prominent at the upper end, comparatively smaller at the distal end of the primary appendage, reduced to a mere covering on the sides of spore.

COLLECTION EXAMINED: on horse dung, Shaqlawa(Arbil), July 6, 1970, SKA 100.

This species was recorded from Iraq by Ahmed et al.

(1971). We have not noticed this species again.

ACKNOWLEDGMENTS

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NOTES ON CORTICIACEAE (BASIDIOMYCETES) II

by

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Abstract

A new genus *Brevicellicium* is proposed with *Corticium exile* Jacks. as type species. Two new species are described viz. *Hyphoderma subclavigerum* and *Tubulicrinis globisporus*. Two combinations are made viz. *Brevicellicium olivascens* (an earlier name for *Odontia mutabilis* (Pers.) Bres.) and *B. viridulum*.

Brevicellicium K-H Larss. & Hjortst. nov. gen.

Fructificatio resupinata, effusa, tenuis, hymenio plus minusve pruinoso vel reticulato, membranaceo, levi vel granulato; systemate hyphali monomitico; hyphis basalibus distinctis, cellulis mediocriter prolatis, parietibus fere parallelis, hyphis subhymenialibus item distinctis sed cellulis brevibus, parietibus isodiametris; basidiis Trechisporae similibus; sporis subglobosis vel asymmetricis, non-amyloideis.

GENERITYPUS: *Corticium exile* Jacks.

Fruitbody resupinate, effused, thin or slightly thickened, hymenium more or less pruinose, with age reticulate to membranaceous, smooth or granulose. Hyphal system monomitic, basal hyphae distinct, with nearly parallel walls, proportionately longcelled, subhymenial hyphae of short, broad, distinctly isodiametric cells. Basidia short, subclavate, somewhat constricted and with 4 sterigmata. Spores subglobose to ellipsoid or lacrimiform, with distinct apiculus, neither cyanophilous nor amyloid.

REMARKS: Eriksson and Ryvarden (1975, p. 453), when describing *Hyphoderma albocremeum* (Höhn. & Litsch.) Erikss. & Strid, briefly discussed another species with similar hyphal structure. They were of the opinion that this species could be more related to *Trechispora* than to *Hyphoderma*. It was later identified as *Corticium exile* Jacks. by Eriksson and Hjortstam.

The genus *Conohypha* with the type species *Corticium albocremeum* was described by Jülich (1975) and primarily delimited by its isodiametric subhymenial hyphae. The species treated below, *Corticium exile*, *Odontia olivascens* and *Athelopsis viridula* correspond with Jülich's description of *Conohypha* in having the same kind of subhymenial hyphae. However, the basidia as well as the spores and hyphae are of much larger dimension in the type of *Conohypha*. The new genus *Brevicellicium* is in our opinion more related to *Trechispora* but separated for example by its smooth basidiospores.

Some other species with smooth basidiospores generally treated in *Trechispora* are *T. confinis*, *T. amianthina* and *T. byssinella*. The first one is with some doubt delimited from *Brevicellicium* but has a fragile structure and thus resembles *Trechispora farinacea*. The spores of *T. confinis* are, unlike those of *Brevicellicium*, slightly cyanophilous. *T. amianthina* and *T. byssinella* are rather well separated in their hyphal layer which reminds of *Athelia sensu lato*.

Key to the species of *Brevicellicium*

- 1 Hymenium grandinioid, spores globose to subglobose.....2
- 1 Hymenium smooth, spores elliptical to tearshaped.....
- *B. exile*
- 2 Fruitbody sulphur yellow to light greenish. *B. viridulum*
- 2 Fruitbody whitish to cream-coloured..... *B. olivascens*

Brevicellicium exile (Jacks.) K-H Larss. & Hjortst. nov. comb.

BAIONYM: *Corticium exile* Jacks., Can. Journ. Res. 28:721, 1950.

Fruitbody resupinate, effused, thin but not inconspicuous, whitish to cream-coloured, hymenium smooth, under a lens slightly pruinose, margin indistinct. Hyphal system monomitic, basal hyphae thinwalled, 2-3 μ m wide, with clamps, subhymenial hyphae broad, isodiametric, reaching 8-10 μ m across, with clamps. Cystidia or cystidial organs lacking.

Basidia short, subclavate, slightly constricted, 10-15 x 5-6 μm , with a small clamp at the base and with rather thin, curved sterigmata. Spores smooth, short-ellipsoid, somewhat lacrimiform, 5-6 x 3,5-4 μm , with distinct apiculus, non-amyloid.

HABITAT: All Swedish finds from decorticated deciduous wood.

DISTRIBUTION: A few collections from Sweden, Norway, Denmark, Canary Islands and Canada

REMARKS: *Brevicellicium exile* is usually well recognized by its isodiametric hyphal cells and by its small, drop-shaped basidiospores. All material that we studied was identical with the type. The spores vary slightly from 4-6 μm in length.

SPECIMENS STUDIED: CANARY ISLANDS. Tenerife, Cruce de la Rosas, 3 km S of la Esperanza, 1974-01-08. Ryvarden 12342. DENMARK. Sjaelland, Korsør skov, on old stump, 1974-11-16. Hauerslev 4938. NORWAY. Oppland, Gausdal, Ormtjernkampen nasj. park, on Picea, 1975-09-21. I. Johansen 1224/75; Nordland, Hamarøy, V. Kilvatnet, on coniferous wood, 1975-09-29. K. Bjørgum 675; Nordland, Bangsund. Å. Strid 11431. SWEDEN. Västergötland. Skepplanda par., N of Skantås, on deciduous wood, 1967-09-25. Hjortst. s.n.; Långared par., W side of lake Anten, on decayed *Alnus glutinosa*, 1976-06-07. Hjortst. 6701; Medelplana par., Kinnekulle, Råbäck, on deciduous wood, 1976-10-30. K-H Larss. & Hjortst. 7536. CANADA. Ontario, woods W of Maple, on coniferous knot (*Tsuga* or *Pinus*), 1942-10-12. Jackson 18831 (TYPE); Bear Island, Timagami, on bark of *Thuja occidentalis*, 1939-08-24. Jackson 16686.

Brevicellicium olivascens (Bres.) K-H Larss. & Hjortst. nov. comb.

BASIONYM: *Odontia olivascens* Bres., Fungi Trid. 2:36, 1892.

Hydnum granulatum Pers. var. *mutabile* Pers., Mycol. Europ. 2:184, 1825.

Odontia mutabilis (Pers.) Bres., Ann. Mycol. 9:426, 1911.

Grandinia mutabilis (Pers.) Bourd. & Galz., Bull. Soc. Mycol. France 30:250, 1914.

Cristella mutabilis (Pers.) Parm., Eesti NSV Tead. Akad. Toim. Biol. Seer. 14:223, 1965.

Trechispora mutabilis (Pers.) Liberta, Taxon 15:319, 1966.

Fruitbody resupinate, effused, thin to becoming thickened, grandinioid, whitish to cream-coloured, margin indistinct. Hyphal system monomitic, basal hyphae thin, ab. 5 μm wide, subhymenial hyphae short-celled, isodiametric, 7,5-8-10 μm wide, all hyphae with clamps. Cystidia lacking. Basidia subcylindrical, slightly constricted, 15-20 x 6-8 μm , with a clamp at the base and with 4 sterigmata. Spores smooth, subglobose and somewhat asymmetric, 4,5-5 μm across, with distinct apiculus, neither cyanophilous nor amyloid.

HABITAT: In Sweden only collected on deciduous wood.

DISTRIBUTION: Not uncommon in the south part of Sweden but rare in the northern part (Strid 1975).

REMARKS: *Brevicellicium olivascens* is well recognized by its grandinioid hymenium and subglobose, slightly asymmetric spores. It is similar to *B. exile* in having isodiametric subhymenial cells.

TYPE SPECIMEN STUDIED: Ad truncos Rosae caninae - "Ortise" VIII 1890 (the protologue says Aestate-Autumno, ad ramos Rosae caninae "Val di Sole"). Herb S.

Brevicellicium viridulum (Parm.) K-H Larss. & Hjortst. nov. comb.

BASIONYM: *Athelopsis viridula* Parm., Consp. Syst. Cort. p 203, 1968.

Corticium sulphurellum Höhn. & Litsch., Wiesner Festschr., p 66, 1908. Not *Corticium sulphurellum* Cke & Masee, Grevillea 20:35, 1891.

Microscopically it is not possible to separate *B. viridulum* from *B. olivascens* but in our concept of the species the sulphur-yellow colour is satisfactory to establish *B. viridulum* as a species of its own. *B. olivascens*, which we have collected and studied for several years, is in most cases whitish to cream-coloured, never bright yellow. We have not been able to discern any intermediate stages.

HABITAT: On deciduous wood.

DISTRIBUTION: A little known species and probably very rare in Sweden as well as in the whole of Northern Europe.

REMARKS: Easily recognized species thanks to its colour and to its similarity to *B. olivascens*.

SPECIMENS STUDIED: ESTHONIA. Jögeva, Vooze, on Alnus, 1970-09-16. E. Parmasto; Juudi AO. Oblutsenski r., Bol. Sololi

400-600 m, 1061-08-08. E. Parmasto (TYPE of *Athelopsis viridula*). POLAND. The Carpathians, distr. Gorlice, on Quercus, 1963-08-18. St. Domanski. SWEDEN. Uppland. Uppsala, Vård-sätra naturpark, on Fraxinus, 1937-10-28. S. Lundell, det. John Erikss.

Hypoderma subclavigerum K-H Larss. & Hjortst nov. spec.

Fructificatio resupinata, effusa adhaerans; hymenio continuo, albo vel cremeo; margine plus minusve indistincto; hyphis indistinctis, tenuitunicatis, 2,5-3,5 µm latis, fibulatis; cystidiis biformibus, 1. cylindricis vel subclavatis, projectis, 90-120 x 10-12 µm, 2. clavatis, inclusis, 50-80 x 4-6 µm; basidiis clavatis vel subclavatis, 25-40 x 5-6 µm, 4 sterigmatibus; sporis suballantoideis, tenuitunicatis, 10-14 x 4-5 µm, nonamyloideis.

HOLOTYPUS: SWEDEN. Västergötland. Medelplana par., Kinnekulle, Råbäck, on branch of deciduous wood, 1976-10-03. KHL & Hjortst. 7293.

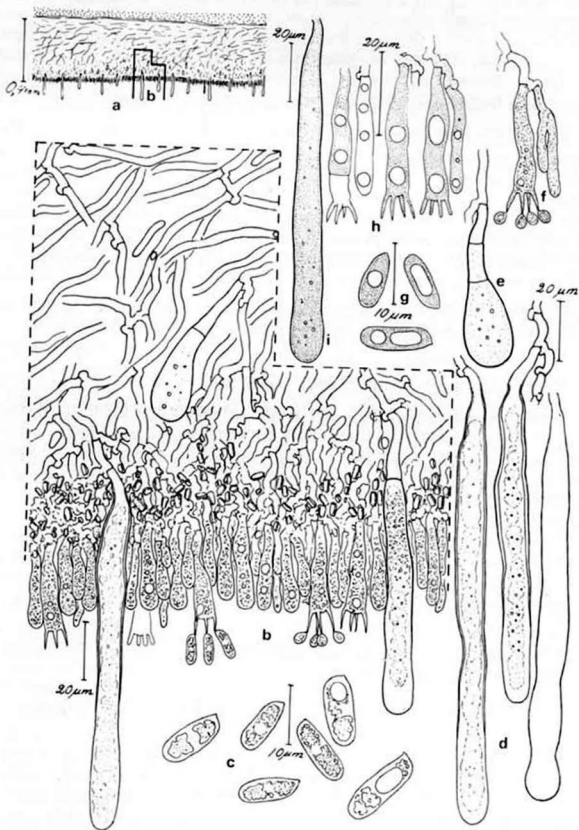
PARATYPI: KHL & Hjortst. 7264, 7288 and 7290.

Fruitbody resupinate, effused, adnate, whitish to dark cream-coloured, margin indistinct. Hyphae thinwalled, branched and with clamps, 2,5-3,5 µm wide. Cystidia of two kinds 1. cylindrical to subclavate, projecting, with thin or somewhat thickened walls, 90-150 x 10-12 µm, 2. clavate, thinwalled, more or less imbedded, 50-80 x 4-6 µm. Both kinds of cystidia sometimes with one or more adventitious septa without clamps. Basidia terminal, subclavate, somewhat constricted, 25-40 x 5-6 µm with 4 sterigmata. Spores suballantoid, thinwalled, with oil droplets in the protoplasm, 10-14 x 4,5-5 µm, non-amyloid.

HABITAT: On decayed branches and trunks of deciduous trees in herb-rich deciduous wood.

DISTRIBUTION: Only known from Mt Kinnekulle, SW part of Sweden.

REMARKS: Well recognized species by its large cystidia and allantoid spores which measure 12-14 µm in length. *H. subclavigerum* is related to *H. clavigerum* (Bres.) Donk in the shape of the cystidia and spores but differs from this species by having larger spores and two kinds of cystidia. The cylindrical cystidia of *H. subclavigerum* are also considerably longer and lack the excreted resinous matter of



H. clavigerum. It is also related to *H. setigerum* (Fr.) Donk but seems to be well distinguished by its non-septate cystidia and larger spores.

Tubulicrinis globisporus K-H Larss. & Hjortst. nov. spec.

Fructificatio resupinata, effusa, tenuis, saepe inconspicua, hymenio primum albido deinde ravidio; margine indeterminato; hyphis tenuitunicatis post crassiusculis, fibulatis, 2,5-4 μm latis, non-amyloideis; cystidiis biradicatis, projectis, subcylindricis, infra medium crassitunicatis, sursum tenuitunicatis, nunquam dilatatis, valde amyloideis, circiter 90-120 \times 5-7 μm ; basidiis subclavatis, infra crassitunicatis, 13-15 \times 5-7 μm , 4 sterigmatibus, nonamyloideis; sporis tenuitunicatis, globosis vel subglobosis, circiter 4 μm diametro, nonamyloideis.

HOLOTYPUS: SWEDEN. Ångermanland. Junsele par., Åkerbränna, on *Pinus silvestris*, 1970-09-20, Stig Jacobsson & Hjortst. Hjm. 4187.

Fruitbody resupinate, effused, when young very thin and somewhat inconspicuous, with age thickening, whitish to greyish white, under a lens slightly pilose due to the projecting cystidia, margin indistinct. Hyphal system monomitic, individual hyphae thin- to slightly thickwalled, 2,5-4 μm wide, with clamps, non-amyloid. Cystidia frequent, strongly amyloid, subcylindric, bi-rooted, thickwalled in lower part, the wall gradually thinning out towards the apex, upper part not expanded, 90-120 \times 5-7 μm . Basidia clavate, basal wall thickening, with 4 sterigmata, 13-15 \times 5-7 μm , non-amyloid. Spores nearly globose, about 4 μm across, non-amyloid.

HABITAT: On fallen branches and trunks of coniferous wood. Mostly on *Pinus* but also on *Picea* and *Abies*

DISTRIBUTION: Hitherto collected a few times in different parts of Sweden. One record by John Eriksson from Canada,

Figure. *Hyphoderma subclavigerum*. Type specimen. John Eriksson del. 1977. a) schematical section through fruitbody b) section through hymenium and part of subiculum c,g) spores d,i) projecting cystidia e) enclosed cystidium f,h) basidia. a-e from 2% KOH prep., f-i from cottonblue prep.

British Columbia. According to Oberwinkler (1965) the species is not uncommon in the Alps e.g. Germany, France and Italy.

REMARKS: This species is according to description and figure the same one as Oberwinkler (1965) has treated as *Tubulicrinis cf. callosus* Cunningham. The real *callosus*, the type of which has been studied by us, does not belong to the genus *Tubulicrinis*, but rather to *Hypochnicium* as the basidiospores are thickwalled and cyanophilous and the cystidia not bi-rooted. *Tubulicrinis globisporus* is easily recognized by its thin fructifications, strongly amyloid cystidia, and by its globose to subglobose basidiospores.

ADDITIONAL SPECIMENS STUDIED: SWEDEN. Halland. Särö, 1970-10-06. John Erikss.; Västergötland. Östad par., E of lake Valsjön, on decayed trunk of *Pinus silvestris*, 1970-10-02. Hjortst. 5006, 5041, 5054; Jämtland. Kall par., Kolåsen, Storzvallen, on branch of *Picea abies* on the ground, 1951-08-21. Berit & John Eriksson 5160. CANADA. British Columbia. Revelstoke Park, 6000-6500 ft, on fallen trunk of *Abies lasiocarpa*, 1969-07-31. Berit & John Eriksson 13184.

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DIDYMIUM FLEXUOSUM: AN SEM STUDYINDIRA KALYANASUNDARAM¹Department of Botany, University of Bristol,
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SUMMARY

An SEM study of the capillitium and sporelike vesicles of Didymium flexuosum confirms earlier observations with the light microscope which suggested that the vesicles are indeed a part of the capillitium.

INTRODUCTION

Didymium flexuosum Yamashiro, first described from Japan in 1936 and subsequently from the U.S.A. and other parts of the world, is a very interesting myxomycete. Its special features are (a) the presence of a wall-like columella extending throughout the length of the laterally compressed plasmodiocarps and (b) even more interesting, the presence within the spore mass of large vesicular bodies, similar to the spores in colour and ornamentation but several times larger in size and often irregular in shape. The present study is aimed mainly at investigating the nature of these vesicles, as it is uncertain whether they are giant spores or part of the capillitium.

MATERIALS AND METHODS

The material used in this study was collected by the author on dead leaves of Coffea arabica L. in Pollibetta, Coorg, India (Herbarium of the Madras University Botany Laboratory No. 2267), and is described in an earlier paper (Kalyanasundaram, 1975).

Since myxomycete spores usually collapse in vacuum, the material was subjected to critical point drying (Anderson, 1951) before being coated for SEM study. The fructifications were first immersed in a drop of Tween 20 solution to wet them and teased with dissection needles to liberate the contents, which were then diluted down with distilled water. The material was washed twice in distilled water, fixed in 1% OsO₄ in 0.1 M sodium cacodylate buffer at pH 7.2 for 1½ hours at room temperature, washed in two changes of distilled water and dehydrated in a graded ethanol series; the alcohol was replaced by amyl acetate in a graded series and the material dried in CO₂ in a critical point drying apparatus on 5mm square glass slips. The glass slips were mounted on aluminum stubs using double-sided adhesive tape, coated first with carbon followed by gold-palladium in an Edwards 12E6 coating unit, and examined with a Cambridge Stereoscan S4 scanning electron microscope.

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RESULTS

Unlike the spores, the vesicular bodies were seen to be definitely attached to the capillitial threads (Figs. 1, 2). The vesicles are several times larger than the spores. The ornamentation is similar to that of the spores and consists of irregularly shaped spines which are often confluent (Figs. 2, 3). However, while the wall of the vesicles is even, that of the spore appears highly corrugated, which gives it a somewhat reticulate appearance (Fig. 3). Moreover the vesicles are hollow, as seen from a ruptured vesicles in Fig. 1. The capillitial threads show a high degree of branching and anastomosis.

The calcareous crystals on the peridium are seen as dense, needlelike crystals forming stellate aggregates (Fig. 4), whereas on the columella they are seen as laminate crystals in cupulate formation (Fig. 5).

The above observations confirm the author's suggestion, made earlier on the basis of light microscopical studies (Kalyanasundaram, 1975), that the large spore-like vesicles of D. flexuosum are an essential part of the capillitium.

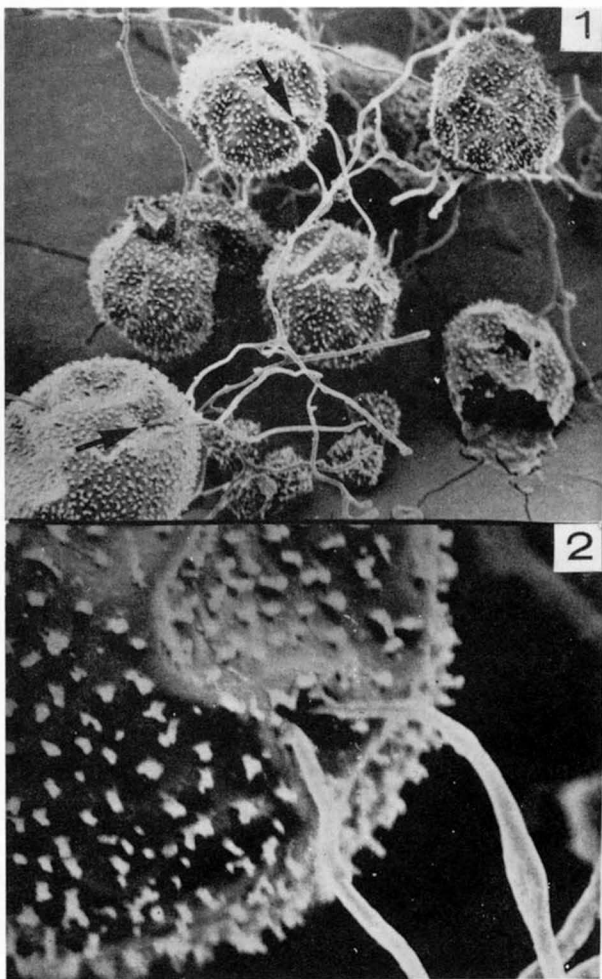
DISCUSSION

Martin and Alexopoulos (1969), in their description of this species, refer to these vesicles as ".....vesicular bodies colored like the spores but paler, larger and more irregular in shape." They state that Yamashiro speaks of the vesicular bodies as borne on the capillitium, but that it is not clear in their material. However, Yamashiro (1936) actually neither speaks of, nor illustrates them as being borne on the capillitium. On the contrary he speaks of them as "..... giant spores, averaging 14-20 μ in diameter, some oval, some elliptical or cocoon-shaped, etc." He describes the capillitium as having calyciform or vesicular-form thickenings, but these refer to the rather insignificant thickenings illustrated by him. Martin and Brooks (1938) in their original description of Didymium parietale, later considered synonymous with D. flexuosum, state that the vesicular bodies are not intimately associated with the capillitium.

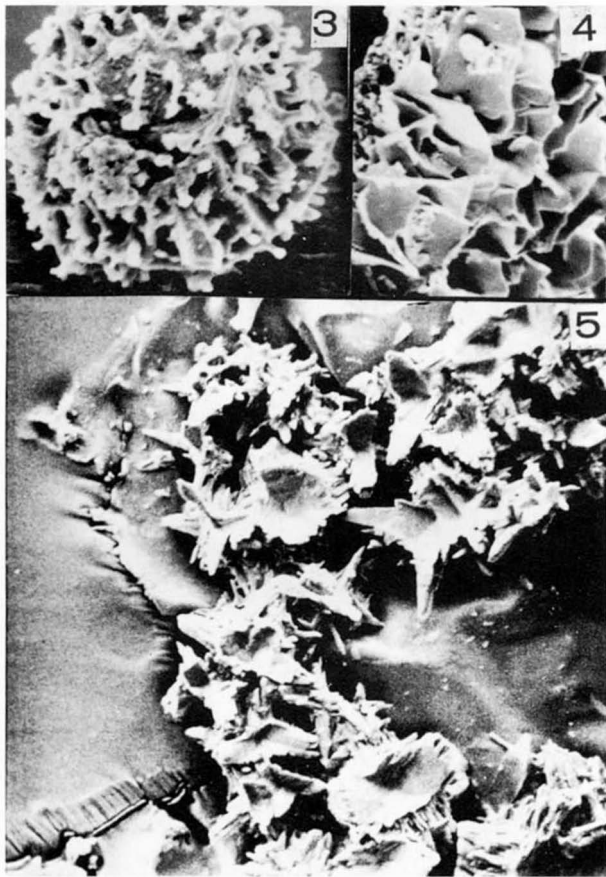
In the first report of D. flexuosum from India, Lakhanpal (1971), merely described the vesicles as sporelike bodies.

Thus the connection of the vesicles with the capillitium, illustrated in the photographs shown here, seems to have been missed in most light microscopical studies, probably because the vesicles get detached from the threads under pressure from the coverslip. These bodies may not be very different from the small vesicular expansions commonly seen in capillitia of several Didymium species, and are perhaps identical with those of D. serpula Fries (Martin and Alexopoulos, 1969). What is remarkable here is the similarity of these vesicles to the spores. It is possible that the walls of the vesicle and the spore are ontogenetically similar. During subsequent development, however, the spore wall has to shrink or convolute to fit the protoplast that it covers, bringing the surface markings closer together to form a reticulate pattern; whereas the vesicle wall remains intact and hollow, so the markings remain distinct.

The calcareous crystals on the peridium differ from those of the columella, as do those of most Didymium species. In the light microscope, those of the columella appear angular and rhomboidal, as shown in the illustrations (Yamashiro, 1936; Martin and Brooks, 1938).



Figs. 1-2. *Didymium flexuosum*. Fig. 1. Capillitium with network of threads attached to vesicles (arrows point to attachment areas); note spores and a ruptured vesicle in the foreground, X ca. 700. Fig. 2. Part of a vesicle showing attachment of capillitial threads. X ca. 4000.



Figs. 3-5. *Didymium flexuosum*. Fig. 3. Spore. X ca. 5000. Fig. 4. Calcareous crystals from columella. X ca. 3000. Fig. 5. Peridial calcareous crystals. X ca. 2000.

ACKNOWLEDGMENTS

I am grateful to the authorities of the Bristol University for the facilities made available; to the Science Research Council, for a grant B/RG/14088 made to the Botany Department; to my colleagues Drs. M. F. Madelin, A. Beckett, Mary Syrop and Mr. Robert Porter for their help; and to the British Council, U.K. and the University Grants Commission, India, for the award of a Visitorship.

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NOTES ON HYPHOMYCETES. XXII.
Phaeoisariopsis bambusicola SP. NOV.

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ABSTRACT

Phaeoisariopsis bambusicola Morgan-Jones, a new species, is described and illustrated from a collection made on leaves of *Bambusa* sp. in Alabama.

INTRODUCTION

A fungus collected on leaves of *Bambusa* sp. in Alabama has been determined to be an undescribed species of *Phaeoisariopsis* Saccardo. It resembles *Phaeoisariopsis bambusae* (Cooke) Deighton which is known from a single collection made in Assam, India during the latter part of the last century. The new taxon differs from *P. bambusae* by possession of much smaller and more slender conidia. Its conidiophores are also narrower.

TAXONOMIC PART

Phaeoisariopsis bambusicola sp. nov. (Fig. 1).

Coloniae effusae, fuscae, velutinae. Mycelium partim superficiale, partim in substrato immersum, ex hyphis ramosis, septatis, subhyalinis vel pallide brunneis, levibus, 2 - 3 μ crassis compositum. Stromata in substrato immersa, pseudoparenchymatica. Conidiophora macronemata, mononemata, fasciculata, ex stromatibus oriunda, simplicia, recta vel flexuosa, laevia, septata, subhyalina vel pallide brunnea, apicem versus pallidiora, usque ad 120 - 240 μ longa, 3 - 4 μ crassa. Conidia singula, fusiformia vel obclavata, subhyalina vel pallide brunnea, laevia, recta vel leniter curvata, 3-septata, 37 - 56 μ longa, 4 - 5 μ crassa, basi truncata.

In foliis vivis Bambusae, Chewacla State Park, Lee County, Alabama, April 1976, G.W. Karr Jr., BPI, holotypus.

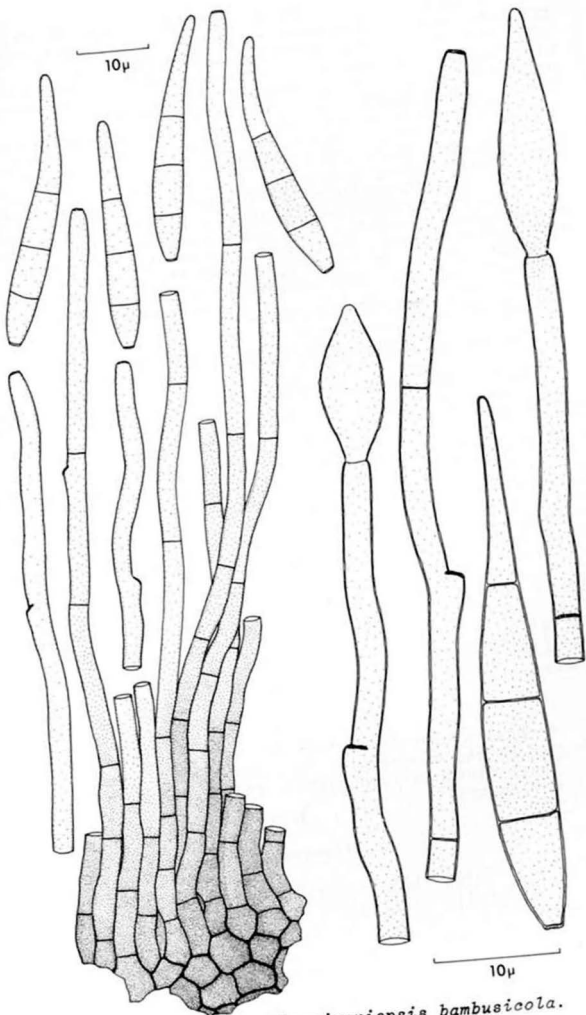


FIGURE 1. *Phaeoisariopsis bambusicola*.

Colonies effuse, dark brown, velutinous. Mycelium immersed in the substratum or partly superficial, composed of branched, septate, subhyaline to pale brown, 2 - 3 μ wide hyphae. Stromata at first immersed, later becoming partly erumpent, large, elongate, brown, pseudoparenchymatic. Conidiophores macronematous, mononematous, caespitose, arising from the upper cells of the stromata, simple, straight, or more frequently flexuous, smooth, multiseptate, subhyaline to pale brown, paler towards the tip, proliferating sympodially, scars thin, 120 - 240 X 3 - 4 μ . Conidiogenous cells monoblastic or polyblastic, cylindrical, integrated, terminal or intercalary. Conidia holoblastic, solitary, dry, acropleurogenous, straight or slightly curved, fusiform to obclavate, subhyaline to very pale brown, at first appearing roughened, later smooth, 3-septate, apex obtuse, base somewhat truncate at a thin scar, 37 - 56 X 4 - 5 μ , 2 μ wide at the tip, 3 μ wide at the base.

On living leaves of *Bambusa* sp.; North America.

Collection examined: on *Bambusa* sp., Chewacla State Park, Lee County, Alabama, April 1976, G.W. Karr Jr., BPI, AUA, type.

Although both *P. bambusicola* and *P. bambusae* bear caespitose conidiophores from large stromata on leaves of *Bambusa* they can be distinguished by conidium dimensions. Subramanian (1956, 1971) and Ellis (1976) give conidium dimensions of 35 - 91 X 11.2 - 14 and 45 - 120 X 11 - 19 respectively for *P. bambusae*. *P. bambusae* also resembles *Phaeoisariopsis magnoliae* (Ell. and Harkn.) Jong and Morris which was described in a previous paper in this series (Morgan-Jones and Brown, 1976). It differs from *P. magnoliae* in its slightly narrower and longer conidia as well as host relationship. The conidia of *P. magnoliae* are also different in being predominantly two-septate.

ACKNOWLEDGEMENT

I thank my former student Mr. Guy W. Karr Jr. for allowing me the opportunity to study his collection. Dr. S.C. Jong, American Type Culture Collection, kindly reviewed the manuscript.

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NOTES ON HYPHOMYCETES. XXIII.
PARAPHAEOISARIA ALABAMENSIS GEN. ET SP. NOV.

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ABSTRACT

Paraphaeoisaria alabamensis de Hoog and Morgan-Jones, a new genus and species, is described and illustrated from isolates from galls caused by *Cronartium quercuum* on *Pinus taeda* in Alabama.

INTRODUCTION

A survey of microfungi associated with aecial galls of *Cronartium quercuum* f.sp. *fusiforme*, the southern fusiform rust, on trunks of *Pinus taeda* in Alabama, yielded two isolates of a dematiaceous hyphomycete possessing characteristics unlike those of any known genus. In respect of its semi-macronematous, dark conidiophores the fungus bears similarity to the black yeast-like fungi, particularly *Exophiala* Carmichael, but we know of no existing genus in which it can be satisfactorily classified. A new taxon is therefore proposed herein to accommodate it.

TAXONOMIC PART

Paraphaeoisaria gen. nov.

Deuteromycotina, Hyphomycetes.

(Etym. *Phaeoisaria* et Gr. *para*, near).

Coloniae lente crescunt, leves vel floccosae, virides ad olivaceo-nigrae. Hyphae submersae crebro ramosae, leves, crassitunicatae, maturitate olivaceae; hyphae aeriae fasciculatae, pigmento incrustato asperatae. Cellulae conidiogenae intercalares in hyphis indistinctis, unum vel compluria rostra conidiifera proferentes, subinde inconspicue sympodialiter elongascentes. Conidia hyalina, levia,

tenuitunicata, breviter cylindrica vel fusiformia.

Species typica: *Paraphaeosaria alabamensis* de Hoog and Morgan-Jones.

Colonies growing slowly, appearing smooth or floccose, green to olivaceous-black. Submerged hyphae profusely branched, smooth, thick-walled at maturity, olivaceous; aerial hyphae fasciculate, rough-walled due to encrusted pigment. Conidiogenous cells intercalary on undifferentiated hyphae, each with one or several conidiiferous pegs which may later branch in an inconspicuously sympodial manner. Conidia hyaline, smooth, thin-walled, short-cylindrical to fusiform.

Paraphaeosaria alabamensis sp. nov. (Figs. 1 and 2). Coloniae in agaro farina avenacea decocto post 14 dies 20 - 22°C ad 14mm diametro, primo leves, planae, grisea-albae, margine regulari et acuta delimitatae; subinde flocculosae in medio, olivaceo-virides, mycelio aereo viridi-griseo, ad 2mm alto obiectae. Coloniae in agaro extracto malti decocto ad 1mm altae, leves, lucidae, olivaceo-nigrae margine 1 - 2mm lata hyalina circumdatae, partim floccos myceliales aereos ad 2mm altos formant. Hyphae submersae compactae, primum leves at hyalinae, (0.6-) 1.5 - 2.5µm latae, radiantes, saepe anastomosantes, deinde inspissatae, olivaceae, saepius ramosae, ad 3µm latae, cellulis 8 - 12 µm longis saepe fertilibus; in agaro farina avenacea decocto saepe hyphae ad 3.8µm latae, dense septatae, e cellulis latioribus quam longis constantes; hyphae aerae fasciculatae, parce ramosae, plerumque 2 - 3.5µm latae, olivaceae, modice crassitunicatae, asperulatae, cellulis (4-) 8 - 12µm longis saepe fertilibus. Cellulae conidiogenae intercalares in hyphis indistinctis, rostris conidiiferis singulis vel compluribus, circa 1.2µm latis and 0.6µm sursum angustatis, 2 - 3µm longis, elongatione sympodiali 1 - 2 (-10) rostra formant e cellula laterali ad 10 (-15) µm longa nonnumquam septo basilari delimitata. Conidia hyalina, levia, tenuitunicata, ellipsoidea, latissima paulo supra medium, vel fusiformes, (2.6-) 3.2 - 5 X 1 - 1.6µm, basi acutata vel rotundata.

Isolatus ex aecidiis Cronartii, Auburn, Lee County, Alabama, July 15, 1976, W.D. Kelley, CBS 101.77B, holotypus.

Colonies on oatmeal agar at 20 - 22°C attaining a diameter of 14mm in 14 days, appearing smooth when young, flat, greyish white, with a rather straight and sharp margin; soon becoming flocculose at the center, olivaceous-green with greenish-grey aerial mycelium up to 2mm high, the marginal part remaining smooth or nearly smooth, finally becoming somewhat lobed. Colonies on malt agar consisting of a 1mm high, elevated, smooth, glistening, olivaceous-black submerged mycelium with a 1 - 2mm wide hyaline margin, with local, pale greyish-olivaceous tufts

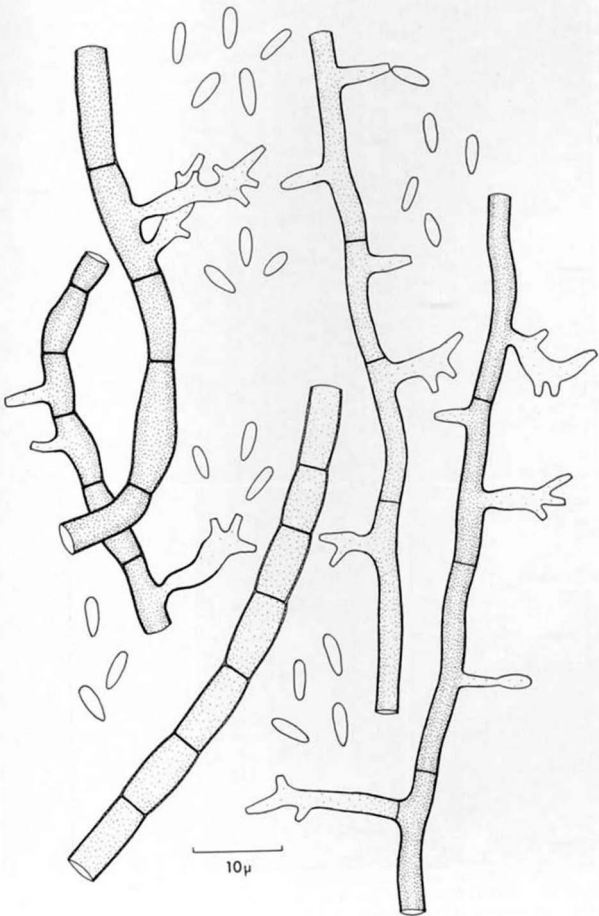


FIGURE 1. *Paraphaeoisaria alabamensis*.

of aerial mycelium up to 2mm high and locally forming a colorless exudate. Submerged mycelium compact, very tough, initially consisting of smooth, hyaline, regular hyphae, (0.6-) 1.5 - 2.5 μ m wide, running radially, with numerous anastomoses, later becoming thick-walled, olivaceous, profusely branched, up to 3 μ m wide hyphae, with usually 8 - 12 μ m long cells, nearly all conidiogenous; submerged hyphae on oatmeal agar locally intermingled with up to 3.8 μ m wide hyphae which later become strongly septate, the cells often being wider than long. Aerial hyphae strongly fasciculate, little branched, regular, usually 2 - 3.5 μ m wide, olivaceous, somewhat thick-walled, becoming rough-walled due to encrusted pigment, cells (4-) 8 - 12 μ m long, frequently conidiogenous. Conidiogenous cells intercalary on undifferentiated hyphae, each one with one or several conidiiferous pegs which are usually about 1.2 μ m wide at the base, tapering to 0.6 μ m at the apex, 2 - 3 μ m long when monoblastic, frequently with 1 - 2 (-10) successive conidiogenous loci being formed in a sympodial manner, the peg often growing out to form an irregularly subulate lateral cell with scattered, occasionally branched pegs which arise at acute angles; lateral cell up to 10 (-15) μ m long. Conidia hyaline, smooth, thin-walled, short cylindrical with the widest part somewhat above the middle, or fusiform, (2.6-) 3.2 - 5 X 1 - 1.6 μ m, with a rounded or pointed base.

On aecial galls of *Cronartium quercuum* (Berk.) Miyabe ex Shirai f.sp. *fusiforme* on *Pinus taeda* L.; North America.

Collections examined; two isolates from *P. taeda*, Auburn, Lee County, Alabama, July 15, 1976, W. D. Kelley, CBS 101.77B (type), CBS 101.77A.

DISCUSSION

The process of conidium initiation in *P. alabamensis* is not fully clear. On the apex of the conidiiferous peg a short frill, which resembles a phialidic collarete, often remains (Fig. 2). No percurrent proliferation has been observed. The structure of the conidiogenous cells point to a possible relationship with *Exophiala* Carmichael and *Sarcinomyces* Lindner. The local occurrence of broad, strongly septate hyphae is also reminiscent of the latter genus where they are common (Hermanides-Nijhof, 1977). *Paraphaeoisaria* differs from these two genera, where the conidia are produced in basipetal succession and branched conidiiferous pegs are but rarely produced, by bearing solitary conidia. The conidiogenous cells of *Exophiala* are flask-shaped with attenuate annellated tips. In addition, torulose hyphae and budding cells are common in young cultures of *Exophiala* (de Hoog, 1977) and *Sarcinomyces* species but are absent in *Paraphaeoisaria*. The lateral,

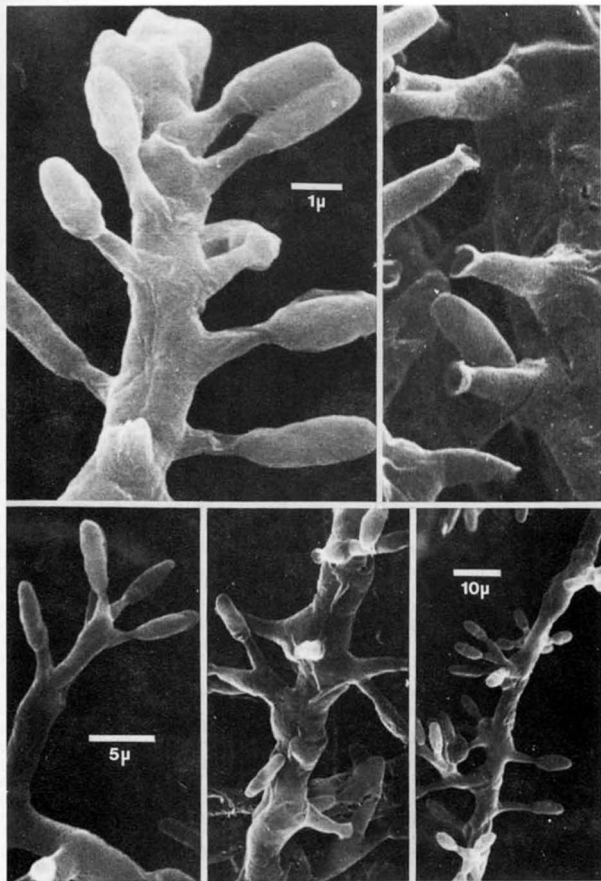


FIGURE 2. *Paraphaeoissaria alabamensis*. Scanning electron micrographs.

more or less sympodially branched, conidiogenous cells are similar to those of *Phaeoisaria glauca* (Ellis and Everhart) de Hoog and Papendorf, but species of *Phaeoisaria* Hohnel have considerably different cultural characteristics and nearly all their conidiogenous cells are lateral or terminal (de Hoog and Papendorf, 1976). Single pegs on intercalary cells are unknown in *Phaeoisaria*.

ACKNOWLEDGMENT

We thank Dr. Walter D. Kelley for affording us the opportunity to study his isolates and Dr. C.J.K. Wang for kindly reviewing the manuscript.

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TWO CONTROVERSIAL DISCOMYCETE NAMES

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1. *Dasyscypha* Fuckel

This name is now generally taken as a mere orthographic variant of *Dasyscyphus* Gray. As pointed out by me (1976) this practice is in fact illegal, *Dasyscypha* Fckl being an independent name. In a recent paper Korf (1977) has argued in favour of the current view. He thinks that Fuckel, when publishing the name, gave an indirect reference to *Peziza tribus Dasyscyphae* Fr., the correct author citation then being *Dasyscypha* (Fr.) Fckl, not *Dasyscypha* Fckl. This interpretation will make *Dasyscypha* an obligate synonym of *Dasyscyphus*.

Dr. Korf's remark is very interesting and worthy of serious consideration. I am sorry that I cannot agree with him; it would have made things easier. It is true that an "indirect reference" can be sufficient to validate a name (Art. 32); unfortunately it is also true that the precise meaning of the term is not defined in the Code. However, even with a very liberal interpretation it cannot reasonably be invoked here; the examples given in Art. 32 are widely different from the present case. It is indisputable that Fuckel described *Dasyscypha* with a new generic description, crediting solely himself with the authorship. Of course he was aware of the Friesian tribe *Dasyscyphae*, but knowledge of it is not synonymous to reference to it. On the other hand I may have exaggerated the difficulties which will be the consequence of treating *Dasyscypha* Fckl as an illegitimate homonym of *Dasyscyphus* Gray. I suggested that epithets cannot be transferred from *Dasyscypha* to *Dasyscyphus* "as this would create new illegitimate names: e.g. *Dasyscyphus cerineus* would be antedated by *Dasyscypha cerinea*". As pointed out to me by Mr. E. Gunnerbeck those names are not homonyms, being based on the same type (cfr Art. 64).

2. The typification of *Rutstroemia* Karst.

"In choosing a lectotype, any indication of intent by the author of a name should be given preference, unless such indication is contrary to the protologue" (Seattle Code, Guide for the determination of types, p. 76). Conforming to this prescription I have analyzed Karsten's own treatment of *Rutstroemia*, in different publications, in order to get some

clue for the typification of the name (Holm, 1976). I reached the conclusion that *R. amentacea* would be the appropriate choice for a lectotype.

Korf and Dumont (1977) have disagreed, feeling themselves bound by the first lectotypification, viz. Honey's (1928). These authors do not believe "that it can be proved that Honey used *only* the 'simple first species rule' that Holm claims to have been the basis of his choice". On the contrary they hold the view that "Honey weighed other elements in making his lectotypifications, and that therefore the choice may not be superceded under Article 8 of the Code under the rubric of a choice 'made arbitrarily'".

I must persist in a dissentient opinion. There is no indication whatsoever that Honey "weighed other elements" when typifying *Rutstroemia*. On the contrary it is apparent that he was guided by the first species rule only. In his article (1928) Honey lectotypified 4 generic names (*Ciboria*, *Rutstroemia*, *Sclerotinia*, and *Stromatinia*) and in *all* cases he choose the first species.

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GECORYNE, A NEW GENUS OF DISCOMYCETES
FROM MACARONESIA AND INDIA

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SUMMARY

Two undescribed inoperculate discomycetes with an outermost apothecial gel layer are described as new and assigned to a new genus of the Leotiaceae, *Geocoryne* Korf. The type species, *G. variispora* Korf, occurs in the Canary Islands and has large apothecia easily mistaken for an operculate discomycete. An Indian species, *G. exogloea* Singh & Tewari, has smaller apothecia and ascospores, and different paraphyses. Both occur on bare soil. The closest relatives of the new genus are *Ascocoryne* with wood and bark-inhabiting species, and *Pezoloma* with species on watersoaked wood, stems and decaying leaves, both of which differ in tissue structure from *Geocoryne*.

A relatively common, large, soil-inhabiting discomycete in the Canary Islands in one region on Tenerife (and also known from two collections on Gomera) was assumed by the senior author in the field to be an operculate discomycete belonging to the genus *Peziza* St.-Amans, though the translucent

outer surface also brought to mind another operculate discomycete genus, *Discina* Fries. It proves instead to be an inoperculate species with the outer layer of the apothecium composed of hyphae immersed in a copious gelatinous matrix. There are few, large, soil-inhabiting inoperculate species of discomycetes, and no appropriate genus apparently exists for this fungus. It must clearly be assigned to the tribe Leotieae of the Leotiaceae (Helotiales) in Korf's (1973) classification.

A second, congeneric species from India was called to Korf's attention by Singh and Tewari. Their proposed new species differs from the Macaronesian material in having smaller ascospores, smaller apothecia, and different paraphyses, but like it, occurs on bare soil. They originally assigned their species to *Pezoloma* Clements (= *Sphagnicola* Vel., = *Ciliatula* Vel., = *Pseudodiscinella* Dennis). That is clearly an allied genus, with apothecia on water-soaked wood, stems and decaying leaves, which differs in having a more restricted basal pad of gel tissues and an inner ectal excipulum with large, brick-shaped or isodiametric cells.

The two species constitute a new genus, *Geocoryne*, a name coined from the habitat and the gross similarity, particularly of the developing apothecia, to *Ascocoryne* Groves & Wilson. Members of that genus have apothecia on wood, with the outermost layer of the excipulum composed of angular cells, enclosing the gelatinized medullary excipulum. In *Geocoryne* there are no angular or brick-shaped cells, but all apothecial tissues are composed of long-celled hyphae. The ectal excipulum is two-layered, the outermost composed of hyphae widely dispersed in a gelatinous matrix, often not quite reaching the margin, and an inner ectal layer of non-gelatinized textura porrecta. The medulla is composed of textura intricata immersed in a not particularly evident gel matrix.

GEOCORYNE Korf, gen. nov.

Apothecia terrae nudaе insidentia, parva vel modice magna. Excipulum ectale e duobus stratis constans: stratum interius e textura porrecta non gelatinosa et marginem et hypharum zonam excipulo medullari gelatinoso contiguam formante consistens; stratum exterius e textura intricata consistens, hyphis dispersis et in matrice gelatinosa immersis. Asci porus per KOH affectus in iodo caeruleus. Genus *Ascocorynae* Groves & Wilson affine sed texturae angularis/prismaticae strato ectali exteriori carens, itidem *Pezolomati* Clements affine sed texturae angularis/prismaticae strato excipulari interiore carens.

Species typica: *Geocoryne variispora* Korf.

Apothecia on bare soil, small to moderate in size. *Ectal excipulum* of two layers, innermost of textura porrecta lacking a gelatinous matrix that forms both the margin and a band of hyphae adjacent to the gelatinized medullary excipu-

lum; outermost excipular layer of widely spaced hyphae immersed in a gelatinous matrix. *Ascus* pore blueing in iodine after KOH pretreatment. Differs from *Ascocoryne* in the absence of an outermost ectal layer of *textura angularis/prismatica*, and differs from *Pezoloma* in lacking an inner excipular layer of *textura angularis/prismatica*. Holotype species: *Geocoryne variispora* Korf.

ETYMOLOGY: *Geo-*, from the Greek, earth, + *-coryne*, from the generic name *Ascocoryne*.

1. *Geocoryne exogloea* Singh & Tewari, sp. nov.

(PLATES 1 & 2)

Apothecia 3-12 mm diam, 2-5 mm alta, substipitata, tenue cupulata infundibuliformia, flavidula, in sicco rufo-brunnea; excipulum medullosum textura intricata constitutum, hyphis 5.0-6.5 μ m latis, excipulum ectale etiam textura intricata, hyphis laxè dispositis in matricem gelatinosam non ad marginem extensam immersis, circa 3.5-5.0 μ m latis; asci ope jodi caerulescentes, octospori, cylindrici, 84-101.5 \times 5.0-10.5 μ m; ascosporae ex ovale ellipsoideae, 1-2-guttulatae, oblique uniseriatae vel irregulariter biseriatae, 6.5-11.5 \times 3.5-4.5 μ m; paraphyses 2-3-septatae, prope basim ramosae, filiformes, ca. 105 \times 2.0-3.0 μ m. Typus: BHUPP 907.

Apothecia substipitate, 3-12 mm in diam and 2-5 mm in height (including stipe), scattered; hymenium flat, pale yellow, turning reddish brown on drying; receptacle shallow cupulate to funnel-shaped, concolorous with the hymenium; margin smooth, slightly recurved on drying; stipe very short, tapering towards the base. In section: *hymenium* 82-205 μ m thick; *subhymenium* 12-65 μ m thick; *medullary excipulum* 164-656 μ m thick, of *textura intricata*, hyphae 5.0-6.5 μ m wide; *ectal excipulum* 41-389 μ m thick, of *textura intricata* with widely spaced hyphae embedded in a gelatinous matrix, but the gel layer not extending all the way to the margin, hyphae 3.5-5.0 μ m wide and not blued by iodine; stipe similar to receptacle in tissue structure; *asci* with J+ pore, 8-spored, cylindrical, 84-101.5 \times 5.0-10.5 μ m; *ascospores* ellipsoidal to oval, 1-2-guttulate, the guttae often unequal and separated by 1 or 2 protoplasmic bands, obliquely uniseriate or biserially arranged, 6.5- 11.5 \times 3.5-4.5 μ m; *paraphyses* 2-3-septate, branched 2 or 3 times in the lower half, filiform, equal in length to the asci.

ETYMOLOGY: Refers to the sticky and gelatinous nature of the receptacle.

HABITAT: On soil.

TYPE LOCALITY: INDIA: Majhkhali (Ranikhet), Almora, U.P.

HOLOTYPE: BHUPP 907, K. B. Khare, October 7, 1968; ISOTYPE, CUP-IN 565.

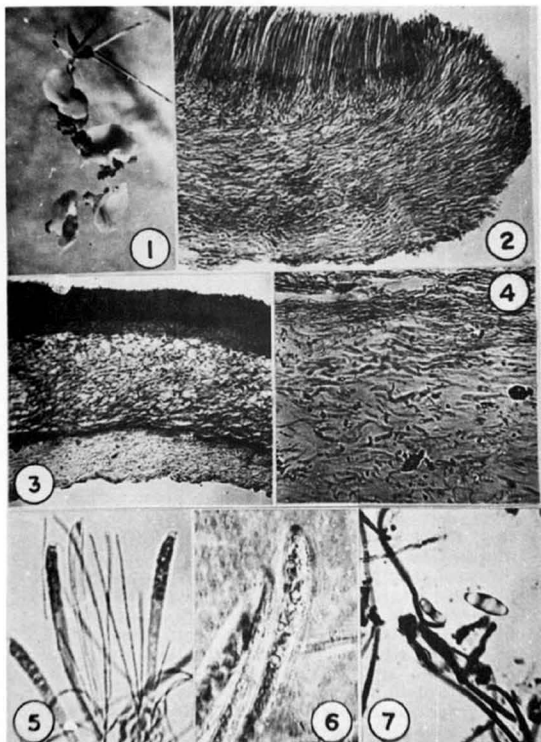


PLATE 1. *Geocoryne exogloea*. 1. Apothecia on soil, $\times 1.4$. 2. Vertical section of apothecium showing marginal tissue, subhymenium and hymenium, $\times 130$. 3. Vertical section of apothecium showing tissues, $\times 50$. 4. Part of ectal and medullary excipulum, $\times 50$. 5. Asci and paraphyses, $\times 400$. 6. Asci showing pores, $\times 800$. 7. Ascospores, $\times 1000$.

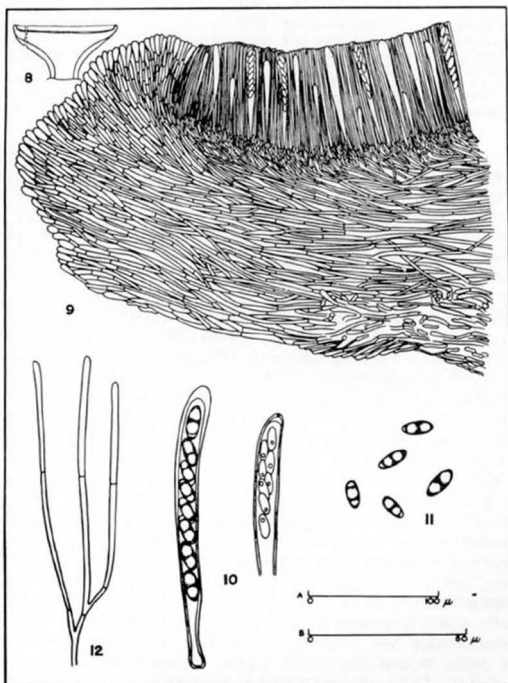


PLATE 2. *Geocoryne exogloea*. 8. Apothecium (diagrammatic). 9. Vertical section of apothecium showing tissue structure, gelatinized layer just beginning at lower right. 10. Asci with ascospores. 11. Ascospores. 12. Paraphysis. Scale line A for fig. 9; B for figs. 10-12.

2. *Geocoryne variispora* Korf, sp. nov.

(PLATES 3 - 5)

Apothecia ochracea vel brunneolo-vinacea, extus translucientia, profunde cupulata vel applanata. Excipuli ectalis stratum exterius gelatinosum 20-250 (-600) μm crassum, e textura intricata constans; stratum interius non gelatinosum e textura porrecta constans. Asci 75-90 \times 6.6-10.2 μm . Ascospores hyalinae, (8-) 9.5-16.1 (-18.3) \times 5.1-6.6 (-7.3) μm , magnitudine et forma intra quemque collectionem valde variabiles. Paraphyses filiformes, infra non ramosae, non septatae, apicibus saepe deformibus et brevissime ramosis. Typus: CUP-MM 3.

Apothecia ochraceous to brown to brownish violaceous, exciple paler and more or less translucent, turbinate when young, deep cupulate to nearly applanate at maturity, up to 1.5 (rarely to 3) cm diam, constricted below into a short, stem-like base, separate or gregarious, sometimes fused together along the sides or edges where they meet. *Ectal excipulum* of two major layers, the outer of hyphae immersed in a gel, the inner of hyphae without gel; outer layer often not reaching the margin, usually beginning 100-250 μm below the margin, becoming 20-250 (-600) μm broad as it approaches the base, thickness varying greatly between collections (apparently based on moisture conditions), consisting of moderately thin-walled hyphae widely spaced in a gelatinous matrix, individual hyphae straight or spirally coiled, 1.5-5.0 μm diam, forming a loose to fairly tight textura intricata, usually with an outer cortex-like zone of more densely packed, up to 8.8 μm broad, more densely staining and thicker-walled hyphae irregularly arranged or sometimes parallel to the outside or frequently turning outwards to form a gelatinized trichodermium (soil algae are sometimes trapped in the outermost gels); inner layer of the ectal excipulum of densely staining hyphae, forming a textura porrecta in an irregular and rather narrow band (ca. 20 μm broad) parallel to the outer surface and separating the ectal excipulum from the medullary excipulum, but flaring outward to form the whole margin at the point where the outer layer tapers down and ceases to exist. *Medullary excipulum* of a fairly tight textura intricata, cells not strongly staining, immersed in a gelatinous matrix but the gel usually not particularly noticeable, hyphae very variable in size, 2.0-14 μm broad, sometimes constricted at the septa. *Subhymenium* scarcely differentiated from the medullary excipulum, but sometimes forming a more densely staining zone about 20 μm thick below the hymenium, of a tight textura intricata to a vertical textura porrecta. *Asci* clavate-cylindric, 75-90 \times 6.6-10.2 μm , with a thick apex, pore not reacting to iodine unless pretreated with KOH and then distinctly J+, 8-spored, not infrequently with some asci with 4 or fewer spores. *Ascospores* exceptionally variable

within collections (and sometimes between collections), both in size and in shape, hyaline, ellipsoid to fusoid to allantoid, with 1, 2 or more guttulae, (8-) 9.5-16.1 (-18.3) × (4.4-) 5.1-6.6 (-7.3) μm. Paraphyses filiform, aseptate, about 1.5 μm broad and unbranched below, slightly enlarged and often deformed or irregularly branching at the very apex, equalling or slightly exceeding the asci.

ETYMOLOGY: Refers to the great variability in spore shape and size within each collection.

HABITAT: On bare soil, sometimes among mosses.

TYPE LOCALITY: SPAIN, CANARY ISLANDS, *Tenerife*: on soil, Las Mercedes, 2.5 km toward El Moquinal on road from La Laguna to Pico del Inglés.

HOLOTYPE: CUP-MM 3, R. P. Korf, W. C. Denison, L. M. Kohn & M. A. Sherwood, 4. I. 1976; ISOTYPES, FH, K, OSC, TFMC.

PARATYPES: SPAIN, CANARY ISLANDS, *Gomera*: In footpath, Lomo de Cerpa, s.w. of Agulo, ca 1030 m alt., G. Gulden 101/73, 9. I. 1973 (CUP-MM 1161, 0). On naked soil, same data, G. Gulden 105/73 (CUP-MM 1163, 0).

Tenerife: On soil, Monte Cruz de Taborno in *Laurus/Erica* forest, A.-E. Torkelsen 144/74, 9. I. 1974 (CUP-MM 1139, 0). On soil, Monte de las Mercedes in *Laurus* forest, A.-E. Torkelsen 451/74, 18. I. 1974 (CUP-MM 1145, 0). Same data, A.-E. Torkelsen 478/74 (CUP-MM 1149, 0). On soil, Las Mercedes, 2.5 km toward El Moquinal on road from La Laguna to Pico del Inglés (*topotype*), R. P. Korf, W. C. Denison, L. M. Kohn & M. A. Sherwood, 4. I. 1976 (CUP-MM 5). On soil, Las Mercedes, 3 km south west of Bailadero, same collectors, 4. I. 1976 (CUP-MM 20). On soil, Las Mercedes, 1.5 km toward El Moquinal on road from La Laguna to Pico del Inglés, same collectors, 4. I. 1976 (CUP-MM 43, OSC, TFMC). On soil, 0.5 km toward Orilla from c.f. 9, 4.2 km from Pedro Alvarez, Monte de las Mercedes, same collectors, 5. I. 1976 (CUP-MM 129, OSC, TFMC). On soil, Las Mercedes, 2.5 km toward El Moquinal on road from La Laguna to Pico del Inglés (*topotype*), same collectors, 7. I. 1976 (CUP-MM 214). Same data (*topotype*) (CUP-MM 215). On soil, Fayal-Bresal near Rogne de los Passos on road from Taganana to Valle Jiminez, Anaga, R. P. Korf, W. C. Denison, L. M. Kohn, M. A. Sherwood, W. Wildpret, E. Beltrán & A. Beñares, 10. I. 1976 (CUP-MM 419, OSC, TFMC). Same data (CUP-MM 420). Same data (CUP-MM 426). Same data (CUP-MM 427). Same data (CUP-MM 436). On soil, just below west entrance, Monte de las Mercedes, R. P. Korf, W. C. Denison, L. M. Kohn & M. A. Sherwood, 10. I. 1976 (CUP-MM 453). On mossy soil along trail, west of Fuente de las Pulgas, Las Yedras, Monte de las Mercedes, same collectors, 12. I. 1976 (CUP-MM



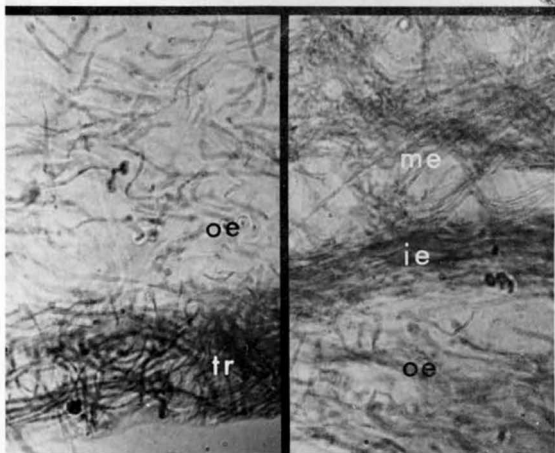
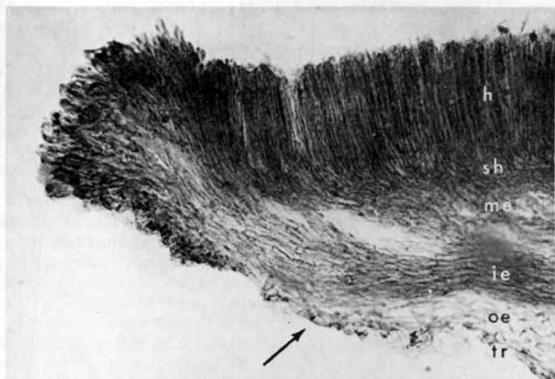
PLATE 3. *Geocoryne variispora*. Left, deep cupulate, sub-otideoid apothecium. Right, clusters of turbinate, immature apothecia and cupulate, mature apothecia, fused at base or margin. CUP-MM 1208, $\times 1.86$.

548). On soil, 3.5 km toward El Moquinal from intersection of road from Las Mercedes to Pico del Inglés, R. P. Korf, R. Fogel, G. L. Hennebert & L. M. Kohn, 28. XII. 1976 (CUP-MM 1208). On mossy soil, 1 km west of Fuente de las Pulgas, Las Yedras, same collectors, 30. XII. 1976 (CUP-MM 1282, TPMC).

NOTES: The very localized distribution of this species is noteworthy. Two specimens in the Oslo Herbarium were collected from one locality on the island of Gomera. Three collections from the Oslo Herbarium and 16 collections by the Cornell group were all taken on Tenerife in the Monte de las Mercedes region within a radius of 4 km. The Cornell groups never found the species on any other part of Tenerife, nor on the islands of Gomera, Hierro, Gran Canaria or La Palma, nor in their exploration of another Macaronesian island, Madeira. In December and January, when all known collections were made, this species was certainly the dominant soil inhabiting discomycete in the Monte de las Mercedes region.

The ascus pore of this species does not blue in iodine when the material is merely rehydrated in water and mounted in

PLATE 4. *Geocoryne variispora*. Top, cross section of apothecium, CUP-MM 419, $\times 250$. Below, CUP-MM 548, $\times 500$; left, part of ectal excipular layer and trichodermium; right, part of outer excipular layer, inner layer, and part of medullary excipulum. h = hymenium, ie = inner ectal excipulum, me =



medullary excipulum, oe = outer ectal excipulum, sh = subhy-
 menium, tr = trichodermium. Arrow indicates point at which
 the outer ectal excipular layer begins and above which the
 inner ectal excipulum flares out to form the margin.

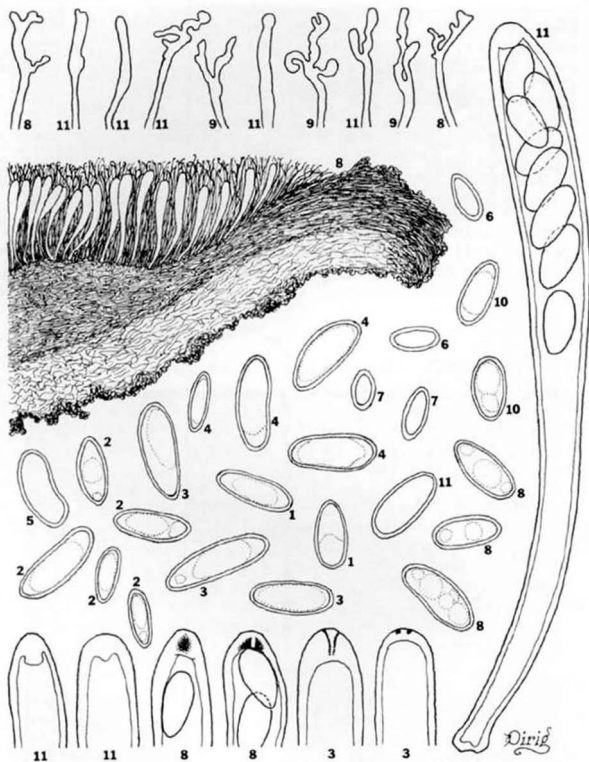


PLATE 5. *Geocoryne variispora*. Section of apothecium $\times 100$; paraphysis apices, loose ascospores, ascus, and ascus apices all $\times 1000$. Ascus and two ascus apices at left rehydrated in water and mounted in Melzer's Reagent; four ascus apices at right rehydrated in 2% KOH mounted in Melzer's Reagent. Numbers refer to collections from which drawings were made: 1=CUP-MM 3; 2=MM 5; 3=MM 20; 4=MM 43; 5=MM 129; 6=MM 419; 7=MM 548; 8=MM 1139; 9=MM 1163; 10=MM 1208; 11=MM 1282.

Melzer's Reagent, but does blue when rehydrated in 2% or 10% aqueous KOH and then mounted in Melzer's Reagent, a phenomenon discussed earlier for a few other genera by Kohn and Korf (1975) and by Nannfeldt (1976). In the paratype species, *G. exogloea*, the pore blues faintly without KOH pretreatment, but the reaction is markedly enhanced by pretreatment with 10% KOH.

ACKNOWLEDGEMENTS

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Taxonomy and Nomenclature of the
Supraspecific Taxa of Porphyrellus¹

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Taxonomic and nomenclatural revisions of the supraspecific taxa of *Porphyrellus* are presented in view of new data obtained from scanning electron microscopy studies of spores of the various type specimens. One new combination is proposed.

Porphyrellus was proposed as a genus by Gilbert (1931) and has since received summary treatments by Singer (1945, 1951, 1962, 1975). Smith & Thiers (1971) accepted *Porphyrellus* as a subgenus of *Tylophilus*. The purpose of this paper, however, is to examine taxonomically and nomenclaturally the supraspecific taxa within *Porphyrellus* rather than to present arguments in favor of either of the proposed ranks of the taxon.

When described by Gilbert (1931), *Porphyrellus* was diagnosed by smooth, red-brown to purple-brown spores. Singer (1945) later expanded the generic concept to include those taxa with "perforate-punctate" spores, i.e. section *Graciles*, typified by *P. gracilis* (Peck) Singer. Simultaneously, he described section *Tristes* with *P. tristis* (Patouillard & Baker) Singer as the nomenclatural type for the smooth spored taxa; this section included the type species of the genus, *P. porphyrosporus* (Fries in Fries & Hök) Gilbert. Singer (1962) later recognized that section *Tristes* was nomenclaturally superfluous to and taxonomically synonymous with the understood type section *Porphyrellus*. McNabb (1968) described a smooth-spored taxon, *P. viscidus*, from New Zealand, considering it intermediate between *Tylophilus* and *Porphyrellus*. It did not fit well into any of the sections available in *Porphyrellus*, however, so he proposed section *Pseudotylophilii* with *P. viscidus* as the nomenclatural type. Singer (1962) described and validated (Singer, 1970) two subsections of *Graciles*, subsection *Gracilini* typified by *P. gracilis*

¹This paper represents contribution no. 489 from the Botanical Laboratories, University of Tennessee.

(Peck) Singer and subsection *Subflavidini* typified by *P. subflavidus* (Murrill) Singer. He also described as new (Singer, 1970) two subsections of section *Pseudotylopili*, subsection *Viscidini* typified by *P. viscidus* McNabb and subsection *Niveini* typified by *P. niveus* (G. Stevenson) McNabb. A summary of all these taxa is presented in Table I.

TABLE I

Infrageneric taxa of *Porphyrellus* as summarized by Singer (1975)

Porphyrellus Gilbert T: *P. porphyrosporus* (Fries in Fries & Hök) Gilbert

Section *Porphyrellus**

= Section *Tristes*¹ T: *P. tristis* (Pat. & Baker) Singer

Section *Pseudotylopili*² T: *P. viscidus* McNabb

Subsection *Viscidini*³ T: *P. viscidus* McNabb

Subsection *Niveini*⁴ T: *P. niveus* (G. Stevenson) McNabb

Section *Scrobiculati*⁵ T: *P. conicus* (Rav. apud Berk. & Curtis) Singer

Section *Graciles*⁶ T: *P. gracilis* (Peck) Singer

[= *Boletus* Subgenus *Austroboletus* Corner T: *B. dictyotus* (Boedijn) Corner⁶]

Subsection *Gracilini** T: *P. gracilis* (Peck) Singer

Subsection *Subflavidini*⁷ T: *P. subflavidus* (Murr.) Singer

Recent studies (by CBW) using scanning electron microscopy have elucidated external spore morphology of the type specimen of the type species of some supraspecific taxa of *Porphyrellus*. As a result a realignment of the taxonomy of the supraspecific taxa can be presented.

*Taxa accepted without discussion.

1-8 Superscripts refer to the order in which the taxa are discussed in the text.

Because Singer (1975) has presented the most comprehensive summary of these taxa, with authorities, the reader should refer to that publication during examination of the data below. It must be made perfectly clear that because light microscopy cannot resolve the detail of structure shown on SEM photomicrographs, previous reports and summaries of the taxa discussed here cannot be judged on data unobservable to their authors. Nevertheless, these taxa must be scrutinized for the sake of taxonomic accuracy and nomenclatural stability. Due to various methods of preservation and age of the specimens examined, spore quality may differ in the SEM's presented in this paper.

All specimens cited are listed at the close of the paper; herbaria abbreviations used in this paper are from Holmgren and Keuken (1974).

OBSERVATIONS

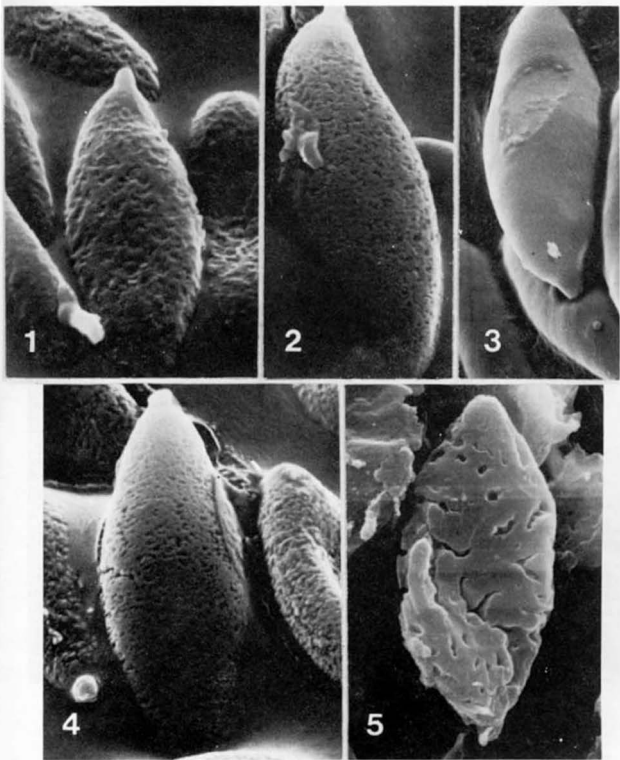
1. As originally proposed (Singer, 1945) section *Tristes* contained the type species of *Porphyrellus* (*P. porphyrosporus*), but its type species was designated as *P. tristis* (Pat. & Baker) Singer, the spores of which Singer described as "...slightly cloudy-punctulate with paler and darker brown zones..." SEM's of the spores of the type specimen of *P. tristis* (Fig. 1) show the spore wall clearly to be ornamented with complex ridges and shallow pits, probably the "paler and darker brown zones" of Singer. Corner (1972) in his redescription of *Boletus longipes* Masee indicated that it was an earlier synonym of *P. tristis*, with which we concur, based on spore morphology (Fig's. 2, 4) and other characters. Basionym of the correct name for the type species of the section *Tristes* therefore is *Boletus longipes* Masee.

2. The limits of section *Pseudotylopili* as proposed by McNabb (1968) are accepted. Spores of the type specimen of *P. viscidus* are smooth (Fig. 3).

3. Subsection *Viscidini* is diagnosed from the following subsection by having a smooth stipe (Singer, 1975)

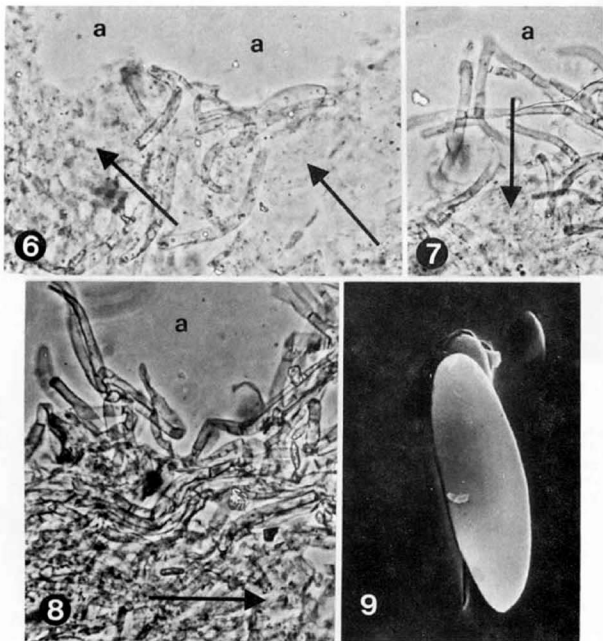
4. Subsection *Niveini* was circumscribed by Singer (1970) as showing viscid pileus, smooth spores, and "costate-reticulate-lacunose" stipe. SEM's of the spores of the type specimen of *P. niveus* (Fig's. 12, 13) show a punctulate, warty, spore surface with meandering ridges. The subsectional type species, therefore, violates the sectional circumscription; consequently the subsection must be removed from the section. See no. 7 below.

5. Section *Scrobiculati* was originally described by Singer (1945) within *Tylopilus*, but later (Singer, 1975) was transferred to *Porphyrellus*. Studies of the type specimen of *P. conicus* reveal the pileus cuticle as a gelatinizing trichodermium (Fig's. 6, 7, 8,) and the spores (Fig. 9) as



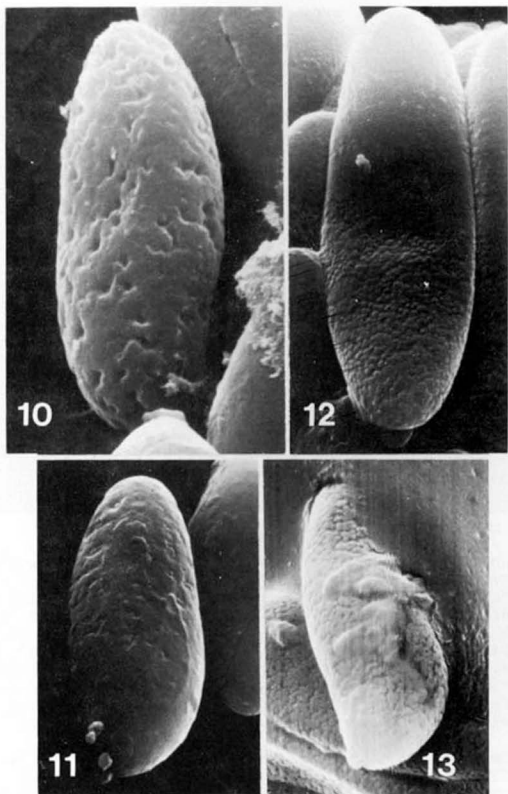
Fig's. 1-5. SEM's of *Porphyrellus* spores.

Fig. 1. *P. tristis*, X5640. Fig's. 2, 4. *P. longipes*, X6040.
Fig. 3. *P. viscidus* X6000. Fig. 5. *B. dictyotus*, X5934.



Fig's. 6-9. Photomicrographs and an SEM of *Porphyrellus*.

Fig's. 6, 7, 8. *P. conicus* trichodermium; gelatinizing elements (arrow); a = nontrichodermal areas; all X200. Fig. 9. *P. conicus* spore, X3144.



Fig's. 10-13. SEM's of *Porphyrellus* spores.

Fig's. 10, 11. *P. gracilis*, X5460, X3726. Fig's. 12, 13. *P. niveus*, X5600, X5360.

smooth. According to Singer (1945), the context reacts strongly to KOH.

6. The circumscription of section *Graciles* as proposed by Singer (1945) is accepted as including the "perforate-punctate" spore surface, and SEM's of the type specimen of *P. gracilis* (Fig's. 10. 11) show the spore ornamentation to be exactly so.

7. We accept the limits of subsection *Subflavidini* as established by Singer (1962, 1970, 1975). SEM's from an authentic Murrill specimen of *P. subflavidus* (Fig's. 14, 15, 16) show spores that are heavily punctate with broad meandering ridges. Grand & Moore (1971) presented data on *P. subflavidus* showing the same ornamentation pattern as presented here.

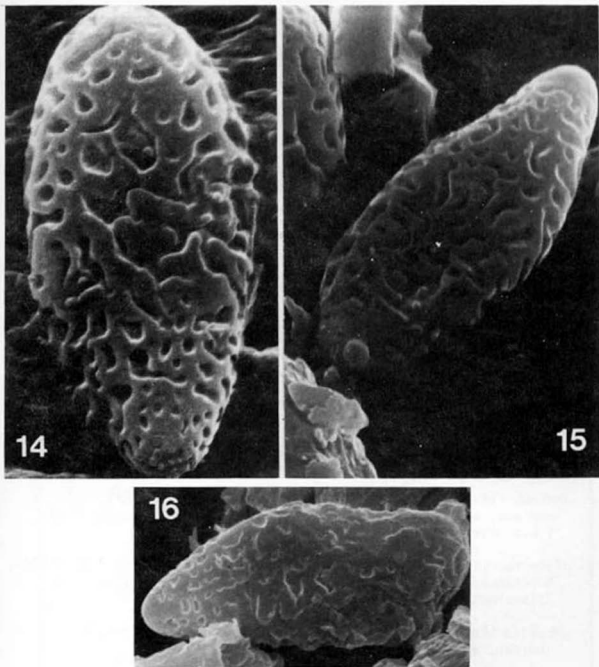
8. In describing *Boletus* subgenus *Austroboletus*, Corner (1972) indicated that it was taxonomically synonymous with *Porphyrellus* section *Graciles*. SEM's of the spores of the type specimen of *B. dictyotus* (Fig. 5) show the spores to be punctate with broad meandering ridges. Singer (1975) considered *Boletus* subgenus *Austroboletus* synonymous with the genus *Porphyrellus*.

DISCUSSION

SEM studies of spore morphology of type specimens of the several type species of these supraspecific taxa have furnished data previously unreported. These data make some taxonomic and nomenclatural revisions necessary.

Section *Pseudotylopili* and its subsection *Viscidini* are taxonomically and nomenclaturally acceptable taxa as described by McNabb (1968) and Singer (1975). Typification of section *Pseudotylopili* subsection *Niveini* with *P. niveus* (which has warted, punctulate spores) violates the circumscription (smooth spores) of the section. *Porphyrellus niveus* belongs in section *Graciles* subsection *Subflavidini* on the basis of spore and fruitbody characters, and such a transfer of a type species renders subsection *Niveini* synonymous with section *Graciles* subsection *Subflavidini*.

Section *Tristes* would be synonymous with (and the name superfluous to) section *Porphyrellus* were it not for the rugulose-punctate nature of the spore surface. Because the spore and stipe characters of *P. tristis* fit the circumscription of section *Gracilis* subsection *Gracilini*, these two taxa are considered synonymous. *Boletus longipes* Massee is the basionym of the correct name of the type species of section *Tristes* (see above) and we propose the following new combination.



Fig's. 14-16. SEM's of *Porphyrellus* spores.

Fig's. 14, 15, 16. *P. subflavidus*, X6440, X5240, X3640.

Porphyrellus longipes (Massee) Wolfe & Petersen, comb. nov.

Basionym: *Boletus longipes* Massee. 1909. Kew Bull. (1909): 207.

= *Porphyrellus tristis* (Pat. & Baker) Singer. 1945. Farlowia 2: 118.

≡ *Boletus tristis* Patouillard & Baker. 1918. J. Straits Branch Roy. Asiatic Soc. 78: 70.

The nature of the cuticle and smooth spores of the type species of section *Scrobiculati* indicate this section as being closely related to section *Pseudotylopili*. The context reactivity to KOH and pileus surface are nevertheless sufficient to separate these two sections.

Because the sectional diagnostic characters of the type species of *Boletus* subgenus *Austroboletus* Corner and *Porphyrellus* section *Graciles* Singer are contaxic, we consider these supraspecific taxa to be synonymous.

A realigned taxonomic scheme is now proposed in light of the new data obtained from our studies of the types of supraspecific taxa of *Porphyrellus*, and is summarized in Table II.

SPECIMENS EXAMINED

- P. conicus* (Rav. apud Berk. & Curtis) Singer: FH - "(2929); *Boletus conicus*; ad terram humidi in Pinetis, Julio 1849; Santee Canal, S.C.; Ravenel (1024)" Holotype.
- B. dictyotus* (Boedijn) Corner: BO - "Herb. Hort. Bot. Bog.; no. 15054; Boletaceae, *Boletus*, Vindplaats: Eiland, Java; Plaats; Tjiseureuh; 29.ix.1935" Holotype.
- P. gracilis* (Peck) Singer: NYS - "Coll. N.Y. State. Garrisons, Thurman, and Greig; Leg. C. H. Peck" Holotype.
- P. longipes* (Massee) Wolfe & Petersen: K - "Ex. Herb. Hort. Bot. Reg. Kew.; Ridley 81; Singapore" Herbarium sheet H345/77.1. Holotype.
- P. niveus* (G. Stevenson) McNabb: K - "Herb. Bot. Reg. Kew; Totaranui headland, New Zealand; 12.4.1955. G. Cone 978" Herbarium Greta Stevenson Cone. K. Herbarium sheet no. H2018.76.3. Holotype.
- P. subflavidus* (Murrill) Singer. NY - "Gainesville, Fla.; 7-11-38; Coll. & Det. West, Arnold, & Murrill" Authentic specimen; holotype specimen misplaced at FLAS.
- P. tristis* (Pat. & Baker) Singer: FH - "4995; *Boletus tristis*; Botanic Gardens, Singapore. Solitary among decaying leaves in jungle. C. F. Baker; Aug. '17" Holotype.

TABLE II

Proposed taxonomic scheme
within *Porphyrellus*

Porphyrellus Gilbert. 1931. Les Bolets. Paris. p. 99. T: *P. porphyrosporus* (Fries in Fries & Hök) Gilbert.

Section *Porphyrellus*. T: *P. porphyrosporus* (Fries in Fries & Hök) Gilbert.

Section *Pseudotylopili* McNabb. 1968. N. Zealand J. Bot. 5: 546. T: *P. viscidus* McNabb.

Subsection *Viscidini* Singer. 1970. Fl. Neotropica Monog. 5: 19. T: *P. viscidus* McNabb.

Section *Scrobiculati* (Singer) Singer. 1975. Agaricales in Modern Taxonomy p. 748. T: *P. conicus* (Rav. apud Berk. & Curtis) Singer.

Section *Graciles* Singer. 1945. Farlowia 2: 119. T: *P. gracilis* (Peck) Singer.

= *Boletus* subgenus *Austroboletus* Corner. 1972. Boletus in Malaysia p. 76. T: *B. dictyotus* (Boedijn) Corner.

Subsection *Gracilini* Singer. 1970. Fl. Neotropica Monog. 5: 22. T: *P. gracilis* (Peck) Singer.

= Section *Tristes* Singer. 1945. Farlowia 2: 115. T: *P. longipes* (Masse) Wolfe & Petersen. (= *P. tristis* (Pat. & Baker) Singer).

Subsection *Subflavidini* Singer. 1970. Fl. Neotropica Monog. 5: 20. T: *P. subflavidus* (Murr.) Singer.

= Section *Pseudotylopili* subsection *Niveini* Singer. 1970. Fl. Neotropica Monog. 5: 20. T: *P. niveus* (G. Stevenson) McNabb.

P. viscidus McNabb: PDD - "25185; scattered under *Leptosperman scoparium/ericoides*; Auckland, Kerikeri, Opito Bay; 16.v.1966; R. F. R. McNabb" Holotype.

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PODONECTRIA, A GENUS IN THE PLEOSPORALES
ON SCALE INSECTSAMY Y. ROSSMAN¹

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SUMMARY

The genus *Podonectria* occurs on scale insects and is characterized by fleshy, uniloculate ascocarps, abundant pseudoparaphyses, bitunicate asci and long, multiseptate ascospores. At present, eight species are included of which the type species, *P. coccicola*, is the most common. The associated anamorphic species have holoblastic staurospores and are placed in the sporodochial genus *Tetracrium* and the pycnidial genus *Tetranacrium*.

The genus *Podonectria* was erected by Petch (1921) and described as being nectriaceous, that is, like *Nectria*. *Nectria* belongs in the Euscomycetes, Hypocreales, characterized by bright-colored fruiting bodies and unitunicate asci. Although the ascocarps are light-colored, the lectotype species, *Podonectria coccicola*, has bitunicate asci and this genus belongs in the Pleosporales, Pleosporaceae, bearing only a superficial resemblance to members of the Hypocreales.

Petch (1921) included three species in *Podonectria*: *Podonectria coccicola*, *P. aurantii* and *P. echinata*, all occurring on scale insects. Dingley (1954) described *P. novae-zealandica* and *P. gahnia* on scale insects, including the genus in the Clavicipitaceae. *Podonectria tenuispora* was described by Dennis (1958) from England, also on scale insects. Petch (1927) described *Ophionectria coccorum* which was transferred to *Podonectria* by Rossman (1977). She also transferred *Lasiosphaeria larvaespora* to *Podonectria*. The genus currently contains eight species and is characterized by fleshy, white to brown, uniloculate ascocarps with bitunicate asci and long, multiseptate ascospores, occurring on scale insects.

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PODONECTRIA Petch, Trans. Brit. Mycol. Soc. 7:146. 1921.

Ascocarps superficial in or on a scant to well-developed stroma, fleshy, white to brown, smooth, scurfy, with hairs or covered with an outer stroma, ostiolate, hairs, if present, developing as extensions of outer cells of ascocarp wall. Pseudoparaphyses numerous, reticulate, filiform. Asci bitunicate, long-clavate to cylindrical, 8-spored. Ascospores long-clavate to cylindrical, hyaline, multiseptate. Associated anamorphs: *Tetracrium* and *Tetranacrium* having holoblastic staurospores. On scale insects in tropical, rarely mild temperate, regions.

LECTOTYPE: *Podonectria coccicola* (Ellis & Everh.) Petch designated by Clements & Shear (1931) [as "*Podonectria coccophila* (Ellis & Everh.) Petch"].

Podonectria is related to *Puttemansia* P. Henn. and *Tubeufia* Penzig & Sacc., all having light-colored, fleshy ascocarps, bitunicate asci and multiseptate ascospores. *Podonectria* species occur on scale insects while species of *Puttemansia* are found on foliicolous fungi and have shorter ascospores which become only short-clavate to fusiform. Species of *Tubeufia* have long-clavate ascospores and are saprophytes on carbonous pyrenomycetes or well-rotted debris.

All the species included in *Podonectria* appear to be closely related, varying primarily in ascocarp ornamentation and ascospore length, with the exception of *Podonectria coccorum* and *P. gahnia*. These two species have brown ascocarps which form in or on a brown stroma and have narrow, cylindrical ascospores.

Several *Tetracrium* species were described by Petch (1921) as the imperfect states of his *Podonectria* species. Although these anamorphs and the ascocarps are repeatedly collected together, Petch's claim has not been proven using pure culture isolation. These *Tetracrium* species and the related *Tetranacrium* pycnidia associated with *Podonectria gahnia* are regarded here only as associated anamorphic fungi.

Members of the genus *Podonectria*, particularly *P. coccicola*, may be important in the biological control of destructive scale insects on citrus trees. In their bulletin, Rolfs & Fawcett (1908, revised 1913) present a method for spreading several fungi throughout citrus orchards to control scale insects. The three species mentioned in the bulletin often occur together: *Ophionectria coccicola* (= *Podonectria coccicola*), the white-headed fungus; *Sphaerostilbe coccophila*

(=*Nectria flammea*), the red-headed fungus; and *Myriangium duriaei*, the black fungus. In recent times this role has undoubtedly been usurped by chemical sprays.

Key to Species of *Podonectria*

1. Ascocarps light-colored, fleshy, with pigmented outer wall or covered with superficial, pigmented scurf, which may be yellow to brown, rarely reddish, or covered with hairs; if present, stroma not brown; ascospores greater than 5 μm wide or, if less, then longer than 125 μm . 2
1. Ascocarps brown to dark-brown; stroma brown; ascospores generally less than 5 μm wide; if present, associated anamorph *Tetracrium* with holoblastic staurospores enclosed in a pycnidium. 7
 2. Ascocarps smooth, at most covered with scurfy, pigmented granules which may be yellow to brown, rarely red; rarely with a few thick-walled hairs around ostiole; associated with sporodochial staurospores of *Tetracrium coccicolum*. 1. *Podonectria coccicola*
 2. Ascocarps with numerous hairs or hyphal covering. 3
3. Ascocarps subtended and covered with byssoid hyphae encrusted with bright-yellow granules. 2. *P. larvaespora*
3. Ascocarps with hyaline hairs or hyphal covering. 4
 4. Ascocarps covered with straight, hyaline hairs. 3. *P. novae-zealandica*
 4. Ascocarps covered with hyaline, flexuous hairs or with deltoid fascicles of hairs. 5
5. Ascocarps with deltoid fascicles of hyaline hairs; associated with sporodochial staurospores of *Tetracrium echinata*. 4. *P. echinatum*.
5. Ascocarps covered with flexuous hyphae, not aggregated into fascicles. 6
 6. Ascospores 55-85 x 7.5-12 μm ; associated with *Tetracrium aurantii*; tropical. 5. *P. aurantii*
 6. Ascospores 125-150 x 3-7 μm ; no known associated anamorph; temperate. 6. *P. tenuispora*
7. Ascocarps smooth or with a few, thick-walled, straight hairs around ostiole; ascospores 55-95 x 1.5-3 μm . 7. *P. coccorum*
7. Ascocarps enclosed in a well-developed, outer stroma with a layer of reddish-brown granules; ascospores 90-130 x 3.5-6 μm ; associated pycnidial staurospores belonging to *Tetracrium*. 8. *P. gahnia*

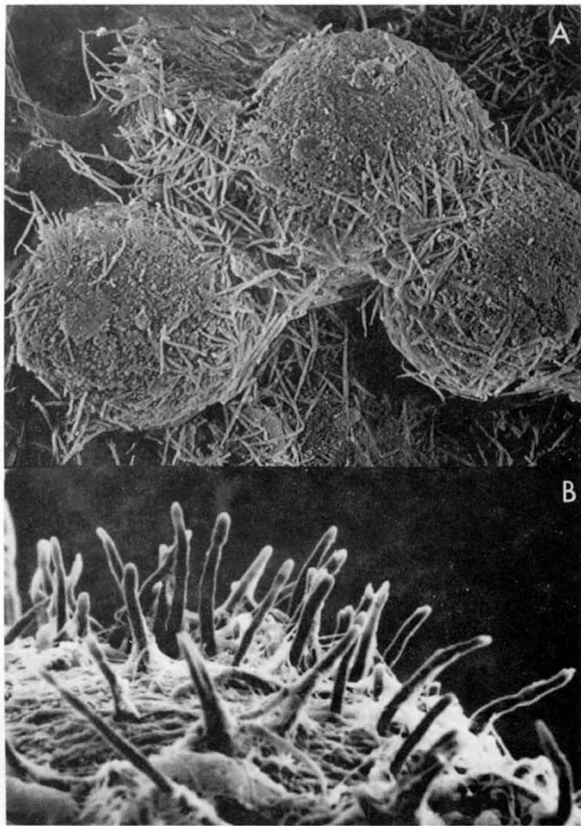
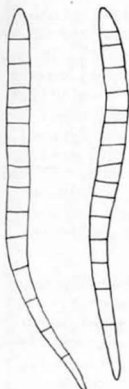


Fig. 1. A. *Podonectria coccicola* ascocarps and conidia of associated *Tetracrium coccicolum*. x100. B. *Podonectria novae-zealandica* hairs on ascocarp Holotype (PDD 10942). x550.



1. *Podonectria coccicola* (Ellis & Everh.) Petch, Trans. Brit. Mycol. Soc. 7:146. 1921. (Figs. 1A, 2, 3A-C)
 = *Nectria coccicola* Ellis & Everh., J. Mycol. 2:39. 1886.
 = *Ophonectria coccicola* (Ellis & Everh.) Berl. & Vogl., Add. Syll. Fung. p. 218. 1886.
 = *Dialonectria coccicola* (Ellis & Everh.) Ellis & Everh., J. Mycol. 2:137. 1886.
 = *Scoleconectria coccicola* (Ellis & Everh.) Seaver, Mycologia 1:198. 1909.
 = *Puttemansia coccicola* (Ellis & Everh.) Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 120:408. 1911.
 = *Scleroderris gigaspora* Masee, Kew Bull. 1910:3. 1910.

Fig. 2. Ascospores of *P. coccicola* x500.

Fruiting bodies solitary to densely gregarious, superficial on a white, byssoid stroma which often completely obscures the scale insect. Ascocarps obovate or globose to subglobose, 300-650 μm tall x 300-600 μm wide, flattened apically, smooth to scurfy, dirty-white to light-brown, often appearing darker due to patchy, granular scurf which may be yellow to brown, rarely red; rarely with thick-walled, hyaline hairs 25-60 x 10 μm , tips rounded, walls 1.5-2.5 μm thick; ostiole delimited by absence of granules, often depressed when dry, sometimes broad, up to 200 μm diam when ascocarp apex worn away; ascocarp wall 45-70 μm wide, composed of globose cells 6-10 μm diam forming *textura angularis*, cell walls 1-1.5 μm thick, cells of outer layer larger with thicker walls, sometimes pigmented. Pseudoparaphyses numerous, reticulate, filiform, 1-2 μm diam. Asci bitunicate, cylindrical, 180-290 x 17-30 μm , ascospores parallel to spirally twisted toward base. Ascospores long-clavate, 110-190 x 7.5-9 μm , rounded apex tapering to a narrowly rounded base, vermiform, multiseptate, 13-21 septa per ascospore, forming cuboidal or subcuboidal to rectangular cells toward base, surface faintly verrucose.

Associated anamorph: *Tetracrium coccicolum* Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 120:408. 1911.

Sporodochial stroma white to cream, tough to cartilaginous, pulvinate, up to 800 μm wide and 500 μm tall, composed of hyaline cells, 5-20 μm diam forming textura epidermoidea in basal and central region but becoming textura angularis toward the margin; conidiophores moniliform, 20-30 x 4-7 μm , dilute yellow, sparsely branched, densely crowded on surface of stroma; conidia holoblastic staurospores, hyaline, 3-armed, rarely 4-5-armed; each arm long-fusiform with acute apex, 75-215 x 6-7.5 μm , multiseptate, 9-25 septa per arm, the middle arm usually longest; arms united at base by a globose cell, 2.5-5 μm diam, with truncate base where staurospores break off from conidiophore. The holotype specimen is the same as that of *Podonectria coccicola*.

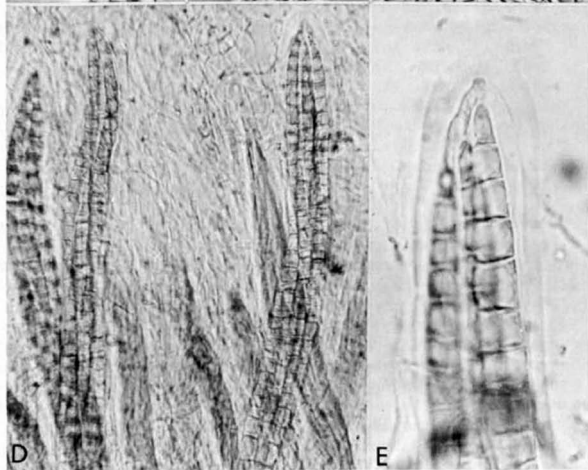
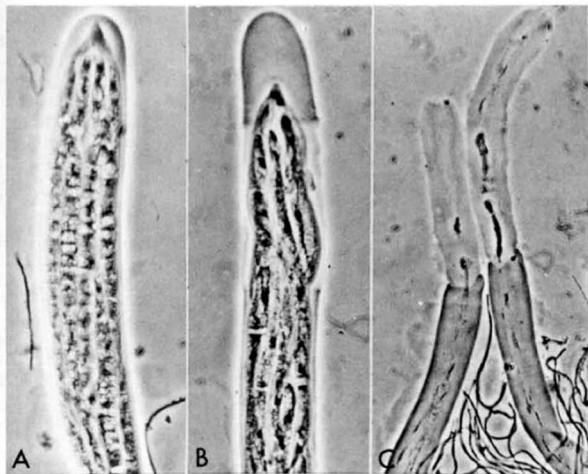
SUBSTRATE: On scale insects, known from *Aspidiotus ficus*, *A. perniciosus*, *Chionaspis citri*, *Lepidosaphes beckii*, *L. gloverii*, *Leucapsis* sp., *Mytilaspis citricola*, *M. gloverii*, *Parlatoria pergandii* and *P. zizyphi*, inhabiting citrus trees, *Citrus aurantii*, *C. nobilis*, *C. pomelanus* and *C. sinensis*, and other higher plants, *Brachyglottis repanda*, *Coprosma australis* and *Meliclytus ramiflorus*.

DISTRIBUTION: Cosmopolitan in tropical and subtropical regions.

ILLUSTRATIONS: Dingley, Trans. & Proc. Roy. Soc. New Zealand 81:497 f. 3-5, 1954; Masee, Kew Bull. 1910:1 f. 1-5, 1910; Miyabe & Sawada, J. Coll. Agric. Tohoku Imp. Univ. 5:pl. 7 f. 11-16, 1913; Petch, Trans. Brit. Mycol. Soc. 7:pl. 4 f. 9, pl. 5 f. 1-3, 15, 1921; Pirozynski, Kew Bull. 31:602 f. 3A-3C, 1976; Rolfs & Fawcett, Florida Agric. Exp. Sta. Bull. 94: f. 6-14, 1908; Rolfs & Fawcett, Florida Agric. Exp. Sta. Bull. 119:f. 17-25, 1913; Tai & Wei, Sinensia 4:100 t. 28, 1933; Zimmerman, Centralbl. Bakteriol., 2 Abth. 7:874 f. 2, 1901.

HOLOTYPE: UNITED STATES, Florida, Brooksville, on scale insects on bark of living orange trees, Feb. 1886 (NY) Isotypes (BPI) (FH).

Fig. 3. A-C. *Podonectria coccicola* A. Ascus before rupture of outer wall. x470. B. Ascus in which the outer wall has ruptured with the extension of the inner wall. "Thimble" remains of outer wall on ascus apex are an artifact of rupture under a coverglass. x470. C. Asci in which the outer wall has ruptured with the extension of the inner wall and ascospores have been discharged. x415. D-E. *Podonectria larvaespora* Isotype (NY) D. Asci among pseudoparaphyses. x415. E. Apex of bitunicate ascus. x1160.



OTHER SPECIMENS EXAMINED: BRAZIL, Vicosa, Escola, A. S. Muller, 6 Oct. 1929 (BPI) (CUP-MG 47); Vicosa, Escola, A. S. Muller, 13 Oct. 1929 (BPI) (CUP-MG 53); Cantareira, E. de São Paulo, E. Ract., 27 May 1933, 914 (BPI). CEYLON, Glenugie, T. Petch, March, 1919 (FH). JAMAICA, intercepted at Philadelphia, Pennsylvania, C. G. Albrecht, 26 Dec. 1929, Philadelphia 10235 (BPI). NEW ZEALAND, Auckland, Puketi, J. M. Dingley, 20 June 1963 (PDD 23001); Auckland, Turangi, J. M. Dingley, Oct. 1949 (PDD 10947) (DAOM 46901); Auckland, Waitakere Ranges, Fairy Falls Track, J. M. Dingley, 1963 (PDD 21807). PERU, Tingo Maria, Janier Diegues, 26 June 1945 (BPI). PUERTO RICO, Espinoza, J. A. Stevenson, 25 Jan. 1917 (BPI); F. J. Seaver & C. E. Chardon 1064, 24 Jan.-4 Apr. 1923 (NY). REPUBLIC OF SOUTH AFRICA, Natal (Zululand), Eshowe, T. Parkins, June 1912 (PRE 2438). TRINIDAD, J. Rorer (FH Thaxter 1057). UNITED STATES, Florida, Brooksville, Dr. Martin, 15 March 1880 (FH) labelled *Nectria coccicola* authentic. This may be a paratype specimen on which the date has been miscopied, the 6 being mistaken for a 0, or the specimen may have been collected earlier but identified after Ellis and Everhart described the species; Florida, City Point, J. Bentel, Apr. 1904, ex USDA-BPI 1554 (B) (CUP 13632) (FH) (IARI) (MA) (NY); Florida, Gainesville, Bayer (FH Thaxter 5167); Florida, Lake Helen, 16 Feb. 1909 (HBG); Florida, Melbourne, J. Young, 28 June 1937 (NY); Florida, Monteverde, J. Franklin, Mar. 1890 (NY); Florida, Orlando, H. S. Fawcett, 12 Sept. 1908 (FH Thaxter 5340); Florida, Umatilla, C. L. Hopkins, 23 April 1891 (BPI); Florida, ex Herb. Ellis (FH Thaxter 401) (This may be another isotype); Louisiana, Plaquemines Co., Alliance, O. W. Barrett, 7 May 1907 (BPI); Mississippi, Ocean Springs, L. E. Miles 707, 12 June 1921 (BPI). VENEZUELA, Caracas, A. S. Muller, 15 Dec. 1937 (BPI) (CUP-VZ 2092).

The type specimen of *Scleroderris gigaspora* could not be located but the description and illustrations suggest that Petch (1921) was correct in placing this species in synonymy with *Podonectria coccicola*.

Two specimens from New Zealand (PDD 10947 & 21807) have ascocarps with purplish-red instead of the usual light- to dark-brown granules. In both specimens the species *Nectria flammea* with red-orange pigments in the ascocarp wall occurs on the same scale insects. The pigments in the fruiting bodies of both species turn purple in 2% KOH. The wall pigments of *Nectria flammea* have apparently become incorporated as granules into the outer layer of the ascocarps of *Podonectria coccicola* where they they appear purplish-red instead of red-orange.

2. *Podonectria larvaespora* (Cooke & Masee) Rossman, Mycologia 69:379. 1977. (Figs. 3D-E, 4A)
 = *Lasiosphaeria larvaespora* Cooke & Masee, Grevillea 19:83. 1891.
 = *Ophionectria larvaespora* (Cooke & Masee) Hansf., Proc. Linn. Soc. New South Wales 81:31. 1956.

Fruiting bodies solitary, partially immersed in a byssoid stroma; hyphae of stroma 3-5 μm diam, encrusted with bright-yellow granules, walls 1 μm thick. Ascocarps globose to obpyriform, 600-750 μm tall x 375-650 μm wide, light yellow-orange appearing bright-yellow due to loose covering of hyphae encrusted with bright-yellow granules, outer hyphal layer up to 50 μm thick; ostiole present; ascocarp wall 30-40 μm wide composed of globose cells 5-10 μm diam forming *textura angularis*, cell walls 1-1.5 μm thick becoming thicker in outer cell layer. Pseudoparaphyses numerous, reticulate, filiform, 1 μm diam. Asci bitunicate, cylindric, 240-295 x 25-32 μm , ascospores parallel to spirally twisted toward base. Ascospores long-clavate, 135-190 x 7.5-10 μm , rounded apex tapering to a narrowly rounded base, vermiform, multiseptate, 13-23 septa per ascospore forming cuboidal, subcuboidal to rectangular cells toward base.

SUBSTRATE: On scale insects inhabiting unidentified tree.

DISTRIBUTION: Known only from Australia.

ILLUSTRATIONS: Berlese, Icon. Fung. 1:t. 119 f. 1, 1894; Cooke, Handb. Austral. Fungi pl. 24 f. 220, 1892.

HOLOTYPE: AUSTRALIA, Victoria, Mt. Macedon, Martin 566 (K) Isotype (NY).

OTHER SPECIMEN EXAMINED: AUSTRALIA, Melbourne, ex Herb. Masee (NY).

Podonectria larvaespora differs from other species in the presence of bright-yellow hyphae forming a byssoid stroma which also covers the ascocarps and the lack of an associated *Tetracrium* anamorph. The ascospore size and shape are similar to that of *P. coccicola*.

3. *Podonectria novae-zealandica* Dingley, Trans. & Proc. Roy. Soc. New Zealand 81:496. 1954. (Figs. 1B & 4B)

Fruiting bodies solitary to aggregated in small groups, superficial on a pseudoparenchymatous stroma subtending the ascocarp and surrounded by a scant, white, byssoid stroma. Ascocarps broadly obpyriform or globose to subglobose, 450-600 μm

tall x 500-560 μm wide, cream to light-yellow, with hairs; hairs hyaline, straight to slightly flexuous with rounded tips, 35-100 x 6-8.5 μm , sparsely septate, walls 2-2.5 μm thick; ostiole 40-50 μm diam; ascocarp wall 35-60 μm thick composed of unpigmented, globose cells 7-12 μm diam forming *textura angularis*, cell walls 1-2 μm thick, becoming 5 μm thick, slightly yellow in outermost layer. Pseudoparaphyses numerous, reticulate, filiform, 0.5-1 μm thick. Asci bitunicate, long-clavate to cylindric, 225-275 x 20-24 μm ; ascospores long-clavate, 110-150 x 7.5-10 μm , apically rounded, tapering to narrowly rounded base, often slightly sigmoid to vermiform, multiseptate, 13-21 septa per ascospore forming cuboidal to subcuboidal cells.

SUBSTRATE: On scale insects, *Leucapsis* sp., inhabiting *Olearia rani*.

DISTRIBUTION: New Zealand. Known only from type locality.

ILLUSTRATIONS: Dingley, Trans. & Proc. Roy. Soc. New Zealand 81:497 f. 2a-b, 1954.

HOLOTYPE: NEW ZEALAND, Auckland, Hunua Range, on *Leucapsis* sp. on *Olearia rani*, J. M. Dingley, Oct. 1946 (PDD 10942).

The light-yellow ascocarps and lack of a *Tetracrium* associate suggest a relationship with *Podonectria tenuispora* from which *P. novae-zealandica* is distinguished by the wider ascospores and straight setae covering the ascocarps.

4. *Podonectria echinata* Petch, Trans. Brit. Mycol. Soc. 7: 151. 1921. (Fig. 4C)

Fruiting bodies scattered to aggregated in small groups, superficial on a scant, white, byssoid stroma. Ascocarps globose, 300-425 μm tall x 275-420 μm wide, light-yellow to yellow, covered with deltoid fascicles of hyaline hairs or solitary hairs; fascicles 70-100 μm at base by 110-180 μm long; hairs straight to flexuous, tips rounded, sparsely septate, 2.5 μm wide; ostiole 20-40 μm , conspicuous for lack of hairs; ascocarp wall 20-35 μm wide, composed of globose to subglobose cells, slightly flattened parallel to wall, 4-10 μm diam, forming *textura angularis*, cell walls 1.5-2 μm thick, thicker and slightly pigmented toward outside of ascocarp. Pseudoparaphyses numerous, reticulate, filiform, 1 μm diam. Asci bitunicate, long-clavate to broadly cylindric, 135-175 x 20-25 μm , ascospores slightly spirally twisted in asci. Ascospores long-clavate, 100-125 x 5-8 μm , apically rounded, tapering to a narrowly rounded base, vermiform,

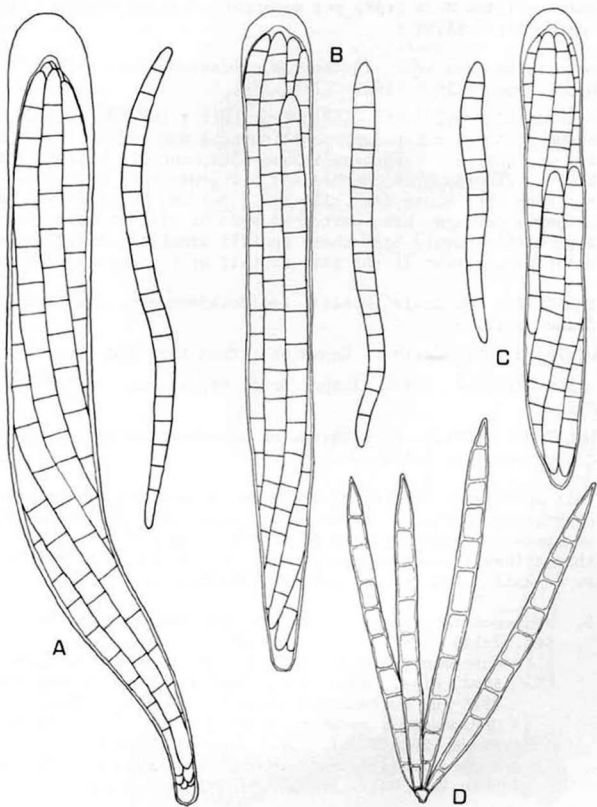


Fig. 4. A. *Podonectria larvaespora* ascus and ascospore Holotype (K). B. *P. novae-zealandica* ascus and ascospore Holotype (PDD 10942). C. *P. echinata* ascus and ascospore Holotype (K). D. *Tetracrium echinatum* conidium Holotype (K). All x500.

multiseptate, 9-15 septa per ascospore forming cuboidal to subcuboidal cells.

Associated anamorph: *Tetracrium echinatum* Petch, Trans. Brit. Mycol. Soc. 7:162. 1921. (Fig. 4D)

Sporodochium pulvinate, 550-600 μm tall x 300-400 μm wide, orange to chestnut-brown; conidiophores moniliform, 20-30 x 4-7 μm , sparsely branching toward apex; conidia hyaline holoblastic staurospores composed of 3-4 arms; each arm long-fusiform with acute apex, 100-180 x 6-8 μm , multiseptate, 9-21 septa per arm; arms united at base by globose cell, 4-5 μm diam with truncate base where conidia break off conidiophore. Holotype specimen is the same as that of *Podonectria echinata*.

SUBSTRATE: On scale insects, *Lepidosaphes* sp., inhabiting *Citrus nobilis*.

DISTRIBUTION: Ceylon. Known only from type locality.

ILLUSTRATIONS: Petch, Trans. Brit. Mycol. Soc. 7:pl. 4 f. 7, 1921.

HOLOTYPE: CEYLON, Peradeniya, on *Lepidosaphes* sp. on pumelo, *Citrus nobilis*, Petch, Oct. 1919 (K).

This species is similar to *Podonectria aurantii* in centrum characters, ascocarp structure and associated anamorph. *P. echinata* is differentiated by the fascicles of hairs, although they are occasionally solitary, resembling those of *P. aurantii*, and longer, narrower ascospores.

5. *Podonectria aurantii* (Höhn.) Petch, Trans. Brit. Mycol. Soc. 7:149. 1921. (Figs. 5A-B)

≡ *Puttemansia aurantii* Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 120:408. 1911 (ut *Puttemansia aurantii* (P. Henn.) Höhn.).

[≡ *Ophionectria aurantii* (Höhn.) Petch, Trans. Brit. Mycol. Soc. 7:151. 1921 *lapsus calami*.]

= *Ophionectria tetraspora* Miyabe & Sawada, J. Coll. Agric. Tohoku Imp. Univ. 5:85. 1913.

Fruiting bodies solitary to aggregated in small groups, superficial on a thick, white, byssoid stroma closely surrounding the ascocarps. Ascocarps globose to subglobose, 300-500 μm tall x 250-550 μm wide, light-yellow to brown, covered with flexuous hyphal hairs obscuring the outer wall; hairs hyaline, 40-150 x 3-6 μm , tips rounded, walls 1 μm thick, sparsely septate; ostiole 20-40 μm diam; ascocarp wall 35-50 μm thick

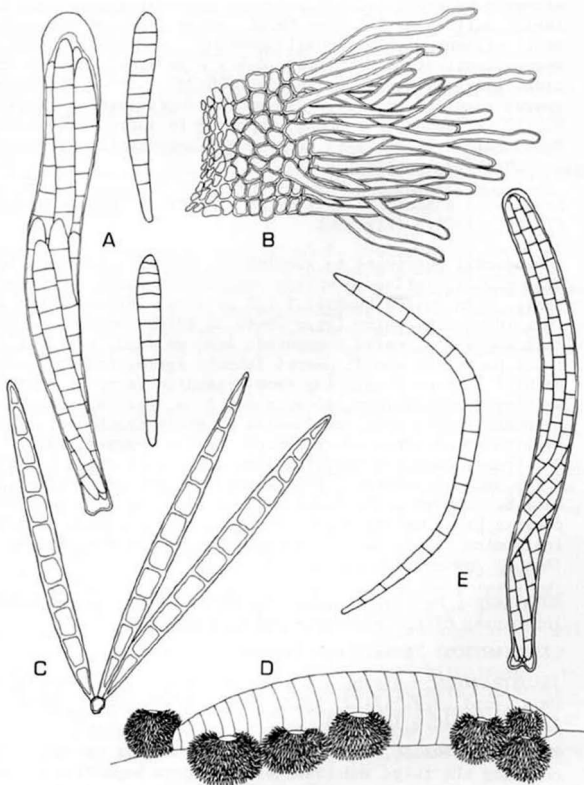


Fig. 5. A-B. *Podonectria aurantii* Holotype (B). A. Ascus and ascospores. B. Section of ascocarp wall with hairs. C. *Tetra-carium aurantii* conidium Holotype (B). D-E. *Podonectria tenuispora* Holotype (K). D. Ascocarps on scale insect. E. Ascus and ascospore. All x500 except D which is x50.

composed of globose cells 5-7.5 μm diam forming *textura angularis*, cell walls 1-1.5 μm thick, outer layer of ascocarp cells pigmented below hyphal covering. Pseudoparaphyses numerous, reticulate, filiform, 0.5-1.5 μm diam. Asci bitunicate, long-clavate to cylindrical, 150-200 x 17-20 μm ; ascospores parallel in asci. Ascospores long-clavate, 55-85 x 7.5-12 μm , apically rounded, tapering to narrowly rounded base, multiseptate, 9-13 septa per ascospore forming cuboidal to subcuboidal cells.

Associated anamorph: *Tetracrium aurantii* P. Henn., *Hedwigia* 41:116. 1902. (Fig. 5C)

Sporodochia pulvinate to subglobose, 310-375 μm tall x 400-625 μm wide, yellow to yellow-orange; internally composed of small, thin-walled hyphae, 1-1.5 μm diam, forming loose *textura intricata*, outer layer 20-40 μm thick composed of *textura angularis*, cells pigmented, 4-10 μm diam, cell walls 1-1.5 μm thick; conidiophores densely aggregated on sporodochial surface developing from pigmented layer of *textura angularis*, moniliform, 40-60 x 4-7.5 μm , yellow, sparsely branched toward apex, cell walls slightly thickened; conidia hyaline holoblastic staurospores, mostly 4-armed, rarely 2-7-armed; each arm long-fusiform with acute apex, 125-180 x 6-9 μm , multiseptate, 9-21 septa per arm; arms united at base by globose cells 5-7.5 μm diam with truncate base where conidia break off from conidiophore, rarely with a second cell below basal cell. Holotype specimen is the same as that of *Podonectria aurantii*.

SUBSTRATE: On scale insects including *Parlatoria zizyphi* inhabiting *Citrus aurantium* and *C. nobilis*.

DISTRIBUTION: Brazil and Taiwan.

ILLUSTRATIONS: Miyabe & Sawada, J. Coll. Agric. Tohoku Imp. Univ. 5:pl. 7 f. 17-22, 1913; Petch, Trans. Brit. Mycol. Soc. 7:pl. 4 f. 10 & 14, 1921.

HOLOTYPE: BRAZIL, São Paulo, Horto Botanico, on insect larvae covering the twigs and branches of *Citrus aurantium* L., A. Puttemans 282, 26 June 1901 (B as *Tetracrium aurantii*). In addition, there are four slides and a fragmentary isotype specimen in the Høhnel collection at FH as an unpublished new combination in *Scoleconectria*.

OTHER SPECIMEN EXAMINED: TAIWAN, Tennaiho, Taihoku, on *Parlatoria zizyphi* (Lucas) Sign. infesting *Citrus nobilis* Lour., Y. Fujikuro, 11 Mar. 1911 (SAP) HOLOTYPE of *Ophionectria tetraspora*.

The type specimen of *Podonectria aurantii* was described as an imperfect fungus for which Hennings erected the genus *Tetracrium*. In examining Hennings's specimen, Höhnelt discovered and described the perfect species *Puttemansia aurantii*. When Petch (1921) erected *Podonectria*, he transferred this species to his genus.

Petch (1921) considered *Ophionectria tetraspora* synonymous with *Podonectria aurantii*. Miyabe & Sawada (1913) recognized the relationship of their species to *Ophionectria coccicola* ($\equiv P. coccicola$).

Podonectria aurantii is similar to *P. coccicola*, *P. echinata* and *P. tenuispora* in centrum characters and ascocarp wall structure. It is differentiated by the dense layer of hyphae covering the ascocarp which Petch suggests is occasionally united into fascicles as in *P. echinata* and the ascospores which are shorter and wider than any other known *Podonectria* species.

6. *Podonectria tenuispora* Dennis, Kew Bull. 1957:404. 1958.
(Figs. 5D-E)

Fruiting bodies solitary to aggregated in small groups, superficial with scant, white, byssoid stroma. Ascocarps globose to subglobose, 300-350 μm tall x 250-400 μm wide, translucent yellow to ochraceous yellow, densely covered with hyaline, flexuous hairs obscuring the outer wall; hairs 50-100 x 3-4 μm , sparsely septate, cell walls 1-1.5 μm thick becoming thinner at apex, tips bluntly rounded to slightly inflated; ostiole 75-100 μm wide; ascocarp wall composed of globose, unpigmented cells 3-5 μm diam forming textura angularis, cell walls 1-1.5 μm thick. Pseudoparaphyses scant to numerous, reticulate, filiform, 0.5-1.5 μm diam. Asci bitunicate, cylindrical, 150-190 x 12-15 μm , ascospores parallel in young asci, becoming spirally twisted toward base at maturity. Ascospores long-cylindrical, 125-150 or more x 3-7 μm , curved to vermiform, multiseptate, 15-17 or more septa per ascospore forming rectangular cells.

SUBSTRATE: On scale insects, *Lepidosaphes ulmi*, inhabiting *Calluna vulgaris*.

DISTRIBUTION: Scotland. Known only from type locality.

ILLUSTRATIONS: Dennis, Kew Bull. 1957:403 f. 4, 1958; Dennis, British Cup Fungi and Their Allies f. 19D, 1960; Dennis, British Ascomycetes f. 19D, 1968.

HOLOTYPE: SCOTLAND, West Inverness-shire, Camas 'na Togalach, Loch Morar, on scale insects, *Lepidosaphes ulmi* on *Calluna vulgaris*, R. W. G. Dennis, 13 July 1957 (K).

This species is the only temperate representative of *Podonectria*. Few mature ascospores were found so that the measurements may not be entirely representative of the species.

7. *Podonectria coccorum* (Petch) Rossman, Mycologia 69:379. 1977. (Fig. 6A)

≡ *Ophionectria coccorum* Petch, Trans. Brit. Mycol. Soc. 12:49. 1927.

Fruiting bodies solitary to aggregated, superficial on a dark, byssoid stroma which obscures the scale insect. Ascocarps globose to broadly ovoid, 180-300 μm diam, brown to dark-brown, scurfy due to shedding of dark, outer wall cells, sometimes with flexuous, thick-walled hairs around ostiole; hairs 17-25 x 5 μm , rarely intermixed with straight hairs, 100-125 x 9 μm ; ascocarp wall 25-45 μm thick composed of globose to rectangular cells 3-8 μm diam with walls 1-1.5 μm thick, forming *textura angularis*, becoming *textura globulosa* in pigmented outer layer. Pseudoparaphyses numerous, reticulate, filiform, 0.5-1 μm thick. Asci bitunicate, cylindrical, 85-110 x 7.5-9 μm ; ascospores parallel to slightly twisted. Ascospores cylindrical, 55-95 x 1.5-3 μm , straight to slightly sigmoid, multiseptate, 5-9 septa per ascospore forming rectangular cells, hyaline, becoming dilute brown at maturity.

SUBSTRATE: On scale insects, *Fiorinia juniperi*, inhabiting *Juniperus bermudiana*.

DISTRIBUTION: Ceylon.

ILLUSTRATION: Petch, Trans. Brit. Mycol. Soc. 12:pl. 8 f. 6-10, 1927.

HOLOTYPE: CEYLON, Peradeniya, Royal Botanic Gardens, on *Fiorinia juniperi* Green on *Juniperus bermudiana*, E. E. Green, Petch 3172, 1910 (K).

OTHER SPECIMEN EXAMINED: CEYLON, Peradeniya, Petch, 1 Nov. 1923 (FH).

Podonectria coccorum is an unusual member of the genus. The dark ascocarps, small asci and small, narrow ascospores which become dilute brown are not typical of *Podonectria* species but do suggest a relationship with *P. gahnia*, the other anomalous member of this genus.

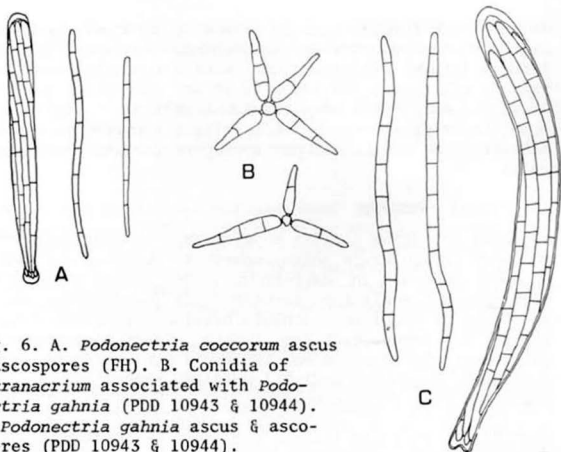


Fig. 6. A. *Podonectria coccorum* ascus & ascospores (FH). B. Conidia of *Tetranacrium* associated with *Podonectria gahnia* (PDD 10943 & 10944). C. *Podonectria gahnia* ascus & ascospores (PDD 10943 & 10944). All x 500.

When Petch (1927) described this species, he mentioned two associated imperfect species: *Peziotrichum lachnella* (Sacc.) Lind. and *Volutella epicoccum* Petch. Because these species have no apparent relationship to the other imperfect fungi associated with *Podonectria* species, the relationship between *Podonectria coccorum* and these associated fungi remains tenuous. *Peziotrichum lachnellum* is known to occur on living leaves, not necessarily associated with scale insects. Unrelated fungal species are occasionally found on the same scale insect.

8. *Podonectria gahnia* Dingley, Trans. & Proc. Roy. Soc. New Zealand 81:498. 1954. (Fig. 6C)

Fruiting bodies gregarious, each immersed in a well-developed outer stroma; stroma dark-brown, 40-80 μm thick composed of globose cells 3-12 μm diam with walls 2-5 μm thick, forming textura angularis, enclosing a layer, up to 50 μm thick, of large, reddish-brown, water-soluble granules. Ascocarps globose to subglobose, 270-390 μm tall x 190-310 μm wide, brown to dark-brown, surrounded by outer stroma; ostiole sunken, 20-40 μm diam; ascocarp wall 20-35 μm thick, composed of elongated cells with thin to slightly thickened walls 0.5-

1.5 μm thick forming *textura prismatica*, becoming globose and pigmented toward outside. Pseudoparaphyses numerous, reticulate, filiform, 1-1.5 μm diam. Asci bitunicate, long-clavate to cylindrical, 135-190 x 12-18 μm ; ascospores parallel in asci. Ascospores long-clavate to cylindrical, 90-130 x 3.5-6 μm , tapering to rounded ends, slightly curved to vermiform, multiseptate, 9-11 septa per ascospore forming rectangular cells.

Associated anamorph: *Tetranacrium* sp. (Fig. 6B)

Pycnidia appearing similar to ascocarps of *Podonectria gahnia* but more irregular in shape, somewhat involuted and eventually open; immersed in dark-brown, outer stroma with ascocarps; conidiophores moniliform forming dense layer lining the base and sides of pycnidium; conidia hyaline holoblastic staurospores, 3-4 armed; each arm clavate, widest toward point of attachment, 20-40 x 5-6 μm , 1-3 septa per arm; arms united at base by a globose cell 3-4 μm diam, truncate where conidia break off from conidiophore.

SUBSTRATE: On scale insects including diaspid, mostly unidentified insects, inhabiting *Gahnia setifolia*, *G. xanthocarpa* and *Podocarpus ferrugineus*.

DISTRIBUTION: New Zealand.

ILLUSTRATIONS: Dingley, Trans. & Proc. Roy. Soc. New Zealand 81:497 f. 1a-b, 1954.

HOLOTYPE: NEW ZEALAND, Auckland, Waitakere Ranges, Simla Rd., 1000 ft., on diaspid scale on *Gahnia setifolia*, J. M. Dingley, 19 Oct. 1947 (PDD 19045).

OTHER SPECIMENS EXAMINED: NEW ZEALAND, Auckland, Omahuts Forest, Sanctuary Reserve, J. M. Dingley, 19 June 1963 (PDD 23868); Auckland, Waitakere Ranges, Sharp's Bush, J. M. Dingley, 13 Oct. 1965 (PDD 24775); Auckland, Waitakere Ranges, J. M. Dingley, Nov. 1948 (PDD 10943); Auckland, Swanson, J. M. Dingley, Nov. 1945 (PDD 10944); Wellington, Kaitohe, A. H. Healy, April 1953 (PDD 12753).

The peculiar outer stroma surrounding the ascocarps distinguishes *Podonectria gahnia*, related to *P. coccorum* in having brown ascocarps and small, narrow ascospores. Despite the formation of pycnidia, the shape and development of the conidia of the associated *Tetranacrium* suggest a relationship to *Tetracrium*, the anamorph associated with several *Podonectria* species. *Tetranacrium* was described with one species, *T. gramineum*, immersed in dead leaves of *Saccharum officinarum*

and *Sorghum vulgatum* (Hudson & Sutton, 1964). The peculiar imperfect fungus associated with *Podonectria gahnia* belongs in *Tetranacrium*.

Excluded species

Podonectria bambusicola (Rehm) Pirozynski, Kew Bull. 31:603. 1976.

Trichonectria bambusicola Rehm, a later synonym of *Ophionectria erinacea* Rehm (Rossman, 1977), was transferred to *Podonectria* on the basis of the bitunicate asci, multiseptate ascospores and *Tetranacrium* associated anamorph. It occurs on living leaves of bamboo rather than scale insects and remains a loculoascomycete of uncertain disposition.

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The curators and their assistants at the following herbaria are sincerely acknowledged for the generous loan of specimens: B, BPI, CUP, DAOM, FH, HBG, IARI, K, NY, PDD and SAP. This project was initiated while visiting the New York Botanical Garden in 1971 as the recipient of the Gertrude S. Burlingham Scholarship and continued at Oregon State University, Department of Botany. I am particularly grateful to Dr. William C. Denison for his unfailing support and encouragement.

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ADDENDUM

While this paper was in press, two additional species recently placed in *Podonectria* came to the attention of the author. Their type specimens will be examined and evaluated in a later publication.

- Kobayasi, Y. & D. Shimizu. 1977. Two new species of *Podonectria* (Clavicipitaceae). Bull. Natl. Sci. Mus., Ser. B (Bot.) 3:93-97.

NOTICE

RESULTS OF THE POLL TAKEN OF MYCOTAXON SUBSCRIBERS

Along with the subscription renewal notice for volume 6, the Co-Editors of MYCOTAXON included a small questionnaire designed to determine the sentiments of subscribers concerning editorial policies, in particular those policies relating to long articles.

In establishing the journal, the Co-Editors were (i) anxious to avoid imposing page charges on authors (or their institutions), and were (ii) willing to accept articles of any length. In the first six volumes, the articles have ranged from one page to 277 pages in length, averaging about 15 pages per article.

The Co-Editors began to worry what might happen if we were flooded with several book-length manuscripts. No volume, even in the expanded "at least 512 pages" size now in force, has ever run more than 3 quarterly issues, and three volumes were completed in two issues. A series of book-length manuscripts might find us producing more than two volumes in a year, which at the current subscription rates (\$12 or \$14 per volume for personal subscriptions) might prove a burden to our subscribers beyond their financial resources.

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We have had many, many comments and thoughtful suggestions from our subscribers. All these have been weighed in our thinking. We are pleased to report that a substantially large number of subscribers do not wish to change the present policy. We will, therefore, continue as we have done in the past. There has been no flood of book-length papers submitted. Those that have been are of high quality, even though of course not of universal interest. Were such monographs published instead as separate books, or in a separate monograph series with fewer subscribers, the cost per monograph would increase drastically.

One editorial change seems appropriate: we shall ask authors planning on long papers, in excess of 50 pages, to provide us sample pages of their manuscripts before proceeding to final typing, so that we may offer advice on ways to save space in publishing the material.

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