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SOME AGARICALES FROM THE CONGO

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(With 44 Text-figures)

Clitocybe cystidiosa, Neoclitocybe membranacea, N. lifotama, Hydropus xanthosarx, Xerocomus microsporus, Pulveroboletus paspali and the genus *Hiatulopsis* are described as new; the new combinations *Clitocybe subtilis* (Berk.) Sing. & Grinl., *Hydropus funebris* (Speg.) Sing., *Hiatulopsis amara* (Beeli) Sing. & Grinl. are proposed. A key to the species of *Neoclitocybe* and another to the sections *Mycenoides* and *Irrorati* of *Hydropus* are given. *Chaetocalathus niduliformis, Gyrodon intermedius, Xerocomus alliaceus*, and *Boletellus obscurecoccineus* are redescribed. *Hiatulopsis* forms axially symmetric spores on autobasidia.

The following descriptions of new species and redescriptions of known species from the Congo region are mainly based on collections made by one of us (Grinling) in the vicinity of Brazzaville, République du Congo; a few are added from collections made by Belgian botanists and sent for determination since they were mixed in with the *Marasmius* material monographed by Singer (*1964a*, *1965*); they are from the "Bas-Congo" and the "District Forestier Central" of the ex-Belgian Congo, respectively.

Many collections from the Congo have been studied and published under various names by a number of mycologists; yet, the mycoflora of the combined Congo region is by no means exhausted and some of the descriptions available in the literature are either incomplete as far as the modern requirements of descriptive agaricology are concerned, or they are, because of the limited material available until now, not fully representative of the complete range or variability exhibited by each species.

We have therefore considered it useful to describe every specimen in detail.

In one case we have been forced to recognize a new genus of Agaricaceae, *Hiatulopsis*; in other cases (two boletes, four agarics) we believe our collections to represent species new to science. For *Neoclitocybe* we have considered it useful to add a key to the known species since no such key, even on a regional basis, has been published before. We have also added a key to all the species known in sections *Mycenoides* and *Irrorati* of the genus *Hydropus*. Both these sections as well as the genus *Neoclitocybe* are new to tropical Africa.

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As for *Hiatulopsis*, we are particularly surprised by the hitherto—as far as we are aware—undescribed type of spore attachment to the sterigma which differs from the classical type of half-sickle-shaped sterigma and asymmetric spore. It is at present too early to conclude that this new type of spore attachment is restricted to the genus *Hiatulopsis*.

The specimens are conserved at the Cryptogamic Herbarium of the Facultad de Ciencias Exactas y Naturales of the Universidad Nacional de Buenos Aires (BAFC) and in the private herbarium of K. Grinling.

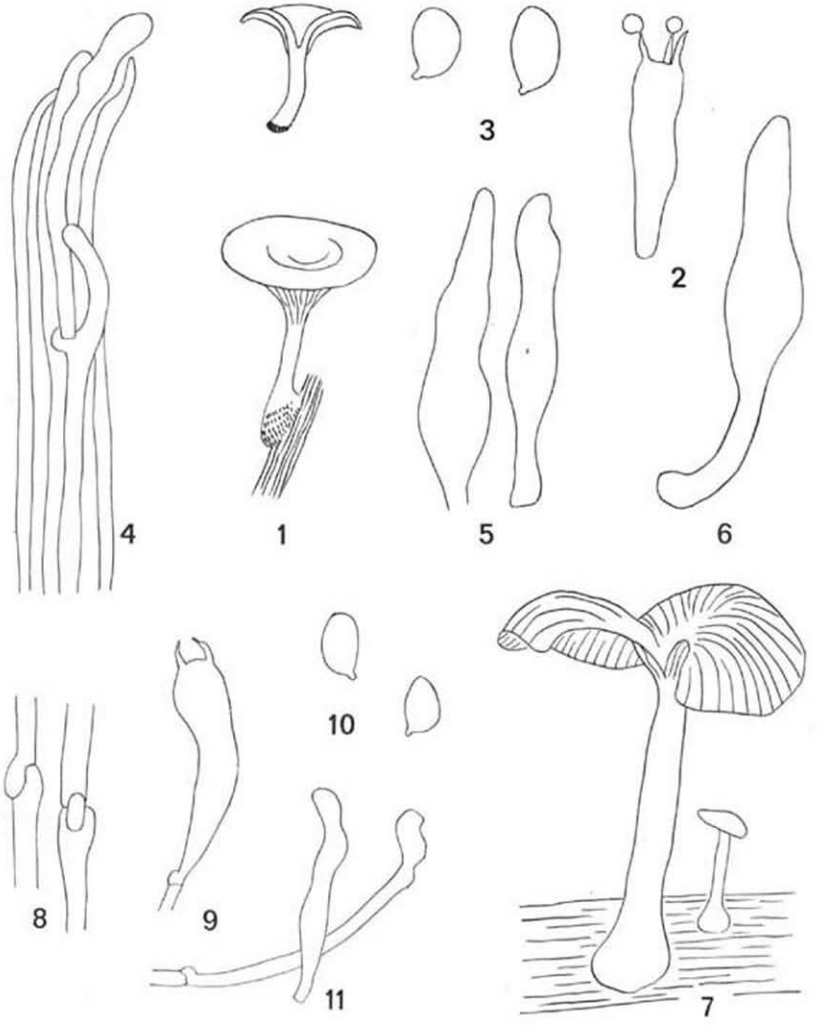
TRICHOLOMATACEAE

Clitocybe cystidiosa Sing., *spec. nov.*—Figs. 1–6

Pileo sordide cremeo-subargillaceo vel ochraceo-brunneo, centro atro-brunneo, concentrice rivuloso, praesertim in centro, margine primum involuto, ciliato, paullum striatulo, convexo, centro depresso et plerumque profunde infundibuliformi, 16–40 mm lato; lamellis clare cremeis acie integris, polydymis, sat confertis, decurrentibus; sporis in massa albis, s.m. 5–7 × 3.3–4 μ, ellipsoideis, levibus, hyalinis, inamyloideis; cystidiis opalescentibus sed haud metuloideis, haud metachromaticis in caeruleo cresylico nec pseudoamyloideis, 50–60 × 8–12 μ; hyphis inamyloideis fibulatis; hymenophore tramate irregulari, ex hyphis filamentosis sed interdum multiseptatis formato ex hymenopodio subregulari a subhymenio separato, haud gelatinisato; stipite ± concolori cum pileo, glabro, solido, albomycelioso ad basin 15–25 × 2.5–6 mm; carne tenui mollique in pileo, tenaci in stipite; sapore inamoeno dein amaro. — Ad culmos emortuos adustos graminum, Congo, Brazzaville, 'route de Lifoula', novembri 1965, *Grinling 51,110* (BAFC), typus.

Pileus dirty cream with an argillaceous tinge, varying to ocher brown, with deep brown center where the surface is concentrically rivulose, with at first involute margin which is finely ciliate-fimbriate, indistinctly striatulate over one quarter of the radius, convex, with depressed then deeply infundibuliform center in most caps, 16–40 mm broad. — Lamellae rather light cream, with entire edge, narrow, rather close, decurrent. Spore print white. — Stipe more or less concolorous with the pileus, strongly beset with sand particles, apparently glabrous, slightly thickened towards the base, solid, 15–25 × 2.5–6 mm, veil none; basal mycelium white, fibrillose. — Context thin and soft fleshy in the pileus, tough in the stipe; somewhat unpleasant grassy taste, later bitter.

Spores 5–7 × 3.3–4 μ, ellipsoid, smooth, hyaline, inamyloid. — Hymenium with basidioles, basidia and cystidia, the basidia 22.5–29 × 5–6 μ, clavate, hyaline, tetrasporous, with basal clamp, contents as well as that of the spores deep blue granulated in many cells when seen in cresyl blue mounts; cystidia deep rooted but not continuing into differentiated hyphae, on edges and sides of lamellae, 50–60 × 8–12 μ, rarely smaller, opalescent, thin-walled but the inner surface of the wall indefinitely delimited when seen in KOH, but appearing thin-walled when seen in cresyl blue mounts where the whole interior is clear and uniform, ventricose to fusoid or subampullaceous with rounded tip which may be somewhat mucronate or constricted-subcapitate, not pseudoamyloid; cheilocystidia not differentiated. — Hyphae with clamp connections (and some non-clamped secondary septa), inamyloid; hymenophoral trama consisting of mostly filamentous hyphae which are strongly interwoven and make the trama almost irregular, some elements of the hyphal chains very short and almost isodiametric (e.g. 9 × 5 μ), especially in the hymenopodium which is less interwoven, not gelatinized; context of pileus



Figs. 1–6. *Clitocybe cystidiosa*. — 1. Carpophores (× 1). — 2. Basidium (× 1000). — Spores (× 2000). — 4. Erect hyphae of the epicutis (× 1000). — 5. Cheilocystidia (× 1000). — 6. Pleurocystidium (× 1000).

Figs. 7–11. *Neoclitocybe membranacea*. — 7. Carpophores (× 1). — 8. Hyphae of the epicutis (× 1000). — 9. Basidium (× 1000). — 10. Spores (× 1400). — 11. Cheilocystidia (× 1000).

consisting of filamentous hyphae which are, although interwoven more radially arranged. — Covering layer: Epicuticular layer consisting of erect hyphae rising from a cutis and sometimes many such hyphae (e.g. 45–55 × 3.3 μ) combined into a peg-like formation; the lower layer a cutis of filamentous hyphae 3.5–4 μ thick, the erect hyphae with acute or rounded tips; pigment brownish (KOH), dissolved in the cell sap; without incrustations, with smooth, hyaline wall.

On dead culms of Gramineae which were in part burned over. Congo, Brazzaville, savannah on the 'route de Lifoula', November 1965, *Grinling 51,110.*

This is a very puzzling species which obviously belongs in the neighborhood of the neotropical *Pleurotus subtilis* (Berk.) Sing. on one hand and the acystidiate *Clitocybe aprilis* Sing. on the other. *Clitocybe kabulensis* Sing. also appears to be close. Under these circumstances it follows that *Pleurotus subtilis* has been misplaced by Singer (*1961*: 136) who was misled by the more elongate spores of that species. Since all the affinities of this species are with *Clitocybe* we have no other choice but to transfer *Pleurotus subtilis* to *Clitocybe* as **Clitocybe subtilis** (Berk.) Sing. & Grinl., *comb. nov.* [basionym, *Lentinus subtilis* Berk. *in* J. Linn. Soc. (Bot.) **15**: 50. 1876].

All these species belong in or near section *Aberrantissimae* Sing.

Neoclitocybe membranacea Sing. & Grinl., *sp. nov.*—Figs 7–11

Pileo isabellino-griseo, uniformiter colorato sed lilacino-tincto, pellucido, striato usque ad centrum, margine ± lobato-crenulato et frequenter fisso, glabro, convexo, profunde infundibuliformi et perforato, usque ad 80 mm lato. — Lamellis pileo concoloribus, distantibus, interdum furcatis, angustissimis (1.5 mm), acie obtusiusculis, decurrentibus. — Stipite pileo concolori, glabro- sericello, fistuloso, subaequali sed bulbo subgloboso basali praedito, usque ad 40 × 6 mm; velo nullo; mycelio basali e disco radiato-fibrilloso albo angustissimo consistente, qui substrato applicatus permanet. — Contexto membranaceo-tenaci, in stipite tenaci-fibrilloso, latice destituto, in pileo tenuissimo; odore iucundo fructuum; sapore haud notabili. — Sporis in massa albis subcremaceis. — Sporis (6–)6.5–7.5 × 3.5–4.5 μ, hyalinis, levibus, tenui-tunicatis, ellipsoideis, inamyloideis. — Hymenio: Basidiis 28–35 × 6.2–7 μ, clavatis, hyalinis, tetrasporis. Cystidiis nullis, sed cheilocystidiis numerosis et differentiatis, ut membra terminalia hypharum tramalium nec non ad marginem zonae sterilis marginalis hymenium versus et ita hymenium basidiorum delimitantibus 22–31 × 3–6 μ, versiformibus, frequenter flexuoso-constrictis et in parte centrali vel inferiore inflatis, interdum excrescentiis brevibus munitis, frequenter hyphiformibus vel clavatis, tenui-tunicatis, hyalinis; acie lamellarum meteromorpha. — Hyphis inamyloideis, fibulatis; tramate hymenophorali hyphis axialiter dispositis sed fortiter intertextis, hyalinis efformato, haud gelatinoso; strato supralamellari ex hyphis radiatim dispositis subparallelis, tenuibus, sed densiore quam trama carnis suprajacentis quod stratum pro ratione tenue inter epicutem et stratum supralamellare format et laxius est quam epicutis et stratum supralamellare, ex hyphis pro parte latioribus magisque variabilibus (3–7 μ diam.), hyalinis, subparallelis, haud manifeste gelatinisantibus efformato, parietibus hypharum tenuibus. — Epicute pilei ex hyphis tenuibus (1–1.5 μ), interdum levibus, interdum leniter distanterque obtuse-diverticulatus (diverticulis subglobosis vel brevissime hyphosis), cutem formantibus, externis interdum pigmento pallide brunneolo incrustante granulari sparso ornatis, ceterum hyalinis. — Ad lignum putridum gregatim. Congo, Brazzaville, Februario 1966, *Grinling 60,209* (BAFC), typus.

Pileus uniformly isabelline grey tinged with lilac, transparent striate to the center, lobed and crenated at the margin, frequently split, glabrous, convex, deeply infundibuliform and perforated, up to 80 mm broad. — Lamellae concolorous,

distant, occasionally forked, narrow (1.5 mm), with rather obtuse edge, decurrent. Spore print white or slightly cream. — Stipe concolorous, glabrous, subsericeous, fistulate, subequal but swollen at the base, up to 40 × 6 mm, without veil; basal mycelium forming a white fibrous disc narrowly surrounding the point of attachment to the substratum. — Context tough, membranous, tough-fibrillose in stipe, without latex, very thin in pileus, smell somewhat fruitlike, taste negligible.

Spores (6–)6.5–7.5 × 3.5–4.5 μ, hyaline, smooth, thin-walled, ellipsoid, inamyloid. — Hymenium: Basidia 28–35 × 6.2–7 μ, clavate, hyaline, 4-spored. Cystidia none; but cheilocystidia numerous and differentiated as end members of the tramal hyphae and likewise at the borderline between the hymenium and the sterile edge zone and thus forming a row where the basidia end, 22–31 × 3–5 μ, versiform, frequently flexuous-constricted, in the central or lower part often inflated, often with very small, short excrescences, often also hyphoid or clavate, thin-walled, hyaline; edge of lamellae heteromorphous. — Hyphae inamyloid, clamped; hymenophoral trama of axially arranged hyphae which are strongly interwoven and hyaline, non-gelatinous; supralamellar layer of radially arranged hyphae which are subparallel with each other and thin, but are denser than those of the pileus trama which forms a relatively thin layer between the supralamellar layer and the cuticular layer, being differentiated from both by its less densely arranged hyphal elements, by the partly broader and more variable (3–7 μ diam.) hyphae, which are hyaline, subparallel with each other, not distinctly gelatinized; hyphal walls in trama thin. — Epicutis of thin (1–1.5 μ diam.) hyphae, sometimes smooth, sometimes slightly and distantly diverticulate with obtuse, subglobose to short-hyphous appendages, the outermost sometimes with pale brownish granular pigment incrusted which is sparse, otherwise all elements hyaline in KOH and NH_4OH; structure of epicutis—a cutis.

On rotten wood, gregarious. Congo, Brazzaville, hollow filled with primitive forest at the Djoumouna stream below the Linzolo road, February 1966, *Grinling 60,209*.

This species has somewhat the appearance of *Gerronema*, *Trogia*, or certain species of *Micromphale* but its anatomical structure is that of *Neoclitocybe*, a predominantly tropical genus. We have described this particular species as new because it does not agree with any described material published previously; nevertheless, we have some doubts as regards the specific and generic identity of *Cantharellus membranaceus* Seynes and *Trogia violaceogrisea* (Henn.) Pat. and *T. discopus* (Pat.) Pat. We do not know whether type material of *C. membranaceus* and *T. violaceogrisea* still exists. At any rate our Brazzaville material does not combine the anatomical characters of either *Cantharellus* or *Trogia*. This and the following species prove that *Neoclitocybe* is not a genus restricted to the Neotropics alone.

Neoclitocybe lifotama Sing., *spec. nov.*

Pileo albido, margine substriato, leniter subsulculato, glabro, convexo, leniter umbilicato, 11–24 mm lato. — Lamellis albis, moderatim latiusculis, confertis, vel subconfertis, in maturis intervenosis anastomosibus basalibus, interdum furcatis, adnato-decurrentibus. — Stipite albido, sordide griseolo ad basin quae in discum vel bulbum dilatatum est, subtomentoso ad basin, glabro vel subglabro supra basin, (10–)30 × 0.5–1.5 mm; velo nullo; mycelio basali e fibris radiantibus consistente, bulbum vel discum efformante. — Sporis 7.7–9 × 3.7–5 μ, hyalinis, levibus, inamyloideis, ellipsoideis. — Hymenio: Basidiis 23–24 × 8–8.5 μ, hyalinis, clavatis, tetrasporis. Cystidiis nullis visis; cheilocystidiis nodoso-ramuloso-

irregularibus. — Hyphis inamyloideis fibulatis. Epicute typi Ramealium, irregulariter fortiterque coralloideo-diverticulata. — Ad ramulos ligneos Dicotyledonum nec non ad folia dejecta arborum Dicotyledonum in silva inundabili, dense gregatim. Congo: Eala, Septembri 1923, *Goossens-Fontana 292* (BR), typus.

Pileus whitish with somewhat striate margin which is also slightly sulcate, glabrous, convex, slightly umbilicate, 11–24 mm broad. — Lamellae white, moderately broad, close or subclose, with low anastomoses, sometimes forked, adnate-decurrent. — Stipe whitish, sordid-grayish at base which is broadened into a disc or bulb, subtomentose at base, glabrous or subglabrous above, (10–)30 × 0.5–1.5 mm; veil none; basal mycelium consisting of radiant fibrils which form the bulb or disc.

Spores 7.7–9 × 3.7–5 μ, hyaline, smooth, ellipsoid, inamyloid. — Hymenium: Basidia 23–24 × 8–8.5 μ, hyaline, clavate, 4-spored. Cystidia none seen; cheilocystidia nodose-ramulose-irregular. — Hyphae inamyloid with clamp connections. — Epicutis of the Rameales type, hyphae irregularly and strongly coralloid-diverticulate.

On woody twigs of Dicotyledones and also on fallen leaves of trees in the low inundable tropical forest, densely gregarious. Congo, Central Forest district, Eala, September 1923, *Goossens-Fontana 292*.

This species is closely related to *Micromphale euomphalum* (Berk.) Sing. which, according to the conclusions which its affinity with the Congo material suggests, apparently should be transferred to *Neoclitocybe*. The spore print is said to be white. There is a colored picture at Brussels, with the type. This fungus is known under the vernacular name "lifotama", hence the specific epithet.

KEY TO THE KNOWN SPECIES OF NEOCLITOCYBE

1. Spores larger than 6 μ long.
   2. Sterigmata very large; spores very broad (5.5–9.3 μ). . . . . *N. latispora* Sing. ined.
   2. Sterigmata normal; spores less broad.
      3. Pileus white, whitish, cinereous-whitish.
         4. Spores 7.7–9 × 3.7–5 μ. African species . . . . . *N. lifotama* Sing.
         4. Spores slightly smaller. Tropical and subtropical American species.
            5. Cystidia none; spores rather short: 6–7.5(–10) × 4.2–5.7(–6.8) μ.
               6. Stipe eccentric, 4–6 × 0.5–1 mm. Pileus whitish to pale buff-yellow. *N. tropicalis* (Speg.) Sing.
               6. Stipe central, larger; pileus white and over 20 mm broad. *N. nivea* (Rick) Sing.
            5. Cystidia and/or hyphae breaking through the hymenium more or less differentiated; stipe mostly central; spores 6–7.5 × 3–4.5 μ.
               7. Lamellae subclose; base of stipe generally more or less socle-like with very fine radiating fibrils forming a basal mycelium. Amazonas. *N. euomphala* (Berk.) Sing.
               7. Lamellae distant; base of stipe with a white, fibrillose mycelial disc. Northern part of Neotropics. . . . . *N. substenophylla* (Murrill) Sing.
      3. Pileus not white nor whitish to grayish white.
         8. Pileus, stipe and lamellae with a lilac tinge when fresh. African species with narrow lamellae . . . . . *N. membranacea* Sing. & Grinl.
         8. Pileus, stipe and lamellae without a lilac tinge. American species, with rather broad to broad lamellae (with rather narrow to narrow lamellae, see "11" below).

9_1. Mostly on the ground in South Brazil and subtropical Argentina. Pileus generally more than 20 mm broad; lamellae white to melleous, stramineous; spores strikingly variable; base of stipe at first white and white myceloid.
N. subnimbata (Rick) Sing.

9_2. On sticks, trunks and living cortex of dictyledonous trees (often *Phoebe porphyria*) in the mountains of northwestern Argentina; pileus generally not more than 20 mm broad; lamellae white to dirty gray; stipe pigmented below and with very scanty basal mycelium; spores 7.5–9.6 × 4–4.8 μ.
N. omphalina (Sing.) Sing.

9_3. On wood, 20 or more mm broad; lamellae yellow or grayish (see "11" below).

1. Spores generally not larger than 6 μ long.

10. Pileus white to cinnamon; spores up to 3.3 μ broad.

11. Pileus convex, not umbilicate; spores 2.2–3 × 1.6–2 μ. Southern Chile.
N. microspora Sing. ined.

11. Pileus at least at maturity infundibuliform; spores somewhat larger: 4.2–6.2 × 2–3.3 μ. . . . . *N. byssiseda* (Bres.) Sing.

10. Pileus fresh not white to cinnamon in moist condition, or spores broader.

12. Spores relatively large: 5–7.5 × 3.5–4.2 μ; lamellae yellow; on wood in southern Brazil. . . . . *N. irregularis* (Rick) Sing.

12. Spores smaller or lamellae not yellow.

13. Pileus larger (up to 72 mm broad), blue-black; pigment of epicutis dark green in KOH or NH_4OH, amethyst in HCl, incrusting. Amazonas.
N. portentosa Sing.

13. Pigment either incrusting and rusty to chestnut brown in KOH and NH_4OH, or scanty to intracellular, or nil in epicutis.

14. Stipe generally eccentric; pileus cream-isabelline-whitish; small. Brazil.
N. sublateralis Sing.

14. Stipe generally central; pileus some other color.

15. Pileus umber-bister; spores 4.8–6.2 × 2.8–3.6 μ. On fallen and rotting leaves, ferns, etc. . . . . *N. nauseosa* (Rick) Sing.

15. Pileus "kis Kilim" to "burnt umber" (M & P) from a strong incrusting pigment; spores somewhat larger. On dead wood.
N. myceliosa Sing.

CHAETOCALATHUS NIDULIFORMIS (Murrill) Sing.

A specimen of this species, originally described from Bermuda, has been found among the *Marasmius* material from the Congo. The pilei were 1–5 mm broad, the lamellae subclose to medium close, the cystidia distributed fairly far up towards the lamellae-ground and predominantly pseudo-amyloid and thick-walled, the hairs of the pileus 2.5–5 μ in diameter with 0.7–1.7 μ thick wall. In this as in all other regards they agree satisfactorily well with the description given by Singer (*1942*: 521) from the type material. We mention the Congo material here because it is another example of a Central American–West African disjunctive area such as had previously been observed in *Marasmius conicopileatus* Henn. and *Crinipellis pseudostipitaria* subsp. *occidentalis* var. *mesites* Sing.

Congo, Bas-Congo, Kisanga, Kwango vicariate, April 11, 1910, *H. Vanderyst* (BR).

Hydropus xanthosarx Sing. & Grinl., *spec. nov.*—Figs. 12–17

Pileo stramineo-griseo nitido, glabro, subrugoso, longitudinaliter supralamellariter plicatulo, convexo, umbilicato, in umbilico acute papillato, 30 mm lato. — Lamellis aurantiacis ut in *Hygrophoropside aurantiaca*, distantibus, 16 lamellis percurrentibus, tridymis, subangustis (usque ad 3 mm latis), decurrentibus, venis perangustis intervenosis. — Stipite aurantio-brunneo, minus vivide quam lamellae colorato, flocculis albis in zona apicali ornato, ceterum glabro, levi, polito, fistuloso, cylindraceo, 40 × 3 mm, haud insiticio. — Contexto submembranaceo sed succoso (succo aurantiaco), aurantiaco, parte interna stipitis albida; odore nullo; sapore dulcidulo. — Sporis in massa tenui albis. — Sporis 7–9.5 × 3.5–4.8 μ. ellipsoideis vel cylindraceo-ellipsoideis, rarius suboblongis, levibus, hyalinis, inamyloideis. — Hymenio e basidiis, basidiolis, cystidiis, cheilocystidiis formato; basidiis 31–47 × 5.5–8(–9) μ, tetrasporis; cheilocystidiis 25–36 × 6.5–13 μ, clavatis, saepe longe pedicellatis, tenuitunicatis, hyalinis; cystidiis ad latera lamellarum cheilocystidiis simillimis, sparsis. — Hyphis tramatis hyalinis, inamyloideis, ita ut basi basidiorum fibulatis, haud gelatinisatis; hyphis laticiferis numerosis, flavis, 3.5–4.5 μ diam.; tramate hymenophorali regulari, ex hyphis ± intertextis efformato. — Strato corticali ex epicute hypodermioque consistente; epicute pallide fuscidula, ex hyphis levibus subparallelis, jacentibus, cutem efformantibus consistente et ex eis dermatocystidia 6–38 × 5.5–12 μ, integra vel usque ad 4 diverticula apicalia producentia, prostrata vel ascendentia, sparsa ecrescentia, hyphis 2.5–4 μ diam.; hypodermio pallide fuscidulo, simili sed hyphis latis (15–19 μ diam.) efforanto. — Ad truncum arboris in silva marginali fluminis. Congo, Brazzaville, Fl. Djoué, Martio 1965, *Grinling 50,313* (BAFC), typus.

Pileus greyish straw color, shining, glabrous, slightly rough, radially ridged along the lamellae, convex, umbilicate with small pointed papilla, 30 mm broad. — Lamellae bright orange as in *Hygrophoropsis aurantiaca*, narrow (< 3 mm), distant (16 lamellae reaching the stipe), of three lengths, interlamellar spaces with irregular, very small veins on the underside of the pileus, which in part run parallel with the lamellae. — Stipe brownish orange, duller than the lamellae, with white floccules on upper part, elsewhere glabrous, smooth, polished, fistulate, cylindrical, 40 × 3 mm, not insititious. — Context submembranous yet succulent (orange sap), white in upper part of stipe, odor none, taste sweetish. — Spores appearing white in very thin print.

Spores 7–9.5 × 3.5–4.8 μ, ellipsoid or cylindrical-ellipsoid, more rarely almost oblong, smooth, hyaline, inamyloid, — Hymenium: Basidia 31–47 × 5.5–8(–9) μ, 4-spored. Cheilocystidia 25–36 × 6.5–13 μ, clavate, often long-pedicellate, thin-walled, hyaline. Cystidia similar, sparsely scattered. — Hyphae in trama hyaline, inamyloid, clamped (as is the base of the basidia), not gelatinized; numerous laticiferous hyphae present, these yellow, 3.5–4.5 μ broad; hymenophoral trama regular, of more or less interwoven hyphae. — Cortical layer of pileus with a pale fuscous epicutis, consisting of smooth hyphae which are 2.5–4 μ broad, almost parallel with each other, repent, forming a cutis and from these dermatocystidia rising; dermatocystidia 6–38 × 5.5–12 μ, entire or with up to four apical diverticulate appendages, prostrate or ascendant, scattered, sparse; hyphodermium pale fuscous, similar to the epicutis, but of broader (15–19 μ) hyphae.

On tree trunk in marginal forest. Congo, Brazzaville, Djoué river, right bank, 1200 meters below dam, March 1965, *Grinling 50,313*, type, *50,328* (herb. Grinling), paratypus.

Collection 50,328 from the same station was similar but two fruit-bodies were thinner and showed a yellow (Séguy 215–227) surface of the pileus and stipe. A third collection which was otherwise like the type collection (50,313) showed

a very dirty yellow vestiment which becomes dissociated showing between radial fibrils the orange colored flesh and thus giving a general color value near Séguy 174 tinged with Séguy 134. The orange latex is contained in the laticiferous hyphae. The pigment of fresh material in the cortical layer of the pileus appeared incrusting on the narrow hyphae but the dried material, mounted in KOH showed no incrusting pigment.

Hydropus xanthosarx seems to fade from orange to yellow whereby the cuticle proper develops a progressively more dirty yellow color. This is the first species known in this genus that has orange or yellow pigments. It belongs in section *Mycenoides* Sing.

The species of this section, characterized by an epicuticular structure as indicated above and by inamyloid spores can be determined by the following key.

KEY TO THE SPECIES OF HYDROPUS SECT. 'MYCENOIDES SING.

1. Cystidia thin-walled or very scattered or absent.
   2. European species with deep sepia pileus and long cheilocystidia [48–62 × 6–7(–9.5) μ, apex to 48 μ long and 3.4–4 μ broad, obtuse], evidently adventitious in greenhouse in The Netherlands . . . . . *Hydropus* spec. ined.
   2. American or African species with differentiated pleurocystidia or cystidioles (in the former case—broader than indicated above for the cheilocystidia), or without pleurocystidia.
      3. Spores 6 or more μ long, ellipsoid or short ellipsoid; pleurocystidia present.
         4. On dead *Lycopodium* or on the earth in subxerophytic vegetation; stipe white, tapering downwards; pileus grey, umbilicate. Northwestern Argentina. *H. xerophilus* Sing. ined.
         4. In moister forest, mostly on trunks or chips of scattered wood; not combining the characters indicated above.
            5. Pileus and stipe with orange or yellow tinges, or at least lamellae orange. Congo . . . . . *H. xanthosarx* Sing. & Grinl.
            5. Pileus, stipe and lamellae some other color, generally gray-black or deep gray or fuliginous in the cuticle of the pileus.
               6. Tropical species; cystidia numerous or, if scarce, cheilocystidia with thin appendage absent; never on needles of conifers; lamellae narrow to medium broad.
                  7. Lamellae intervenose and sordid gray when dried. On wood in Panamá. *H. panamensis* (Sing.) Sing.
                  7. Lamellae not intervenose, white when dried; cystidia with oily contents and very long (up to 125 μ). On wood in Belem, Pará. *H. paraensis* Sing. ined.
               6. Subtropical-montane and south-temperate species without pleurocystidia or, if pleurocystidia are present, with basidiomorphic or long-appendiculate cheilocystidia; on wood or on needles.
                  8. On wood of *Aristotelia* on Juan Fernandez; pileus 5–7 mm, gray black or deep gray; stipe concolorous; cheilocystidia long-appendiculate, at least some of them; habit mycenoid . . . . . *H. aristoteliae* Sing.
                  8. On other woods or conifer needles; pileus larger; habit omphalioid clitocyboid; cheilocystidia not long-appendiculate.
                     9. On wood in marginal forest; pileus finely blackish fibrillose on paler ground; lamellae white; stipe concolorous with pileus; spores 7.5–9.5 × 4.5–5.5 μ . . . . . *H. platensis* Sing. ined.

9. On needles of *Podocarpus* in the montane zone; pileus gray fading to white; lamellae and stipe white; spores 5.5–7 × 2.8–4.2 μ broad. *Marasmius podocarpi* Sing.[1]

3. Spores in their majority less than 6 μ long when mature. Pileus brown or ochraceous.
10. Clamp connections present; pleurocystidia present; among mosses (Polytrichaceae and others on rocky ground) in South Chile . . . . *H. pyxidatoides* Sing. ined.
10. Clamp connections absent; pleurocystidia absent or very inconspicuous; in tropical rain forest in Brazil . . . . . *Marasmius depauperatus* Sing. ined.

1. Cystidia thick-walled, metuloid.
11. Lateral stratum of hymenophoral trama very loosely arranged; spores 4–6.2 × 3–4 μ; cystidia pseudoamyloid (sect. *Irrorati* Sing.) . . . *H. irrorata* (Pat. apud Duss) Sing.
11. Not combining the above characters.
12. Lamellae white (but interlamellar spaces often concolorous with the pileus); spores up to 8.2 × 5 μ. Tropical species.
13. Epicutis consisting of a hymeniform layer of vesiculose cells interrupted by rather scattered dermatocystidia with more or less thickened wall and up to 330 μ long . . . . . *H. marasmioides* Sing. ined.
13. Epicutis with broad ascendant hyphae which do not form a continuous hymeniform layer; occasional dermatocystidia not thick-walled and relatively short . . . . . *H. mycenoides* (Dennis) Sing.
12. Lamellae partly or entirely gray; spores 6.5–10.2 × 5.5–9.5 μ. South-temperate species . . . . . *H. funebris* (Speg.) Sing.[2]

AGARICACEAE

Hiatulopsis Sing. & Grinl., *gen. nov.*

Genus novum familiae Agaricacearum; pileo squamoso pectinato epicute ex hyphis densis jacentibus subintertextis sed cutem efformantibus pigmento membranali praeditis consistente; lamellis remotis, lamellulis angustatis; cystidiis nullis; basidiis tetrasporis, sterigmatibus vix curvatis, sporis globosis vel subglobosis, symmetricis, inamyloideis, membrana firma complexa ornamentatione immersa praeditis sed extus levibus, poro germinativo destitutis; hyphis inamyloideis, fibulatis, haud gelatinisatis, in tramate hymenophorali subregulari hyphis haud divergentibus, plus minusve intertextis; ad quisquilias ligneas et truncos putridos in silva tropicali. — Species typica: *Lepiota amara* Beeli.

Hiatulopsis amara (Beeli) Sing. & Grinl., *comb.* nov.—Figs. 18–23

Lepiota amara Beeli *in* Flore iconogr. Champ. Congo Fasc. 2: 42 *pl. 8, fig. 9.* 1936.

Pileus with large brownish detersile scales on whitish ground, especially in the center, or when older with smaller verrucose scales and fine fibrils which are brown and numerous in the center, more scattered towards the margin, eventually distinctly yellowing, strongly radially pectinate in the manner of *Leucocoprinus* up to half or three quarters of the radius, conic to convex, eventually more flattened, with a distinct but obtuse umbo, 35–55 mm broad. — Lamellae whitish, later pale

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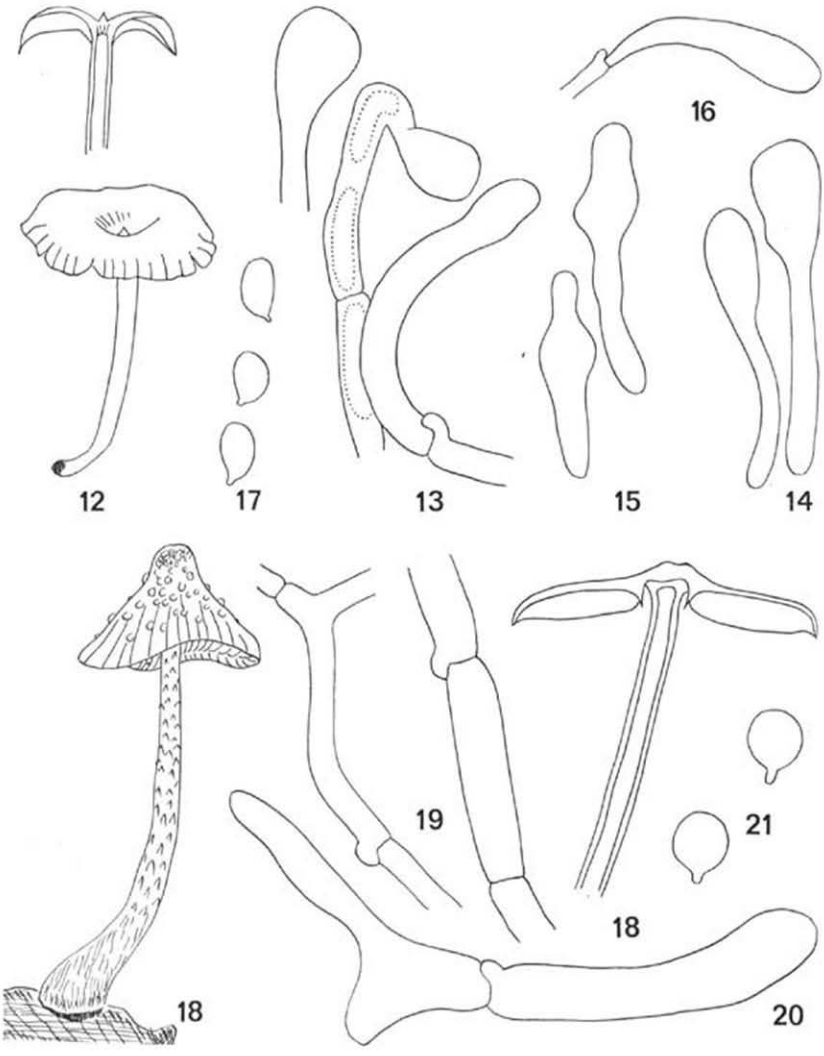
[1] The separation line between *Hydropus* sect. *Mycenoides* and *Marasmius* sect. *Alliati* is now subject to revision. *Marasmius podocarpi* as well as *M. depauperatus* (see below) are somewhat intermediate. For the time being we insert in *Hydropus* only species with either fleshy or latex bearing stipes and in *Marasmius* species with tough, reviving stipes.

[2] **Hydropus funebris** (Speg.) Sing., *comb. nov.* (basionym, *Agaricus funebris* Speg. *in* Boln Acad. nac. Ci. Córdoba **11**: 9. 1887).



Figs. 12–17. *Hydropus xanthosarx*. — 12. Carpophores (× 1). — 13. Pilocystidia (× 1000). — 14. Cheilocystidia (× 1000). — 15. Pleurocystidia (× 1000). — 16. Caulocystidium (× 1000). — 17. Spores (× 1100).

Figs. 18–21. *Hiatulopsis amara*. — 18. Carpophore (× 1). — 19. Elements of the scales of the pileus (× 1000). — 20. Element of the trama (× 1000). — 21. Spores (× 2000).

sordid cream color with a slight pinkish tinge, rather narrow (3–4 mm broad when mature), polydymous, subclose to close, with narrowed lamellulae, adnate to a collar at first adhering to the stipe then becoming remote, ascendant, later horizontal. Spore print white. — Stipe entirely covered by fine more or less fibrillose scales which are at first grayish or brownish gray, and in young carpophores often accompanied, towards the base by broader scales like those of the pileus, this covering becoming brownish, hollow to fistulose, tapering upwards (apex ± 3 mm across), 60–70 × 4–5 mm; veil restricted to the general scaly covering, no annulus ever formed nor even an annular zone; the frequently swollen base with abundant whitish basal mycelium. — Context thin, white and cottony in the umbo region, unchanging, fragile especially in the pileus; odor none or faint, pleasant; taste not noticeable.

Spores 4–5(–6.2) × 3.7–4.5(–4.8) μ, symmetric or occasionally subsymmetrical in continuation of a spiculum which is bent outwards with regard to the sterigma and becomes the hilar appendage, globose to subglobose, hyaline, the wall firm and consisting of a thin, often poorly developed endosporium, which is often metachromatically colorable (pink) in cresyl blue mounts, an episporium which is ornamented by faint (sometimes absent) very thin, rodlike or sheetlike ornamentations which perforate the exosporium (but in young spores exo- and episporium poorly differentiated from each other), leaving the circumference of the spore generally smooth, only exceptionally very slightly projecting and then lifting the perisporium (otherwise not demonstrable) which is extremely thin, neither of the strata either pseudoamyloid or amyloid. — Hymenium: Basidioles narrowly clavate to cylindric-subfilamentose; basidia 25–30 × 5–8 μ, tetrasporous, hyaline, with four almost or quite straight sterigmata which are apical and bend over outwards to form a spiculum which bears the spore. Cheilocystidia and pleurocystidia none. — Hyphae nowhere gelatinized, hyaline excepting the covering layers, with clamp connections, inamyloid; subhymenium subcellular, hyaline; hymenopodium rather easily demonstrable, of somewhat thinner subparallel hyphae which run towards the edge, the hymenophoral trama proper not showing any differentiation into mediostratum and lateral stratum, subregular but hyphae rather strongly interwoven, all hyaline and not gelatinized. — Cortical layers: Epicutis of pileus consisting of a rather dense cutis of elongated hyphae (only occasionally a short, small, generally apical element) which may be somewhat ascendant according to the position of the scales, hyphal elements with a brown membranal pigment and clamp connections; no epicutis differentiated in the ground tissue between the scales and fibrils; stipe covering with a similar structure.

On rotten wood and forest litter containing leaves and woody particles. In hollow containing remnants of primitive forest. Congo: Brazzaville, Djoumouna stream below Linzolo road, April 1966, *Grinling 60,420* (herb. Grinling and BACF), *60,409* (id.).

This species is extremely interesting, because, although obviously belonging in the Agaricaceae, it shows a number of very peculiar character combinations. As for its taxonomic position, it does not agree with any of the established genera in the group. While genera with inamyloid spores are known, these are not round and ornamented and, in the genera known, not correlated with the type of epicuticular structure described for *H. amara* above. While the particular ornamentation type (XI of the scale of Singer) exists in Agaricaceae, the respective genera showing it, are quite removed from *Hiatulopsis* by (a) a different epicuticular structure and (b) a better development of the annular veil. *Melanophyllum* which has a

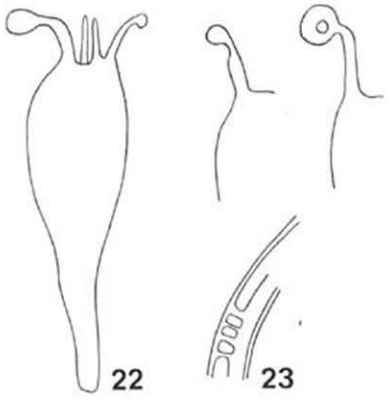


Fig. 22, 23. *Hiatulopsis amara.* — 22. Sporogenesis on the basidia (× 1500). — 23. Spore wall (× 10.000).

similar structure of the spore wall differs aside from that in colored spore print and less remote lamellae and the characteristic coprinoid pectination of the pileus is wanting. *Smithiomyces*, perhaps the most closely related genus among those known until now, does not show any degree of this pectination either, is devoid of pigmented scales and has a well developed partial veil. The roughness of the episporium, if present at all in *Smithiomyces*, is still fainter and the remnants of a general veil are thin-membranous, not squamulose. It is also remarkable that the habitat of our species is not on earth as usual in Agaricaceae but on rotten wood.

The same habitat and generally the same important characters are indicated for a species described by Beeli (*1936*: 42 *pl. 8 fig. 9*) under the name *Lepiota amara* Beeli. We identify our species with this latter in spite of the fact that *L. amara* is said to have an acrid odor and bitter taste and a squamulose not persistent annulus, inasmuch as Heinemann told one of us that the odor and taste indications by Madame Goossens-Fontana are frequently much exaggerated.

Another observation is of more general interest. It has been postulated in the past that the spores of Agaricales have asymmetrical spores which seemed to be an essential part of their capacity to be thrown off the sterigma which should be curved with the convex side at the outside. Although *Hiatulopsis*, when mature, throws a thick spore print, the discharge apparatus is different. Thus, we have here undoubtedly an autobasidium and not, in spite of the symmetry of the spores and the shape of the sterigmata, an apobasidium. The eccentric position of the spore is achieved by a spiculum which forms when the spore has reached a certain size and is directed outwards. Consequently, since the axis of the spore is not directed in the same direction as the axis of the sterigma, the spore is not typically orthotropic but the hilar appendage is consistently inserted at the proximal end of the spore

and the long axis of this latter so that, seen after discharge, the spores differ in nothing from a typical Gasteromycete spore. It is to be desired that detailed observations on other species of Agaricaceae, in the future, might show whether this new type of autobasidium is restricted to *Hiatulopsis*.

BOLETACEAE

GYRODON INTERMEDIUS (Pat.) Sing.—Figs. 24–28

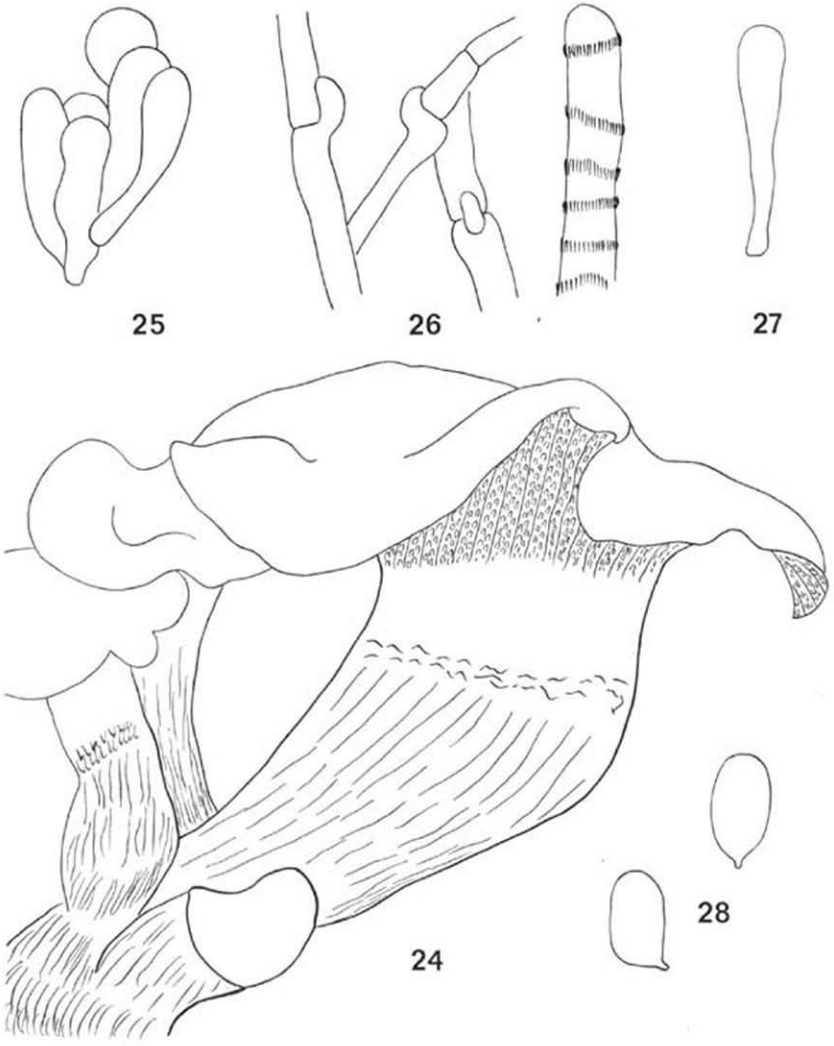
Phylloporus intermedius Pat. *in* Bull. Soc. mycol. Fr. **11**: 86. 1895. — *Gyrodon intermedius* (Pat.) Sing. *in* Revue Mycol. **3**: 172. 1938.

Pileus beautifully russet brown ("russet" Ridgway, or ground color Séguy 342 tinged with 174, whereby a color between Séguy 202 and 192 results), covered, generally, by a silvery lustre or by small appressed squamules in the center which are somewhat darker than the ground color, otherwise glabrous, with non-separable cuticle, with the margin somewhat involute and wavy, convex becoming applanate, 50–170 mm broad. Lower surface of pileus at times not covered by tubes, but merely by a narrow zone of reticulated hymenial surface at the margin. — Hymenophore at first strongly boletinoid with sublamellar, often forked radial walls and continuing on the apex of the stipe as a reticulum, decurrent; tubes relatively short (4–8 mm long), at first clearly arcuate; pores radially elongated, large, irregular and compound by irregular anastomoses, dirty yellow to bright yellow (Séguy 226, Ridgway "lemon chrome") like the tubes but sometimes becoming pink along a zone 5—15 mm wide around the stipe, bluing when bruised. Spore print rather dark olive brown to sordid olive gray. — Stipe reddish or paler than the rest of the stipe surface in a zone bordering the hymenophore at the apex, with blackish or blackening base, otherwise concolorous with the pileus and fibrillose or subfibrillose, solid to stuffed-hollow, cylindric but short or difform and sometimes compressed-flattened, 50–80 × 14–30 mm; sometimes conglobated at the base with neighboring carpophores; veil none. — Context pallid, then cream, bluing when bruised, then yellowing after a few minutes of exposure, soft in the pileus, very firm in the stipe; odor strong, disagreeable to weak, at the same time spirituous and raphanaceous; taste not remarkable.

Spores (6–)6.5–9(–9.3) × (3.5–)4–5.3(–5.5) μ, mostly around 6.8–8 × 4.2–5 μ, ovoid to ellipsoid or short cylindric, melleous to brownish, smooth. — Hymenium: Basidia 14–28 × 6.7–8 μ, 4-spored. Pleurocystidia rare and scattered, about 19 × 9 μ or like the cheilocystidia; cheilocystidia 9.2–33 × 2.4–9 μ, versiform, generally varying between cylindrical, small and lobed to medium sized ampullaceous or ampullaceous-subcapitate to ventricose or ventricose-subvesiculose, mixed in with basidioles and basidia (pores not heteromorphous), hyaline, sometimes with a secondary (clampless) septum or two, the nodose-lobed cells merely slightly differentiated hyphal ends protruding on the pore edges. — Hyphae inamyloid, with clamp connections (base of cystidia and basidia also clamped), some clamps of the medallion type; hymenophoral trama hyaline, bilateral of the *Boletus*-type, slightly gelatinized, hyphae of the lateral stratum 5.5–7.5 μ in diameter. — Cortical layers: Epicutis of pileus—a trichodermium which is ochraceous yellow and consists of interwoven hyphae, the terminal members often subclavate and hyaline and hyaline-incrusted cells forming bunches of semi-erect to plastered down cells.

Chemical characters: surfaces with NH_4OH dark greenish blue.

On the ground in secondary or partly cleared forest, once found in a big cespitose group, fruiting in October-November. Congo, Brazzaville, Mikatu, *Grinling 41,105, 51,004*. Also Liberia, Firestone no. 3, July 25, 1926, *Linder* (FH).



Figs. 24–28. *Gyrodon intermedius*. — 24. Carpophore of conglobate specimen (× 1). — 25. Cheilocystidia (× 1000). — 26. Elements of the epicutis (× 1000). — 27. Pleurocystidium (× 1000). — 28. Spores (× 2000).

This may be an example of cicatrizer mycorrhiza in tropical Africa; *Saepium cornetum* was present at every station where this fungus has been collected by Grinling but root anatomy has not been studied. There were no conifers or Fagales present at these stations.

As for the identity of this fungus we believe it to be conspecific or at least strictly affined with *G. intermedius* from Madagascar. The West African race differs from the type specimen studied by Singer in slightly smaller, especially slightly narrower spores (in *G. intermedius* they are 7.8–9.2 × 5–6.8 μ, mostly 8.5–9 × 5.3–5.7 μ). The bluing is not indicated by Patouillard who had not seen this species in living condition. The hymenophore is perhaps even more strongly boletinoid than in Liberia and the Congo, and the carpophores are not conglobated and somewhat smaller than described. All together, for the time being, these differences do not warrant the description of a new species for our material and we have to wait for more observations on the fresh material in Madagascar in order to decide on the validity and constancy of the aberrant characters in the Madagascarian form. If it were not for the large cystidia described by Heinemann for his *Gyrodon cupreus*, we would consider this latter species a synonym of ours. These large cystidia would be entirely aberrant and uncharacteristic for the genus *Gyrodon*.

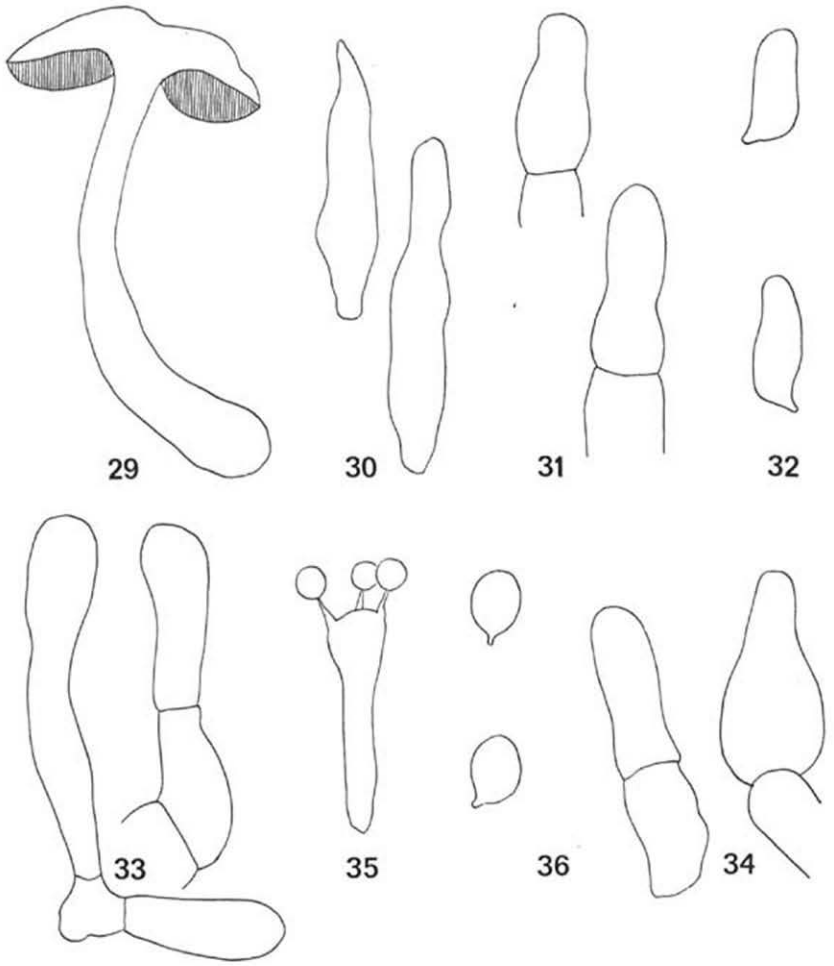
The pinkish zone observed in the fasciculate specimen of our Congo material is comparable with that seen in *G. rompellii*, an American tropical species which differs in the color of the pileus and has the spores over 5.5 μ broad and different to absent odor (cf. description by Singer, *1964b:* 118–120) where the material from Liberia is critically compared with *G. rompellii* as well as with some other African Gyrodons mentioned by Heinemann). The specimens showing the pink zone were also the ones that showed the silvery lustre on the pileus and a paler zone on the apex of the stipe; these are the specimens that were found to grow in a conglobated group *(Grinling 51,004)*.

The other specimens we refer to here did not show these characters even when young and fresh. Since they are identical in all other regards we have given a single description for all collections but we wish to point out that only further observation will show whether the form with pink zone and fasciculate growth habit has the silvery lustre and the paler apical zone on the stipe as constant correlated characters. If this were the case, we might be dealing with at least two closely related forms, perhaps species.

XEROCOMUS ALLIACEUS (Beeli) Heinemann—Figs. 29–32

Boletus alliaceus Beeli *in* Bull. Soc. r. Bot. Belg. **58**: 210. 1926. — *Xerocomus alliaceus* (Beeli) Heinemann *in* Bull. Jard. bot. Brux. **21**: 266. 1951.

Pileus rather light gray to deeper grayish brown (so when quite young), subvelutinous, not shining, convex, about 45 mm broad when mature. — Hymenophore tubulose; tubes about 5 mm long, when mature, at first adnate, slightly depressed-sinuate around the stipe when mature and the tube walls connecting sublamellarly and continuing as veins on the apex of the stipe, where there is a



Figs. 29–32. *Xerocomus alliaceus*. — 29. Carpophore (× 1). — 30. Pleurocystidia (× 1000). — 31. Erect cells of the epicutis (× 1000). — 32. Spores (× 2000).
Figs. 33–36. *Xerocomus microsporus*. — 33. Caulocystidia (× 1000). — 34. Erect cells of the epicutis (× 1000). — 35. Basidium (× 1000). — 36. Spores (× 2000).

shallow reticulation, sordid yellowish, at first a very light yellow, almost pallid-whitish; pores concolorous with tubes, about 0.5 mm wide, i.e. neither very narrow nor wide, unchanging when bruised or touched. — Spore print light brown in thin layer. — Stipe concolorous with the pileus or a little lighter, striate-sulcate below, reticulate at apex, dry, solid, tapering upwards, about 60 × 9 mm when mature. Basal mycelium white. — Context cream colored, unchanging, soft-fleshy, rather thick; odor strong, of garlic even in dried material upon moistening.

Spores 8.5–9.5 × 3–3.5 μ, cylindric-fusiform, or cylindrical, smooth, pale melleous. — Hymenium: Basidia 21–32 × 7.5–9 μ, clavate, tetrasporous. Cystidia rather numerous in tubes and on pores, 27.5–45 × 6–8.5 μ, hyaline, thin-walled, projecting beyond the basidia, fusoid to ampullaceous with obtuse tip. Base of basidia and cystidia without clamp. — Hyphae of the context and hymenophoral trama without clamp connections, hyaline, 4.5–15 μ broad. — Subhymenium well developed, of short, small elements; hymenophoral trama bilateral of the *Phylloporus* type; hyphae of the lateral stratum 5–10 μ broad. — Covering layers: Epicutis of the pileus well developed as a trichodermial palisade and brown (in KOH) on top of a trichodermial hypodermium; terminal members of epicuticular layer brownish-tawny, some with subhyaline granular incrustation, mostly broadly rounded at the tips, few acute, either short ventricose and 20–53 × 8–18(–19) μ (also sometimes constricted in the middle or above and then 30–53 × 9–10 μ), or cylindrical and 35–42 × 11–12 μ, more rarely fusoid-obtuse or subulate and then 19–36 × 9–15 μ.

Chemical characters: NH_4OH slightly rusty-tawny on the surface of the pileus, otherwise negative.

On forest litter in remnant of forest gallery, Congo, Brazzaville, right shore of Djoué river 1200 meters below dam, March 1965, *Grinling 50,316* (BAFC, herb. Grinling).

We are quite certain that our material corresponds to the species as described by Beeli and Heinemann (ll. cc.) but consider it useful to give a redescription of the Djoué river material since it differs slightly in some aspects, especially the smaller size of the carpophores, the presence of the reticulation at the apex of the stipe and the absence there of a purplish tinge. Since there are only few collections on hand, it does not seem justified to describe a new infraspecific taxon for our material before the full variability of the species is known. For the time being, the three characters indicated do not appear to be very weighty.

The tramal structure makes it necessary to consider this species as belonging in *Xerocomus*. Within this genus, due to the unchanging context and hymenophore, the absence of a deep blue ammonia reaction in young fresh pilei, and the concolorous apical reticulum of the stipe, we believe that the species belongs in section *Moravici*, as does the following species.

Xerocomus microsporus Sing. & Grinl., *sp. nov.*—Figs. 33–36

Pileo castaneo, convexo, 35 mm lato; hymenophoro tubuloso, pallide flavido; tubis brevibus; poris subangustis; tramate hymenophorali bilaterali typum phyllopori approximante; sporis minutis 5.5–6.5 × (3–)3.7–4 μ, ellipsoideis, pallide ochraceis, levibus; stipite pileo concolori, pustuloso, farcto, demum cavernoso; carne alba, immutabili; odore fructuum amoeno; hyphis defibulatis. — Ad terram in silva marginali tropicali. Congo, prope Brazzaville, *Grinling 51,204* (BAFC), typus.

Pileus chestnut brown, velvety-opaque, smooth, convex, then convex-applanate, and occasionally with uplifted margin, 35 mm broad. — Hymenophore tubulose, tubes short (2 mm long), sinuate-emarginate at the stipe, pale yellowish as are the small pores. Spore print not obtained. — Stipe concolorous with the pileus, velutinous-cracked so that it appears pustulose on the surface because of small bunches of raised fibrils, at first stuffed, eventually with cavities; cylindrical-difform, 40 × 8 mm; veil none; basal mycelium of dried material pale brownish, woolly, not abundant. — Context white, unchanging, soft-fleshy, spongy in pileus; odor fruitlike, pleasant.

Spores 5.5–6.5 × (3–)3.7–4 μ, ellipsoid, with one rounded oil droplet, smooth, with moderately thin wall, pale ocher. — Hymenium: Basidia (16–)27–32 × 5.7–7.5 μ, clavate, hyaline, tetrasporous. Pleurocystidia very few, like cheilocystidia; cheilocystidia numerous, extremely versiform, varying from cylindrical to club-shaped, with or without a narrow apical mucro, also sometimes constricted in the middle, hyaline, 18–24 × 3.8–7 μ. — Hyphae without clamp connections; hymenophoral trama all hyaline, with an axial mediostratum which is thin, slightly gelatinized but rather dense, with the hyphae filamentous, parallel with each other to slightly interwoven and 1.5–4.5 μ broad, with a lateral stratum of divergent hyphae but these not strongly curved excepting in the pore region, not strongly separated from each other and not more gelatinized than those of the mediostratum, 2.8–8 μ broad. — Covering layers: Epicutis of the pileus and stipe consisting of fascicles of brownish ascendant to erect elements which are elongated and form fragments of trichodermium or trichodermial palisade, the terminal members of the hyphae clavate to broadly cylindric or slightly narrowed in the upper part, with broadly rounded tip, 26–58 × (4.5–)9–15(–18) μ, wall 0.4–0.8 μ thick; pigment intracellular, dissolved, partly vacuolar, fulvous in KOH mount, soluble in NH_4OH, mounts from fresh material.

On earth in remnant of gallery forest. Congo, Brazzaville, 400 metres below dam on right shore of Djoué river, December 1965, *Grinling 51,204*.

This species has macroscopically the appearance of a *Gyroporus*. It may very well be the same as *Gyroporus castaneus* var. *microsporus* Heinemann (*1951*: 232) but our species is by no means conspecific with any known *Gyroporus* and the lack of clamp connections and the configuration of the hymenophoral trama place it in *Xerocomus*. It would be interesting to obtain a fresh spore print of this species in order to have a further indication as to whether we are dealing with a truly intermediate form or a case of external convergence.

Pulveroboletus paspali Sing. & Grinl., *sp. nov.*—Figs. 37–40

Pileo citrino vel vitellino, rubescente, humido, pulvinato dein applanato 20–50 mm lato, cute obtecto; hymenophoro tubuloso, tubis brevibus vel longiusculis, poris dein compositis, pallidissime griseolo-flavidis, dein flavidis, demum sordide olivaceo-brunneis, sporis in cumulo olivaceo-brunneis, s.m. 5.5–8.5 × 3–3.5 μ, versiformibus, cystidiis 20–30 × 4.5–4.8 μ, fusoideo-subventricosis; tramate hymenophorali adulto bilaterali typi phyllopori; stipite flavido, e velo subannulato et fibrillis brunneis ornato, 20–45 × 4–8 mm; carne flava, ex hyphis defibulatis efformata; odore saporeque haud notabilibus. — Ad *Paspala* frequenter obvius in Congo: Brazzaville, in urbe Djoué, *Grinling 41,104* (BAFC), typus.

Pileus lemon yellow to egg yellow, paler on the margin, young specimens reddening when bruised, humid to subviscid in wet weather but never clearly glutinous,

eventually reddish-brown to dark brown where a covering leaf has been attached, with slightly projecting margin so that it appears somewhat appendiculate, mat, convex-pulvinate, then gradually becoming more applanate, 20–50 mm broad. — Hymenophore tubular; tubes of variable length but generally shorter than the thickness of the context, adnate to free and often sinuate at the stipe, rarely subdecurrent, but usually free or at least deeply depressed when mature; yellow or yellowish, finally becoming dirty olive brown; pores at first small (less than 0.5 mm in diameter) and daedaleoid-gyrose, very pale grayish-yellow, then light yellow and eventually dirty olive and compound, a large superficial pore (to 1 mm diameter) with smaller component pores at a lower level, unchanging. — Spore print deep olive brown. — Stipe light yellow, fibrillose and finely excoriated at apex, in the lower portion covered by veil fibrils, solid, sometimes becoming somewhat hollowed, often curved or flexuous, or else broad-cylindrical especially when young, 20–45 × 4–8(–20) mm; veil present, forming traces of a lacerate annulus and a brown fibrillosity which covers the surface of the lower portion of the stipe of the adult specimens, fibrillose; basal mycelium often directly attached to the roots of *Paspalum*. — Context yellow, unchanging, soft-fleshy; odor none; taste not noticeable.

Spores 5.5–8.5 × 3–3.5 μ, cylindrical and attenuated below, or cylindrical-subovate or clavate, the smaller ones ellipsoid to short-cylindrical or sometimes clavate to reniform, smooth, golden brown to golden ochraceous, with firm wall without germ pore, young spores likewise dimorphic but hyaline. — Hymenium: Basidia 19–24.5 × 6–8.5 μ, clavate, hyaline, tetrasporous. Cystidia moderately numerous in tubes, numerous on pores, 20–30 × 4.5–4.8 μ, fusoid-subventricose, with obtuse apex, thin-walled, hyaline to yellowish. — Hyphae inclusive the septa between subhymenial cell and basidium and cystidium without clamps, hymenophoral trama in fully adult specimens of the *Phylloporus* type (bilateral) with a very thin mediostratum of axial slightly interwoven thin ($\pm$ 3 μ) hyphae, the lateral stratum moderately divergent but not strongly curved, the hyphae touching each other, hyaline in KOH, up to 7.5 μ thick. — Covering layers: Epicutis of pileus now (fully adult specimens) appearing as a cutis of elongate hyphal elements, hyaline to pale yellowish in KOH excepting the brown spots where a brown pigment is visible; the surface hyphae show a yellow granular incrustation in water mounts.

On turf, composed principally of *Paspalum*, Congo, Brazzaville, in residential area of Djoué, fruiting at the beginning of the rains in October, November, *Grinling 41,104*, type, *50,109* paratypus (herb. Grinling).

This species is remarkable by its veil remnants which would tend to put it in either *Suillus* or *Pulveroboletus*. Since no conifers have been found nearby and no yellow basal mycelium has been observed, *Suillus* seems to be excluded. The cystidia are likewise not of the type found in that genus. On the other hand, the *Phylloporus* type of hymenophoral trama is likewise encountered in adult specimens of *Pulveroboletus hemichrysus*. In *Pulveroboletus*, this species seems to be somewhat intermediate between the sections *Pulveroboletus* and *Sulphurei* (Sing.) Sing. Among the African species this species appears to be similar to **Pulveroboletus kivuensis** (Heinemann & Goossens) Sing., *comb. nov.* (basionym, *Gyrodon kivuensis* Heinemann & Goossens *in* Bull. Jard. bot. Brux. **25**: 37. 1955), which differs from our new species in larger carpophores, bluing context, less evident veil, consistently arcuate-decurrent tubes; it is thus clearly referable to section *Lignicolae*.

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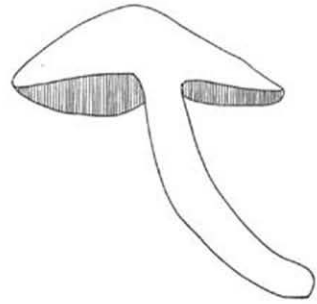

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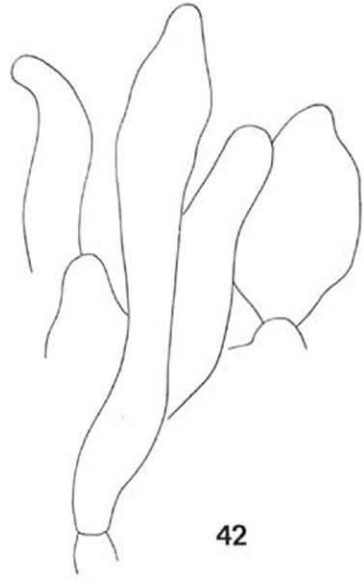

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Figs. 37–40. *Pulveroboletus paspali*. — 37. Carpophore (× 1). — 38. Cheilocystidia (× 1000). — 39. Basidium (× 1000). — 40. Spores (× 2000).

Figs. 41–44. *Boletellus obscurecoccineus*. — 41. Carpophore (× 1). — 42. Elements of the epicutis (× 1000). — 43. Cystidium (× 1000). — 44. Spore (× 1400).

STROBILOMYCETACEAE

BOLETELLUS OBSCURECOCCINEUS (Höhn.) Sing.—Figs. 41–44

Strobilomyces obscurecoccineus Höhn. *in* Sber. Akad. Wiss. Wien (Math.-nat. Kl., Abt. I) **123**: 88. 1914. — *Boletellus obscurecoccineus* (Höhn.) Sing. *in* Farlowia **2**: 127. 1945.
Boletus versicolor var., Patouillard *in* Mém. Acad. Malgache **6**: 20. 1927.

Pileus deep red (approximately Séguy 66) with somewhat cracked covering which occasionally lets appear the whitish context, convex, 25 mm broad. — Hymenophore tubulose, yellow, 6 mm long, the tube walls close to the stipe sublamellarly attached and somewhat decurrent on the apex of the latter, sinuate; pores to 1 mm broad, concolorous, irregularly shaped, unchanging. Spore print not obtained. — Stipe concolorous with the pileus but with whitish apex, with white base, with innate carmin red longitudinal stripes, with the whitish context showing between the fibers where these are separating, cylindric and somewhat flexuous, 45 × 3 mm; veil none; basal mycelium white and cottony. — Context in thickness about equal to the tube length in the pileus, white, unchanging, taste acidulous, at length peppery.

Spores 17–19(–21.5) × (4.5–)5.7–7 μ, fusiform, rarely with constriction, appearing subsmooth but distinctly longitudinally striate (striae elevated to 0.3 μ in mature spores), with the wall melleous and 0.5–0.7 μ thick, with suprahilar depression, without a germ pore, the striae concurrent but touching each other at the poles. — Hymenium: Basida 31–37 × 10.5–12 μ, mostly tetrasporous, fewer bisporous, hyaline. Cystidia in tubes and on pores moderately numerous but very distinct, 38–50 × 13–15 μ, tapering upwards or slightly ampullaceous, with thin hyaline walls, often hyaline or melleous incrusted. — Hyphae without clamp connections, all inamyloid, mediostratum of the hymenophoral trama pale melleous, more hyaline in lateral stratum, clearly bilaterally arranged. Covering layers: Epicutis of the pileus subhymeniform, terminal members erect, attenuated-obtuse to broadly rounded at the tips, 26–57 × 10–15 μ.

Chemical characters: NH_4OH negative.

On the earth at the base of a shrub, in narrow marginal forest. Congo: Brazzaville, right bank of the Djoué river, 1200 meters below dam, April 1965, *Grinling 50,402* (BAFC).

This species reminds one of the European "*Xerocomus versicolor*" (or what some European mycologists determine as such) which is a form of *Xerocomus chrysenteron* and forms mycorrhiza with *Eucalyptus* and *Salix* in South America and with other forest trees in Europe and North America.

Our African material has been compared with the type; fragments of Heinemann's material from the Congo as well as Patouillard's from Madagascar were compared by J. Perreau-Bertrand (*1961*: 421–422) with that of the type communicated by Singer (ex FH), so that there cannot be much doubt about the identity of all four collections now known. Nevertheless a redescription of this species seemed in order.

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SOME TROPICAL SPECIES OF GANODERMA (POLYPORACEAE) WITH PALE CONTEXT

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(With Plates 10–14)

Five species of *Ganoderma* Karsten are discussed, which are confined to the tropics and characterized by the presence of a light-colored context, but which are devoid of the laccate upper surface of the pileus typical of the species of the *Ganoderma lucidum*-group. *Ganoderma neurosporum* J. Furtado is proposed as a new species. Three of the five species—*Ganoderma amazonense* Weir, *G. coffeatum* (Berk.) J. Furtado, *comb. nov.*, and *G. neurosporum* J. Furtado—are from the neotropics. *Ganoderma lloydii* Pat. & Har. is known only from Africa, and *G. asperulatum* (Murrill) Bres. has been reported only from the Philippines and Borneo. Regardless of their geographical distribution, the five species under discussion are distinguished particularly by their basidiospore characteristics. In their morphological features they show several characteristics also found in some trocial species of *Amauroderma* Murrill.

Introduction

The genus *Ganoderma* Karsten, included in the subfamily Ganodermoideae, encompasses wood-rotting polypores commonly recognized by their reddish, yellowish or brownish woody basidiocarp showing a laccate appearance. The basidiospores are generally ovate, usually yellowish to pale brownish, and provided with a special duplex wall structure (Furtado, *1962*, *1965*; Heim, *1962*) which recalls, in its general aspect, the U-thickening of the cells in the annulus of fern (Filicineae) sporangia. The laccate appearance has been given variable importance in the taxonomy of the ganodermoid polypores and the reader may be unaware that this single feature has been used to segregate the genus *Elfvingia* Karsten from *Ganoderma*. The evidences derived from a recent analysis of the microstructures of the basidiocarps and their value in the taxonomic treatment of the ganodermoid polypores indicate, however, that the laccate appearance plays no role in the segregation of genera in the subfamily Ganodermoideae (Furtado, *1965*). Nevertheless, the analysis of a large sample of specimens revealed that, at the extremes of a range showing a complete series of intermediates regarding the laccate appearance, there is a group of species which always show a laccate appearance and another group that never exhibits any evidence of a laccate aspect. In both groups there are species with dark (brown, ferruginous, blackish, dark-grayish, etc.) context and others with pale (pale-brown, white, cream, pale yellowish, etc.) context.

This paper deals with five species of *Ganoderma* which never exhibit any evidence of a laccate appearance and have pale context. One species is proposed as new and two are being cited for the second time from new collections. They are known to occur only in tropical areas of the world, but there is no record that any one extends beyond its continent: three species are from the neotropics, one from Africa and another from the Phillipine Islands. Despite their distinct geographical distribution, these five species compose an interesting group, homogeneous in view of their general characteristics.

Materials and methods

The type specimen, or part of the type specimen, of each taxon referred to in this paper was examined. The specimens studied are cited in the herbaria indicated by the abbreviations proposed by Lanjouw & Stafleu (*1964*), as follows: Farlow Herbarium, Cambridge, Mass., U.S.A. (FH); Instituto de Botânica, São Paulo, S.P., Brazil (SP); Herbarium of the Royal Botanic Gardens, Kew, England (K); The National Fungus Collections, Plant Industry Station, Beltsville, Maryland, U.S.A. (BPI); and The New York Botanical Garden, New York, N.Y., U.S.A. (NY).

The techniques of sampling and mounting were based on those described by Teixeira (*1962*), summarized as follows: samples were taken from specific parts of the basidiocarp, teased apart and mounted in one drop of 1 per cent phloxin mixed with another drop of 3–4 percent KOH, covered with a cover slip and examined. Additional techniques involved semipermanent mounts with lactophenol cotton blue, permanent mounts with the water-soluble plastic ABOPON (Hrushovetz & Harder, *1962*), and staining with 0.5 percent aqueous solution of toluidine blue. Phase contrast and dark field illuminations for microscopic observation gave the best results for the hyaline structures, especially the collapsing generative hyphae.

Special attention was given to the pattern of septation of generative hyphae. As most of these hyphae were collapsed, the septa were studied in the generative hyphae that had undergone modification. Although the concept of modified and differentiated hyphae has been emphasized and repeated elsewhere (Furtado, *1965*), it is opportune to insist upon the necessary distinction between these two types of hyphae, especially because of their implication in the analysis of the hyphal system as a taxonomic aid in classification. The process of hyphal modification involves any change of diameter, pigmentation, thickness of the walls, etc., without loss of the capacity for further cell division. Modification of the generative hyphae may affect terminal, intercalary or both kinds of cells. Hyphal differentiation is a phenomenon characterized by formation of functionally and morphologically distinct structures which have limited growth. This means that a differentiated structure usually does not show cell division: the cross-walls that may appear in differentiated hyphae are usually false septa.

The identification of the skeletal hyphae in the specimens examined was never difficult, despite their poor contrast, because of the hyaline or subhyaline nature of their walls. A distinction between the binding elements and the broken tapering

ends of the branched parts of the arboriform skeletal hyphae could be made by following the branching pattern of the two kinds of differentiated hyphae. The arboriform skeletal hyphae always show distinct direction of growth and, independently of the number of branches, they always show a main axis. The binding hyphae are usually multidirectional or, at least, bidirectional. The more serious problem in the study of the binding hyphae is the decidedly fragile nature of the binding elements.

The color of several parts of the basidiocarp was compared with the color charts of Maerz & Paul (*1950*). The colors are indicated by the initials MP followed by the corresponding plates, row and matched number.

The nomenclature of the structure of the pilear cover and other terminology related to the microstructures of the basidiocarp have been discussed elsewhere (Furtado, *1965*).

Treatment of the species

The general features of the species under discussion are as follows:—

Basidiocarp stipitate, sessile or subsessile, woody to corky; pilear cover without a laccate appearance, zonate or azonate, wrinkled or smooth; context light-colored, almost pure white to pale yellowish, darkening with 3–4 percent KOH; basidiospore of the *Ganoderma*-type; tropical.

KEY TO THE SPECIES DISCUSSED

1. Mature basidiospores up to 12 μ long 2
1. Mature basidiospores more than 14 μ long 3
   2. Basidiospores plicate, rarely reticulate, 8–12 × 6–9 μ . . . . . *G. coffeatum*
   2. Basidiospores punctate, 7–9 × 6–7 μ . . . . . *G. amazonense*
      3. Basidiospores reticulate, 14–18 × 10–13 μ . . . . . *G. lloydii*
      3. Basidiospores plicate or asperulate 4
         4. Context soft, almost cottony; basidiospores yellowish, asperulate or short-plicate, 17–24 × 10–14 μ . . . . . *G. asperulatum*
         4. Context fibrous and formed of agglutinated hyphae; basidiospores hyaline to faintly yellowish, longitudinally plicate, 18–20 × 11–15 μ. . . *G. neurosporum*

GANODERMA AMAZONENSE Weir—Pl. 10.

Ganoderma amazonense Weir *in* Bull. U.S. Dep. Agric. **1380**: 93 *pl. 6.* 1926. — Type: Weir (BPI, Path. Coll. 62043). — Type locality: Cocal Grande, Pará State, Brazil; growing on several species of trees, especially on *Hevea brasiliensis*, either alive or as decayed stumps (Weir, *1926*).

MACROSCOPIC CHARACTERISTICS.—*Pileus* (Figs. 1, 2) sessile, imbricate or not, often developing pileoli on the surface or in the growing margin, also stipitate, solitary, pleuropodal or mesopodal; woody to soft woody, occasionally corky; applanate when sessile, centrally depressed in some specimens, regular or not in outline when stipitate; margin sterile below. *Pilear cover* opaque, pale-brown (MP 14 E 8), dark-brown (MP 8 H 10), or reddish-brown (MP 8 H 3), yellowish-white toward the margin, zonate or azonate, rugose or smooth, radially wrinkled or not. *Context*

light-colored, yellowish-cream (MP 11 D 5), darkening with KOH, variously thickened, about 5 mm thick towards the stipe, 1 mm thick near the growing margin. *Tubes* darker (MP 12 D 6) than the context or concolorous, variously developed, 4–10 mm long. *Pores* whitish-yellow (MP 10 B 2) to concolorous with the context, rounded to pentagonal, 4–6 per mm, edges entire. *Stipe* mesopodal or pleuropodal, concolorous with the pilear cover or darker.

MICROSCOPIC CHARACTERISTICS.—*Pilear cover* a typical crust 100–200 μ thick, derived from an indeterminate derm. *Hyphal system* trimitic: generative hyphae bearing clamp-connections (Fig. 3), thin-walled, collapsed, 2–4 μ diam.; skeletal hyphae (Figs. 4, 5) both aciculiform and arboriform, hyaline to subhyaline, thick-walled to subsolid, 3–7 μ diam.; binding hyphae (Fig. 4a) thick-walled to subsolid, 2–3 μ diam. *Hymenium* collapsed; basidiospore (Fig. 6) short-ovoid, hyaline to faintly yellowish, truncate or rounded at the apex, 7–9 × 6–7 μ, with a punctate appearance in the tangential optical section; in the specimens examined the basidia appeared as a honeycomb-like structure.

DISTRIBUTION AND MATERIAL EXAMINED.—

Brazil: Mato Grosso State, Rio Ouro Prêto, *Weir 30534* (BPI); Pará State, *Weir 20538* (BPI); Amazonas State, Tacoatiari, *Weir 30534* (BPI), Colônia Pedro Borges, *Weir 30537* (BPI).

British Honduras: Peck, 1906 (NY).

Grenada Island: Broadway, IX–1905 (NY).

Puerto Rico: Rio Piedras, *Johnston 437* and *589* (NY). *Nelson*, 29-VI-1919 (NY); Sierra Naguabo, vicinity of La Florida, *Shafer 3390* (NY).

Jamaica: Port Antonio, *coll. unknown 589* (NY).

Ganoderma amazonense is well represented by Weir's collections from Brazil in BPI, but the species has not been reported since it was described (Weir, *1926*). Because of its stipitate form, *G. amazonense* could be mistaken for *G. coffeatum*. The distinction between these two neotropical species is provided by the features of the basidiospores: in *G. amazonense* the basidiospores are hyaline to faintly yellowish, with a punctate appearance, and 7–9 × 6–7 μ (Fig. 6), whereas in *G. coffeatum* the basidiospores are yellowish, with a plicate or irregularly reticulate appearance, and 8–12 × 6–9 μ (Figs. 17–18).

The basidiospores of *Ganoderma amazonense* were described by Weir (*1926*) as brown, but it is likely that the color of these structures was misinterpreted because of the bubbles filling them and blocking light transmission.

GANODERMA ASPERULATUM (Murrill) Bres.—Pl. 11.

Amauroderma asperulatum Murrill *in* Bull. Torrey bot. Club **35**: 407. 1908. — *Ganoderma asperulatum* (Murrill) Bres. *in* Annls mycol. **9**: 549. 1911. — *Ganoderma asperulatum* (Murrill) Sacc. & Trott. *in* Sacc., Syll. Fung. **21**: 307. 1912. — *Polyporus asperulatus* (Murrill) Lloyd, Mycol. Writ. **6**: 1063. 1921. — Type: Copeland, 1904 (NY and BPI, merotypes). — Type locality: Lamao, Bataan Province, Luzon Island, Philippines.

MACROSCOPIC CHARACTERISTICS.—*Pileus* (Figs. 7–8) stipitate, solitary, woody to corky, convex-concave, regular or not in outline; margin acute to subacute, deflexed, regular to undulate, fertile or sterile below. *Pilear cover* opaque, dark-brown (MP 15 A 6) to blackish-brown (MP 8 A 9), zonate or azonate, rugulose or smooth. *Context* light-colored, whitish-cream (MP 9 E 3) or paler (MP 9 C 2), darkening with KOH, variously thickened, usually thinner than the length of the tubes.

Tubes usually darker than the context (MP 14 B 7), up to 15 mm long. *Pores* whitish to grayish, round to pentagonal, 3–6 per mm, edges entire. *Stipe* pleuropodal, single, concolorous or darker than the pilear cover, cylindric, solid or tubular.

MICROSCOPIC CHARACTERISTICS.—*Pilear cover* a typical crust 70–100 μ thick, derived from an indeterminate derm. *Hyphal system* trimitic: generative hyphae bearing clamp-connections, hyaline, thin-walled, collapsed, 2–4 μ diam., also modified, thickened to subsolid, hyaline to subhyaline, 2–5 μ diam.; skeletal hyphae (Fig. 9) usually aciculiform but also sparingly branched-arboriform, thickened to subsolid, hyaline to subhyaline, thick-walled, 3–5(–7) μ diam.; binding hyphae very delicate, easily broken, hyaline to subhyaline, thick-walled to subsolid, 1–3 μ diam. *Hymenium* collapsed; basidiospore (Figs. 10–11) large, ovoid, truncate or rounded at the apex, distinctly yellowish, thick-walled, 17–24 × 10–14 μ, with an asperulate to shortly plicate appearance in the tangential optical section.

DISTRIBUTION AND MATERIAL EXAMINED.—

Philippines: Luzon Island, Mount Maquiling, *Reinking* (BPI, Lloyd Coll. 26868 and ex-Reinking 9931), *Ferrer* (BPI, Lloyd Coll. 26876, 55744, and ex-Phill. Isl. College Agric. 9767).

Borneo: (not seen; Bresadola, *1911*).

In its gross morphology, *Ganoderma asperulatum* resembles a common species of *Amauroderma* found in the Philippine Islands which is usually identified as "*Amauroderma rugosum* (Blume & Nees) Pat."

Ganoderma coffeatum (Berk.) J. Furtado, *comb. nov.*—Pl. 12.

Polyporus coffeatus Berk. *in* Ann. Mag. nat. Hist. **3**: 385. 1839 (basionym). — *Fomes coffeatus* (Berk.) Sacc., Syll. Fung. **6**: 163. 1888. — *Amauroderma coffeatum* (Berk.) Murrill *in* Bull. Torrey bot. Club **32**: 367. 1905. — Type: Guilding (K). — Type locality: Saint Vincent, West Indies.

Polyporus opacus Berk. & Mont. *in* Annls Sci. nat. (Bot.), sér. 3, **11**: 236. 1849. — *Fomes opacus* (Berk. & Mont.) Cke. *in* Grevillea **13**: 118. 1885. — *Ganoderma opacum* (Berk. & Mont.) Pat. *in* Bull. Soc. mycol. Fr. **5**: 67. 1889.

Polyporus angustus Berk. *in* Hook. J. Bot. **8**: 143. 1856. — *Fomes angustus* (Berk.) Cke. *in* Grevillea **13**: 117. 1885. — *Amauroderma angustum* (Berk.) Torrend *in* Broteria (Bot.) **18**: 137. 1920.

Polyporus hemibaphus Berk. *in* Hook. J. Bot. **8**: 193. 1856.

Amauroderma flaviporum Murrill *in* North Amer. Flora **9**: 116. 1908. — *Ganoderma flaviporum* (Murrill) Sacc. & Trott. *in* Sacc., Syll. Fung. **21**: 304. 1912.

Polyporus infulgens Lloyd, Mycol. Writ. **5**: 656. 1917. — *Amauroderma infulgens* (Lloyd) Torrend *in* Broteria (Bot.) **18**: 134. 1920. — *Ganoderma infulgens* (Lloyd) Sacc. & Trott. *in* Sacc., Syll. Fung. **23**: 407. 1925.

MACROSCOPIC CHARACTERISTICS.—*Pileus* (Figs. 12, 13) stipitate, single, woody, also coriaceous-woody, applanate to central-depressed, irregular or orbicular in outline; margin acute to obtuse, sometimes deflexed, regular to undulate, fertile or sterile below. *Pilear cover* opaque, brown (MP 14 K 9), yellowish-brown (MP 12 D 5), reddish-brown (MP 8 H 14) or grayish to blackish-brown (MP 8 C 8); regularly concentrically zonate or not, zones usually darker than the rest of the pilear cover, reddish-brown; rugose or smooth, variously radially plicate or concentrically wrinkled. *Context* light-colored, cream (MP 9 G 4), darkening with KOH, variously thickened. *Tubes* concolorous or darker than the context (MP 13 E 8), up to 10 mm long. *Pores* yellowish to whitish, rounded or pentagonal, 4–8 per mm,

edges entire. *Stipe* mesopodal or pleuropodal, single, dark-brown, cylindric or flattened, variously thickened, tubular or solid.

MICROSCOPIC CHARACTERISTICS.—*Pilear cover* a typical crust 200–300 μ thick, derived from an indeterminate derm. *Hyphal system* trimitic: generative hyphae bearing clamp-connections (Fig. 16), thin-walled, hyaline, often collapsed 2–3 μ diam., or modified, thick-walled to subsolid, up to 5 μ diam.; skeletal hyphae (Fig. 14) aciculiform and sparingly branched-arboriform, hyaline to subhyaline, thick-walled to subsolid (2–)4–6(–8) μ diam.; binding hyphae (Fig. 15) very fragile, hyaline, slender, thick-walled to subsolid, branched, 1.5–2.5 μ diam. *Hymenium* collapsed; basidiospore (Figs. 17–18) short-ovate, thick-walled, yellowish, 8–12 × 6–9 μ with a plicate to irregularly reticulate appearance in the tangential section.

DISTRIBUTION AND MATERIAL EXAMINED.—

Brazil: Rio Grande do Sul State, *Rick* (BPI, ex-Weir Herb. 30567, 30568, and 30569); São Paulo State (SP 7396); "Horto Florestal do Inst. Agro. Campinas", Ubatuba, *J. S. Furtado*, 21-IV-1966 (SP 95408); Guanabara State, Rio de Janeiro (not seen; Lloyd, *1920*); Bahia State, *Blanchet* (K and BPI, as type specimen of *Polyporus opacus*), *Torrend*, 1923 (BPI, Lloyd Coll. 23406, as type specimen of *Polyporus infulgens*); Amazonas State, Panuré, *Spruce 211* (K and BPI, as type specimen of *Polyporus angustus*).

Peru: Dept. Loreto, *Killip & Smith 28731* (BPI); Navarro-Chipurana, *Stakman 21b* (BPI).

Colombia: Puerto Lopes, *Little 10028* (BPI).

Trinidad: *Rorer*, 1912 (NY).

Panamá: Canal Zone, Barro Colorado, *Woodworth*, 25-VII-1925 (BPI).

Costa Rica: San Antonio de Nicoya, *Valerio 97* (BPI); *Carpenter*, 16-XI-1950 (BPI).

Haiti: near Jean Raper, *Leonard & Leonard 12783* (BPI).

Jamaica: Hope Mine, *Earle 105* (NY, as type specimen of *Amauroderma flaviporum*).

Puerto Rico: *Seaver & Chardon 944* (NY); Santa Isabel, *Johnston*, 10-I-1912 (NY).

Cuba: Pinar del Rio, Guane and vinicity, *Shafer*, 30-XII-1911, and *11271* (NY); Soledad, Harvard Botanical Garden, *Weir*, 16-XI-1924 (BPI); Guantanamo, *Dumas*, XII-1918 (BPI); Santiago de Cuba, Alto Cedro, *Earle & Murrill*, 19-20-III-1905 (NY); *Weir*, 5-XII-1924 (BPI).

The holotype of *Ganoderma coffeatum* is represented by a single collection from the West Indies which is almost completely destroyed. Nevertheless, the distinguishing features of this species—the peculiar basidiospore wall appearance, the light color of the context, and the structure of the pilear cover—are still detectable in the remaining fragments. The adult structure of the pilear surface is a typical crust derived from an indeterminate derm. In young specimens the surface is formed by a loose, short trichoderm which undergoes incrustation and interweaving as the specimen ages. At certain stages of development of the basidiocarp, the typical crust is usually completely formed, but the hyphal tips of the juvenile trichoderm are still free. This condition gives a velutinous aspect to the surface when it is examined with a hand lens. The basidiospore (Figs. 17–18) is the principal distinguishing characteristic of *G. coffeatum*. The small difference between the largest and the smallest diameters of the spore may cause some difficulty for the detection

of the correct shape of the basidiospores. The short-plicate or irregularly reticulate appearance of the wall in the tangential optical section observed in the basidiospores of *G. coffeatum* is seen also in the basidiospores of *G. asperulatum*. The latter species, however, has much larger basidiospores, which are 17–24 × 10–14 μ, and has not been found yet in the area of the neotropical flora. The woody form of *G. coffeatum* could be mistaken for the stipitate, woody specimens of *G. amazonense*. The distinction between these two neotropical species is discussed under the latter species.

The difficulty in observing the correct shape of the basidiospores of *Ganoderma coffeatum* led various authors to place this species (under its various disguises) sometimes in *Amauroderma*, at other times in *Ganoderma*.

GANODERMA LLOYDII Pat. & Har.—Pl. 13.

Ganoderma lloydii Pat. & Har. *in* Bull. Soc. mycol. Fr. **28**: 281 *pl. 14, fig. 3*. 1912. — Type: coll. unknown (FH, merotype; also in the Museum of Natural History, Paris, according to Heim, *1962*). — Type locality: West Africa.

MACROSCOPIC CHARACTERISTICS.—*Pileus* (Figs. 19–20) stipitate, single, woody, convex, regular or irregular; margin subacute, deflexed, regular or undulate, sterile below. *Pilear cover* opaque, brown (MP 15 A 7) to grayish-brown, zonate, rugose, radially wrinkled. *Context* light-colored, yellowish-cream (MP 11 E 5), darkening with KOH, 1–4 mm thick. *Tubes* concolorous with the context, 3–6 mm long. *Pores* yellowish to grayish-yellow, rounded to pentagonal, 4–6 per mm, edges entire. *Stipe* mesopodal, single or multiple, concolorous with the pilear cover, solid.

MICROSCOPIC CHARACTERISTICS.—*Pilear cover* a typical crust 160–200 μ thick, derived from an indeterminate derm. *Hyphal system* trimitic: generative hyphae bearing clamp-connections (Fig. 22), hyaline, thin-walled, collapsed, 2–3 μ diam. or modified, thickened to subsolid, hyaline to subhyaline, 2–5 μ diam.; skeletal hyphae (Fig. 21) aciculiform and arboriform, hyaline to subhyaline, thickened to subsolid, 3–6(–8) μ diam.; binding hyphae delicate, slender, thickened to subsolid, hyaline to subhyaline, easily broken, 1.5–2.5 μ diam. *Hymenium* collapsed; basidiospore (Figs. 23–24) large, ovate, truncate but also rounded at the apex, hyaline to faintly yellowish, 14–18 × 10–13 μ, with a peculiar reticulate appearance in the tangential optical section.

DISTRIBUTION AND MATERIAL EXAMINED.—
Congo, *Trotter* (BPI, Lloyd Coll. 23433, det. as *Polyporus fasciculatus*).

The basidiospores are the most distinctive characteristic of *Ganoderma lloydii*. They appear reticulate in tangential optical section (Figs. 23–24). In certain specimens of *G. coffeatum* (a species restricted to the American tropics), the basidiospores may have an irregular reticulate appearance. These basidiospores, however, are 8–12 × 6–9 μ, whereas those of *G. lloydii* are 14–18 × 10–13 μ.

Ganoderma lloydii was theoretically 'discovered' by Lloyd *(1912)* who mentioned an unnamed specimen of *Ganoderma* that he found in Paris. The species was described in Lloyd's honor but, despite the conspicuous and large *Ganoderma*-type basidiospores, Patouillard & Hariot *(1912)* placed this species in Patouillard's (1889) section *Amauroderma*. *Ganoderma lloydii* appears not to have been reported since its original description, except in studies dealing with its type specimen (Heim, *1962*). I identified a specimen collected by Trotter in the Congo (identified by Lloyd as *Polyporus*

fasciculatus, which is a species of *Amauroderma*) as *G. lloydii*. This is, perhaps, the second collection ever known of this species. It is represented by an excellent specimen.

Ganoderma neurosporum J. Furtado, *sp. nov.*—Pl. 14.

Pileus stipite instructus, lignosus, applanatus, leviter umbonatus; pilei superficies opaca, concentrice zonata, rugosa, radialiter rugulosa, distincte crustosa, fusco-brunnea; superficies hymenialis porosa: pori rotundi, parvi, circiter 200 μ diam., 4–5 per mm; tubi 1,5 cm longi; basidia non visa; sporae magnae, hyalinae, pallide flavescentes, ovoideae, longitudinaliter costatae, 18–20 × 11–15 μ.

TYPE: *Myer*, 18-VII-1945 (BPI and SP, merotypes). — Type locality: Buenos Aires, Panama.

PARATYPES:

Brazil, Mato Grosso State, Santa Ana da Chapada, Buriti, *Malme*, 15-VI-1894 (BPI).

Venezuela, Amazonas Territory, Tributary of Rio Conucunuma, Playa Alta, *B. Maguire, R. S. Cowan, & J. J. Wurdack 29390* (NY and SP).

Costa Rica, Limon Province, tributary of Rio Siquirres, *Dodge & al. 5668* (BPI).

MACROSCOPIC CHARACTERISTICS.—*Pileus* (Figs. 25–26) stipitate, subsessile or sessile; applanate; with an irregular umbo between two concrescent parts (holotype) or symmetrical; convex; margin obtuse, regular to undulate, sterile below. *Pilear cover* opaque, brown (MP 15 E 9) with reddish-brown concentric zones, rugose, radially wrinkled. *Context* light-colored, creamish (MP 9 C 2) or brownish-cream in older specimens, darkening with KOH, typically fibrous, 2–5 mm thick. *Tubes* darker than the context, tending to a grayish-brown (MP 14 E 7), 1–1.5 cm long. *Pores* creamish or grayish, small, about 200 μ diam., rounded, 4–5 per mm. *Stipe* pleuropodal, when present, irregularly compressed, short, thick and solid (in the holotype).

MICROSCOPIC CHARACTERISTICS.—*Pilear cover* a typical crust 400–500 μ thick, derived from an indeterminate derm. *Hyphal system* trimitic: generative hyphae bearing clamp-connections (Fig. 28–29), thin-walled, hyaline, collapsed, or modified, hyaline to subhyaline, thickened to subsolid, 3–5 μ diam.; skeletal hyphae (Fig. 27) mostly aciculiform but also sparingly branched-arboriform, thick-walled to subsolid, hyaline to subhyaline, 3–7 μ diam.; binding hyphae (Fig. 30) very slender, delicate, much branched, twisting prominently, thick-walled to subsolid, 1–2.5 μ diam. *Hymenium* collapsed; basidiospore (Figs. 31–32) ovate, hyaline to faintly yellowish, 18–20 × 11–15 μ, with a distinctive longitudinally plicate appearance in the tangential optical section.

In its morphological features, *Ganoderma neurosporum* may resemble old specimens of *G. coffeatum*, but the latter has smaller basidiospores.

One of the paratype specimens is a fragment of the basidiocarp collected in Brazil by Malme in 1894 whose hymenomycete collections were studied by Romell (*1901*). The cited specimen was unknown to Romell and probably also to Bresadola who, according to Romell (*1901*), received specimens for identification. The annotation slip attached to the basidiocarp fragment at BPI indicates that Romell, suspecting a new species, used an unpublished name.

RESUMO

Cinco espécies de *Ganoderma* Karsten restritas às regiões tropicais do globo e caracterizadas pela presença de contexto de coloração clara e ausência do aspecto lacado da cobertura pilear, que é típica para as espécies do grupo *Ganoderma lucidum*, foram discutidas. Uma delas, *Ganoderma neurosporum* J. Furtado, é proposta como nova.

Tres das cinco espécies—*Ganoderma amazonense* Weir, *Ganoderma coffeatum* (Berk.) J. Furtado, comb. nov., e *Ganoderma neurosporum* J. Furtado—são encontradas nos trópicos americanos. *Ganoderma lloydii* Pat. & Har. é conhecida apenas para a Africa, e *Ganoderma asperulatum* (Murrill) Bres. tem sido reportada ùnicamente para as Filipinas e Borneo.

Apesar da distinta distribuição geográfica, as cinco espécies discutidas distinguem-se das demais do gênero *Ganoderma* pela coloração clara do contexto. Pelas características gerais do basidiocarpo, as mesmas espécies podem ser confundidas com algumas espécies do gênero *Amauroderma* Murrill. A distinção entre as cinco espécies de *Ganoderma* discutidas é feita fundamentalmente pelo exame dos basidiosporos.

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EXPLANATION OF PLATES 10–14

PLATE 10

Figs. 1–6. *Ganoderma amazonense*. — 1. Stipitate basidiocarp. — 2. Pileoli in the growing margin. — 3. Originally penultimate segment of generative hypha showing broken part of the clamp-connection (× 600). — 4. Skeletal and (a) binding hyphae (× 200). — 5. Branched arboriform skeletal hypha (× 200). — 6. Basidiospores in distinct optical section (× 2800).

PLATE 11

Figs. 7–11. *Ganoderma asperulatum*. — 7, 8. Basidiocarps. — 8. Holotype. — 9. Arboriform skeletal hypha (× 220). — 10, 11. Basidiospores, in median and tangential optical sections (× 1350).

PLATE 12

Figs. 12–18. *Ganoderma coffeatum*. — 12, 13. Basidiocarps. — 12. Type specimen of *Polyporus opacus*. — 13. Type specimen of *Amauroderma flaviporum*. — 14. Aciculiform skeletal hyphae (× 200). — 15. Broken pieces of binding hyphae (× 200). — 16. Clamp-connection of generative hypha (× 1500). — 17, 18. Basidiospores, in tangential and median optical sections (× 1500).

PLATE 13

Figs. 19–24. *Ganoderma lloydii*. — 19, 20. Basidiocarp col. Trotter, Congo. — 21. Arboriform skeletal hypha (× 200). — 22. Modified generative hypha showing clamp-connection at superior level (× 350). — 23, 24. Basidiospores in tangential and median optical sections (× 1400).

PLATE 14

Figs. 25–32. *Ganoderma neurosporum*. — 25, 26. Holotype. — 27. Skeletal hypha (× 500). — 28, 29. Part of clamp-connection in broken hyphae (× 1400). — 30. Binding hypha (× 600). — 31, 32. Basidiospores in median and tangential optical sections (× 2250).

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STUDIES ON THE GENUS EUPENICILLIUM LUDWIG

1. Taxonomy and nomenclature of Penicillia in relation to their sclerotioid ascocarpic states

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(With Plate 15 and four Text-figures)

The ascocarpic genus *Eupenicillium* Ludwig has been re-instated and reviewed taxonomically. It accommodates the perfect states of species characterized by pseudoparenchymatic or sclerotioid cleistothecia. The imperfect states belong to *Penicillium* Link ex Fries. Descriptions and synonomy of the genus and its type species *E. crustaceum* are presented. The generic name *Eupenicillium* has priority over the generic name *Carpenteles* Langeron. *Penicillium kewense* is reduced to the synonomy of *E. crustaceum*. The fungus misidentified by Shear as *C. asperum* is redescribed as *E. shearii* sp. nov. Species which had not previously been assigned to *Eupenicillium* are here so assigned.

Introduction

The first account of the development of a perfect state in a species of *Penicillium* was given by Brefeld in 1874. In "Die Entwicklungsgeschichte von *Penicillium*" he described and figured in great detail the formation of sclerotioid cleistothecia, slowly ripening from the centre outwards and producing bivalve ascospores. He identified the studied species as "*Penicillium crustaceum* Fries, *Penicillum glaucum* Link". It is, however, very questionable whether Brefeld's species represented the species described by Link and Fries. The illustrations of the conidial state strongly suggest that Brefeld dealt with mixed cultures. Brefeld stated that no new name for the Ascomycete he discovered is required, the name *Penicillium* should be used for both the perfect and the imperfect state.

Winter (1887) included the perfect state described by Brefeld in the Pyrenomycetes as *P. crustaceum* (L.) Fr. He gave an extract of Brefeld's paper together with a few of Brefeld's illustrations.

Based on the name in Winter's paper, which was thus founded on the perfect state reported by Brefeld, Ludwig (1892) introduced the new generic name *Eupenicillium*. The single species which typified the new genus was named *Eupenicillium crustaceum* (L.) Fr. (*P. glaucum*) and was described by the author. The correct citation of the name is *E. crustaceum* Ludwig.

Langeron (1922), unaware of Ludwig's genus, proposed the generic name

Carpenteles for ascus-producing Penicillia. As provisional type "*P. glaucum* (Link) Brefeld", rather '*P. glaucum*' Link sensu Brefeld, was indicated. Langeron stated that Brefeld presumably worked with a mixture of different species of *Penicillum* and with the term "provisional type" he meant to indicate that he considered the ascosporic portion of Brefeld's '*P. glaucum*' to be the type, but that the precise identity of the species thus singled out had not yet been established. He decided that only when Brefeld's ascosporic species is refound could the type species be defined more precisely.

Clements & Shear (1931) proposed as a new combination the name "*Carpenteles glaucum* (Link) Langeron" though Langeron never proposed this name.

In view of the uncertainty regarding the application of '*P. glaucum*' and the confusion which exists in its use, Shear (1934) introduced the new name *Carpenteles asperum*, nom. nov. for Brefeld's fungus. He thus gave a new specific name to that portion of '*P. glaucum*' described by Brefeld as ascosporic. Moreover, Shear reported the discovery of an ascosporic *Penicillium*, which he regarded as conspecific with Brefeld's species. The description of *P. asperum* (Shear) Raper & Thom published by Raper & Thom (1949: 263) and based on Shear's strain, shows that Shear's fungus is not identical with Brefeld's '*P. glaucum*.'

Thom (1930) and Raper & Thom (1949) rejected the assignment of the perfect Penicillia to ascomycetous genera. They adopted a classification with the emphasis on the conidial stage and treated all species as members of the single genus *Penicillium*, irrespective of whether or not an ascosporic state is present. Both *Eupenicillium* and *Carpenteles* were regarded as synonyms of *Penicillium*.

Benjamin (1956) reassigned the perfect Penicillia to ascomycetous genera. He considered *Carpenteles* to be the correct generic name for those species producing sclerotioid ascocarps.

Raper (1957) insisted, however, that in the case of *Penicillium* or *Aspergillus* it was "needlessly confusing to resurrect old and unused generic names or to construct new ones for the minority of isolates which succeed in developing an ascosporic stage."

Although there is much to say in favour of Raper's view, we feel obliged, in accordance with the "International Code of Botanical Nomenclature" (Art. 59), to assign the perfect Penicillia to ascomycetous genera and to acknowledge *Eupenicillium* as a legitimate generic name.

Generic diagnosis and specific descriptions

EUPENICILLIUM Ludwig

Eupenicillium Ludwig, Lehrb. nied. Krypt. 256, 257. 1892.
Carpenteles Langeron *in* C.r. Séanc. Soc. Biol. **87**: 344. 1922.

Fungi ascomyceti plectascales. Cleistothecia globosa vel subglobosa, firma vel dura, textura pseudoparenchymatica vel sclerotioidea, e cellulis crassitunicatis polygonalibus composita, peridermio subcolorato et persistente sed ad maturitatum cellulis interioribus evanescentibus. Asci laterales, e hyphis ascogonicis nati, singuli vel catenati, globosi vel ellipsoidei, octospori,

evanescentes. Ascosporae lenticulares vel ellipsoideae, continuae, hyalinae, luteae, vel brunneae, cum vel sine cristis aequatorialibus, partibus convexis levibus vel spinulosis.
Status conidicus *Penicillium* Link ex Fries.
Species typica *Eupenicillium crustaceum* Ludwig.

Cleistothecia globose to subglobose, developing as a solid mass of pseudoparenchymatous or sclerotioid tissue, firm to hard, composed of thick-walled, polygonal cells; central part evanescent. Peridium persistent, hyaline or slightly coloured. Ripening occurs from the centre outwards. Asci arise as branches from ascogenous hyphae, developing singly or in chains, evanescent, globose to ellipsoid, 8-spored. Ascospores lenticular to ellipsoid, continuous, hyaline, yellow or brown, often showing equatorial ridges, with convex surfaces smooth or roughened. Cleistothecial initials consist of modified and undifferentiated cells in the crotch of an arborescent network of hyphae.
Conidial state: *Penicillium* Link ex Fries.
Type species: *Eupenicillium crustaceum* Ludwig.

The ultimate type material of the genus *Eupenicillium* consists of Brefeld's illustrations and description of '*P. glaucum*'. This material is in a measure heterogeneous.

The illustrations demonstrate clearly the existence of an ascosporic state connected with a conidial state (Brefeld's Figs. 10–51, cf. Pl. 15). In addition at least two other species are illustrated. His Figures 5, 8, 52 and 53–54 may even represent four different imperfect *Penicillium* species. Brefeld's description of the perfect state clearly applies to his Figures 10–51, they typify the species *E. crustaceum*. As a conidial state belonging to the described perfect state, Ludwig referred to "*Coremium glaucum* oder *vulgare*". This is one of the conidial states illustrated by Brefeld (cf. Brefeld's Figs. 53 and 54), but which we regard as belonging to another fungus.

Since Brefeld's description of '*P. glaucum*', many authors claim to have refound Brefeld's ascosporic species. Shear (1934) considered his isolate from Honduras soil (in this paper redescribed as *E. shearii*) identical with Brefeld's species. However, in *E. shearii* the asci are borne singly and not in chains like those figured by Brefeld.

Emmons (1935) stated *P. egyptiacum* to be more nearly Brefeld's fungus because of the disposition of the asci, which develop in a similar manner to those figured by Brefeld. However, the shape of the ascospores of *P. egyptiacum* differs markedly from Brefeld's fungus.

van Beyma (1940) considered his *P. euglaucum* to be the true representative of Brefeld's '*P. glaucum*', but the ascospores of this species are much smaller than the ascospore sizes indicated by Brefeld.

According to Raper & Thom (1949: 262) *P. baarnense* might better represent the fungus studied by Brefeld. *Penicillium baarnense* agrees reasonably well with Brefeld's description and Figures 10–51. Its cleistothecia are strongly sclerotioid, the asci are borne in helicoidal chains and the ascospores are rough-walled with two equatorial ridges.

In our opinion the fungus described by Smith (1961) as *P. kewense* resembles Brefeld's fungus even more. This species is closely related to *P. baarnense*; its cleistothecia are also strongly sclerotioid, asci are borne in chains and the ascospores

are rough-walled with two prominent, well-separated equatorial ridges, thus agreeing very well with Brefeld's figures of the perfect state. The dimensions of the ascospores of *P. kewense* (4.2–5 × 3–3.2 μ) are slightly smaller than the measurements given by Brefeld (5–6 × 4–4.5 μ). However, according to Neuhoff (1924) and Donk (1966) the microscopical measurements given by Brefeld must be regarded as unreliable. In Brefeld's Figures 49, 50, and 51 mycelia are figured originating from ascospores and developing biverticillate-asymmetric penicilli consisting of branches, metulae and phialides with the composing elements closely appressed. The penicilli of *P. kewense* show exactly the same pattern, whereas those of *P. baarnense* are slightly different because the branches are lacking. Therefore we consider *P. kewense* to represent Brefeld's species.

EUPENICILLIUM CRUSTACEUM Ludwig—Text-fig. 1, Pl. 15

[*Penicillium crustaceum* (L.) Fr. *sensu* Winter *in* Krypt Fl. Deutschl., 2. Aufl., **1** (2): 64. 1887 (misapplied nomen anamorphosis)]. — *Eupenicillium crustaceum* Ludwig, Lehrb. nied. Krypt. 263. 1892 ["*Eupenicillium crustaceum* (L.) Fr. (*P. glaucum*)"]. — *Carpenteles glaucum* Langeron *ex* Clem. & Shear, Gen. Fungi 247. 1931 ["*Carpenteles glaucum* (Link) Langeron"]. — *Carpenteles asperum* Shear *in* Mycologia **26**: 107. 1934 (name change).

Penicillium kewense Smith *in* Trans. Br. mycol. Soc. **44**: 42. 1961.

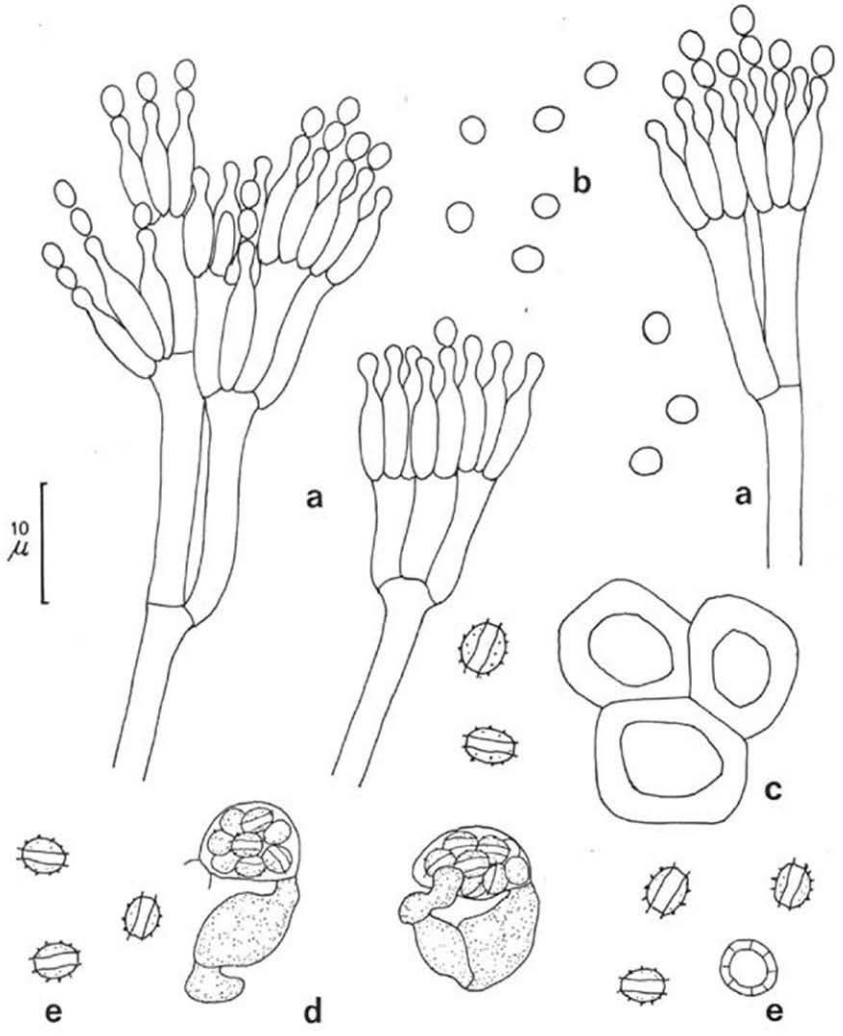
Status conid.: *Penicillium kewense* Smith, *ibid.* **44**: 42. 1961; not *P. crustaceum* (L.) Fr., Syst. myc. **3**: 407. 1829 (nomen ambiguum); not *P. glaucum* Link *in* Magazin Ges. naturf. Fr. Berl. **3**: 17. 1809 (nomen ambiguum).

Colonies growing somewhat restrictedly on Czapek agar, attaining a diameter of about 3 cm within 14 days at 25° C, azonate, comparatively thin, showing buff shades near Avellaneous and Vinaceous Buff (Ridgway, Pl. 40) because of the development of abundant cleistothecia with surface growth slightly flocculent. Conidial structures limited in number, lending the colony margin a faintly bluish shade in very young colonies. Exudate clear, sometimes reddish. Reverses of colonies show brown shades approximating Kaiser Brown (Ridgway, Pl. 14) with the colour diffusing in the surrounding agar.

Colonies on malt agar and oatmeal agar generally agree with those on Czapek agar, being plane, thin, consisting of a dense layer of cleistothecia. On oatmeal agar growth is somewhat faster.

Cleistothecia avellaneous, globose to ovoid, 190–280 μ in diameter, sclerotioid, consisting of masses of thick-walled, polygonal cells (Text-fig. 1c), in their young stages resembling sclerotia, ripening slowly from the centre outwards after 4–5 weeks. Asci (Text-fig. 1d) borne in chains, ovoid, 9–10 × 6–7 μ, containing 8 ascospores. Ascospores broadly lenticular, 4.2–5 × 3–3.2 μ, with two prominent, well-separated equatorial ridges and with the convex surfaces coarsely roughened (Text-fig. 1e).

Conidiophores arising from the substratum and from aerial hyphae, smooth-walled up to 300 μ in length by 2–4 μ in diameter. Penicilli (Text-fig. 1a) biverticillate and asymmetrical, commonly showing one branch (rarely 4-verticillate) with all elements closely appressed and smooth-walled. Small penicilli consisting of 1 verticil of 2–4 metulae occur as well. Branches 20–22 × 2.5–4 μ. Metulae in clusters of 2–4, 10–15 × 2.5–3.5 μ with apices slightly inflated. Phialides 8.5–10 × 2–2.5 μ showing definite conidium-bearing tubes. Conidia pear-shaped, smooth to slightly roughened, 2.5–3(–4) × 2–2.5(–3.5) μ (Text-fig. 1b).



Text-fig. 1. *Eupenicillium crustaceum*, CBS 344.61. — a. Different types of penicilli. — b. Conidia. — c. Thick-walled cleistothecial cells. — d. Asci produced in chains. — e. Ascospores.

The species is represented by CBS 344.61 sent to the CBS by G. Smith in 1961 as the type culture of *P. kewense*. The lectotype consists of Brefeld's description and Figures 10–51 of '*P. glaucum*' (1874).

Eupenicillium shearii Stolk & Scott, *sp. nov.*—Text-fig. 2

Penicillium asperum (Shear) Raper & Thom, Man. Penicillia 263. 1949 (misapplied).
Status conid.: *Penicillium shearii* Stolk & Scott, *st. n.*

Coloniae in agaro Czapekii tarde crescentes, mycelio basali coacto, cleistotheciis griseis involutis, penicillis restricte numerosis, reverso bubalino vel luteolo deinde fuscescente.

Cleistothecia globosa vel subglobosa vel ovoidea, usque ad 500 μ diam., sclerotioidea, tarde maturescentia. Asci octospori, singuli et laterales in hyphis ascogonicis, globosi vel ovoidei, 5–6 μ diam. Ascosporae 2.5–3 × 2–2.5 μ, lenticulares, luteolae, partibus convexis spinulosis, cristis duabus aequatorialibus contiguis, 0.5 μ latis.

Conidiophora usque ad 500 μ alta, 2–2.5 μ lata, levia vel sublevia. Penicilli monoverticillati vel biverticillati, divaricati, quoque verticillio plerumque metulis 2–4 divaricatis instructo. Metulae leves, 10–15 × 2–3 μ. Phialides 3–8 per metulam, 7–10 × 2.2–2.8 μ ostio tubulari aperte angustato et elongato. Conidia ovoidea vel ellipsoidea, levia, 2.2–3 × 2–2.5 μ, catenas intermixtas constituantia.

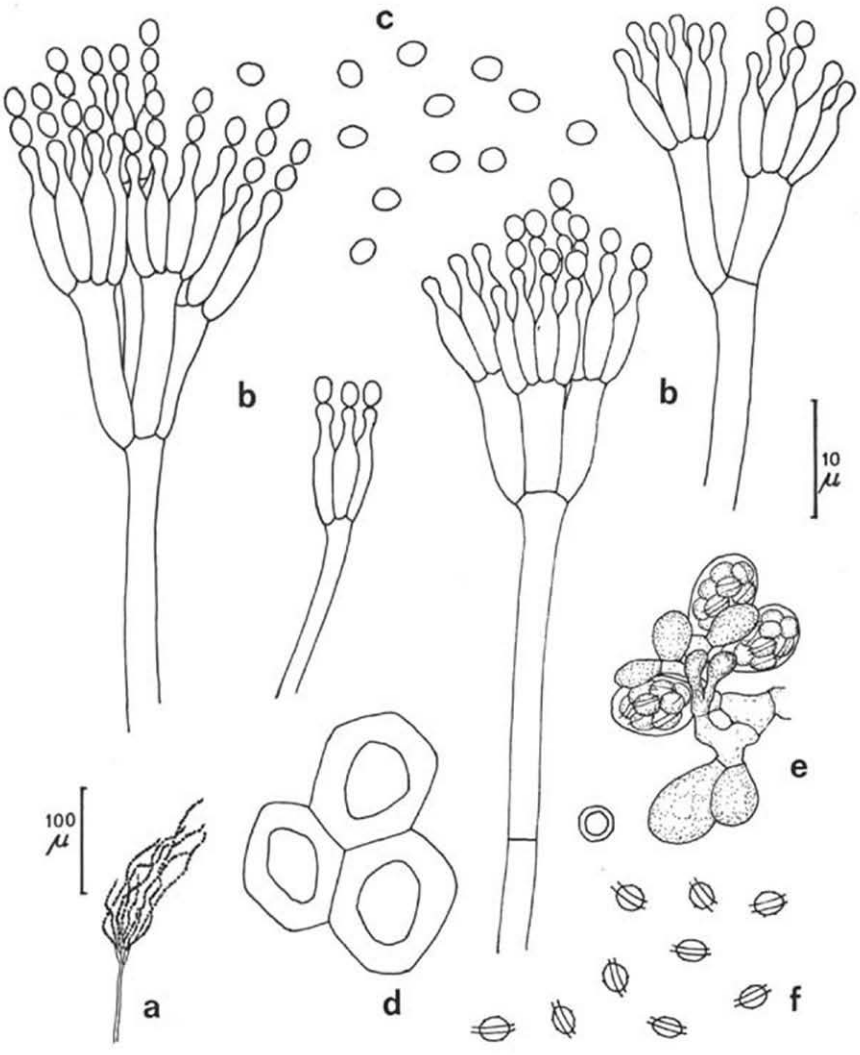
Typus: CBS 290.48 a Otto A. Reinking in 1931 e terra Tela, Honduras isolatus (cultura vivida et desiccata).

Colonies growing slowly on Czapek agar, attaining a diameter of 2.5–3 cm within 14 days at 25° C, zonate, showing grey shades near Mouse Gray (Ridgway, Pl. 51), consisting of an uncoloured mycelial felt, which is somewhat wrinkled and buckled in central areas and in which numerous greyish or almost black cleistothecia are embedded, the surface growth being somewhat flocculent. Conidial structures usually do not affect the colony appearance. The reverse of the colonies showing buff to yellowish shades, becoming dark brownish to fuscous, especially in central areas with age.

Colonies on malt agar attaining a diameter of 3–3.5 cm within 14 days at 25° C, thinner than those on Czapek agar, plane, becoming avellaneous from the development of abundant cleistothecia, with marginal areas grey-green, approximating Court Gray or Mineral Gray (Ridgway, Pl. 47). Colonies on oatmeal agar generally agree with those on malt agar, their growth being slightly faster and exudate occurring more abundantly, collecting in conspicuous, clear drops.

Cleistothecia globose, subglobose or ovoid, up to 500 μ in diameter, in their young stages very hard and resembling sclerotia, consisting of sclerotioid masses of thick-walled, polygonal cells (Text-fig. 2d), ripening slowly, producing ascospores after 4–5 weeks or more. Sometimes ascospores are never produced. Asci (Text-fig. 2e) borne singly, developing as branches from ascogenous hyphae, globose to ovoid, 5–6 μ in diameter. Ascospores lenticular, yellowish, 2.5–3 × 2–2.5 μ, with convex surfaces more or less roughened, with two closely appressed equatorial ridges about 0.5 μ wide (Text-fig. 2f).

Conidiophores arising primarily from the substratum, but sometimes also from aerial hyphae, up to 500 μ or more in length by 2–2.8 μ in diameter, with walls smooth or nearly so. Penicilli (Text-fig. 2b) divaricate, consisting mostly of a terminal verticil of 2–4 slightly diverging metulae; usually monoverticillate structures occur as well. Metulae smooth-walled, 10–15 × 2–3 μ; metulae of different length may occur in one verticil. Phialides in clusters of 3–8, 7–10 × 2.2–2.8 μ, their conidium-bearing tubes being definitely narrowed and fairly long. Conidia



Text-fig. 2. *Eupenicillium shearii*, CBS 290.48. — a. Habit sketch showing tangled conidial chains. — b. Different types of penicilli. — c. Conidia. — d. Thick-walled cleistothecial cells. — e. Development of asci. — f. Ascospores.

(Text-fig. 2c) ovoid to ellipsoid, 2.2–3 × 2–2.5 μ, smooth-walled, forming tangled chains (Text-fig. 2a).

The type strain CBS 290.48 = NRRL 715 was isolated by Dr. Otto R. Reinking from soil at Tela, Honduras in 1931, and misidentified as *Carpenteles asperum* by Dr. C. L. Shear. The species is also represented by two additional strains: CBS 343.54 isolated from soil of the Congo by Dr. J. Meyer in 1954 and CBS 488.66 isolated from soil of the savanna near Abidjan (R.C.I.) at the 'Laboratoire de Phytopathologie', Abidjan in 1966. CBS 343.54 and CBS 486.66 differ slightly from the type strain in their cultural aspect. They produce more definite yellow and brown colours in reverse. The cleistothecia of these two strains on Czapek agar vary from tan to grey, whereas those of CBS 290.48 are grey or almost black.

In view of the confusion gathered around the name '*Penicillium glaucum*' Link, Shear (1934) introduced *Carpenteles asperum* as a new name for '*P. glaucum*' Link sensu Brefeld. At the same time Shear claimed to have refound Brefeld's ascosporic '*P. glaucum*'. However, the description of Shear's strain, given by Raper & Thom (1949) under the name *Penicillium asperum* (Shear) Raper & Thom, shows that Shear's claim is not correct. According to Brefeld, his fungus produces asci in chains, but in Shear's strain asci are borne singly. The fact that Shear proposed the name *C. asperum* as nom. nov. and not as spec. nov., and moreover that he reproduced Brefeld's illustrations (Brefeld's Figures 51, 34–39, 45–46) makes it clear that he intended not to create a new species based on Reinking's collection, but simply to rename Brefeld's fungus. Shear took the material collected by Reinking to represent the same species as Brefeld's fungus which is an error and, consequently, the recombination proposed by Raper & Thom and based on Shear's description is a misapplied name.

New combinations

A number of *Penicillium* species were described as perfect forms, but placed in the 'imperfect genus' *Penicillium*. These species are characterized by pseudoparenchymatous or sclerotioid cleistothecia as occurring in *Eupenicillium*. Some of them have been transferred to *Carpenteles* which is a later synonym of *Eupenicillium*. Since valid descriptions of the species under consideration, inclusive of their perfect states, were published, we propose the following new combinations:

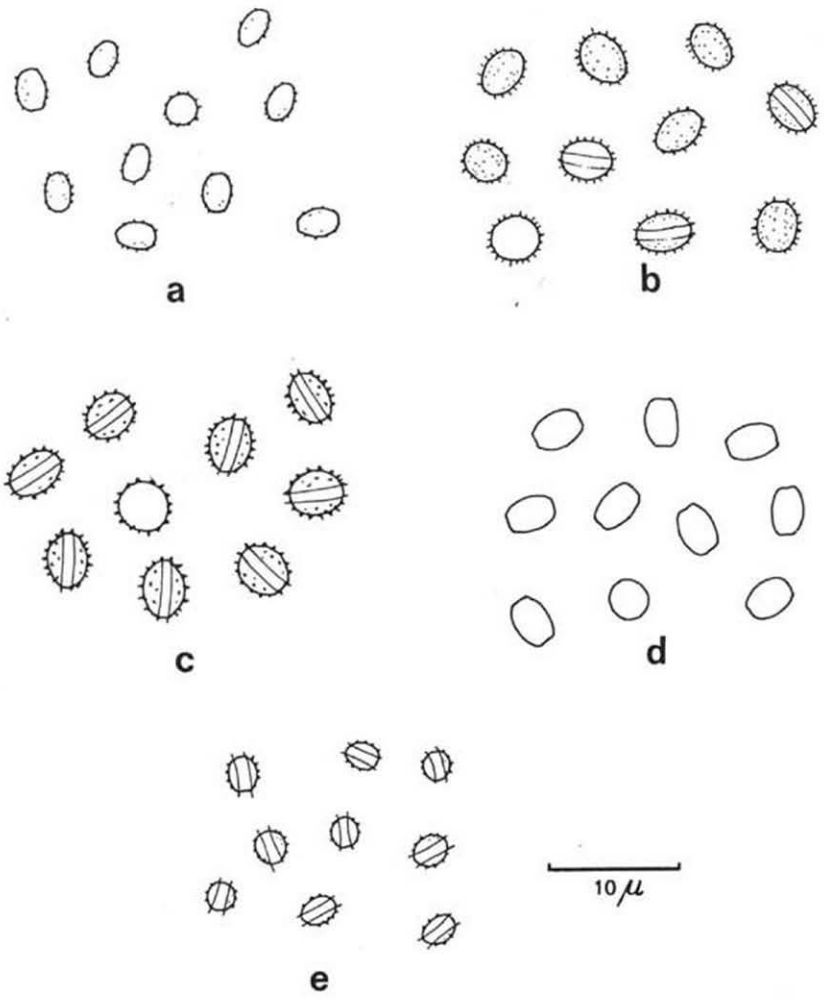
Eupenicillium javanicum (Beyma) Stolk & Scott, *comb. nov.*—Text-fig. 3a

Penicillium javanicum Beyma *in* Verh. K. Akad. Wet. Amst. (Natuurk., II) **26**: 17. 1929 (basionym). — *Carpenteles javanicum* (Beyma) Shear *in* Mycologia **26**: 107. 1934.

Penicillium oligosporum Saito & Minoura *in* J. Ferment. Technol., Osaka **26**: 5. 1948 (Latin description lacking, not validly published).

Status conid.: *Penicillium javanicum* Beyma *ibid.* **26**: 17. 1929.

SPECIAL LITERATURE: Raper & Thom (1949: 135).



Text-fig. 3. Ascospores. — a. *Eupenicillium javanicum*, CBS 341.48. — b. *E. brefeldianum*, CBS 298.48. — c. *E. ehrlichii*, CBS 324.48. — d. *E. egyptiacum*, CBS 244.32. — e. *E. parvum*, CBS 359.48.

Cleistothecia pseudoparenchymatous to slightly sclerotioid, yellow to brown, 100–150 μ in diameter, usually ripening within 2 or 3 weeks. Asci borne singly, 6–8 μ in diameter. Ascospores lenticular, 2.5–3 × 2–2.5 μ, slightly roughened, with equatorial areas flattened, sometimes showing a trace of an equatorial furrow (Text-fig. 3a). Penicilli usually monoverticillate with an occasional branch. Phialides 8–13 × 2–2.5 μ, with long, narrow conidium-bearing tubes. Conidia ellipsoid to pear-shaped, 2.2–3 × 1.5–2 μ.

The type strain CBS 341.48 = NRRL 707 was isolated from tearoots coming from Java and described by van Beyma as *P. javanicum*. The species is also represented by CBS 349.51, described by Saito & Minoura (1948) as *P. oligosporum*. This type culture does not produce the red pigment characteristic of *E. javanicum* on Czapek agar. Notwithstanding this we regard it as a strain of *E. javanicum* because of the similarity of the ascospores and the conidial state.

Eupenicillium brefeldianum (Dodge) Stolk & Scott, *comb. nov.*—Text-fig. 3b

Penicillium brefeldianum Dodge *in* Mycologia **25**: 92. 1933 (basionym). — *Carpenteles brefeldianum* (Dodge) Shear *in* Mycologia **26**: 107. 1934.
Status conid.: *Penicillium brefeldianum* Dodge.
SPECIAL LITERATURE: Raper & Thom (1949: 141).

Cleistothecia pseudoparenchymatous to slightly sclerotioid, cream to light tan, 100–200 μ in diameter, ripening within 2 weeks. Asci borne singly, 7.5–9 μ in diameter. Ascospores broadly lenticular, finely echinulate, showing sometimes a trace of an equatorial furrow, 3–4 × 2.5–3 μ (Text-fig. 3b). Penicilli monoverticillate with an occasional branch. Phialides 7–10 × 2.5–3 μ, with conspicuous narrow conidium-bearing tubes. Conidia subglobose to ellipsoid, 2–3 × 1.5–2 μ.

The species is represented by CBS 298.48 = NRRL 2083, isolated by Wm. I. Illman, University of Toronto, and described by Raper & Thom in 1949 as a characteristic representative of *P. brefeldianum*. *Eupenicillium brefeldianum* is closely related to *E. javanicum* and *E. ehrlichii*, the dimensions of the ascospores being in between these two species. Though *E. brefeldianum* sometimes produces a yellow pigment on Czapek agar, its colonies are less coloured than those of *E. javanicum* and *E. ehrlichii*, which may produce red or purplish pigments.

Eupenicillium ehrlichii (Klebahn) Stolk & Scott, *comb. nov.*—Text-fig. 3c

Penicillium ehrlichii Klebahn *in* Ber. dt. bot. Ges. **48**: 374. 1933 (basionym).
Status conid.: *Penicillium ehrlichii* Klebahn.
SPECIAL LITERATURE: Raper & Thom (1949: 146).

Cleistothecia pseudoparenchymatous, yellow to brownish, 100–200 μ in diameter, ripening within 2 weeks. Asci borne singly, 8–10 μ in diameter. Ascospores lenticular, conspicuously roughened, 3.5–4.5 × 3–3.5 μ, showing a shallow equatorial furrow and inconspicuous low marginal ridges (Text-fig. 3c). Penicilli fragmentarily monoverticillate. Phialides 10–15 × 2.5–3.5 μ. Conidia ellipsoid 4–5 × 3.5–4 μ.

The type strain CBS 324.48 = NRRL 708 was isolated by F. Ehrlich and described by Klebahn as *P. ehrlichii* in 1930.

Eupenicillium ehrlichii is closely related to *E. brefeldianum*, it differs from this species in producing more coloured colonies with yellow mycelium and showing bright yellow, purplish or orange-red reverses on Czapek- and oatmeal agar. The ascospores are slightly larger than those of *E. brefeldianum* with walls more conspicuously roughened and with two low equatorial ridges. Moreover the conidia are much larger than those of *E. brefeldianum*.

Eupenicillium egyptiacum (Beyma) Stolk & Scott, *comb. nov.*—Text-fig. 3d

Penicillium egyptiacum Beyma *in* Zbl. Bakt. ParasKde (Abt. 2) **88**: 137. 1933 (basionym).
Status conid.: *Penicillium egyptiacum* Beyma.
SPECIAL LITERATURE: Raper & Thom (1949: 269).

Cleistothecia pseudoparenchymatous, cream to pale avellaneous, 100–200 μ in diam., ripening within 3 weeks. Asci in chains, 7–8 μ in diam. Ascospores broadly lenticular, 3–3.5 × 2–2.8 μ, smooth-walled with equatorial areas flattened, occasionally showing two rather widely separated low equatorial ridges (Text-fig. 3d). Penicilli usually biverticillate-divaricate, sometimes also monoverticillate, with all walls smooth. Rami rarely present. Metulae 2–5 in the verticil, 10–25 × 2–2.8 μ. Phialides 8–10 × 1.8–2.2 μ. Conidia globose to subglobose 2–3 μ.

The type strain CBS 244.32 = NRRL 2090 was isolated from soil by Y. S. Sabet, Cairo, Egypt, in 1932.

The species can be easily recognized by its characteristic barrel-shaped, smooth-walled ascospores. The colonies do not show conspicuous colours.

Eupenicillium baarnense (Beyma) Stolk & Scott, *comb. nov.*—Text-fig. 4

Penicillium (*Carpenteles*) *baarnense* Beyma *in* Antonie van Leeuwenhoek **6**: 271. 1940.
Status conid.: *Penicillium baarnense* Beyma *ibid.* **6**: 271. 1940.
SPECIAL LITERATURE: Raper & Thom (1949: 266).

Cleistothecia sclerotioid, buff, 100–200 μ in diameter, ripening after 4 weeks. Asci borne in chains, 10–12 μ in diameter (Text-fig. 4f). Ascospores lenticular, showing two prominent equatorial ridges (which are about 0.5–1 μ in width, usually close together, so that they sometimes appear as a single ridge) with convex surfaces rugulose to echinulate, 5–6.5 × 3.4–4.5 μ (Text-fig. 4g). Penicilli (Text-fig. 4a) ranging from monoverticillate to divaricate. Metulae in clusters of 2–3(–4), appressed, smooth-walled, 10–20 × 2–3 μ. Phialides 8–10 × 2–2.5 μ. Conidia in very young cultures hyaline to slightly greenish, ellipsoid, smooth-walled, 3–3.5(–5) × 2–2.5 μ (Text-fig. 4c). In older cultures also greenish, globose to suglobose, conspicuously roughened conidia occur, about 3–4 μ in diameter (Text-fig. 4d). Penicilli were observed with a few phialides producing smooth-walled ellipsoid conidia while the other phialides produced the rough-walled, globose type of conidium (Text-fig. 4b).

The rough-walled conidia were not mentioned in the descriptions given by van Beyma and Raper & Thom. However, they were observed in all three examined

strains of this species. Single spore cultures demonstrated both types of conidia to belong to *E. baarnense*.

The species is represented by CBS 134.41, type strain of *Penicillium* (*Carpenteles*) *baarnense* Beyma, isolated from soil collected near Baarn in 1939; CBS 339.61, originating from a culture labelled *Penicillium euglaucum* Beyma, and CBS 315.59 which was found as a contaminant in a Petridish culture. CBS 134.41 and CBS 339.61 are identical. The cultural aspect of CBS 315.59 differs slightly from the other two strains in producing a purple-red pigment in localized areas. Moreover, the cleistothecia of CBS 315.59 ripen somewhat more quickly than those of the other two strains.

The species is closely related to *E. crustaceum*. It differs from this species in the character of the ascospores, those of *E. baarnense* being definitely larger. Moreover they have two closely appressed equatorial ridges, whereas in *E. crustaceum* the ridges are widely separated. The penicilli of *E. crustaceum* are larger and more complicated than those of *E. baarnense*.

Eupenicillium levitum (Raper & Fennell) Stolk & Scott, *comb. nov.*

Penicillium levitum Raper & Fennell *in* Mycologia **40**: 511. 1948 (basionym). — *Carpenteles levitum* (Raper & Fennell) C. R. Benj. *in* Mycologia **47**: 685. 1955.
Status conid.: *Penicillium levitum* Raper & Fennell.
SPECIAL LITERATURE: Raper & Thom (1949: 148).

Cleistothecia pseudoparenchymatous, in light tan shades, 50–100 μ in diameter, ripening within 1 or 2 weeks. Asci borne singly, 8–10 μ in diameter. Ascospores broadly lenticular to ellipsoid, 3.5–4.5 × 3–4 μ, smooth-walled, without any indication of an equatorial furrow or ridges. Penicilli fragmentarily monoverticillate. Phialides 7–12(–25) × 2.2–3.5 μ. Conidia subglobose to pear-shaped, smooth-walled, 4.5(–7) × 3–4.5 μ.

The type strain CBS 345.48 = NRRL 705 was isolated by B. O. Dodge from modelling clay.

Eupenicillium parvum (Raper & Fennell) Stolk & Scott, *comb. nov.*—Text-fig. 3e

Penicillium parvum Raper & Fennell *in* Mycologia **40**: 508. 1948 (basionym). — *Carpenteles parvum* (Raper & Fennell) Udagawa *in* Trans. mycol. Soc. Japan **6**: 79. 1965.
Status conid.: *Penicillium parvum* Raper & Fennell.
SPECIAL LITERATURE: Raper & Thom (1949: 138).

Cleistothecia sclerotioid, yellow to orange-brown, 80–150 μ in diameter, ripening after 3 to 4 weeks. Asci borne singly, 6–7 μ in diameter. Ascospores lenticular,

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EXPLANATION OF FIGURE 4

Text-fig. 4. *Eupenicillium baarnense*, CBS 134.41. — a. Different types of penicilli. — b. Monoverticillate penicillus producing both smooth-walled, ellipsoid conidia and rough-walled, globose conidia. — c. Smooth-walled, ellipsoid conidia. — d. Rough-walled, globose conidia. — e. Ascogenous hyphae. — f. Asci produced in a chain. — g. Ascospores.

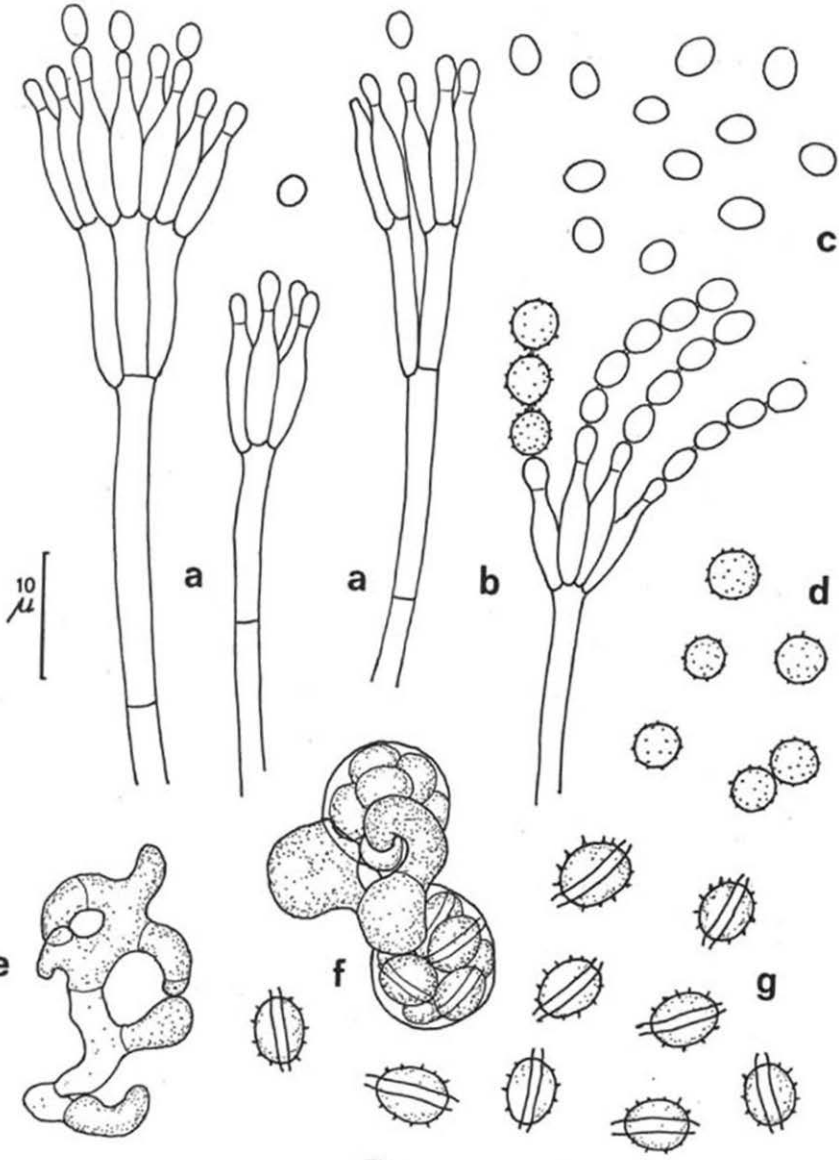

Fig. 4.

2.2–2.8 × 1.5–2 μ with walls conspicuously roughened and with two prominent, widely separated equatorial ridges (Text-fig. 3e). Penicilli monoverticillate. Phialides 7–8 × 1.2–1.8 μ with conidium-bearing tubes slightly narrowed. Conidia subglobose to ellipsoid 1.5–2 × 1.2–1.5 μ.

The type strain CBS 359.48 = NRRL 2095 was isolated in 1945 from a sample of soil from Nicaragua.

The species is closely related to *E. javanicum*. Both species produce a reddish-brown pigmentation in reverse. They differ in the more delayed ripening of the cleistothecia and in the character of the ascospores. In *E. parvum* the ascospores are more conspicuously roughened and show more strongly developed equatorial ridges.

Doubtful species

PENICILLIUM EQUINUM Beyma *in* Zbl. Bakt. ParasKde (Abt. 2) **96**: 423. 1937.

The type culture of *P. equinum* Beyma is lost. According to Raper & Thom (1949: 817) the strain they received in 1945 from the CBS under this name failed to produce perithecia and approximated *P. terrestre* Jensen. The perfect state of *P. equinum* was described by van Beyma in terms which place it near *E. brefeldianum*.

PENICILLIUM (CARPENTELES) EUGLAUCUM Beyma *in* Antonie van Leeuwenhoek **6**: 267. 1940.

Penicillium euglaucum was described by van Beyma as a perfect *Penicillium* with sclerotioid perithecia, producing ascospores 3–4 × 3–3.3 μ, slightly roughened, and showing a definite equatorial band. Unfortunately, the culture CBS 339.61 labelled *P. euglaucum* does not agree any more with this species. It resembles *E. crustaceum* in all details. The notes and drawings van Beyma made of this species are still present at the CBS. They strongly suggest that the culture studied by van Beyma was different from *E. crustaceum*. We therefore presume that the type culture of *P. euglaucum* is lost.

The authors wish to thank Dr. M. A. Donk for his most valuable advices on problems of nomenclature. Thanks are also due to Dr. J. A. von Arx and Dr. G. L. Hennebert for helpful suggestions and again to Dr. Hennebert for preparing the Latin diagnoses.

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EXPLANATION OF PLATE 15

Brefeld's figures of "*Penicillium glaucum*, *Penicillium crustaceum*" reassembled in part, showing mature cleistothecium (Fig. 34), developing asci (Figs. 35–39), mature and germinating ascospores (Figs. 45–47) and penicilli which develop from germinated ascospores (Fig. 49).

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ÜBER EINIGE AUS DEM ERDBODEN ISOLIERTE, ZU SPORORMIA, PREUSSIA UND WESTERDYKELLA GEHÖRENDE ASCOMYCETEN

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(Mit Tafel 16-18)

Einige zur Ascomycetenfamilie der Sporormiaceae gehörende, aus dem Erdboden isolierte Pilze werden als Arten der Gattungen *Sporormia* (Synonym: *Sporormiopsis*), *Preussia* (Synonym: *Honoratia*) und *Westerdykella* (Synonym: *Pycnidiophora*) besprochen und mit einander verglichen. *Sporormia aemulans* var. *ostiolata* wird neu beschrieben. Einige als *Sporormia* und *Preussia* beschriebene Arten werden mit *Preussia fleischhakii* vereinigt.

Im Laufe der letzten Jahre wurden dem Centraalbureau voor Schimmelcultures zahlreiche aus dem Erdboden isolierte Ascomyceten zur Bestimmung oder zur Aufnahme in der Sammlung zugeschickt. Hier sollen einige zu den Sporormiaceae (Müller & von Arx, 1962) gehörende Arten besprochen werden. Diese sind in der Literatur teilweise unter verschiedenen, zum Teil unrichtigen, zum Teil ungültigen Namen bekannt geworden.

Die zu besprechenden Arten werden zu *Sporormia* De Not., zu *Preussia* Fuck. oder zu *Westerdykella* Stolk gestellt. Bei den Vertretern der Gattung *Sporormia* sollen die Ascomata (Perithecien) nach Cain (1934) flaschenförmig sein und im Scheitel eine vorgebildete Mündung haben, während sie nach Cain (1961) bei *Preussia* mehr oder weniger kugelig und mündungslos sein sollen. Die beiden Gattungen stehen sich jedoch sehr nahe und es bestehen störende Zwischenformen. Bei ein und derselben Art, ja bei ein und demselben Stamm können Ascomata mit und ohne Mündung vorkommen.

Anlässlich der Beschreibung von zwei neuen *Sporormia*-Arten begründeten Breton & Faurel (1964) für *Sporormia minima* Auersw. eine neue Gattung *Sporormiopsis*. Diese sollte sich von *Sporormia* s. str. durch dunkle dickwandige mit einem „voluminösen" Mündungshals versehene Perithecien, durch bitunicate Asci und durch mit Keimspalten versehene Ascosporen unterscheiden. Die gleichzeitig als *Sporormia schotteriana* neu beschriebene Art hat aber ebenfalls mit einem Mündungshals versehene Ascomata und bitunicate Asci! Dagegen jedoch sind die Ascomata gerade bei *Sporormia minima* (Taf. 18, Fig. 13, 14) kugelig, dünnwandig, oben flach und nur von einem unscheinbaren Porus durchbohrt. Ihre Typusart entspricht demnach nicht der Beschreibung der neuen Gattung *Sporormiopsis*. Wahrscheinlich haben Breton & Faurel diesen Pilz überhaupt nicht untersucht, und sie scheinen auch *Sporormia fimetaria* De Not., die Typusart von *Sporormia* nicht gesehen zu haben. Man wird den Namen *Sporormiopsis* als unnötiges Synonym von *Sporormia* betrachten müssen. Ein Synonym von *Sporormia* ist *Brochospora* Kirschst. Weitere Unter-

suchungen müssen zeigen, ob sich *Preussia* wirklich von *Sporormia* wird unterscheiden lassen.

Die von Clum (1955) begründete Gattung *Pycnidiophora* wurde von Cain (1961) mit *Preussia*, von Cejp & Milko (1964) mit *Westerdykella* vereinigt. Wie Kowalski (1964) zeigte, lassen sich *Preussia* und *Pycnidiophora* gut trennen. Bei den Vertretern der letztgenannten Gattung sind die Asci breit keulig oder fast kugelig und enthalten bis zu 32 allem Anscheine nach stets vom Anfang an einzellige Ascosporen. Nach Chadefaud, Parguey-Leduc, & Boudin (1966) vermittelt zwar *Preussia nigra* (Routien) Cain einen Übergang von *Preussia* zu *Pycnidiophora*.

Die Typusart von *Westerdykella* hat nach Stolk (1955) kugelige, mit spiralförmigen Wandverdickungen versehene Ascosporen. Sonst stimmt sie aber in jeder Hinsicht mit derjenigen von *Pycnidiophora* überein. Bei beiden gehen die Ascomata aus einer angeschwollenen, sich in allen Richtungen teilenden Hyphenzelle hervor, sind mündungslos und haben eine dunkele Aussenkruste. Bei beiden entwickeln sich die Asci von der Mitte der Fruchtkörper aus und enthalten reif bis zu 32 Ascosporen. Die Gattung *Pycnidiophora* wird daher am besten im Sinne von Cejp und Milko (1964) mit *Westerdykella* vereinigt. Schon wegen der Entstehungsweise der Ascomata kann diese Gattung nicht zu den Eurotiales gehören; vielmehr ist sie ebenfalls zu den Sporormiaceae neben *Preussia* zu stellen.

Zu *Westerdykella* gehörende Arten wurden bisher gelegentlich auch zu *Pseudeurotium* Beyma (Synonym: *Levispora* Routien) gestellt. Bei den typischen Vertretern dieser zu den Eurotiales gehörenden Gattung entwickeln sich die Ascomata aus einer Hyphenspirale oder aus sich umwindenden Hyphen und die Asci enthalten im allgemeinen acht Ascosporen.

1. PREUSSIA FUNICULATA (Preuss) Fuck.—Taf. 16, Fig. 1, 2

Perisporium funiculatum Preuss *in* Linnaea **24**: 143. 1851. — *Preussia funiculata* (Preuss) Fuck., Fungi rhen., Suppl., Fasc. 3, No. 1750. 1866.

Auf Haferagar bildet der Pilz ein weisses Luftmycel und hat bei 24° C ein tägliches Wachstum von 1.7–1.9 mm. Die im Luftmycel nistenden Ascomata sind mehr oder weniger kugelig, etwas durchscheinend schwärzlich, mündungslos und 195–610 μ gross. Ihre Wand besteht aus einer äusseren Kruste von dunkelwandigen Zellen; nach innen folgen mehrere Lagen von farblosen, bei der Sporenreife resorbierenden Zellen. Die mit einem bis zu 140 μ langen Stiel versehenen Asci sind keulig und messen (ohne Stiel) 40–75 × 19–27 μ. Sie entspringen bündelförmig einem basalen Polster und enthalten je acht Ascosporen. Diese sind zylindrisch, beidendig etwas verjüngt, vierzellig, bei den schräg laufenden Querwänden tief eingeschnürt und messen 29–36 × 28–36 × 6–7.5 μ. Bei der Reife zerfallen sie leicht in die mit Keimspalten versehenen Einzelzellen.

Untersuchte Kulturen:
CBS 127.66 (= C933) und CBS 128.66 (= C1325), beide von Dr. W. Gams (Kiel-Kitzeberg) aus dem Erdboden isoliert.

Diese Art wurde von Cain (1961) ausführlich beschrieben. Von den andern Arten der Gattung unterscheidet sie sich durch die schräg verlaufenden (obliquen) Querwände der Ascosporen.

2. PREUSSIA ISOMERA Cain—Taf. 17, Fig. 5, 6

Preussia isomera Cain *in* Can. J. Bot. **39**: 1643, Fig. 32—38. 1961.
Honoratia pisana Cif., Vegni, & Montem. *in* Atti Ist. bot. Univ. Lab. crittogam. Pavia, ser. 5, **20**: 176. 1962.

Auf Haferagar beträgt der tägliche Zuwachs des Mycels bei 24° C 1.8–2 mm. Ein Luftmycel wird kaum ausgebildet und die Ascomata entstehen in Sektoren oder radial verlaufenden Reihen. An diesen Stellen verfärbt sich der Nährboden dunkel. Die Ascomata sind kugelig, schwarz, glatt, oben kahl und erreichen einen Durchmesser von 130–340 μ. Stets sind sie mündungslos. Die breit keuligen Asci sind kurz gestielt und messen 42–55 × 14–18 μ. Die vierzelligen Ascosporen sind bei den Querwänden tief eingeschnürt und zerfallen leicht in die Einzelsegmente. Diese sind zylinderisch mit abgerundeten Enden, hellbraun, haben einen oft nur undeutlich sichtbaren Keimspalt und messen 7–9 × 4–4.5 μ. Die Gesamtspore ist 30–33 μ lang.

Untersuchte Kulturen:
CBS 318.65, Typuskultur von *Preussia isomera*, in Florida von Exkrementen isoliert.
CBS 251.62, Typuskultur von *Honoratia pisana*, in Italien aus *Avena*-Saatgut isoliert.

Die Kulturen der beiden Typusstämme stimmen volkommen miteinander überein. Auch diese Art wurde von Cain (1961) ausführlich beschrieben und abgebildet. Die Gattung *Honoratia* lässt sich neben *Preussia* nicht aufrecht erhalten.

3. PREUSSIA FLEISCHHAKII (Auersw.) Cain—Taf. 16, Fig. 3, 4

Sporormia fleischhakii Auersw. *in* Rabenh., Fungi eur. No. 921. 1866; *in* Hedwigia **7**: 66. 1868. — *Preussia fleischhakii* (Auersw.) Cain *in* Can. J. Bot. **39**: 1640. 1961.
Fleischhakia laevis Auersw. *in* Hedwigia **8**: 2. 1869.
Sporormia fasciculata Jensen *in* Bull. Cornell Univ. agric. Exp. Stn **315**: 473. 1912.
Sporormia montana Peyron. *in* Memorie Accad. Sci. Torino, ser. 2, **66**: 21. 1916.
Sporormia petasoniformis C. Moreau *in* Encycl. mycol. **25**: 285. 1953.
Sporormia pollaccii Elisei *in* Atti Ist. bot. Univ. Lab. crittogam. Pavia, ser. 4, **11**: 255. 1939.
? *Perisporium vulgare* Corda, Icon. Fung. **2**: 27. 1838. — *Preussia vulgare* (Corda) Cain *in* Can. J. Bot. **39**: 1642. 1961.

Der Pilz bildet in Reinkultur auf Haferagar ein weisses oder rötliches, wolliges Luftmycel. Der tägliche Zuwachs bei 24° C beträgt je nach Stamm 0.9–1.3 mm. Früher oder später verfärbt sich der Nährboden rot. Die im Luftmycel nistenden Ascomata sind kugelig oder etwas unregelmässig, oben abgerundet oder gelegentlich mit einer Papille versehen und 200–510 μ gross. Auch bei den mit einer Papille versehenen Fruchtkörpern konnte keine vorgebildete Mündung beobachtet werden. Dagegen waren die grösseren Fruchtkörper öfters multiloculär; sie enthielten dann 2–4 Höhlungen oder ascusbildende Zentren. Die Wand der Gehäuse besteht aus mehreren Lagen von 5–8 μ grossen, aussen braunen, nach innen heller werdenden Zellen. Die Asci sind breit keulig, kurz gestielt, 38–60 μ lang und 19–28 μ breit. Sie enthalten je acht meist in einem Bündel parallel nebeneinander liegende Ascosporen. Diese sind zylindrisch, vierzellig, bei den Septen eingeschnürt und messen 26–35 × 5.5–7.5 μ. Die Einzelzellen sind breit ellipsoidisch, die Endzellen oft etwas verjüngt und jede Zelle hat einen Keimspalt.

Untersuchte Kulturen:
CBS 327.37, von Dr. J. G. ten Houten aus dem Erdboden isoliert.

CBS 362.49, in Gent aus dem Erdboden isoliert, von Prof. van Holder empfangen.
CBS 167.40, Typuskultur von *Sporormia pollacci* Elisei.
CBS 361.49, von Dr. G. A. de Vries aus einem Schilfer eines Fingernagels isoliert.
CBS 565.63 (=C 397) von Dr. W. Gams (Kiel-Kitzeberg) aus dem Erdboden isoliert.

Da die Ascomata oft mit einer kleinen Papille versehen sind, könnte dieser Pilz mit gleichem Recht auch als *Sporormia fleischhakii* Auersw. eingereiht werden (vgl. Jensen, 1912; Truszkowska, Pudelko, & Moreau, 1966). Von den in der Synonymie angeführten Namen konnte nur von *Sporormia pollacci* die Typuskultur untersucht werden. Mehrere andere Kulturen waren als *Sporormia fasciculata*, *Sporormia montana* oder *Preussia vulgare* bestimmt worden. Die letztgenannte Art sollte sich nach Cain (1961) durch schmälere Ascosporen unterscheiden. Bei der betreffenden Kultur (CBS 565.63) wurden sie 26–33 × 5.5–6.5 μ gross gefunden. Bei den andern Kulturen waren sie 6–7.5 μ breit.

4. **Sporormia aemulans** (Rehm) v. Arx, *comb. nov.*—Taf. 17, Fig. 7–9

Ohleria aemulans Rehm *in* Annls mycol. **10**: 392. 1912 (Basionym). — *Sporormia leporina* Niessl var. *aemulans* (Rehm) Höhn. *in* Sber. Akad. Wiss. Wien (Math.-naturw. Kl., I) **122**: 286. 1913.

Der Pilz bildet in Reinkultur ein helles, später dunkel werdendes Substratmycel, das sich bei 24° C auf Haferagar je nach Stamm täglich um 1.7–2.1 mm ausbreitet. Durch ein im Mycel entstehendes, in den Nährboden diffundierendes Pigment erhält dieser oft eine rote Farbe. Auch bei aus einer einzigen Sporenzelle erhaltenen Kulturen bildet der Pilz auf geeigneten Nährböden erneut Ascomata mit reifen Asci; er ist demnach homothallisch.

Die dem Substratmycel oberflächlich aufsitzenden Perithecien sind kugelig, meist etwas niedergedrückt, oben flach und kahl, glatt und erreichen einen Durchmesser von 260–540 μ. Ihre Wand besteht unten und seitlich aus 1–2 Lagen von dickwandigen, braunen Zellen, nach innen folgen einige Schichten von dünnwandigen, hyalinen Zellen. Im flachen Scheitel ist die Wand dünner, kleinzelliger und diese Stelle ist von einem Ringwulst von dunkleren Zellen umgeben. Bei der Reife bildet sich hier durch Autolyse eine oft unregelmässige Mündung. Die wandständigen, parallel nebeneinander stehenden und gegen die Scheitelmitte gerichteten Asci sind länglich keulig oder fast zylindrisch, 110–140 μ lang (wovon 15–25 μ auf den Stiel fallen) und 12–15 μ breit. Sie enthalten je acht Ascosporen und haben eine ziemlich dicke, deutlich zweischichtige Membran. Die Ascosporen sind länglich, beidendig verjüngt und dann abgerundet, vierzellig, bei den Querwänden nur schwach eingeschnürt, derbwandig, braun und 28–35 × 5–7 μ gross. Jede Zelle hat einen Keimspalt. Erst bei völliger Reife ausserhalb der Asci zerfallen die Sporen gelegentlich in die Einzelzellen.

Der Pilz hat eine Konidienform. Im Innern von kugeligen, hellbraunen, 55–115 μ grossen, mit einer Mündung versehenen Pyknidien entstehen an wandständigen Sporenmutterzellen ellipsoidische oder unregelmässig kugelige, hyaline, 2–3 μ grosse, zartwandige Blastosporen.

Untersuchte Kulturen:
CBS 405.54, von Dr. H. Swart aus Mangroven-Erde von der Insel Inhaca (Mozambique) isoliert.

CBS 405.52, aus ruhenden Knospen eines Apfelbaumes isoliert, vom Laboratorium einer chemischen Industrie in Basel empfangen.
CBS 479.62, aus faulendem Holz isoliert, von Dr. W. Liese in München empfangen.
CBS 564.63, von Ir. J. H. van Emden (Wageningen) aus dem Erdboden isoliert.
CBS 563.63 (= C 88), CBS 122.66 (= C 159), CBS 123.66 (= C 723), alle von Dr. W. Gams (Kiel-Kitzeberg) aus dem Boden eines Weizenfeldes isoliert.

Dieser Pilz scheint ein nicht seltener Bodenbewohner zu sein; bisher wurde er aber stets mit *Sporormia leporina* Niessl identifiziert. Unter diesem Namen wurde der Pilz von Arnold (1928) und von Morisset (1963) zu zytologischen und entwicklungsgeschichtlichen Untersuchungen verwendet.

Sowohl von *Ohleria aemulans* wie von *Sporormia leporina* konnten Proben des Originalexemplares aus dem Herbar des Naturhistorischen Reichsmuseums in Stockholm untersucht werden. Vor allem in der Grösse der Ascosporen stimmen die beiden Arten überein und wurden daher bisher miteinander verwechselt (vergleiche von Höhnel, 1913). *Sporormia leporina* unterscheidet sich aber von *Ohleria aemulans* (= *Sporormia aemulans*) durch flaschenförmige, mit einer zylindrischen Mündung versehene Ascomata und durch die Ascosporen, die unten breit abgerundet, oben aber deutlich spitzlich verjüngt sind (Taf. 17, Fig. 10, 11), ferner durch die fehlende Konidienform. Reinkulturen von *Sporormia leporina* konnten nicht untersucht werden: wahrscheinlich ist der Pilz nur coprophil.

Die Konidienform von *Sporormia aemulans* stimmt weitgehend mit derjenigen von *Westerdykella dispersa* überein.

5. SPORORMIA AEMULANS var. OSTIOLATA v. ARX, *var. nov.*

Perithecia botuliformia, nigro-brunnea, ostiolata, 250–350 μ diam., 360–520 μ alta. Asci paralleles, contigui, clavati vel cylindracei, bitunicati, octospori, 110–140 × 12–15 μ. Ascosporae cylindraceae vel subclavatae, basim obtusae, 3-sepatae, crasso tunicatae, brunneae, 28–35 × 5–7 μ, cellulis germinationis fissura praeditis. — Typus cultura CBS 120.66 ex terra agricola, Kiel-Kitzeberg, Germania, a W. Gams (C 513) isolata.

In allen Kulturmerkmalen stimmt diese Varietät völlig mit der Grundart überein. Gelegentlich haben die Ascomata ebenfalls einen flachen Scheitel, häufiger sind sie jedoch flaschenförmig und bilden eine scheitelständige, stumpf kegelförmige, 140–200 μ hohe Mündung. Bei einem Durchmesser von 255–350 μ erreichen sie dann eine Höhe von 360–520 μ. Die Asci stimmen völlig mit denen der Grundart überein. Bei den Ascosporen ist die obere Zelle oft etwas kürzer als die andern und breit abgerundet. Die unterste Sporenzelle ist deutlich verjüngt.

Die Konidienform stimmt völlig mit derjenigen der Grundart überein.

Untersuchte Kulturen:
CBS 120.66 (= C 513), von Dr. W. Gams (Kiel-Kitzeberg) aus dem Erdboden isoliert (Typus).
CBS 523.50, von Dr. F. Cain (Canada) aus dem Erdboden isoliert.

6. SPORORMIA SUBTICINENSIS Mout.—Taf. 17, Fig. 12

Sporormia subticinensis Mout. *in* Bull. Soc. r. Bot. Belg. **36** (C.r. 2): 14. 1897.

Auf Haferagar bildet der Pilz ein dichtes, oft filziges, graugrünes Luftmycel.

Die tägliche Ausbreitung des Mycels bei 24° C beträgt 1.3–1.5 mm. Der Agarboden verfärbt sich vorerst rotviolett, später violettschwarz. Die Art ist homothallisch; Einsporkulturen bilden erneut Ascomata.

Die im Luftmycel nistenden und mit der Basis dem Nährboden eingewachsenen, bei der Reife jedoch hervorragenden Perithecien sind kugelig oder breit flaschenförmig, haben eine kurze, dicke Mündung und erreichen bei einer Höhe von 250–440 μ einen Durchmesser von 230–350 μ. Die schwarze, oben kahle, undurchsichtige Wand besteht aussen aus dunklen, ziemlich dickwandigen Zellen. Die der Fruchtkörperbasis entspringenden, meist nicht zahlreichen Asci haben einen kurzen Stiel, sind zylinderisch keulig, messen 140–190 × 19–22 μ und haben eine doppelte, nach oben etwas verdickte Membran. Sie enthalten je acht zylindrische, meist achtzellige, bei den Septen tief eingeschnürte, hellbraune, 62–75 × 9–12 × grosse Ascosporen. Diese zerfallen leicht in die Einzelzellen, die kurz zylindrisch oder fast isodiametrisch sind. Jede Zelle ist mit einem Keimspalt versehen. Gelegentlich fehlen die Septen teilweise, dann sind die Ascosporen zum Beispiel vierzellig und die Einzelzellen sind dann ungefähr doppelt so lang als breit.

Untersuchte Kulturen:

CBS 124.66 (= C 160) und CBS 125.66 (= C 1103), beide von Dr. W. Gams (Kiel-Kitzeberg) aus dem Erdboden isoliert.

Von *Spororma subticinensis* konnte das Originalexemplar aus dem Herbar des botanischen Gartens in Brüssel nachuntersucht werden. Der in einem dichten Rasen auf einem Stück Holz wachsende Pilz ist gut entwickelt. Die Ascomata, Asci und Ascosporen stimmen völlig mit denen der oben beschriebenen Reinkulturen überein.

Der erst kürzlich von Nicot & Rouch (1966) als *Spororma perplexans* beschriebene, in Frankreich aus dem Erdboden eines Weinberges isolierte Pilz steht *Spororma subticinensis* nahe und wird damit zu vereinigen sein. Wie die Nachprüfung der Typuscultur (CBS 155.67) zeigte haben die Zellen der Ascosporen einen Keimspalt, und die derbe, doppelte Membran der Asci schwillt in Lactophenol stark auf.

7. WESTERDYKELLA DISPERSA (Clum) Cejp & Milko

Pycnidiophora dispersa Clum *in* Mycologia **47**: 900. 1955. — *Preussia dispersa* (Clum) Cain *in* Can. J. Bot. **29**: 1645. 1961. — *Westerdykella dispersa* (Clum) Cejp & Milko *in* Česká Mykol. **18**: 83. 1964.

Westerdykella semeonovii Milko *in* Novit. syst. Pl. non. vasc. **1965**: 124. 1965.

Auf Haferagar bildet diese Art nur wenig Luftmycel und dieses ist locker und hell. Der tägliche Zuwachs bei 24° C beträgt je nach Stamm 2.6–4.5 mm. Die mit der untern Hälfte im Nährboden nistenden Ascomata sind kugelig oder etwas abgeflacht, glatt, kahl, schwarz und haben einen Durchmesser von 180–600 μ. Ihre Wand besteht aus mehreren Lagen von abgerundet eckigen Zellen; zuäusserst sind diese dunkel- und derbwandig, innen sind sie hell und zart. Die unregelmässig liegend das Innere erfüllenden Asci entstehen auf ascogenen Hyphen über einer Hakenzelle und reifen zuerst im Zentrum. Sie sind kugelig oder breit keulig, 12–17 μ lang und 10–14 μ breit. Ihre Membran ist zart und sie enthalten bis zu 32 kurz zylinderische oder würstchenförmige, hellbraune, zwei Vakuolen enthaltende, 3–5 μ lange und 2–2.5 μ breite Ascosporen. Nur selten kommen grössere, bis zu 10 μ lange Sporen vor.

Die Pyknidien entstehen gleichzeitig mit den Ascomata, sind aber oft früher reif.

Sie sind kugelig oder breit flaschenförmig, haben eine helle oder dunkele, im Scheitel von einem Mündungsporus durchbohrte Wand und ihr Durchmesser beträgt 60–100 μ. In ihnen entstehen an wandständigen Sporenmutterzellen ellipsoidische oder eiförmige, einzellige, farblose, 3–4.5 × 1.8–2.5 μ grosse Blastosporen.

Untersuchte Kulturen:

CBS 297.56, Typuskultur von *Pycnidiophora dispersa*.

CBS 390.61, in Cambodja aus dem Erdboden isoliert, von Madame J. Nicot empfangen.

CBS 319.65, Typuskultur von *Westerdykella semeonovii*.

CBS 156.67, in Nigeria aus dem Erdboden isoliert, von Dr. S. O. Alasoadura empfangen.

Die verschiedenen Stämme weichen in ihren makroskopischen Merkmalen teilweise voneinander etwas ab, stimmen aber mikroskopisch miteinander überein. Die Pyknidien haben teilweise eine helle, teilweise eine dunkle Wand. Bei einigen Stämmen wurden nur sporadisch Ascomata gefunden, dagegen sehr reichlich die Konidienform. In der Typuskultur von *Pycnidiophora dispersa* wurden dagegen fast nur Ascomata gefunden (vgl. auch Clum, 1955; Cejp & Milko, 1964; Milko, 1965).

8. WESTERDYKELLA MULTISPORA (Saito & Minoura) Cejp & Milko

Anixiopsis multispora Saito & Minoura *in* J. Ferment. Technol., Osaka **26**: 3. 1948. — *Pseudeurotium multisporum* (Saito & Minoura) Stolk *in* Antonie van Leeuwenhoek **21**: 71. 1955. — *Preussia multispora* (Saito & Minoura) Cain *in* Can. J. Bot. **39**: 1646. 1961. — *Westerdykella multispora* (Saito & Minoura) Cejp & Milko *in* Česká Mykol. **18**: 84. 1964. — *Pycnidiophora multispora* (Saito & Minoura) Thompson & Backus *in* Mycologia **58**: 654. 1966.

Auf Haferagar wächst diese Art bei 24° C etwas langsamer als die vorige und die Ascomata benötigen zu ihrer Entwicklung eine längere Zeit. Reif sind sie kugelig oder etwas unregelmässig, glatt, schwarz, mündungslos und haben einen Durchmesser von 90–360 μ. Die kugeligen oder breit keuligen Asci haben eine dünne Membran, sind 16–26 × 9–15 μ gross und enthalten 32 kurz zylinderische, oft etwas gebogene, hellbraune, 4–6 × 2.5–3.5 μ grosse Ascosporen. Gelegentlich enthalten die Asci weniger Sporen und dann sind diese teilweise 8–10 μ lang, sehr selten 14–16 μ lang und dann 3–4 μ breit.

Untersuchte Kulturen:

CBS 391.51 und CBS 329.52, beide aus Japan empfangen, eine von Kominami, die andere vom Institut für Fermentation in Osaka. Bei beiden handelt es sich wahrscheinlich um Typuskulturen. Ferner konnten in Südafrika und Nigeria aus dem Erdboden isolierte Stämme verglichen werden. Bei diesen entwickelten sich die Ascomata nur spärlich und waren grösstenteils steril.

Westerdykella multispora steht *W. dispersa* sehr nahe und lässt sich eigentlich nur durch die fehlende Pyknidienform unterscheiden. Die Art wurde erst kürzlich von Thompson & Backus (1966) und besonders ausführlich von Chadefaud, Parguey-Leduc, & Boudin (1966) in entwicklungsgeschichtlicher und morphologischer Hinsicht besprochen. Wie eine Nachprüfung der betreffenden Kultur zeigte, haben die letztgenannten Autoren jedoch mit einem nur spärlich die Konidienform bildenden Stamm von *Westerdykella dispersa* gearbeitet.

Zu *Westerdykella* zu stellen und möglicherweise von *W. multispora* nicht zu unterscheiden sind die folgenden als *Preussia* beschriebenen Arten:

Preussia purpurea Cain *in* Can. J. Bot. **39**: 1647. 1961;
Preussia indica (Chattup. & Das Gupta) Cain *ibid.*;
Preussia aurantiaca Rai & Tewari *in* Proc. Indian Acad. Sci. (B) **7**: 45. 1962;
Preussia globosa Rai & Tewari *ibid.*

Von diesen Arten konnte nur von *Preussia globosa* eine Typuskultur untersucht werden und in dieser war der Pilz stark degeneriert. Alle nachgeprüften Fruchtkörper erwiesen sich als steril.

LITERATUR

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ERKLÄRUNGEN DER TAFELN 16–18

TAFEL 16

Fig. 1, 2. *Preussia funiculata.* — 1. Schnitt durch ein Ascoma. — 2. Ascospore.
Fig. 3, 4. *Preussia fleischhakii.* — 3. Asci. — 4. Ascosporen. (Vergr. Ascoma 260 ×, Asci und Ascosporen 1000 ×.)

TAFEL 17

Fig. 5, 6. *Preussia isomera.* — 5. Asci. — 6. Ascosporensegmente.
Fig. 7–9. *Sporormia aemulans.* — 7. Schnitt durch ein Ascoma. — 8, 9. Ascosporen.
Fig. 10, 11. *Sporormia leporina*, Ascosporen (vom Typusmaterial).
Fig. 12. *Sporormia subticinensis*, Ascospore. (Vergr. Ascoma 260 ×, Asci und Ascosporen ca. 1000 ×).

TAFEL 18

Fig. 13, 14. *Sporormia minima.* — 13. Asci. — 14. Medianschnitt durch ein Ascoma. (Vergr. Ascoma 750 ×, Asci ca. 1000 ×).

PERSOONIA
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STUDIES IN CUP-FUNGI—I

R. A. Maas Geesteranus
Rijksherbarium, Leiden

(With 18 Text-figures)

In the present paper four species are chosen at random for closer study. *Melastiza rubra* is proposed as a new combination, *Peziza limnaea* as a new name and species.

This is the first instalment of a series intended to accommodate miscellaneous observations on Ascomycetes.

For information concerning or loan of material I am greatly indebted to the Directors of the following herbaria: 'Botanisch Laboratorium, Afd. Plantensystematiek', Groningen (GRO), The Herbarium, Kew (K), and 'Muséum National d'Histoire Naturelle, Laboratoire de Cryptogamie', Paris (PC).

The material of one of the species dealt with here was found during a collecting trip in the northwestern part of India. This journey was made possible by a grant from the 'Netherlands Organization for the Advancement of Pure Research (Z.W.O.)'.

Melastiza rubra (Batra) Maas G., *comb. nov.*—Figs. 1–6

Aleuria rubra Batra *in* Mycologia **52**: 526, figs. 1–3. 1960 [1961]; *apud* L. R. Batra & S. W. T. Batra *in* Kansas Univ. Sci. Bull. **44**: 135. 1963. — Type locality: India, Uttar Pradesh, Mussoorie.

Apothecia gregarious, up to 25 mm across, discoid, centrally attached. Disc orbicular, scarlet. Receptaculum covered with minute hairs, orange-red except at the margin which is brown. Hairs scattered over the surface and faintly coloured, more densely clustered and dark brown towards the margin, sometimes arranged in streaks. Excipulum made up of textura angularis, the outer cells of which have moderately thickened, yellowish cell walls. Hairs arising from the outer cells (Figs. 1–3), up to 70 μ long, 7–10 μ wide, flexuous or curved, unbranched, septate, moderately thick-walled, with blunt apex, yellowish except towards the margin of the apothecium where they are yellow-brown. Asci 225–245 × 11–12 μ, cylindrical, 8-spored, not stained in Melzer's reagent (Fig. 4). Spores (measured without ornamentation) 12.5–14.3 × 6.7–7.4 μ, ellipsoid, heavily ornamented, colourless, with two large oil drops; ornamentation consisting of a strongly raised reticulum, which at the poles may reach a height of 2.7–4 μ (Fig. 5). Paraphyses 2–2.5 μ wide below, septate, filled with orange granules, the apex swollen up to 5–6 μ (Fig. 6).

Habitat.—On bare loamy soil of road-side, exposed, 2000 m alt.

Material examined.—India: Uttar Pradesh, Mussoorie, near Charleville, 13 Sept. 1964, *R. A. Maas Geesteranus 14519* (L).

The characters indicated above cleary identify this species as a member of *Melastiza*. *Melastiza* is a small genus, but a growing one and the distinction of its species may cause difficulties. The following key is mainly based on the data taken from literature (Graddon, 1961: 609, fig. 3a; Le Gal 1947: fig. 52 and 1958: 151, 152, fig.).

KEY TO THE SPECIES RECOGNIZED IN MELASTIZA

1. Ornamentation of the spores consisting of coarse warts, with a low and often very incomplete reticulum between the warts.
   2. Spores up to 21 μ long (measured without ornamentation).
      3. Spores 6–9 μ broad . . . . . *M. greletii* Le Gal
      3. Spores 9.5–12.5 μ broad . . . . . *M. boudieri* (Höhn.) Le Gal
   2. Spores 23–28 μ long (measured without ornamentation). . . . *M. scotica* Graddon
1. Ornamentation of the spores consisting of a conspicuous reticulum.
   4. Spores under 15 μ long, reticulum strongly raised (Fig. 5) . *M. rubra* (Batra) Maas G.
   4. Spores over 15 μ long, reticulum low (Fig. 7) . . *M. chateri* (W. G. Smith) Boud.

Batra (l.c.) recorded the spores as "(18–)24–26(–28) × 10–13 μ reticulis inclusis . . ." This is an unusual and unfortunate way of measuring the spores considering that the ornamentation forms no part of the spore-body proper. However, from his drawings it is possible to estimate the spore size as approximately 11–12 × 6.5 μ, which is well in agreement with the measurements given above.

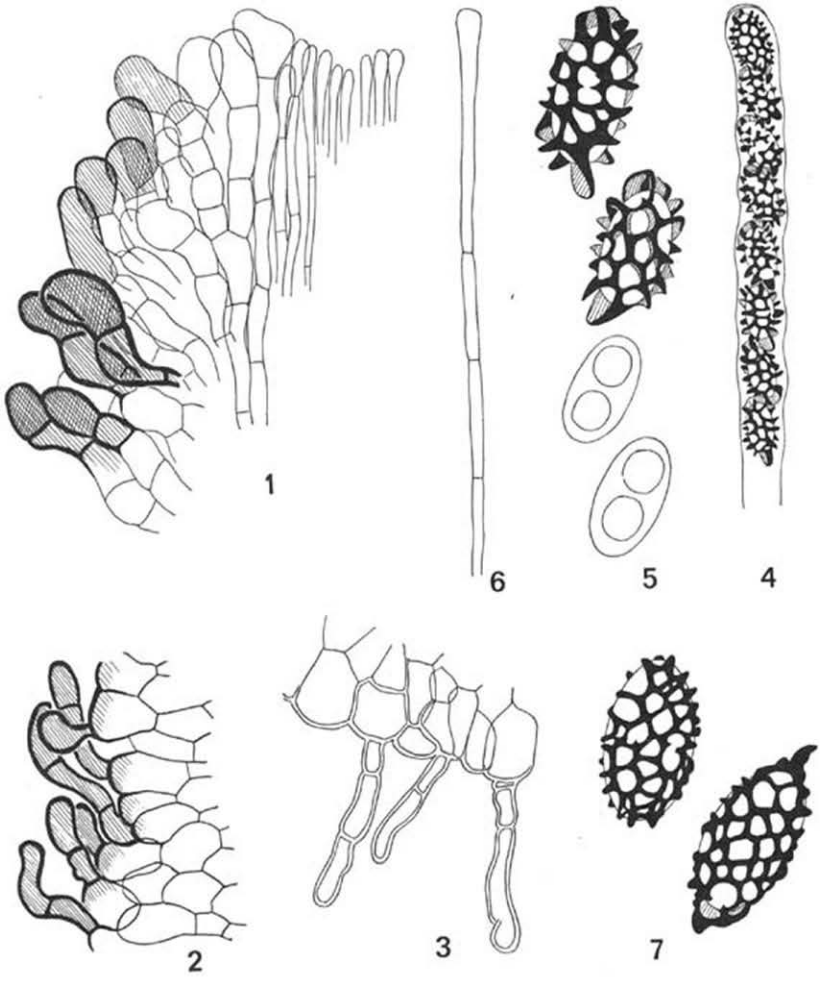
Denison (1963: 109) recorded a find of what he called *Aleuria rubra* from Costa Rica. It is not clear from his description, which lacks information about the surface of the receptacle, whether his specimens are actually referable to *Melastiza*. However, to judge from the spores illustrated in his Fig. 9, it seems safe to conclude that at all events his material is not conspecific with *M. rubra*.

Very likely the size of the spores and their ornamentation are not the only features by which the species can be told. The colour of the disk and the excipular hairs, as indicated by Graddon, may well prove useful as differential characters.

OMBROPHILA VIOLACEA Fr.—Figs. 8–13

Peziza clavus var. *violascens* Alb. & Schw., Consp. Fung. 306. 1805; *ex* Pers., Mycol. eur. 1: 322. 1822; Fr., Syst. mycol. 2: 138. 1822. — *Ombrophila violacea* Fr., Summa Veg. Scand. 357. 1849. — Type locality: Germany, Oberlausitz, 'Moholzer Haide' and 'Schöpswiesen'.

Apothecium up to 4 mm across, at first stipitate, but stipe becoming less apparent with age, finally disappearing and receptaculum centrally attached to the substratum. Disc lilaceous to violaceous, becoming vaulted and wrinkled with age, which makes the fungus resemble a *Tremella* (Fig. 8). Receptaculum glabrous, concolorous with the disc or paler to whitish. Flesh soft, aqueous-gelatinous, made up of loosely interwoven hyphae (Fig. 9); hyphae anastomosing, branched, septate, narrow, 4–6 μ wide, thin-walled, embedded in a gelatinous matrix, more closely spaced toward the excipulum. Excipulum made up of closely coherent, very large and inflated hyphae, measuring 60–200 × 8–24 μ, which are thin-walled, and parallel to the surface (Fig. 10). Asci 80–90 × 6–8 μ, 8-spored, the pore blue in Melzer's reagent (Fig. 11). Spores 9.0–10.7 × 4.2–5.4 μ, obliquely 1-seriate in the



Figs. 1–6. *Melastiza rubra*. — 1. Excipular cells and dark hairs near margin, × 400. — 2. Excipular cells and hairs farther down the receptacle, × 400. — 3. Excipular cells and hairs as they appear in the greater part of the receptacle, × 400. — 4. Ascus, × 600. — 5. Immature and mature spores, × 1400. — 6. Paraphysis, × 600. (*Maas Geesteranus 14519*, L)
Fig. 7. *Melastiza chateri*. Two mature spores, × 1400. (Dutch material, L)

ascus, ellipsoid-fusiform, 1-celled, smooth, colourless, with two oil drops (Fig. 12). Paraphyses 1–1.5 μ wide, unbranched (?), filled with oily matter, 1.8–3.0 μ wide above (Fig. 13).

HABITAT.—On decayed wood, bark, and vegetable debris in Alnetum.

MATERIAL EXAMINED.—NETHERLANDS: Noord-Holland, 's-Graveland, 'Schaep en Burgh', 8 & 9 Nov. 1965, *J. Daams* (L); Kortenhoef, 12 Nov. 1965, *J. Daams* (L).

Ombrophila violacea is a small and inconspicuous species that grows in damp, uninviting places. It is reputed to be rare, but once its environmental requirements are understood it may well prove to be "per totum territorium frequens" (Velenovský, 1934: 106).

von Höhnel (1918a: 350; 1918b: 584) and Seaver (1951: 232) have dealt at some length with the confusion concerning the author's citation of the present species and its alleged relation to some other species. I need not enlarge further upon this point.

Collections and good descriptions of the species seem to be equally rare. The only good description of recent date that I know of has been published by Dennis (1956: 163), but one would have welcomed a figure. The chief purpose of the present note is to provide such one figure.

Oudemans (1902: 686) recorded *Ombrophila violacea* from Valkenburg (prov. Limburg), collected by J. Rick S.J., October 1900, on decayed wood of *Salix*. The record lacks a description but Rick's collection is still in existence (herb. Oudemans, GRO). Although it is in poor condition and probably immature, some of its features seem to indicate that Oudemans identified the material correctly. In my opinion, however, it is too unsatisfactory to be used for further reference.

A species that on account of its violaceous colour might be taken to be related is *Ombrophila palumbina* Malençon (1927: 98, fig. 3, pl. 6 figs. 11–13). However, the similarity is only superficial for it differs from *O. violacea* in that the ascus pore remains unstained in iodine and the spores are said to be "sans globules internes." Very probably the species is not even congeneric.

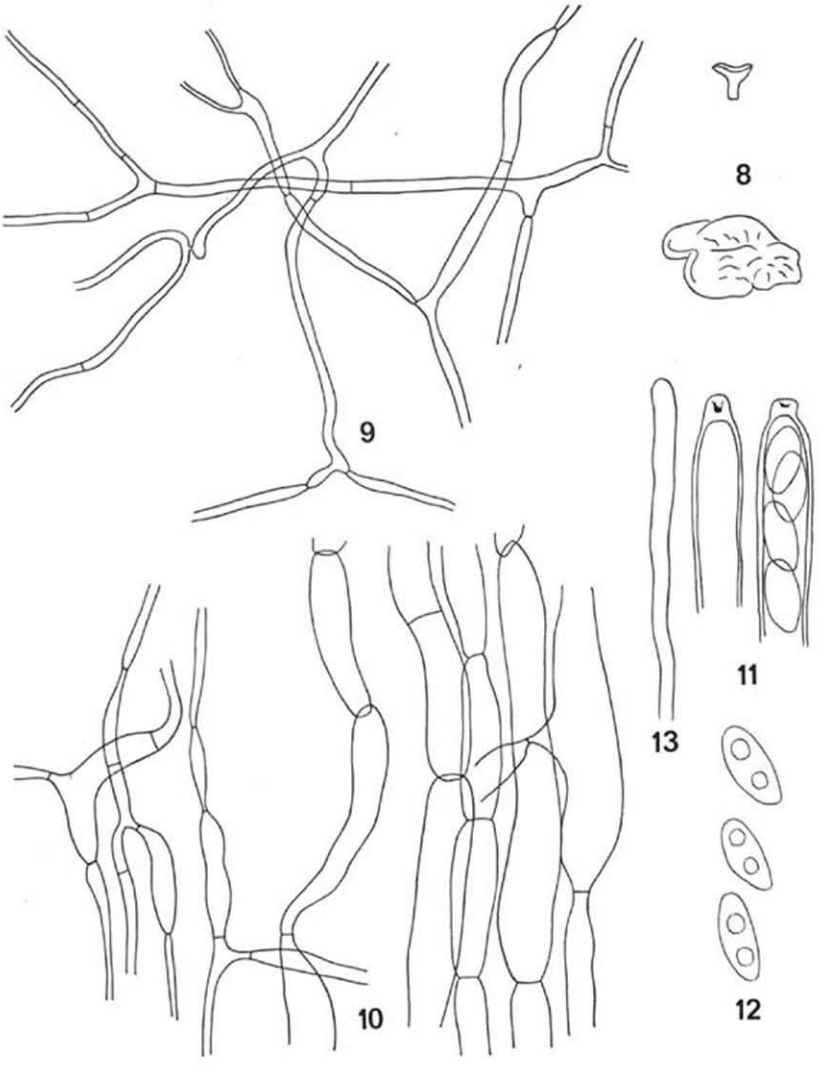
PEZIZA ANTHRACINA Cooke—Figs. 14, 15

Bulgaria carbonaria Fuck., Fungi rhen., No. 1137. 1865. — *Plicaria carbonaria* (Fuck.) Fuck. *in* Jb. nassau. Ver. Naturk. **23–24**: 326, pl. 4 fig. 35. 1870. — *Peziza* (*Humaria*) *anthracina* Cooke, Mycogr. 235, pl. 111 fig. 396. 1878 (name change); not *Peziza carbonaria* Alb. & Schw. *ex* Pers., Mycol. europ. **1**: 228. 1822. — *Barlaea anthracina* (Cooke) Rehm *in* KryptFl. Deutschl., Zweite Aufl., **1**(3): 934. 1894; Sacc., Syll. Fung. **11**: 396. 1895. — Type collection: Fuckel, Fungi rhen., No. 1137 (K).

Plicaria trachycarpa var. *muricata* Grelet *in* Bull. Soc. bot. Centre-Ouest 44. 1937 (not validly published, lacking a Latin description). — *Galactinia muricata* (Grelet) Le Gal *in* Bull. Soc. mycol. Fr. **78**: 212. 1962 (not validly published). — Type locality: France, surroundings of Savigné.

MISAPPLIED NAME: *Plicaria anthracina* (Cooke) Boud., Hist. Class. Discomyc. Eur. 50. 1907; Icon. mycol., Livr. 19, No. provis. 371. 1908 (= **2**: pl. 307; **4**: 170).

Cupulis lato-obconicis turbinatisve, substipatis, 1–2‴ latis, extus pulveraceis, fuscis; disco



Figs. 8–13. *Ombrophila violacea.* — 8. Two apothecia, the smaller one in section, × 5. — 9. Hyphae of the flesh, branched in every direction, loosely interwoven, and embedded in gelatina, × 600. — 10. Hyphae of the excipulum, predominantly longitudinal, coherent, not embedded in a gelatinous matrix, on the left passing into hyphae of the flesh, × 600. — 11. Asci, × 1400. — 12. Spores, × 1400. — 13. Paraphysis, × 1400. (Netherlands, 's-Graveland, collection of 8 Nov., L)

plano, nitido, atro-fusco, gelatinoso-elastico, margine elevato; ascis cylindraceis, stipatis, amplis, 8 sporis; sporidiis globosis, hyalinis, paraphysibus mixtis.

In carbonariis humidis, rarissime. Autumno. In sylva Hostrichiensi.

The above is the original description which accompanied Fuckel's exsiccate. It was in its essentials copied by Cooke, but this author after having studied his copy of the exsiccate added a few characteristic details from his own observation. To Cooke's description the following observations may be added, which I made on the copy of Fuckel's exsiccate preserved at Kew:—

Asci (Fig. 14) operculate, 236–245 × 18–20 μ, the apex blue in Melzer's reagent. Spores (Fig. 15) 1-seriate or zigzag in the ascus, 11.2–15 μ in diameter, colourless, ornamented with blunt spines. Paraphyses about 3 μ wide, colourless, tips united by a yellow-brown mucus.

Plicaria trachycarpa var. *muricata* Grelet has been understood as a fungus, of which the spores are ornamented with fairly slender spines. At least the spores were so pictured by Le Gal (1947: fig. 8E) and Dennis (1960: pl. II fig. D, spore on the left). This is all that can be said of Grelet's variety, for it appears that no material of the two syntypes mentioned by Grelet (collected 8 July 1914 and 24 July 1930) can be located in the herbarium at Paris. A specimen collected by someone else at a later date (1939) and annotated by Grelet with the words "caractères microscopiques de la var. *muricata*," proved on re-examination to be the common *Peziza trachycarpa* Currey. However, taking into account that there is full agreement of Grelet's description with what is now known of the type of *P. anthracina*, *Plicaria trachycarpa* var. *muricata* is here reduced to synonymy.

Re-examination of the collection, which served Boudier for the illustration of his '*Plicaria anthracina*', showed that this fungus bears no relation to *Peziza anthracina*. The asci are 8-spored and do not stain blue in Melzer's reagent. The spores (Fig. 16) are spherical, 7.6–8.5 μ diameter, colourless, and ornamented with low, sometimes stellate warts, very different from the ornamentation of the spores of *Peziza anthracina*. The material seems best referable to *Svrčekia*, a genus recently proposed by Kubička (1960: 214), but the literature has not been sufficiently searched to know whether there exists a specific description that would cover Boudier's collection.

Peziza limnaea Maas G., *nom. et sp. nov.* [1]—Figs. 17, 18

Galactinia castanea var. *limosa* Grelet *in* Bull. Soc. bot. Centre-Ouest 166. 1936 (not validly published, lacking a Latin description). — *Galactinia limosa* (Grelet) Le Gal & Romagnesi *in* Revue Mycol. **4**: 176. 1939 (not validly published). — *Peziza limosa* (Grelet) Nannfeldt *in* Lundell & Nannfeldt, Fungi exs. suec., praes. upsal., Fasc. 19–20: 46. 1941 (not validly published); not *Peziza limosa* Spreng., Syst. Veg., ed. 16, **4**(2): 335. 1827. — Type: "*Galactinia castanea* (Quélet) Boud. var. *limosa* var. nov. [crossed out and rewritten: *limosa* (Grelet) Le Gal et Romagnesi] / (purpureo-brunnea — mycelio floccoso candido insidens) / Sur le bord vaseux d'un fossé, dans la prairie de Savigné (en face de ... [illegible]), le 2 octobre 1914" (PC).

[1] Etymology: λιμναῖος, of or from the marsh.

Figs. 14, 15. *Peziza anthracina*. — Ascus with immature spores, × 400. — Two spores, the lower one presumably being the older, × 1400. (K)

Fig. 16. *Plicaria anthracina* sensu Boud. — Spore, × 1400. (Nice, leg. J. B. Barla, herb. Boudier, PC)

Fig. 17. *Galactinia castanea* var. *limosa*. — Three spores, × 1400. (Type, PC)

Fig. 18. *Peziza limnaea*. — Three spores, × 1400. (Dutch material, L)

Receptaculum sessile, concavum, initio vix cupulatum, dein expansum et interdum lobatum, 5–15 mm latum, fere hymenio concolor sed saepe tomento crasso albo obtectum, margine leviter pruinoso excepto. Hymenium obscure purpuraceo-rufo-umbrinum. Asci cylindracei, ad basin parum attenuati, octospori, 355–425 × 17–22 μ, apice iodo ope coerulescentes. Paraphyses simplices vel ad basin extremam solum divisae, septatae, apice vix incrassato 7–10 μ, interdum partibus superioribus subfulvae. Sporae ellipsoideae, initio laeves et hyalinae, dein verrucosae atque aetate fulvescentes, vulgo 2 guttulis imparilibus praeditae, interdum 1-guttatae, rarius 3-guttatae, 18–20 × 10–11 μ.

The above is the Latin translation of Grelet's description. If only Grelet had copied the few Latin words from his label, these would have validated his publication. As it is, Article 36 of the International Code (1961) dictates that *Galactinia castanea* var. *limosa* was not validly published.

Peziza limnaea is not rare in the Netherlands, where it shows greater variability than has been indicated by Grelet, and therefore it would seem a suitable occasion to redescribe the species as it presents itself in this country. It will be seen that the

spores in the indigenous material (Fig. 18) have a different ratio of length and breadth from that shown in some of the spores of the type (Fig. 17). It should be realized, however, that the latter in all probability are not mature. Most Discomycetes on drying expel their ripe spores first, and the remaining immature ones possibly fail to regain their original shape when soaked in an alkaline solution. The spores of the type were found to measure 19.7–21.5 × (9–)10.3–10.7 μ.

Receptacle sessile on a small base or with a very short stalk, up to 45 mm diameter, variable as to the nature of its surface and its colour: glabrous or finely tomentose below, furfuraceous to verrucose towards the margin; ochraceous yellow-brown, brown, olive brown, chocolate brown or dingy purplish-brown, the margin often purplish-brown; the base covered with a whitish or dingy yellowish tomentum. Flesh brownish. Hymenium often with an olive green bloom when young, soon passing into purplish-brown to dark purplish-brown, nearly black-brown in old specimens. Asci 270–400 × 11–18 μ, the apex blued in Melzer's reagent (this reaction failed to show up in the type material, probably because it had been poisoned). Spores (15–)17.9–22.4 × (8–)9–10.7 μ, with 2 equally large oil drops, or 1 large and 1 small drop; the ornamentation consisting of fairly low, irregularly shaped and often curved warts, which either have tapering spurs or become interconnected by sinuous lines or ridges, without a network being formed (Fig. 18). Paraphyses 3–5 μ wide, colourless, gradually widened to a clavate apex, 6–9 μ, with yellowish contents.

On damp mud in swampy, well-wooded areas, and in muddy banks in deep shade.

MATERIAL EXAMINED. — NETHERLANDS:

Overijsel, Denekamp, Borchbos, 14 Oct. 1961, *C. Bas 2508* (L).

Gelderland, Baak, 6 Sept. 1953, *H. S. C. Huijsman* (L); 's-Heerenberg, Bijvank, 6 Sept. 1953, *H. S. C. Huijsman* (L); Elten - Stokkum, 8 July 1952, *H. S. C. Huijsman* (L); Vorden, 29 Sept. 1957, *E. Kits van Waveren* (L).

Utrecht, Oud-Loosdrecht, 17 Oct. 1963, *J. Daams* (L).

Zuid-Holland, Oegstgeest, 28 Aug. 1961, *M. A. Donk* (L).

Noord-Brabant, Strijbeek, Goudbergven, 15 July 1959, *P. B. Jansen* (L); 18 Aug. 1959, *R. A. Maas Geesteranus 12917* (L); Zundert, Krochten, 28 June 1955, *R. A. Maas Geesteranus 10416* (L); 27 July 1955, *C. Bas 791, 792* (L).

Möller (1958: 108) reported the occurrence of the present species in the Faeroes, where it was found to grow under conditions that do not seem particularly wet. The climate in these islands, however, is more humid than in The Netherlands, whilst their mean temperature in the warmest month, July, is many degrees lower than in this country.

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PERSOONIA
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NOTES ON SOME DUTCH CLADONIAE (LICHENES)

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Cladonia crispata (Ach.) Flot. var. *subcrispata* Hennipm., var. nov. is described, which shows the P + reaction. *Cladonia subrangiformis* Sandst. is reduced to a varietal state under *C. furcata*, and *C. delicata* (Ehrh.) Flörke var. *subsquamosa* Nyl. ex Leight. is transferred to *C. squamosa* (Scop.) Hoffm. as *C. squamosa* var. *allosquamosa* Hennipm., nom. nov.

While studying the species of *Cladonia* represented in the 'Rijksherbarium', some collections were found, which showed sufficient noteworthy or aberrant features as to justify the following remarks.

CLADONIA CRISPATA (Ach.) Flot.
var. **subcrispata** Hennipm., *var. nov.*

A forma typica, cui morphologice congrua, paraphenylendiamino colore rubescente diversa, ut videtur, acidum fumarprotocetraricum continens.
Netherlands (prov. Drente), Dwingelo, 1 Aug. 1941, *R. A. Maas Geesteranus 1460* (type, L).

Cladonia crispata is a member of the subsection *Chasmariae* in the subgenus *Cenomyce*. In this subsection Dahl (1952: 125) proposed two new series, ser. *Furcatae* E. Dahl and ser. *Squamosae* E. Dahl (neither of which were validly published), which he based on different morphological and chemical properties. According to him, the lichen substances thamnolic acid and squamatic acid would be characteristic of ser. *Squamosae*, whereas atronoric acid and fumarprotocetraric acid would be so of ser. *Furcatae*. However, des Abbayes (1963: 218) described from Vietnam a *Cladonia tixieri*, which is obviously related to *C. squamosa* (Scop.) Hoffm., but turns reddish with P.

The unmistakable P + reaction of the present variety, var. *subcrispata*, indicating the presence of the depsidon fumarprotocetraric acid, shows that *Cladonia tixieri* is not an isolated case. Variety *subcrispata* may be expected to give difficulties in its distinction from certain forms of *Cladonia furcata* (Huds.) Schrad.

CLADONIA FURCATA (Huds.) Schrad.
var. **subrangiformis** (Sandst.) Hennipm., *comb. nov.*

Cladonia subrangiformis Sandst. *in* Abh. naturw. Ver. Bremen **25**: 165. 1922 (basionym.) — *Cladonia furcata* (Huds.) Schrad. m. *subrangiformis* (Sandst.) Schade *in* Nova Hedwigia **11**: 293. 1966.

Cladonia furcata can be demonstrated to possess a number of different chemical

constituents. It is proposed to treat the specimens that turn reddish with P and yellow with K, signifying the presence of fumarprotocetraric acid and atronoric acid respectively, as a separate variety. The present variety is a case in point.

Des Abbayes (1937: 160) already regarded Sandstede's species as an infraspecific taxon under *C. furcata* (". . ., il ne constitue rigoureusement qu'une bonne variété de *Cl. furcata*."), but failed to make a new combination. I agree with Schade (1966: 304) that the characters of the cortex have no specific value.

The variety occurs on calcareous soil in open vegetations.

CLADONIA SQUAMOSA (Scop.) Hoffm.
var. **allosquamosa** Hennipm., *nom. nov.*

Cladonia delicata (Ehrh.) Flörke var. *subsquamosa* Nyl. *in* Flora **24**: 421. 1866 (nomen nudum); *ex* Leight., Lichen-Fl. Great Brit. 59. 1871. — *Cladonia subsquamosa* (Nyl. ex Leight.) Nyl. *ex* Cromb. *in* J. Linn. Soc. (Bot.) **17**: 560. 1880; not *Cladonia subsquamosa* Krempelh., Lich. Bras. Warm. 2. 1873; not *Cladonia squamosa* (Scop.) Hoffm. var. *subsquamosa* Nyl. ex Vain. *in* Meddn Soc. Fauna Flora fenn. **6**: 113. 1881.

This variety contains thamnolic acid that gives positive reactions in the presence of both P and K.

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PERSOONIA
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ON THE GROWTH RATE OF THE FOLIICOLOUS LICHEN STRIGULA ELEGANS

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The diametral growth rate of the foliicolous lichen *Strigula elegans* (Fée) Müll. Arg., measured under natural conditions in the African tropical rainforest, has been established to amount to (0.7–)3–3.6(–8) mm annually. As compared to the diametral growth rate of lichens from temperate regions, which are reputed to be slow growers, there is no essential difference.

In 1964, while working in the Laboratory of Hydrobiology near Yaoundé, Camerouns, I had the opportunity of studying the growth rate of the fungus component of *Strigula elegans* (Fée) Müll. Arg. Besides, I did some observations on the growth rate of the lichen thallus under natural conditions. These conditions were prevalent in a certain part of the rainforest close to the laboratory, where the leaves of the underscrub were covered with the present species.

Strigula elegans is a foliicolous subcuticular lichen commonly found in all tropical regions on leaves of various, mostly Dicotyledonous, shrubs. With some experience it is easily recognized among other foliicolous lichens by the pale or bright green, irregularly circular or asteroid blotches of up to *c.* 10 mm across, generally set with minute blackish spots, which are pycnidia or perithecia. It is not too difficult to identify the species with certainty by microscopically examining the paraphyses and ascospores in the perithecium. An extensive description of the species has been given by Santesson (1952: 160–174).

The observations were made in order to find out whether this tropical lichen has a faster growth rate than slow-growing temperate species, of which the fungus components are such slow growers in the laboratory, and whether, consequently, the fungus component of foliicolous lichens may be more suitable for physiological experiments.

There exists an extensive literature on the growth rate of temperate lichens, for the consultation of which the reader is referred to the bibliography. Unfortunately the available data are not fully comparable as the species are different in each case, while the way in which the growth rate is expressed is not homogeneous. Moreover, the climatic conditions (particularly humidity and temperature), as well as substrate and the age of the thallus, all of which are of great influence, appear to have been very different in the circumstances in which the various authors worked. Apart from all this, however, it may be summarized that the diametral growth rate of the thallus—which is the way in which the growth is most commonly expressed in literature—in temperate foliaceous and crustaceous

lichens roughly varies between 0.5–10 mm per year; the growth may be as little as 0.25–0.7 mm per year in *Rhizocarpon geographicum*, or as much as 20–30 mm in certain species of *Parmelia* and *Peltigera*.

My own observations were made during the second rainy season of the year, namely from August till November. Relative humidity in the forest was not measured, but may be taken to be fairly high. The forest was as a rule moistened daily by a shower, while the humidity readings of the meteorological service at Yaoundé during these months ranged from a daily minimum of *c.* 65 % to a daily maximum of *c.* 97 %. The altitude of Yaoundé is *c.* 700 m, while the temperature, registered by a maximum-minimum thermometer placed among the leaves, was found to vary from 15–19° C (at night) to 24–31° C (during daytime).

As suitable leaves for carrying out the experiment the more or less coriaceous leaves of *Acanthus montanus* (Acanthaceae) and *Chaetacme microcarpa* (Ulmaceae) were chosen that had recently developed to mature size and were colonized with young thalli of *c.* 0.1–1 mm across. Enlarged and accurate drawings were made of the shape and nervation of three leaves of *Acanthus* and one leave of *Chaetacme*, while the position of each of the numerous young thalli was accurately marked and numbered. The approximate sizes of the thalli were measured with the aid of a hand-lens. Three months later each thallus was measured again. Thus, the growth of 232 thalli during a period of three months was established. The data given in the table below show minimum, average, and maximum growth respectively of each group of thalli on the leaves studied converted into values for a period of one year.

TABLE I

MEASURED AND CALCULATED VALUES OF THALLUS GROWTH IN STRIGULA ELEGANS

Host	Number of thalli per leaf	Diametral thallus growth values as actually measured	Diametral thallus growth converted into 1 year values
Acanthus I	51	(0.2–)1.1(–2.4) mm/110 days	(0.7–)3.6(–8) mm
Acanthus II	70	(0.4–)0.7(–1.0) mm/86 days	(1.7–)3(–4.2) mm
Acanthus III	49	(0.2–)0.7(–1.1) mm/85 days	(0.9–)3(–4.7) mm
Chaetacme	62	(0.2–)1.0(–2.1) mm/108 days	(0.7–)3.4(–7.1) mm

After three months most thalli, all of which were sterile when measured for the first time, had developed one to several (1–10) pycnidia and/or (0–3) perithecia.

It is a well known fact that the growth of any organism, plotted in a system of co-ordinates, is represented by a curved line, the slope of which tends to diminish with time. Therefore the extrapolation of the values in the case of *Strigula elegans*

contains an element of incertitude, if not inaccuracy. On the other hand, the calculated values agree quite well with those found in nature. The maximum size of the thalli of *Strigula elegans* was found to range from 2 to 5(–10) mm (own observations, and Santesson, 1952: 162). Assuming that (i) the approximate lifetime of Dicotyledonous leaves in the tropics is about 13–14 months (Richards, 1957: 193), and (ii) the first visible thalli appear on leaves *c.* 2 months old, there is one year left for the lichen to grow and produce perithecia. Apparently, the maximum size observed in nature and the calculated growth are well in accordance with each other.

The conclusion that can be drawn from the foregoing is that the growth rate of the tropical foliicolous lichen *Strigula elegans* does not differ markedly from that of temperate lichens generally.

Thanks are due to the Director of the Forestry Department (Service des Eaux et Forêts) in the Camerouns, and to Prof. Dr. A. Quispel and Dr. R. A. Maas Geesteranus (Leiden) for assistance on various points.

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WANG, C. J. K., *Fungi of pulp and paper in New York.* (Technical Publication No. 87 of the State University College of Forestry at Syracuse University). Pp. 115, 88 text-figures, 16 text-plates. Price $ 1.75.

During the manufacture of paper living organisms may be the cause of undesirable slime deposits (consisting of bacterial colonies and fungus hyphae) in the machines. An extensive literature on this subject has accumulated and many of these fungus species have been isolated and described. The aim of Mrs. Wang's investigation is not only to determine the species and their frequency in pulp and paper mills in New York State, but also to provide a compendium describing and illustrating the fungus species in order to facilitate their recognition by workers in this field of microbiology and mycology.

Following a "Review of Literature" and a chapter on "Materials and Methods" there is a chapter entitled "Results and discussion". The bulk of the contents, however, consists of the isolated species: Phycomycetes (8 species), Ascomycetes (6), Basidiomycetes (8), Fungi imperfecti (86), and Actinomycetes (7). Of each species at least one and very often many cultures were studied. The descriptions of the colonies are clear and in conjunction with the illustrations they should enable future workers to recognize the species described. To this *Penicillium* forms an exception since no descriptions and illustrations of this genus are given; Raper & Thom's manual on the genus is referred to. With a few exceptions the photographs reproduced on the text-plates are of cultures on plates. A lengthy bibliography is added.

As is becoming more and more usual in North American monographs treatment of separate species lacks any references to descriptions and illustrations by other authors although these are widely found in the literature. In so far as these contain supplementary details and additional figures they may be of importance in furthering understanding of the taxa.

This 'Flora' will undoubtedly prove very useful since within recent times no other so comprehensive a survey on the subject has been published.

M. A. DONK

M. F. MADELIN (Ed.). *The Fungus Spore.* Proceedings of the 18th symposium of the Colston Research Society (Bristol, 1966) (Butterworths, London, 1966). Pp. 338, illustrated. Price £ 6.—.—.

The part played by fungus spores in the variation, dispersal and survival of fungi is of major significance not only for mycologists, but also for physiologists, systematists, biochemists, cystologists, geneticists, and plant pathologists. It was therefore an

excellent idea to bring a group of scientists together in the above-mentioned symposium to elucidate the various aspects of spores and phenomena related to them.

The proceedings of the symposium contain 24 articles; these can be divided roughly into four groups. Leaving out of consideration the introductory article the four groups are as follows:

1. Initiation and structure of spores. The first article of the six in this group deals in a general way with the genesis of spores of higher fungi and furnishes an excellent outline of the subject. This article is of special interest to the systematists. The other articles refer to research on species or small systematic groups, belonging for the most part to the Phycomycetes. It is striking that the electron microscope is becoming increasingly important in morphological and structural studies.
2. Liberation and dispersal of spores. The main article of the four under this heading deals with the violent discharge of spores. The explosive ascus, the ballistospore and discharge in conidial fungi, including the Phycomycetes, are treated. The other articles deal with air and water dispersal, with special reference to funig of economic importance.
3. Morphology, physiology and biochemistry of spore germination. No less than nine articles are devoted to this topic. Two of the articles refer to morphological and anatomical changes during germination and to the assessment of germination. The other articles treat of the orientation of zoospores and germ tubes, chemical factors in the germination of the spores of Basidiomycetes, respiration and spore germination, biosynthetic processes in germinating spores, types of dormancy as represented by conidia and ascospores of *Neurospora*, the effects of sterols and light on the production and germination of *Phytophthora* spores, and the germination *in vitro* of conidia of powdery mildew fungi. The articles of this group contain a considerable amount of very interesting and entirely new information. It is evident that fungus spores offer an excellent medium for physiological and biochemical studies.
4. Applied aspects. The first two articles of this group discuss the interaction of spores with fungicides; they are closely related to the preceding group. The following two articles deal with epidemiological aspects of spores and treat of spores as propagules of (plant) disease as well as spores in allergies and mycoses of men and animals.

As already indicated, this publication has a wide scope and gives an excellent survey of many aspects of the fungus spore. It must be admitted, however, that one important aspect has been omitted: the significance of the fungus spore in taxonomy. Furthermore it should be borne in mind that as this publication presents the proceedings of a symposium it does not cover adequately every detail of the various subjects treated. Nevertheless the book is strongly to be recommended. The layout is very good and the numerous figures, which are clearly printed, are clear and instructive.

A. J. P. OORT

INDEX

New names are in **bold-face** type. Subdivisions of genera are indicated by the sign §, illustrations by an asterisk (*).

N.B.—Of the "Check list of European hymenomycetous Heterobasidiae", Pages 151-207 are indexed on Pages 303-335; other names included in the „Alphabetical index" on Pages 303-335 are also not indexed below.


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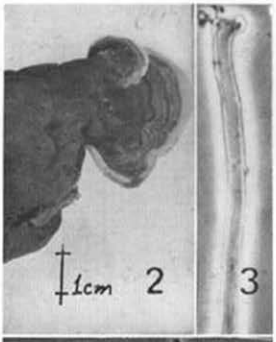
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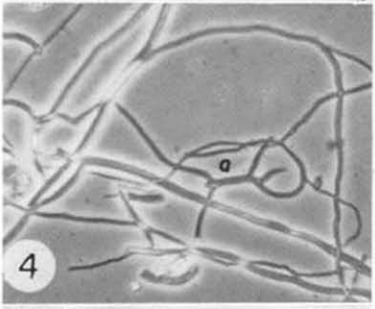
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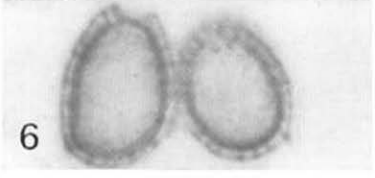
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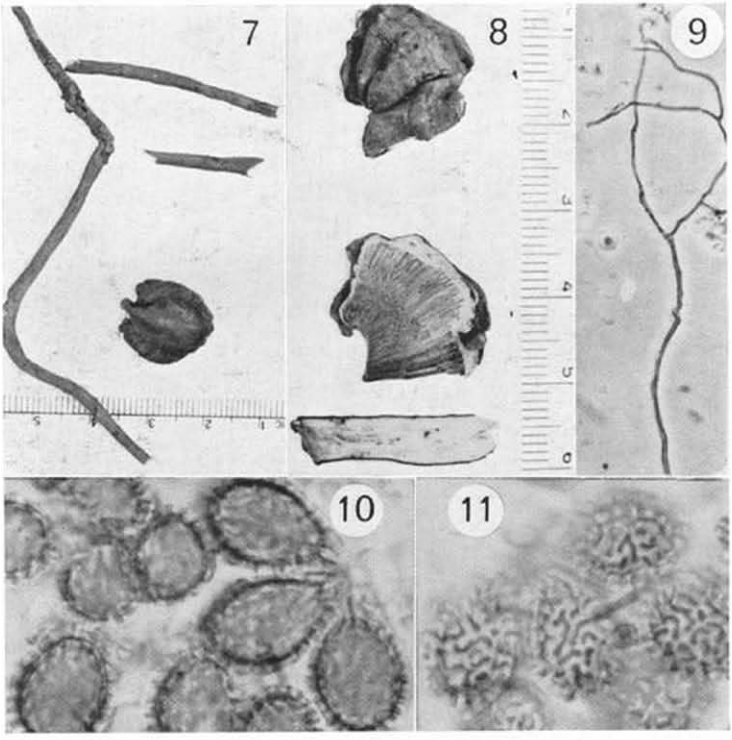
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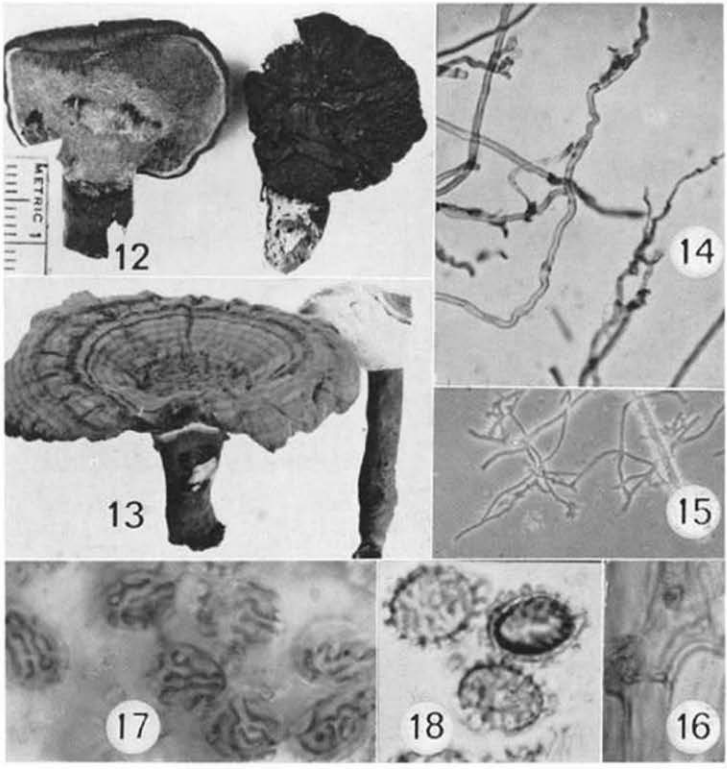
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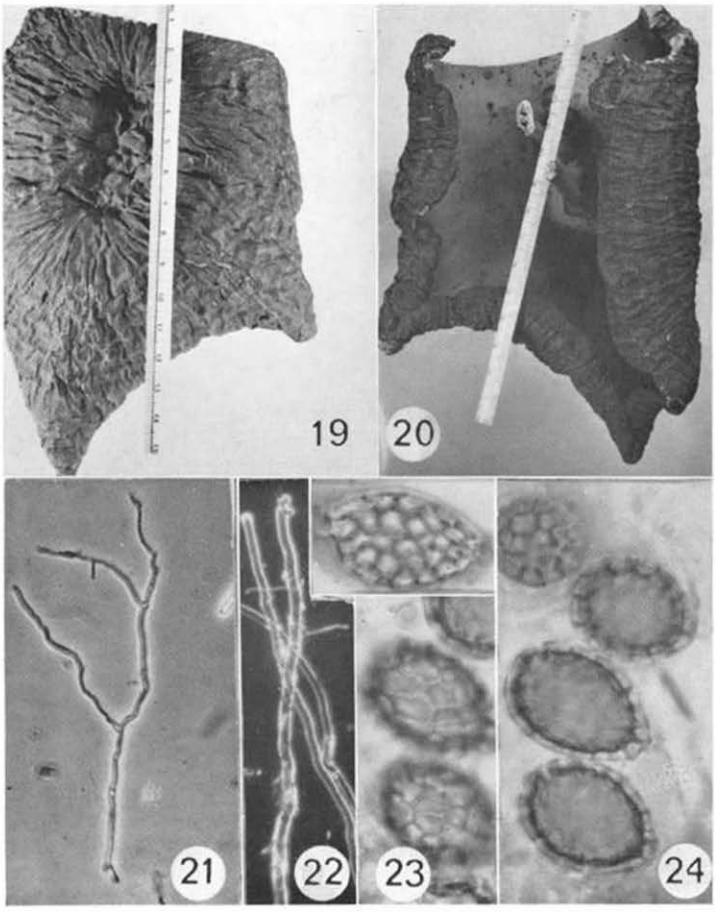
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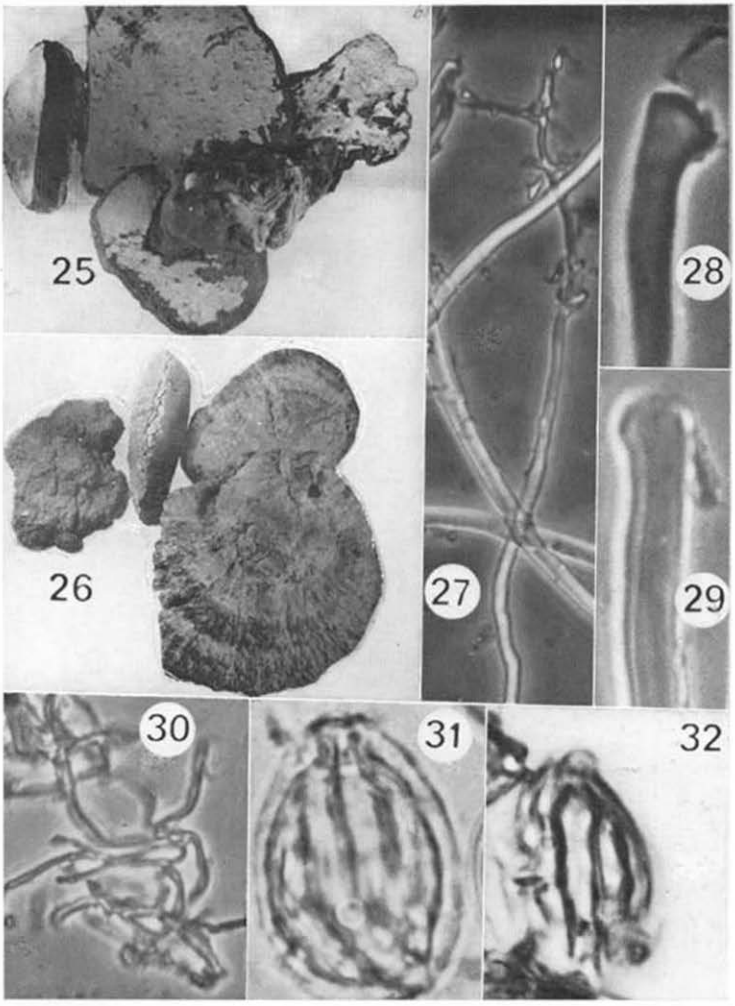
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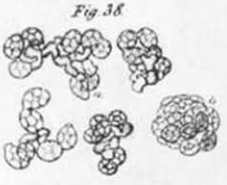
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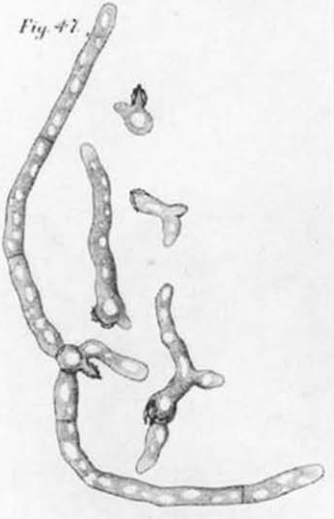
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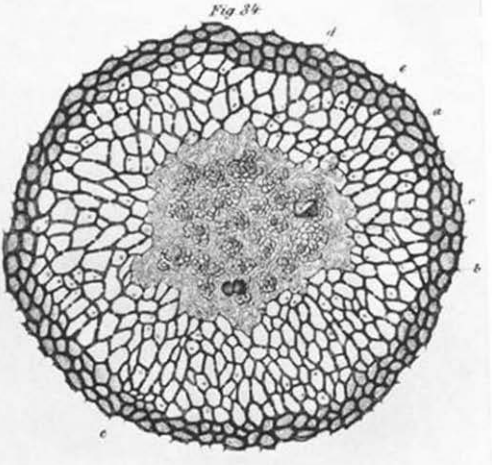
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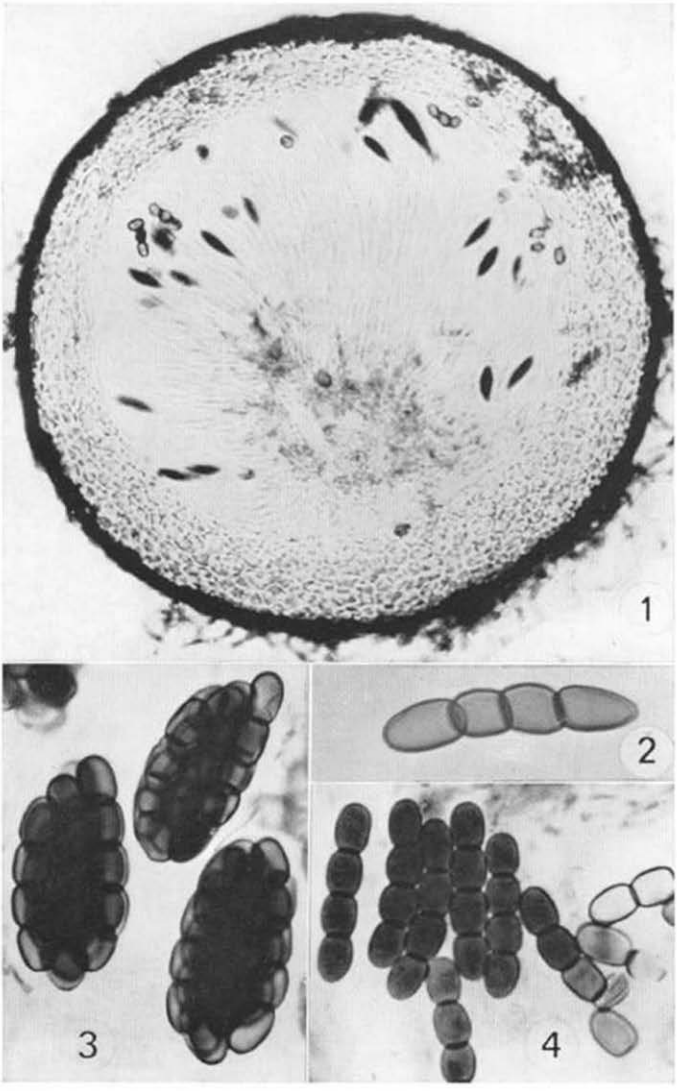
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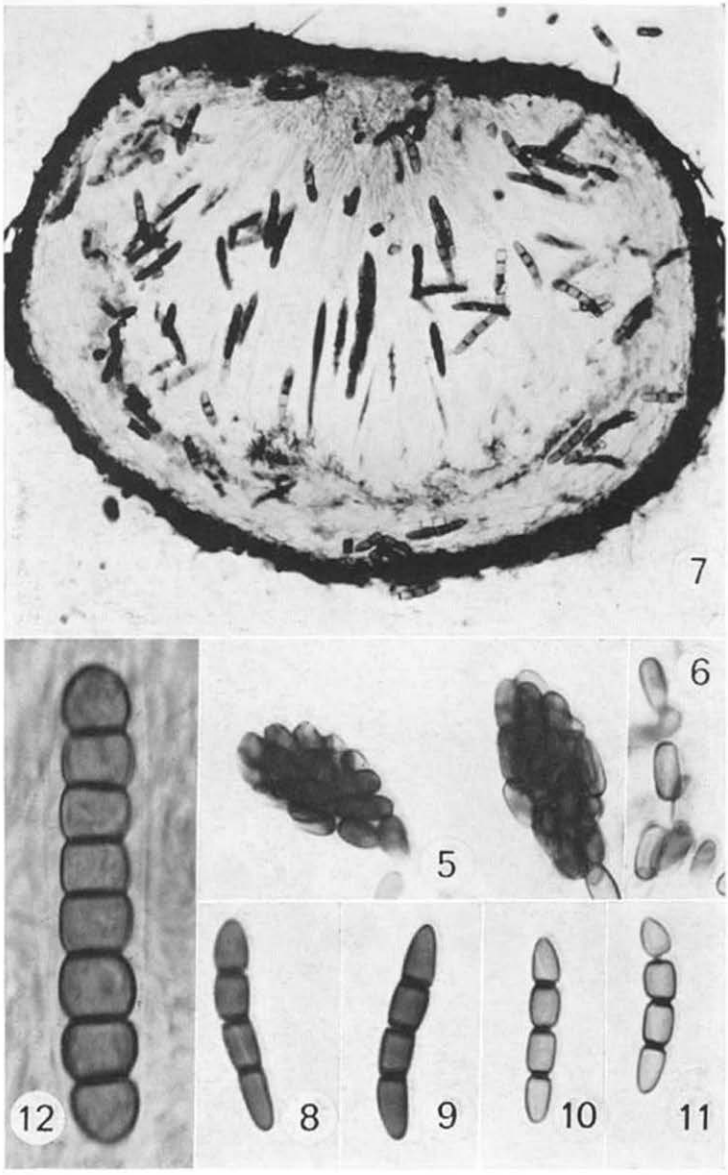
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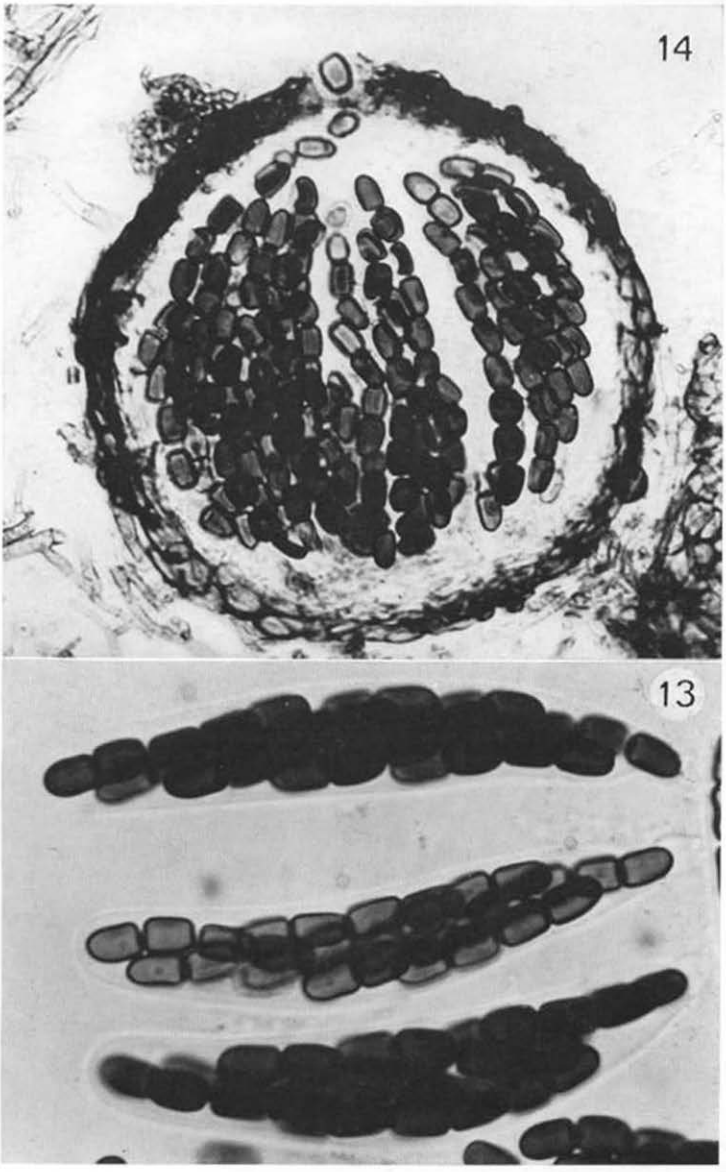
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