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REMARKS ON SPECIES OF PHOMA REFERRED TO PEYRONELLAEA—III

G. H. Boerema, M. M. J. Dorenbosch, and H. A. van Kesteren
Plantenziektenkundige Dienst (PD), Wageningen

Additional data are given on synonymy and hosts. The ubiquitous species commonly known as *Phoma prunicola* (Opiz) Wollenw. & Hochapf., a later homonym of *Phoma prunicola* Schw., is renamed *Phoma pomorum* Thüm. *Phoma indianensis* (Deshpande & Mantri) Boerema *& al.* appears to be conspecific with *Phoma glumarum* Ell. & Tracy described earlier; its occurrence on rice seed is widespread.

The dictyochlamydospore-producing species of *Phoma*, also known under the generic name *Peyronellaea* (Boerema *& al.*, 1965, 1968), are 'polyphagous', weakly parasitic fungi. Our comparative study of *Phoma*-like fungi in culture has revealed some new data on the synonymy and hosts of these dictyochlamydospore-producing species of *Phoma*.

In contrast with our earlier publications author's names in the present paper are abbreviated according to the European lists compiled by Ainsworth (1961: 37–41) and Grummann (1963: 59–74).

Phoma glomerata (Corda) Wollenw. & Hochapf.

Phoma monocytogenetica Curzi *apud* Curzi & Barbaini *in* Atti Ist. bot. Univ. Lab. crittogam. Pavia III, **3**: 169. 1927.
Phoma polymorpha (Planchon) Verona *in* Cellulosa **1939**: 27. 1939 ("n. nom.").

To the numerous synonyms listed in our previous papers (Boerema *& al.*, 1965, 1968) the two cited above can be added.

Phoma monocytogenetica, collected near Pescara (Abruzzi, Italy) and described from dry branches of lemon, was studied in vitro (CBS 235.28; deposited March 1928, Prof. Pollacci, PAV). It produces *Alternaria*-like dictyochlamydospores, typical of *P. glomerata*. The pycnidiospores are described as "oblongo ellipsoideis, continuis, guttulatis, 5,5–7 × 2,5 μ, hyalinis, nebulosis"; this is also in agreement with the characteristics of the spores of *P. glomerata*.

Planchon (1900) in his diagnosis of *Alternaria polymorpha* indicated that the species possessed a pycnidial form. Verona, however, held the opinion that the species was obviously a *Phoma*, also capable of producing *Alternaria*-like spores. When therefore

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Verona introduced *Phoma polymorpha* he proposed not, like he thought, a new name, but a new combination.

Alternaria polymorpha was synonymized with *P. glomerata* (Boerema & *al.*, 1965).

ADDITIONAL DATA.—It is interesting to note that Chantarasnit (1969) recorded the isolation of *P. glomerata* from three Nigerian samples of rice seed. In South Africa this fungus has been isolated from rice seed grown in The Philippines (personal communication Dr. W. F. O. Marasas, Plant Protection Research Institute, Pretoria).

The host plants from which we have isolated *Phoma glomerata* are listed in Table I.

TABLE 1

HOST PLANTS FROM WHICH PHOMA GLOMERATA HAS BEEN ISOLATED

Cactaceae	4	Liliaceae	4	*Pyrus* (1)	
Cereus (1)		*Hyacinthus* (1)		Rutaceae	1
Montagnella (2)		*Allium* (3)		*Citrus* (1)	
Zygocactus (1)		Palmae	1	Salicaceae	1
Caryophyllaceae	1	*Phoenix* (1)		*Salix* (1)	
Dianthus (1)		Papilionaceae	2	Solanaceae	5
Compositae	6	*Lupinus* (1)		*Lycopersicum* (3)	
Chrysanthemum (6)		*Phaseolus* (1)		*Solanum* (2)	
Cucurbitaceae	1	Pinaceae	2	Umbelliferae	1
Cucumis (1)		*Cedrus* (1)		*Daucus* (1)	
Gramineae	3	*Pinus* (1)		Valerianaceae	1
Avena (1)		Ranunculaceae	2	*Valerianella* (1)	
Phragmites (1)		*Ranunculus* (2)		Violaceae	1
Triticum (1)		Rosaceae	6	*Viola* (1)	
Juglandaceae	1	*Fragaria* (1)		Vitaceae	1
Juglans (1)		*Malus* (4)		*Vitis* (1)	

The ciphers in the table refer to the number of isolates we made of *Phoma glomerata*. In the period 1958–1969, 44 isolates were made from diseased or dead plant material distributed over 19 families and 29 genera of Phanerogams. The isolates were obtained from stems (20), leaves (5), roots (4), and seeds or fruits (15).

PHOMA POMORUM Thüm.

Phoma prunicola (Opiz) Wollenw. & Hochapf. *in* Z. ParasitKde **8**: 595. 1936; not *Phoma prunicola* Schw. *in* Trans. Am. phil. Soc. II, **4**: 249. 1832 ("1834"; = Synopsis Fung. Am. bor.).

Phoma pomorum Thüm., Fungi pomicoli 105. 1879.

Phoma bismarckii Kidd & Beaumont *in* Trans. Br. mycol. Soc. **10**: 104, 105. 1924.

In none of all the papers dealing with this ubiquitous fungus it has been noted that the combination *Phoma prunicola* made by Wollenweber & Hochapfel is illegitimate since it has been preoccupied by Schweinitz in 1832. According to its type in

Schweinitz's herbarium (PH) the binomium *Phoma prunicola* Schw. (later renamed *Phyllosticta prunigena* Grove; misapplied) refers to a species of *Asteromella* (small pycnidia with bacilliform spores; cf. Rupprecht, 1959: 12, 13).

For the synonymy of the present fungus (Boerema *& al.* 1965, 1968) the next name available appears to be *Phoma pomorum* Thüm. (1879). There is an older synonym, *Phyllosticta pyrina* Sacc. (1878), but the transfer to *Phoma* would result in a later homonym. *Phoma pyrina* (Fr.) Cooke is the name given to a pycnidial fungus without ostiole that is apparently identical with *Myxofusicoccum mali* (Bres.) Weindlmayr (1965).

TABLE II

HOST PLANTS FROM WHICH PHOMA POMORUM HAS BEEN ISOLATED

Aceraceae	1	*Chamaecyparis* (1)		*Robinia* (1)	
Acer (1)		*Juniperus* (1)		*Vicia* (1)	
Amaryllidaceae	1	Ericaceae	11	Pinaceae	1
Galanthus (1)		*Calluna* (6)		*Pinus* (1)	
Araucariaceae	1	*Erica* (5)		Polygonaceae	1
Araucaria (1)		Geraniaceae	1	*Fagopyrum* (1)	
Berberidaceae	3	*Pelargonium* (1)		Ranunculaceae	2
Berberis (2)		Guttiferae	1	*Clematis* (2)	
Mahonia (1)		*Hypericum* (1)		Rosaceae	40
Boraginaceae	1	Hydrophyllaceae	1	*Fragaria* (19)	
Borago (1)		*Nemophila* (1)		*Malus* (13)	
Campanulaceae	1	Iridaceae	3	*Prunus* (4)	
Campanula (1)		*Gladiolus* (2)		*Pyrus* (1)	
Caryophyllaceae	2	*Iris* (1)		*Rosa* (2)	
Dianthus (1)		Liliaceae	5	*Sorbus* (1)	
Lychnis (1)		*Allium* (1)		Salicaceae	1
Chenopodiaceae	1	*Convallaria* (1)		*Populus* (1)	
Beta (1)		*Dracaena* (1)		Saxifragaceae	1
Compositae	2	*Lilium* (1)		*Philadelphus* (1)	
Chrysanthemum (2)		*Ornithogalum* (1)		Solanaceae	3
Corylaceae	2	Oleaceae	2	*Lycopersicum* (1)	
Alnus (1)		*Ligustrum* (1)		*Solanum* (2)	
Betula (1)		*Syringa* (1)		Umbelliferae	2
Cruciferae	1	Palmae	1	*Daucus* (2)	
Lunaria (1)		*Phoenix* (1)		Urticaceae	1
Cucurbitaceae	2	Papilionaceae	4	*Urtica* (1)	
Cucumis (2)		*Phaseolus* (1)			
Cupressaceae	2	*Pisum* (1)			

The ciphers in the table refer to the number of isolates we made of *Phoma pomorum*. In the period 1961–1969, 101 isolates were made from diseased or dead plant material distributed over 31 families and 51 genera of Phanerogams. The isolates were obtained from stems (61), leaves (27), roots (5), and seeds or fruits (8).

The conspecificity of *Phoma bismarckii* with *P. pomorum* is taken from Boerema & Dorenbosch (1970). Wollenweber & Hochapfel (1936: 587) erroneously listed *P bismarckii*, described from "spotted apples", as a synonym of *Phoma striaeformis* Dur. & Mont., but the latter refers to a species of *Phomopsis*—*P. striaeformis* (Dur. & Mont.) Grove.

ADDITIONAL DATA.—With respect to the hosts of *P. pomorum* we note that apart from apple, pear, and species of *Prunus*, the fungus has often been isolated from different parts of stunted strawberry plants ("Black root rot complex"). The *Phoma* species isolated by Berkeley & Lauder-Thompson (1934) and Wilhelm (1952) from roots of strawberry probably also represents *P. pomorum*. Other "common" hosts appear to be species of *Erica* and *Calluna*. In this connection it is of interest to learn that Wilhelm (l.c.) indicated his *Phoma*-isolates from strawberry roots as "*P. radicis*?", a complex name referring to the different *Phoma*-species described by von Ternetz (1907) and Rayner (1922) from roots of Ericaceae, each with a second epithet relating to the plant from which it had been isolated (see Boerema, 1968). Further we note that *P. pomorum* represents one of the fungi repeatedly isolated by Hanlin (1969) from peanut fruits during their early stages of development.

A general review of the host plants from which we have isolated *Phoma pomorum* is given in Table II.

PHOMA JOLYANA Pirozynski & Morgan-Jones

ADDITIONAL DATA.—Boerema *& al.* (1965), redescribing the present species as *Phoma musae* (Joly) Boerema, Dorenb. & Kest., recorded species of *Musa* and *Eriobotrya* as hosts. To these can now be added rice, *Oryza sativa*, mango, *Mangifera indica*, and pecan, *Carya pecan*. The rice isolate has been obtained from a lot of seed grown in India (cf. Chantarasnit, 1969), the other isolates are made from fruits of mango in India and developing pecan fruits in the U.S.A. (isolate obtained from Prof. R. T. Hanlin, University of Georgia). It is probable that *P. jolyana* is much more widely distributed in tropical and subtropical regions than is presently known.

PHOMA GLUMARUM Ell. & Tracy

Phoma glumarum Ell. & Tracy *in* J. Mycol. **4**: 123. 1888. — *Phyllosticta glumarum* (Ell. & Tracy) Miyake *in* J. Coll. Agric. imp. Univ. Tokyo **2**: 252. 1910. — Neotype: on glumes of *Oryza sativa*, Ocean Springs, Mississippi, Sept. 1889, Tracy (BPI).

Phoma glumicola Speg. *in* Revta Mus. La Plata **15**: 36. 1908. — *Phyllosticta glumicola* (Speg.) Hara, Dis. Rice Plant 164. 1918. — Holotype: on glumes of *Oryza sativa*, São Paulo, Sept. 1905, Usteri (LPS-6021).

Phyllosticta glumarum Sacc. *in* Nuovo G. bot. ital. II, **23**: 207. 1916. — *Phyllosticta oryzina* Padw., Manual Rice Dis. 163. 1950 [as '*P. o.* (Sacc.) Padwick, nom. nov.']. — Holotype: on glumes of *Oryza sativa*, Los Baños, Philippines, Aug. 1914, Baker (Herb. Saccardo '3771', PAD).

Phoma depressitheca Bub. *in* Annln naturh. Mus. Wien **28**: 203. 1914. — Holotype: on leaves of *Eragrostis cynosuroides*, Kwerisch, April 1910, Handel-Mazzetti (No. 870, Herb. Bubák, BPI).

Phoma chartae Verona *in* Cellulosa **1939**: 27. 1939.
Phoma indianensis (Deshpande & Mantri) Boerema, Dorenb. & Kest. *in* Persoonia **5**: 203. 1968. — *Peyronellaea indianensis* Deshpande & Mantri *in* Mycopath. Mycol. appl. **30**: 341–344. 1966.

This species, whose characteristics in vitro have earlier been described in detail under the name *Phoma indianensis* (Boerema *& al.*, 1968), proves to be ubiquitous in tropical and subtropical regions.

It appears to occur in various parts of the world on seeds of rice, among other things; this was shown by isolates obtained for identification from Miss Chantarasnit, who worked at the Danish Government Institute of Seed Pathology for Developing Countries in Copenhagen. The isolates had been taken from rice seed samples from Ghana, India, Nigeria, The Philippines, and Thailand (Chantarasnit, 1969). The morphological characters of the pycnidia on the rice seeds agree completely with those of an original collection of *Phoma glumarum* Ell. & Tracy (designated as neotype, BPI, see above), and the holotypes of *Phyllosticta glumarum* Sacc. (PAD, see above) and *Phyllosticta glumicola* Speg. (LPS, see above).

In their description of *Phoma glumarum* Ellis & Tracy called the spores "smoky-hyaline" and gave the length as 3–4 μ, which is rather shorter than the usual 3.5–6 μ. It is now recognized as a typical feature of all *Phoma* species producing dictyochlamydospores that the colour of the pycnidiospores varies from hyaline to brown. Saccardo, who was probably unaware of the variability of the length and colour of the spores, supposed his species to be different from Ellis & Tracy's fungus (". . . differe sporulis longioribus, perfecte hyalinis . . ."). In the description of *Phoma glumicola* Spegazzini did not refer to the earlier described *Phoma glumarum*. Spegazzini suggested that his species represents the pycnidial state of the ascomycete *Didymella glumicola* Speg. Such a relation, however, has not been proved.

Miyake, Saccardo and Hara favoured the opinion that the present pycnidial fungus belonged to the form-genus *Phyllosticta* Pers. ex Desm. In true *Phyllosticta*,[1] however, the spores are considerably larger and often possess a slimy appendage (personal communication Mr. H. A. van der Aa, CBS). The various other *Phoma* and *Phyllosticta* species described from rice seem to be different from *Phoma glumarum*, cf. Padwick (1950).

In phytopathological literature the infection of rice seed by *Phoma (Phyllosticta) glumarum* is referred to as "glume blight", "grain blight", or "kernel blight". It is recorded from Argentina, Brazil, Ceylon, China, India, Japan, Uganda, and U.S.A. The infected kernels are said to develop poorly or not at all and they are frequently dark in colour and worthless (Padwick, 1950).

Through inoculation experiments with different strains of the fungus Chantarasnit (1969) obtained various disease symptoms on rice, such as reduced germination of

[1] Type species: *Phyllosticta cruenta* (Fr.) Kickx (Donk, 1964: 11, 12; Stafleu & Voss, 1969: 101); syn. *Phyllostictina* Syd.

seed, various degrees of root-rot, dying-off, and different kinds of spots on leaves and culms. Usually, however, the fungus only behaved like a weak parasite. The rice varieties tested showed some differences in susceptibility.

Phoma depressitheca has been described from dead leaves of *Eragrostis cynosuroidis* from the area of Kwerisch (Babylon). Its synonymy with *P. glumarum* is based on a comparative study of the holotype (BPI) and a living culture labelled *P. depressitheca* (IMI 109742, made in 1964 by Coady from leaves of *Eragrostis abyssinica* collected near Addis Ababa, Ethiopia). The epithet "*depressitheca*" refers to a lateral flattening of the pycnidia attributable to the anatomical structure of the leaves of *Eragrostis*.

In the culture description of *Phoma chartae*, isolated in Italy from paper, it was noted that the fungus only produces chlamydospores of various types on media with a high carbon-nitrogen ratio ("molte in via di differenziazione, di forma e dimensioni non constanti, intercalari o laterali"), whereas on media with a relatively low carbon-nitrogen ratio it forms mainly pycnidia. This relation between the C/N ratio of the media and the production of pycnidia or chlamydospores is a typical feature of the 'Peyronellaeas' (cf. Boerema & *al.*, 1965: 49). The type-culture of *P. chartae* deposited in the "Centraalbureau voor Schimmelcultures" (CBS) has been lost, but original notes on it made by Dr. T. H. van Beyma thoe Kingma indicate that the fungus is further characterized by the production of a conspicuous reddish pigment. These data, together with the description of pycnidia and pycnidiospores, have led us to conclude that *P. chartae* is the same as *P. glumarum*, which is known to grow well on paper (Boerema & *al.*, 1968: 203, as '*Phoma indianensis*').

Further we note that the fungus has recently been isolated from seed of wheat grown in India (isolate obtained from Miss Chantarasnit, see above), seed of *Citrus* in India (isolate obtained from Dr. S. B. Mathur, Institute of Seed Pathology for Developing Countries, Copenhagen), and developing peanut fruits in Georgia, U.S.A. (isolate obtained from Prof. R. T. Hanlin, 1969).

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ÜBER DIE TYPUSART, ZWEI NEUE UND EINIGE WEITERE ARTEN DER GATTUNG SPOROTRICHUM

J. A. VON ARX
Centraalbureau voor Schimmelcultures, Baarn

(Mit 3 Abbildungen)

Sporotrichum aureum, der Lectotypus der Gattung *Sporotrichum*, wird auf Grund einer Neuisolierung als zu den imperfekten Basidiomyceten gehörig charakterisiert. Zwei neue Arten werden beschrieben als *Sporotrichum dimorphosporum* und *Sporotrichum sporodochiale*. Der bisher als *Sporotrichum cerebriforme* bekannte Pilz wird in die Gattung *Trichosporiella* gestellt.

Die Gattung *Sporotrichum* wurde von Link (1809) beschrieben und durch Aufnahme im Systema Mycologicum durch Fries (1821) entsprechend den heutigen Nomenklaturregeln validiert. Die 13 durch Link beschriebenen Arten wurden von Hughes (1958) systematisch nachuntersucht. Viele davon erwiesen sich als Basidiomyceten, als sterile Mycelien oder sie liessen sich mit inzwischen unter anderen Namen bekannt gewordenen Pilzen identifizieren. Als Lectotypus wählte Hughes *Sporotrichum aureum* Link. Im Typusmaterial sind ausser Hyphenresten nur goldbraune Aleuriosporen zu erkennen, die von Carmichael (1962) auf Grund eines Präparates von Hughes abgebildet wurden. Da der Pilz in dieser Kollektion nur spärlich vorhanden ist, liess sich die Gattung bisher nicht genügend charakterisieren.

Wohl erkannte man, dass die zahlreichen später als *Sporotrichum* beschriebenen Pilze mit *Sporotrichum aureum* nicht gattungsgleich sein konnten. Viele Arten wurden inzwischen von Müller (1964, 1965), Carmichael (1962) und Taylor (1970) kritisch gesichtet und teilweise in anderen Gattungen untergebracht.

Im April 1970 sandte Madame J. Nicot (Paris) dem CBS eine als *Sporotrichum aureum* Link bestimmte Kultur, die sie von im Januar in den Pyrenäen gesammeltem, faulendem Holz eines Laubbaumes isoliert hatte. Ein Vergleich mit einer Probe von Link's Originalkollektion (B) bestätigte die Richtigkeit der Bestimmung. Auf Grund der Kultur lassen sich nun Gattung und Art eindeutig charakterisieren und zwei weitere bisher nicht bestimmbare Kulturen können als neue Arten der Gattung beschrieben werden.

SPOROTRICHUM Link ex Fr.

Sporotrichum Link *ex* Fr., Syst. mycol. 1: XLIV. 1821. — Lectotypus: *Sporotrichum aureum* Link ex S. F. Gray.

Primäre, sich ausbreitende Hyphen farblos, aber ziemlich derbwandig, regelmässig verzweigt, bei den Septen manchmal mit einfachen Schnallen oder mit

Wirtelschnallen versehen; aufsteigende Seitenzweige bilden ein lockeres oder dichtes, oft flockiges Luftmycel, in dem Schnallen oft fehlen und an dem lateral oder terminal Aleuriosporen gebildet werden. Diese entstehen als Anschwellungen einzeln oder selten in kurzen Ketten. Sie sind ellipsoidisch oder kugelig, an der Basis gestutzt, gliedern sich von der Trägerzelle mit einer Querwand ab, sind einzellig, erst farblos, reif lebhaft gefärbt und oft dickwandig. Sie kommen frei durch Histolyse der Trägerzelle, deren Reste ihr oft noch anhaften, und bilden pulverige Massen.

1. SPOROTRICHUM AUREUM Link ex S. F. Gray—Abb. 1

Sporotrichum aureum Link *in* Mag. Ges. naturf. Freunde, Berl. **3**: 13. 1809; *ex* S. F. Gray, Nat. Arrang. Br. Pl. **1**: 551. 1821; Fr., Syst. mycol. **3**: 418. 1832.

Die primären sich von der Impfstelle aus über die Agaroberfläche ausbreitenden Hyphen sind 4–5,5 μ breit, ziemlich derbwandig, hyalin oder im Alter bräunlich, verzweigt, septiert und bei den oft nur selten gebildeten Septen häufig mit einfachen Schnallen versehen. Der tägliche Zuwachs des Mycels auf Malz-Agar bei 24 °C beträgt 8–9 mm. Die das Luftmycel bildenden Seitenzweige sind vielfach verzweigt,

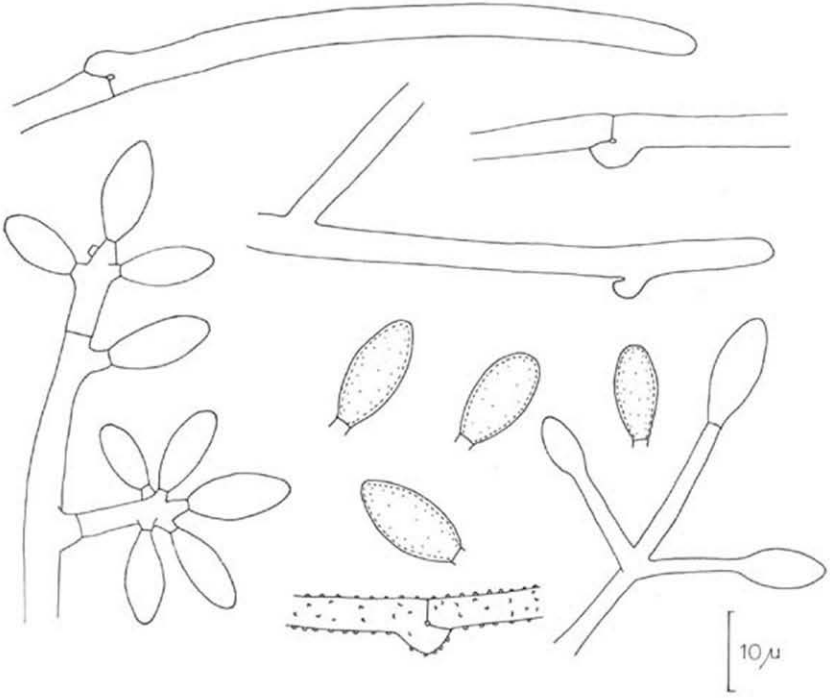

Abb. 1. *Sporotrichum aureum*. Hyphen mit Schnallen, sporogene Hyphen und Aleuriosporen.

2,5–4,5 μ breit und verdichten sich zu unregelmässigen, oft zottigen Polstern. Die am Luftmycel an kurzen oder längeren Seitenästen oder endständig entstehenden Aleuriosporen sind ellipsoidisch, oben verjüngt und abgerundet, unten abgestutzt, 10–16 μ lang und 5–9 μ breit. Sie haben eine glatte, aber ziemlich dicke Wand, sind anfangs farblos und reif goldgelb. Die Sporen brechen etwas unterhalb der 2–3 μ breiten Ansatzfläche leicht von der sporogenen Zelle ab; Reste von ihr bleiben aber der Sporenbasis anhaften. Die pulverigen Sporenmassen sind orange-goldbraun (Ochraceous Orange nach Ridgway, 1912: pl. XV; pale luteous orange nach Rayner, 1970).

Ausser einem Präparat der Typuskollektion (B) wurde folgende Kultur untersucht: CBS 441.70, empfangen von Mme J. Nicot (Paris), gefunden auf in den Pyrenäen gesammeltem Holz eines Laubbaumes.

Die Typusart der Gattung *Sporotrichum* ist demnach ein zu den Basidiomyceten gehöriger Hyphomycet (von Arx, 1970). Die dazugehörige Basidienform ist noch unbekannt. In die Gattung können nur Arten mit basidiomycetenartigem Mycel gestellt werden. Dieses kann oft schon an seiner Wachstumsweise erkannt werden, ferner vor allem durch die Bildung von Schnallen oder beim Fehlen von solchen durch die submikroskopische Struktur der Querwände. Die Konidien sind bei der Gattung *Sporotrichum* Aleuriosporen, die als Anschwellung eines Hyphen- oder Trägerendes entstehen und sich mit einer Querwand abscheiden. Gelegentlich bilden sie auch kurze Ketten, kommen aber leicht frei und bilden dann lockere, pulverige Massen.

2. **Sporotrichum dimorphosporum,** *spec. nov.*—Abb. 2

Hyphae primariae crassitunicatae, hyalinae, 7–10 μ crassae, septa compluribus fibulis circumdata; ramis infra vel e fibulis assurgentibus; hyphae aeriae in multos ramos breves divisae, fibulis plerumque absentibus; aleuriosporae e hyphis ipsis vel e ramulis crassis, saepe lateraliter proliferentibus oriuntur, ellipsoideae, sursum rotundatae, deorsum truncatae, primum hyalinae, deinde laete rubrobrunneae, 17–24 × 9–12 μ; sporae minores cylindricae, hyalinae, 9–13 × 1.5–2 μ, e processibus digitatis ramorum inflatorum protruduntur.

Typus CBS 419.70, isolatus e farina tuberum *Solani*, Groningen, isolatus a G. A. Gerritsen.

Die primären, sich von der Impfstelle aus radial über die Agaroberfläche ausbreitenden Hyphen sind derb- und ziemlich dickwandig, farblos, 7–10 μ breit, verzweigt und bei den Querwänden mit meist 2–4 Schnallen (Wirtelschnallen) versehen. Vor allem bei dünneren Hyphen sind die Schnallen gelegentlich einfach. Der tägliche Zuwachs des Mycels auf Malzagar bei 24 °C beträgt 6 mm. Die das Luftmycel bildenden Seitenzweige entstehen meist paarweise unterhalb der Schnallen oder sie entspringen einzeln aus den Schnallenzellen selbst. Das Luftmycel ist reich verzweigt und septiert, wobei Schnallen oft fehlen oder einfach sind. Die Aleuriosporen entstehen terminal oder an kurzen Seitenästen, die oft unregelmässig angeschwollen oder nochmals kurz sparrig verzweigt sind. Nach der Bildung einer Spore können die sporogenen Zellen seitlich weiterwachsen und erneut Sporen bilden. Die einzeln, in Herden oder Gruppen entstehenden Aleuriosporen sind ellipsoidisch, oben abgerundet oder verjüngt abgerundet, unten gestutzt, haben eine glatte, aber ziemlich dicke Wand und messen 17–24 × 9–12 μ; an der Basis sind sie 3–4,5 μ breit. Anfangs sind sie hyalin und werden mit zunehmender Reife rötlich braun oder hell zimtbraun. Ausser diesen Aleuriosporen werden häufig auch zy-

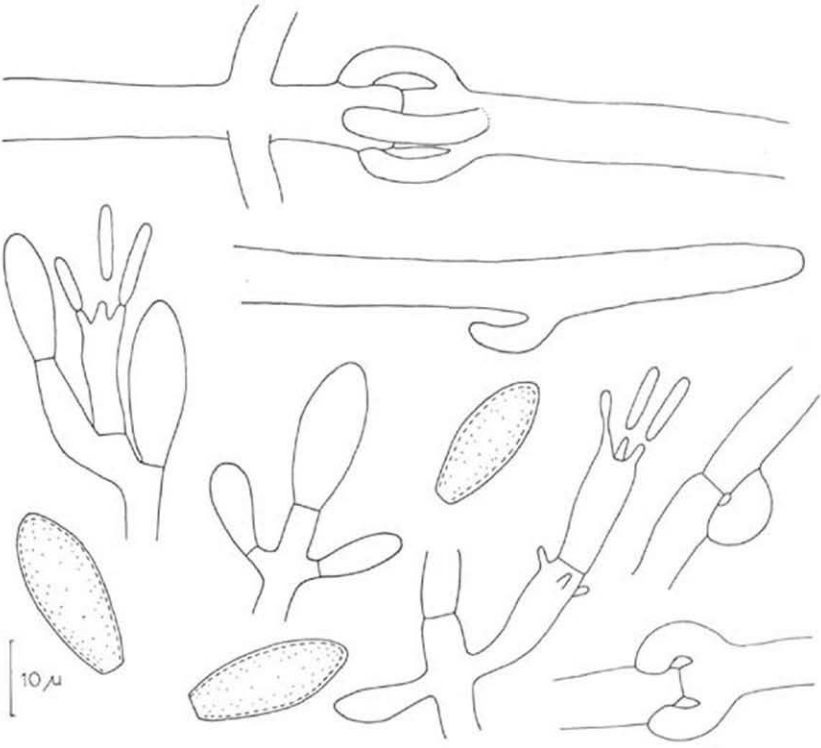

Abb. 2. *Sporotrichum dimorphosporum*. Hyphen mit Wirtelschnallen, sporogene Zellen, Aleuriosporen und Blastosporen.

lindrische oder stäbchenförmige, hyaline, 9–13 μ lange und 1,5–2 μ breite Sporen gebildet, die blastosporenartig auf kürzeren oder längeren, oft fingerförmigen Auswüchsen von Seitenzweigen der Hyphen entstehen. Diese Seitenzweige sind meist kurz, aber unregelmässig geschwollen und tragen dann mehrere sporenbildende Auswüchse. Die leicht abfallenden Aleuriosporen bilden hell zimtfarbige (Cinnamon Buff oder Pinkish Cinnamon nach Ridgway, 1912: pl. XXIX; Cinnamon, 17″b/15″b nach Rayner, 1970), pulverige Massen.

UNTERSUCHTE KULTUR: CBS 419.70, isoliert aus Kattoffrlmehl, Groningen, Niederlande, erhalten von Frl. G. A. Gerritsen (Typus).

3. **Sporotrichum sporodochiale,** *spec. nov.*—Abb. 3

Hyphae primariae superficiei agari appressae, fere crassitunicatae, hyalinae, regulariter ramosae, septa fibulis praedita, 3.5–5 μ crassae; mycelium aerium hyalinum, laxum, saepe

absens; aleuriosporae in coloniis vetustis in pulvinis sporodochialibus formantur, globosae vel piriformes, saepe crassiores quam longae, maturitate brunneae, leves, 8–14 × 8–12 μ, e breviter modo apophysis inflatis ramulorum apicibus oriuntur, qui sporis liberatis diu adhaerent.

Typus CBS 548.70, isolatus e terra agresti, Wageningen, a W. Veenbaas-Rijks.

Die sich von der Impfstelle aus radial ausbreitenden Hyphen sind ziemlich derbwandig, hyalin, regelmässig verzweigt, bei den Septen mit einfachen Schnallen versehen und 3,5–5 μ breit. Der tägliche Zuwachs des Mycels auf Malzager bei 24 °C beträgt ungefähr 5 mm. Luftmycel wird nur spärlich ausgebildet und ist weiss und wollig. Wo es fehlt, hat die Kultur eine hell graubraune (Pale Pinkish Buff nach Ridgway, 1912: pl. XXIX; Rosy buff, 17″f nach Rayner, 1970) Farbe. Die Aleuriosporen entstehen in dichten, sporodochienartigen, 0,3–0,8 mm grossen Polstern. Die sporenbildenden Hyphen stehen dicht und sind reichlich verzweigt, zart, 1,5–2,5 μ dick, unter den Sporen jedoch apophysenartig verdickt. Die Sporen sind unregelmässig kugelig oder birnförmig, gelegentlich breiter als lang, oben breit abgerundet, unten in die 3–5 μ breite Ansatzstelle verschmälert, glatt, ziemlich derbwandig, hell bräunlich oder rotbraun, 8–14 μ breit und 8–12 μ lang. Das apophysenartige Ende der Trägerzellen ist 3–5 μ gross und bleibt mit den abgefallenen Sporen verbunden. Gelegentlich wurden auch grössere, dickwandige, dunklere, 18–20 μ breite Sporen beobachtet.

UNTERSUCHTE KULTUR: CBS 548.70, aus sandiger Erde eines Weizenfeldes isoliert, Wageningen, Niederlande, erhalten von Frau W. Veenbaas-Rijks.

In den Kulturen tritt Sporulation oft erst spät auf und in manchen Subkulturen unterblieb sie völlig. Als geeignet erwies sich vor allem der saure Kirschen-Agar, während der Pilz auf Malzagar und auf Kartoffel-Möhren-Agar steril blieb.

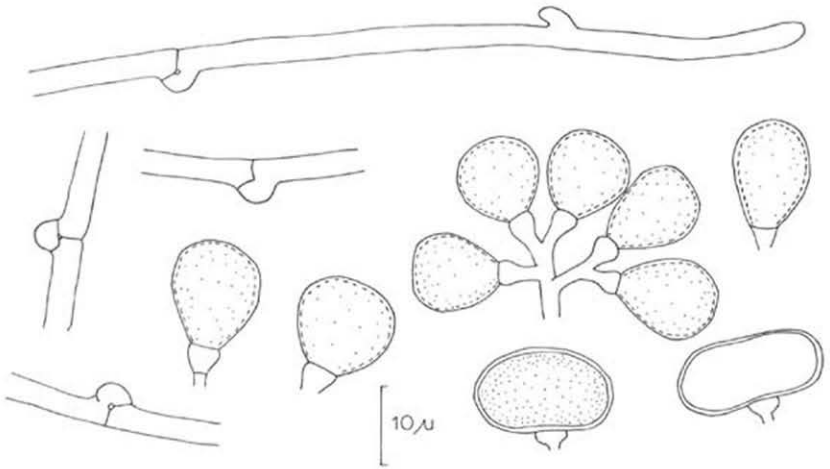

Abb. 3. *Sporotrichum sporodochiale*. Hyphen mit Schnallen, sporogene Hyphenenden und Aleuriosporen.

Von den weiteren im CBS vorhandenen, als Arten der Gattung *Sporotrichum* beschriebenen oder mit solchen identifizierten Kulturen müssen die meisten ausgeschlossen werden. Mehrere Kulturen wurden von Taylor (1970) revidiert. *Sporotrichum cerebriforme* de Vries & Kleine-Natrop sollte nach diesem Autor zu *Fusarium oxysporum* gehören. Wie aber eine erneute Untersuchung zeigte, wurde der Pilz von seinen Autoren richtig beschrieben. Er gehört in die erst kürzlich von Gams und Domsch (1969) validierte Gattung *Trichosporiella* Kamyschko (1960), lässt sich von *Trichosporiella hyalina* Kamyschko morphologisch nicht unterscheiden und muss **Trichosporiella cerebriformis** (de Vries & Kleine-Natrop) W. Gams, *comb. nov.* genannt werden (Basionym: *Sporotrichum cerebriforme* de Vries & Kleine-Natrop *in* Mycopath. Mycol. appl. **8**: 154. 1957).

Sporotrichum thermophilum Apinis wird vorläufig am besten in der Gattung *Sporotrichum* belassen. Zwar konnten weder in den sich ausbreitenden Hyphen noch im Luftmycel Schnallen beobachtet werden. Die Konidien entstehen ähnlich wie bei *Sporotrichum aureum*, sind aber kleiner, meist 5–7×3–4 μ gross, haben eine dicke, oft fein höckerig ornamentierte Wand und bilden reif hell haselnussbraune, staubige Massen. Am schnellsten wächst der Pilz bei 40 °C; auch bei 30° und 25° breiten sich die Kulturen noch aus, während bei 20° kein Wachstum mehr beobachtet werden konnte.

Der Autor dankt Dr. W. Gams für die Durchsicht des Manuskriptes und für die Anfertigung der lateinischen Diagnosen. Frau Dr. J. Nicot (Paris), Ir. J. H. van Emden und Frau W. Veenbaas-Rijks (Wageningen) und Frl. G. A. Gerritsen (Groningen) dankt er für die Überlassung der Reinkulturen.

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TOLYPOCLADIUM, EINE HYPHOMYCETENGATTUNG MIT GESCHWOLLENEN PHIALIDEN

W. GAMS
Centraalbureau voor Schimmelcultures, Baarn

(Mit 3 Abbildungen)

Tolypocladium, eine neue Gattung von bodenbürtigen Moniliales, wird charakterisiert durch langsamwüchsige, polsterförmige, weissliche Kulturen, terminal und lateral, teilweise an kurzen Seitenästen, wirtelig angeordnete Phialiden, die aus einer angeschwollenen Basis und einem fadenförmigen, oft gebogenen Hals bestehen, und kleine einzellige Konidien in Köpfchen. Drei neue Arten werden beschrieben. Anschliessend werden Gattungen der Moniliales mit angeschwollenen Phialiden und Köpfchen von einzelligen Konidien vergleichend besprochen.

Tolypocladium, *gen. nov.*

Genus Hyphomycetum *Beauveriae* simile sed phialides ferens. Coloniae lente crescentes, pulviniformes, floccosae, albae. Hyphae tenues, 1–1.5(–2.0) μ crassae. Post 5–10 dies conidia copiosa in tota colonia sparsa formantur. Conidiophora brevia, lateralia vel terminalia phialides acervatas ferunt. Phialides basi inflatae, in collum longum, saepe obliquum attenuatae. Phialosporae capitulis connexae, parvae, continuae, globosae vel cylindricae, hyalinae, leves. Chlamydosporae absunt.

Species typica: *Tolypocladium inflatum* W. Gams.

Etymologie: τολύπη = Knäuel, κλάδος = Ast.

Kolonien langsamwüchsig, polsterförmig, flockig-wattig, weiss. Hyphen zart, 1–1,5 (–2,0) μ breit; nach 5 bis 10 Tagen über die ganze Kultur gleichmässig verstreut sporulierend. Konidienträger kurz, lateral oder terminal dichte Wirtel von Phialiden tragend. Phialiden mit geschwollener Basis und fadenförmig verjüngtem, oft geknicktem Hals. Phialosporen in Köpfchen, klein, hyalin, glatt, einzellig, kugelig oder zylindrisch. Chlamydosporen fehlen.

SCHLÜSSEL

1. Auffallender Actinomyceten-artiger Geruch, Phialidenbasis mässig geschwollen . *T. geodes*
2. Ohne auffallenden Geruch. Phialidenbasis beinahe kugelig angeschwollen.
   a. Konidien zylindrisch . . . . . *T. cylindrosporum*
   b. Konidien subglobos . . . . . *T. inflatum*

1. **Tolypocladium inflatum**, *spec. nov.*—Abb. 1

Coloniae 10 diebus 13–20 mm diametro, floccosae, albae, reverso medio ochraceo-griseo, odore indistincto. Phialides verticillatae, laterales vel terminales hyphis insident vel e latera-

libus cellulis brevibus crassis, 3.5 × 2–3 μ, oriuntur; phialides e basi inflata, 2.5–3.5 × 2.0–2.5(–3.0) μ, et collo filiformi, saepe deflexo, 2.5–4 × 0.3–0.5 μ, constant. Conidia capitulis connexa, subglobosa, hyalina, levia, 2.0–2.5 × 1.4–2.0 μ. Chlamydosporae absunt.

Typus CBS 824.70, isolatus e terra humosa subalpina, Obergurgl, Austria, 1958.

Kolonien in 10 Tagen 13–20 mm im Durchmesser, wattig, weiss, mit in der Mitte ockergrauer Unterseite, geruchlos. Sporulation reichlich, seitlich und terminal an Hyphen des Luftmycels: Phialiden sitzen in Wirteln entweder direkt auf den Hyphen (insbesondere in terminaler Stellung) oder an oft stark gedrungenen, meist 3,5 × 2–3 μ messenden Trägerzellen; nach einem terminalen Phialidenwirtel endigen die fertilen Hyphen oft mit einer etwas längeren Phialide. Die Phialiden bestehen aus einem stark angeschwollenen Basalteil, 2,5–3,5 × 2,0–2,5 (–3,0) μ, und einem schlanken, fadenförmigen, oft gebogenen Halsteil, 2,5–4 × 0,3–0,5 μ. Konidien zu wenigen in Köpfchen, subglobos, hyalin, glatt, 2,0–2,5 × 1,4–2,0 μ. Chlamydosporen fehlen.

UNTERSUCHTES MATERIAL:

CBS 824.70, Typenstamm, isoliert aus subalpinem Rohhumusboden, Bärrinne bei Obergurgl, Oetztal, Tirol, 2100 m Höhe, 1958, nebst zahlreichen weiteren Stämmen von derselben Herkunft. Ferner von ähnlichen Standorten am Nordhang des Patscher Kofels bei Innsbruck, 1970 m, und bei der Tiefentaler Alm im Pitztal, ca. 2050 m (Gams, 1959).

CBS 714.70, Isolat AM 5-11-4C, isoliert aus Sandbank, Norton Mine drainway bei Elins, W-Virginia, Juni 1964; CBS 715.70, Isolat PR 2-7-3, und CBS 724.70, Isolat PR 2-37-1-1, isoliert vom Cache la Poudre River, Colorado, Juli 1965, durch W. B. Cooke.

CBS 716.70, Stamm E 391/64, isoliert von *Aradus cinnamomeus*, durch E. Müller-Kögler, Darmstadt.

*a*63, isoliert aus Walderde unter *Pinus resinosa*, Petawawa, Ontario, und *a*77, unter *Pinus contorta*, Kananaskis, Alberta, P. Widden, 1967; JB 530, isoliert aus

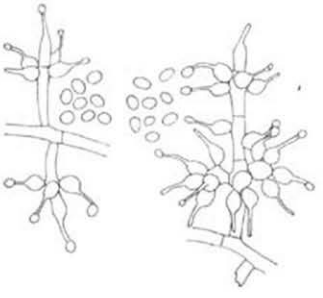

Abb. 1. *Tolypocladium inflatum*, Konidienträger und Konidien aus Kultur auf Malzagar, 9 Tage alt (1000:1).

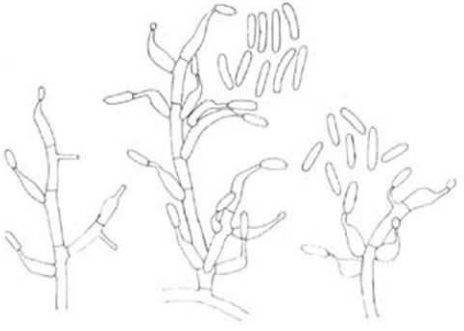

Abb. 2. *Tolypocladium cylindrosporum*, Konidienträger und Konidien aus Kulturen auf Malzagar, 6 und 9 Tage alt (1000:1).

alpinem Boden, Mt. Allan, 1900 m, Kananaskis, J. Bisset, 1969; alle erhalten von G. C. Bhatt.

2. **Tolypocladium cylindrosporum**, *spec. nov.*—Abb. 2

Coloniae 10 diebus 15–20 mm diametro, albae vel pallide bubalinae, reverso incolori, odore indistincto. Phialides verticillatae vel solitariae, laterales vel terminales hyphis insident vel e lateralibus cellulis brevibus, 3–6 × 2,0–2.5 μ, oriuntur; phialides e parte basali inflata, 3–5 × 2.0–2.8 μ, et collo filiformi saepe deflexo, 1.5–2.0 × 0.3–0.5 μ, constant; conidia capitulis connexa, saepe fasciculata, cylindrica, hyalina, levia, 4.0–5.8 × 1.2–1.6 μ. Chlamydosporae absunt.

Typus CBS 718.70, isolatus e terra uliginosa, Anglia, P. M. Latter, 1965.

Kolonien in 10 Tagen 15–20 mm im Durchmesser, wattig-flockig, weiss bis crême, Unterseite ungefärbt, geruchlos. Sporulation lateral und terminal an Hyphen des Luftmycels; Trägerzellen weniger stark gedrungen als bei der vorigen Art, im typischen Fall 3–6 × 2,0–2,5 μ. Phialiden mit stark geschwollenem Basalteil, 3–5 × 2,0–2,8 μ, und einem oft gekrümmten schlanken Hals, 1,5–2,0 × 0,3–0,5 μ. Konidien in Köpfchen, oft parallel gebündelt, zylindrisch, manchmal schwach gekrümmt, mit abgerundeten Enden, hyalin, glattwandig, 4,0–5,8 × 1,2–1,6 μ. Chlamydosporen fehlen.

UNTERSUCHTES MATERIAL:

CBS 718.70, Typenstamm, Isolat 45, und CBS 725.70 A, Isolat 44, aus Torf, Moor House, Northern Pennines, P. M. Latter, 1965.

CBS 717.70, Isolat M 4769, aus Streu von *Pteridium aquilinum*, Roudsea Wood, Lancs., J. C. Frankland, Dez. 1965.

CBS 719.70, isoliert aus Erdboden bei Jeseníky durch O. Fassatiová, Juli 1967.

CBS 720.70, Isolat 681011/249, und 725.70 B, Isolat 690110/448, aus Ackerboden, Wageningen, W. Veenbaas-Rijks.

3. **Tolypocladium geodes**, *spec. nov.*—Abb. 3

Coloniae 10 diebus 13–18 mm diametro, candidae, floccosae, reverso incolori, odor fortissimus terrae similis. Phialides verticillatae vel solitariae, laterales vel terminales hyphis insident vel e cellulis lateralibus, 3–6 × 1.2–2.5 μ, oriuntur; phialides basi modice inflatae, 5–6 × 1.2–2.0 μ, in 2–3 μ longum collum plerumque deflexum egrediuntur, omnino 8–12 μ longae, terminales nonnumquam longiores. Conidia capitulis connexa, globosa vel subglobosa, 1.6–2.0 (–2.2) μ diametro. Chlamydosporae absunt.

Typus CBS 723.70, isolatus e terra agresti, Wageningen, J. H. van Emden, 1967.

Etymologie: γῆ = Erde, -ώδης = riechend.

Kolonien in 10 Tagen 13–18 mm im Durchmesser, wattig, rein weiss, mit farbloser Unterseite (auf Czapek-Agar grünlich). Geruch auffallend Actinomyceten-ähnlich stechend. Sporulation reichlich an Hyphen des Luftmycels lateral und terminal; die Trägerzellen sind im allgemeinen schlanker als bei den beiden anderen Arten der Gattung und messen 3–6 × 1,2–2,5 μ. Phialiden in Wirteln oder unregelmässigen Gruppen, mit mässig geschwollener Basis von 5–6 × 1,2–2,0 μ, die allmählich in einen meist gekrümmten, 2–3 μ langen Halsteil übergeht; Gesamtlänge der Phialiden

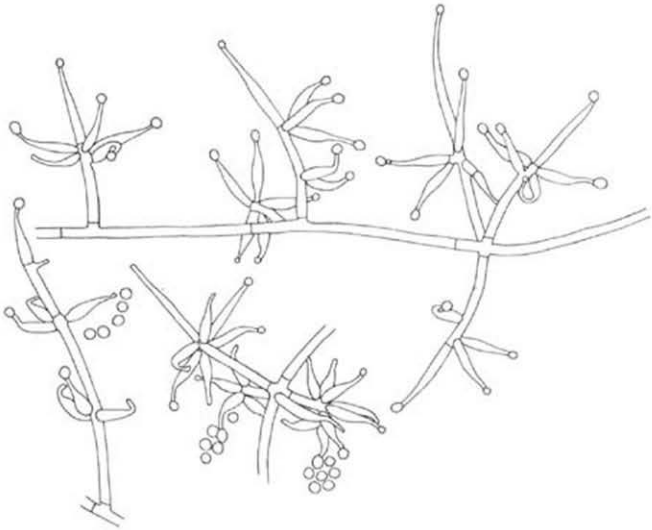

Abb. 3. *Tolypocladium geodes*, Konidienträger und Konidien aus Kultur auf Möhren-Kartoffel-Agar, 5 Tage alt (1000:1).

8-12 μ, in terminaler Stellung oft länger. Konidien in Köpfchen, kugelig oder subglobos, 1,6–2,0 (–2,2) μ im Durchmesser. Chlamydosporen fehlen.

UNTERSUCHTES MATERIAL:

CBS 723.70, Typenstamm, Isolat 671201/323, aus Ackerboden, Wageningen, J. H. van Emden.
CBS 721.70, Isolat 35, und CBS 722.70, Isolat 37A, aus Torf, Moor House, Northern Pennines, P. M. Latter, 1965.
CBS 726.70 A, Isolat S 14/16, von *Picea*-Wurzeln, Seeland, Dänemark, D. S. Malla, 1970.
CBS 726.70 B, isoliert aus Salzmarsch bei Newcastle upon Tyne, C. H. Dickinson, 1970.
Zahlreiche Stämme aus alpinen Rohhumusböden (Gams, 1959), namentlich vom Nordhang des Patscher Kofels bei Innsbruck, 1970 m; Bärrinne bei Obergurgl, Oetztal, NW- und SW-Hang, 2100 m; Tiefentaler Alm im Pitztal, wo die Art an einem O-Hang in 2200 m dominierte; Geolsalm, NO-Hang und SO-Hang, 1900 m, und Loas, O-Hang, 1700 m, im Zillertal.

Diskussion

Tolypocladium kann am treffendsten charakterisiert werden als *Beauveria*-ähnliche Hyphomyceten-Gattung, die jedoch Phialosporen bildet, während sich bei *Beauveria* die sporogenen Zellen sympodial verlängern.

Hyphomycetengattungen mit einzelligen Phialosporen und pfriemlichen Phialiden wurden durch Gams (1971) zusammengestellt und gegeneinander abgegrenzt. Gattungen mit flaschenförmigen und angeschwollenen Phialiden mit Konidienköpfchen sind noch nicht genügend revidiert. In der folgenden Uebersicht wird eine erste Zusammenfassung versucht.

Aufgrund der Konidienträgerstrukturen müssten die hier beschriebenen Arten in *Trichoderma* Pers. ex Fr. gestellt werden. Diese Gattung besitzt jedoch viel rascheres Wachstum, in Pusteln angeordnete Konidienträger und breitere Hyphen. Auch Arten mit stark geschwollenen Phialiden und sterilen Enden der Konidienträger, die oft in *Pachybasium* Sacc. zusammengefasst wurden, werden nun bei *Trichoderma* eingereiht (Rifai, 1969). Die Konidienträger von *Pachybasium niveum* O. Rostrup (1916: 41) ähneln nach der Beschreibung und Abbildung denen von *T. inflatum;* die Art soll geschwollene, 18 × 3 μ messende Phialiden und kugelige, 2 μ grosse Konidien besitzen und kommt in Erde vor; Typenmaterial ist in Kopenhagen nicht erhalten; in der Neubeschreibung durch Brewer (1958) wird der Pilz jedoch deutlich als eine *Trichoderma*-Art charakterisiert. *Harziella capitata* Cost. & Matr. besitzt ebenfalls *Trichoderma*-artiges rasches Wachstum und derbe Hyphen, die Konidienträger sind deutlich differenziert mit terminalen Phialidenschöpfen (von Arx, 1970).

Arten der Gattung *Harposporium* besitzen ähnlich geschwollene Phialiden wie die ersten beiden Arten in *Tolypocladium*, jedoch sind die Konidien fast immer gekrümmt. Nur *H. baculiforme* Drechsler (1959) ähnelt mit zylindrischen Konidien von 2,5–5 × 0,7–1,5 μ Grösse stark *T. cylindrosporum;* bei *H. sicyodes* Drechsler (1959) sind die Konidien leicht gekrümmt und messen 3–5 × 0,9–1,2 μ. Bei beiden Arten sitzen die Phialiden immer in Wirteln oder dichten Gruppen direkt auf den fertilen Hyphen, sie sind etwas grösser als bei *T. cylindrosporum* und besitzen manchmal zwei sporenbildende Hälse. Die fertilen Hyphen sind an den Septen oft eingeschnürt und 1,5–2,5 μ breit. Diese *Harposporium*-Arten sind nur als Nematodenparasiten bekannt und noch nicht in Reinkultur untersucht. Andere *Harposporium*-Arten wurden zum ersten Mal durch Barron (1969) in Reinkultur gebracht. Die einzige bisher nach Reinkulturen beschriebene Art, *H. helicoides* Drechsler (Barron, 1970, CBS 944.70) sowie *H. anguillulae* Lohde emend. Zopf (CBS 945.70, erhalten von G. L. Barron) wachsen doppelt so langsam wie die *Tolypocladium*-Arten, die Kolonienunterseite färbt sich ocker oder braun und das Luftmycel besteht aus derberen, 2,5–3,0 μ breiten Hyphen.

Andere an Nematoden obligat parasitierende Arten mit ± kugeligen Konidien und schwach geschwollenen Phialiden wurden bisher als *Acrostalagmus*, *Verticillium* und *Cephalosporium* beschrieben. Diese Formen sind durch Fehlen der gedrungenen kurzen lateralen Trägerzellen von *Tolypocladium* zu unterscheiden. Ihre systematische Stellung ist noch nicht geklärt.

Arten der Gattung *Aphanocladium* W. Gams (1971) besitzen teils basal geschwollene, an der Spitze fein fädig verjüngte Phialiden, teils reduzierte sporogene Hälse, sogenannte Aphanophialiden. Die erste Form ähnelt der von *Tolypocladium*, jedoch sind die Phialiden bei *Aphanocladium* einzeln oder in unregelmässigen Wirteln direkt auf kriechenden Hyphen des Luftmycels angeordnet.

Sesquicillium microsporum (Jaap) Veenbaas-Rijks & W. Gams (Gams, 1971) ähnelt *T. geodes*, unterscheidet sich aber durch niedrigen Wuchs, fehlende Krümmung im Phialidenhals und häufiges Auftreten kurzer sporogener Hälse (Pleurophialiden) unterhalb der terminalen Phialiden und durch einseitig abgeflachte Konidien. Diese Art nimmt eine Mittelstellung zwischen *Sesquicillium* und *Tolypocladium* ein. Die für *Sesquicillium* charakteristischen Pleurophialiden treten nicht sehr regelmässig auf, und ähnliche Formen kommen gelegentlich auch bei *Tolypocladium*-Arten vor (Abb. 2, links).

Insektenpathogene Arten der Gattung *Hirsutella* besitzen allmählich verjüngte Phialiden, die auf dem natürlichen Substrat an Synnemata entstehen, sowie Phialosporen mit einer auffallenden, stark chromophilen Schleimhülle. Die Phialiden entwickeln sich in zwei getrennten Phasen: zuerst wird ein stumpfer Basalteil angelegt, aus dem später ein schlanker sporogener Hals hervorsprosst.

Durch Synnemata, flaschenförmige Phialiden und Konidienköpfchen ist die ebenfalls insektenpathogene Gattung *Synglíocladium* charakterisiert, deren Arten die Phialosporenform von *Sorosporella*-Chlamydosporenballen darstellen (Speare, 1920; Petch, 1942). Synnemata werden in feuchten Kammern auf den mit *Sorosporella* befallenen Wirtstieren gebildet; die Phialiden sind mässig verjüngt und bilden längliche oder zylindrische Konidien in Köpfchen. Reinkulturen von *Sorosporella uvella* (Krasilščik) Giard = *Synglíocladium cleonis* (Wize) Petch (CBS 326.33 und 225.65) wachsen sehr langsam und bilden nur vereinzelte Phialiden oder schwach verzweigte Konidienträger, die viel schlanker sind als bei *Tolypocladium*.

Die wenig differenzierten Mikrokonidienformen von *Sclerotinia*-Arten, die als *Myrioconium* Sydow (syn. *Cristulariella* Höhnel, *Botryophialophora* Linder) bekannt geworden sind (von Arx, 1970), unterscheiden sich habituell durch rascheres Wachstum und die Ausbildung von Sporodochien von *Tolypocladium;* ausserdem besitzen die Phialiden einen breiteren Hals mit Collarette.

Die Identität der Gattung *Cylindrodendrum* Bon. ist unsicher. Bonorden's (1851) Zeichnung erinnert an *T. cylindrosporum*, lässt aber keine sichere Bestimmung zu. Rostrup (1916: 40) illustrierte *Ç. album* Bon., das sterile Fortsätze an derben, *Trichoderma*-artigen Konidienträgern haben müsste.

Die Gattung *Uncigera* Sacc. & Berl. besitzt kurze, wenig geschwollene, aufwärts gekrümmte Phialiden, die ohne Trägerzellen wirtelig aus den Hyphenzellen entspringen, und — im Gegensatz zur originalen Diagnose — 2-zellige, stäbchenförmige Phialosporen (Typenkollektion in PAD).

Während bei Formen mit pfriemlichen Phialiden zahlreiche Uebergänge in der Anordnung der Konidien in Ketten oder Köpfchen bestehen (Gams, 1971), lässt sich bei Formen mit geschwollenen Phialiden nach der Konidienanordnung eine viel schärfere Grenze zwischen verschiedenen Gattungen ziehen. Damit scheiden kettenbildende Formen, wie *Paecilomyces* Bain., aus dieser Diskussion aus.

Da die drei hier beschriebenen Arten in keiner der genannten Gattungen untergebracht werden können, erscheint die Aufstellung der neuen Gattung *Tolypocladium* gerechtfertigt.

Den im Text genannten Mykologen danke ich für die Zusendung von Kulturen und Frl. A. J. Rademaker für die Reinzeichnung der Abbildungen.

Summary

A new genus of soil-borne Moniliales, *Tolypocladium*, is described with three new species. It is characterized by slow-growing raised floccose whitish colonies, conidiophores arising terminally and laterally from aerial hyphae, consisting of verticillate phialides, sometimes supported by short lateral cells; phialides consist of a swollen base and a narrowly tapering, frequently bent neck; conidia small, 1-celled, in slimy heads.

In the discussion genera of Moniliales with swollen phialides and 1-celled conidia in slimy heads are reviewed and compared with *Tolypocladium*.

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DACTYLARIA LANOSA, A NEW SPECIES FROM THE ROOT SURFACE OF PICEA ABIES

DEVINDRA S. MALLA* and WALTER GAMS
Centraalbureau voor Schimmelcultures, Baarn

(With one Text-figure)

Dactylaria lanosa is a new species isolated from washing-water of the roots of *Picea abies* collected in the northern part of Sjaelland in Denmark. It is characterized by rather slowly growing lanose, white to yellow (luteous) colonies, long conidiophores little differentiated from the vegetative hyphae, and narrowly fusiform, usually two-celled conidia.

For an investigation of the root surface mycoflora of young healthy *Picea abies* trees in northern Sjaelland, Denmark, isolations were made from the washing-water of the roots of about 10 years old trees dug out from a depth of *c.* 20 cm in a humus layer with an average pH of 4.2. In the early spring of 1969 an apparently unknown fungus was isolated, which we tentatively place in the genus *Dactylaria*.

Dactylaria lanosa, *nov. spec.*

Coloniae lente crescunt, 30 mm diametro post 15 dies 20°C, albae vel flavo-luteae, mycelio aerio lanoso, c. 4 mm alto, pigmento luteo vel pallide electrino in agaro diffundente. Hyphae ramosae, septatae 1.0–1.5(–2.0) μ crassae, interdum flavae incrustatae; anastomoses frequentes.

Conidiophora ab hyphis vegetativis paulo differunt, erecta, ad 320 μ alta 1.0–2.0 μ crassa, plerumque simplicia, nonnumquam ramos solitarios ferunt. Conidia (blastosporae) in successione e denticulis in apice aggregatis, demum sympodialiter elongatis oriuntur; verticilli denticulorum etiam sub septis inferioribus conidiophori oriri possunt; denticuli 1–4 μ longi, apice 0.4–1.0 μ crassi. Conidia anguste fusiformia, hyalina, tenui-tunicata, levia, plerumque bicellularia, rarius 3- vel 4-cellularia, apice fere acuto, basi paulatim angustata truncata, 15–28 × 1.5–2.3 μ. Chlamydosporae absunt.

Typus CBS 429.69, isolatus e radicibus *Piceae abietis*, Sjaelland, Daniae, 1969.

Colonies on 2% malt agar or oatmeal agar slow-growing, reaching 30 mm in diameter after 15 days at *c.* 20°C, whitish to yellow (luteous), with lanose aerial mycelium *c.* 4 mm high, luteous to pale amber pigment diffusing into the medium underneath the growing fungus. Vegetative hyphae branched, septate, 1.0–1.5(–2.0) μ wide, sometimes with yellow incrustations and with frequent anastomoses among younger hyphae. Conidiophores little differentiated from vegetative hyphae, erect, up to 320 μ long and 1.0–2.0 μ wide, usually simple, occasionally with solitary side branches. Slender conidiiferous denticles arise in succession in whorls or clusters at

* Formerly at Statens Forstlige Forsøgsvaesen, Springforbi, Denmark; present address: D–28, Bremen–Hastedt, Goslarerstrasse 12/14, W. Germany.

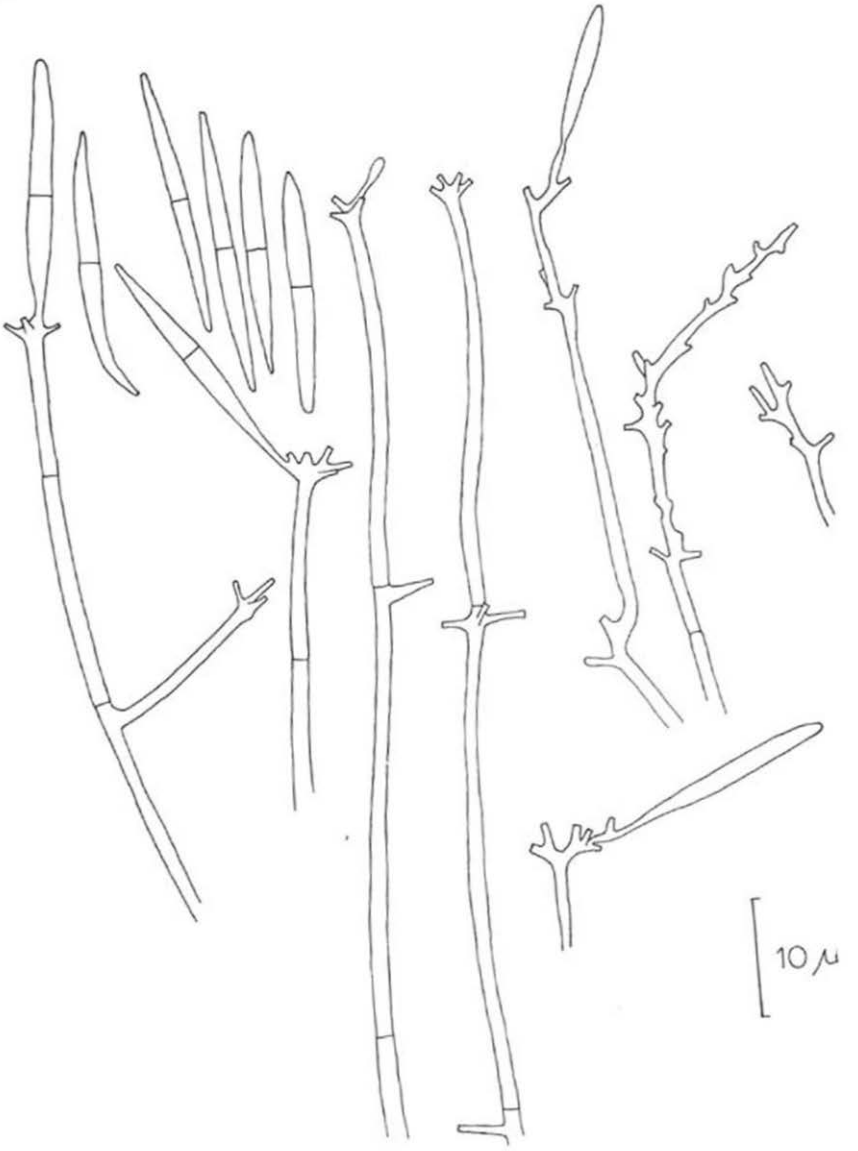

Fig. 1

the apex of the conidiophores; in old colonies the conidiophores may show distinct sympodial prolongations. Groups of denticles can also arise at lower levels of the conidiophore below a septum. The denticles are 1–4 μ long and 0.4–1.0 μ wide at the tip. Conidia narrowly fusiform, hyaline, thin-walled, smooth, usually 2-celled, rarely 3- or 4-celled, on potato-dextrose agar 1-celled conidia were seen to prevail; the distal end almost pointed, tapering more gradually towards the truncate base, 15–28 × 1.5–2.3 μ. Rarely a conidium remains firmly attached to its conidiophore and continues to grow apically with conidiiferous denticles. Mature conidia on germination can produce polar germ tubes on both ends; in larger forms lateral germ tubes also arise from the middle cell. Chlamydospores absent.

Typus: CBS 429.69 isolated from *Picea abies* root surface in north Sjaelland, Denmark, 1969.

The systematic position of the present species is somewhat problematic, because the genera *Dactylaria* and *Diplorhinotrichum* have not yet been revised exhaustively and the generic limits so far have not been fixed. The type species of the older genus *Dactylaria*, *D. purpurella* (Sacc.) Sacc., has only recently been isolated and carefully described (Hering, 1965; Rifai, 1968). Papendorf (1967) suggested that the two genera would have to be combined, and Bhatt & Kendrick (1968) made the necessary new combinations. In the same year Rifai (1968) unaware of the publication of Bhatt & Kendrick objected to this combination, because the shape of the conidiophores—cylindrical in *Diplorhinotrichum* and swollen in *Dactylaria*—would permit a distinction. The importance of this criterium, however, appears to have little value, even less than the shape of the conidiiferous denticles which in *Diplorhinotrichum* are usually very slender and distinct from the rest of the sporogenous cell (Hughes, 1951). The number of septa in the conidia is not recognized as having generic value by any of the recent authors. There remain however also differences in shape of the conidia, upon which the genera *Dactylina* Arnaud ex Subramanian (1963), with filiform conidial apex, and *Mirandina* Arnaud (1952, nomen nudum), with narrow rod-shaped conidia, have been distinguished. For the time being, we accept *Dactylaria* as the only generic name for this heterogeneous complex. From this genus the numerous nematode-capturing species described by Drechsler and his successors and characterized by rather fast growth have to be excluded, and there remain only very slow-growing species with dusty colony surface.

Dactylaria lanosa is related to species hitherto described in *Diplorhinotrichum* on the basis of the slender conidiiferous denticles; it shows similarities mainly with *Diplorhinotrichum affine* Rostrup (CBS 154.65) in the shape and size of conidia. It is however distinguished from all other species in *Dactylaria* by somewhat faster growth, long

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EXPLANATION OF FIGURE 1

Fig. 1. *Dactylaria lanosa*, CBS 429.69. Conidiophores and conidia from 8 days old colony on malt-extract agar (left); conidiophores with unusually strong prolongation from 1 month old colony on potato-carrot agar (right).

conidiophores in a cottony aerial mycelium and stronger concentration of the conidiiferous denticles in an apical cluster. On the other hand, the hyphae are too slender for the species to be included in Rifai's (1968) partly nematophagous genus *Candelabrella*, while also its growth is markedly slower.

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PENICILLIUM INFLATUM SP. NOV.

AMELIA C. STOLK and D. S. MALLA*
Centraalbureau voor Schimmelcultures, Baarn

(With one Text-figure)

A description and drawings are presented of a new species of *Penicillium* which is assigned to the *P. nigricans* series.

During investigations of the fungus flora on the root surface of *Picea abies* carried out in the coniferous forests of Denmark an interesting species of *Penicillium* was encountered. It proved to be sufficiently different from all described species of *Penicillium* (Raper & Thom, 1949; Kulik, 1968) to warrant its description as a new species. This fungus along with many others was isolated from the surface of roots which had been dug out from a depth of about 20 cm and whose length and diameter ranged 30 to 75 mm and 2 to 10 mm, respectively. All root samples were taken from young healthy looking trees not older than ten years. A few strains of the same fungus were isolated from forest soil in the Netherlands.

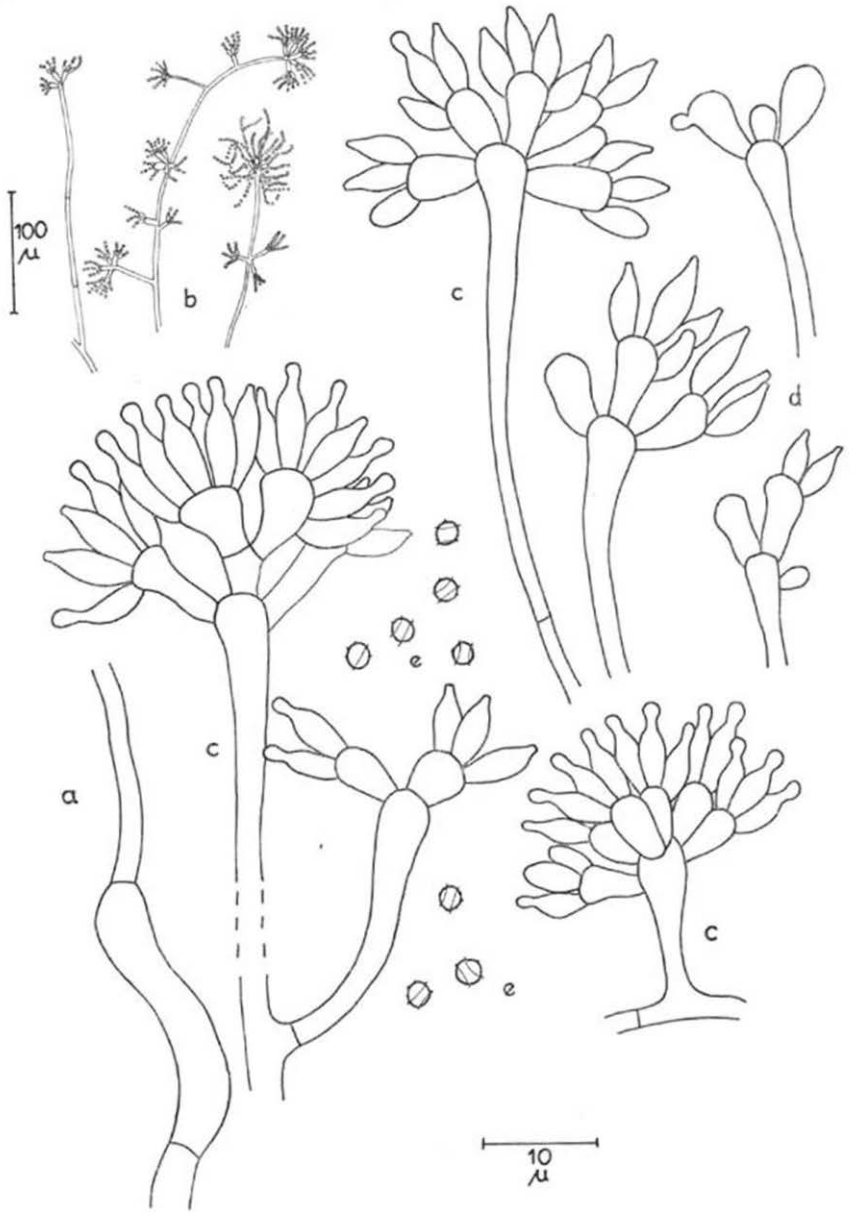
Cultures as well as dried type material of this species have been deposited at the "Centraalbureau voor Schimmelcultures", Baarn, The Netherlands.

Penicillium inflatum Stolk & Malla, *sp. nov.*—Fig. 1

Coloniae in agaro Czapekii post 2 hebdomatas 25 °C 1 cm diametro, durae, dense coactae, parce sporulantes, pallide olivaceae, reverso roseolo vel aurantio-brunneo. Coloniae in agaro maltoso post 2 hebdomatas 25 °C 2.5 cm diametro, margine velutino, parte submarginali medioque laxiores, copiose sporulantes, griseolae vel olivaceae vel bubalinae.

Hyphae vegetativae hyalinae, 1.5–4 μ diametro, cellulae submersae vulgo inflatae. In agaro maltoso conidiophora margine coloniae e hyphis submersis oriuntur penicillis terminata, in dies longitudine augmentata procumbunt et numerosos ramulos laterales penicillis terminatos proferunt; parte submarginali et centrali conidiophora brevia lateralia e hyphis aeriis oriuntur. Conidiophora tenuitunicata, hyalina, levia, longitudine maxime variabilia, nonnumquam ad 500 μ vel longiora, 1.5–3 μ crassa, apice inflato vesiculoso, 3.5–6 μ diametro. Rami irregulariter in conidiophoris dispositi, 5–30 × 1.5–2.5 μ, apice ad 3–4.5 μ inflati. Penicilli biverticillati divaricati, e 2–10 metulis plerumque valde divergentibus et phialidibus constant, omnino hyalini et leves. Metulae deinceps ex apice conidiophori oriuntur, clavatae, 5–10 μ longae, e 1.5–2.2 μ sursum ad 3–6 μ incrassatae. Phialides 3 vel 8 in verticillis, modice divergentes, deorsum modice attenuatae, apice abrupte in tubulum 0.5–1 μ longum constricto, 5.5–7.5 × 2–3 μ. Conidia brunneola, globosa vel subglobosa, asperulata, plerumque duobus

* Formerly at Statens Forstlige Forsøgsvaesen, Springforbi, Denmark; present address: D–28, Bremen—Hastedt, Goslarerstrasse 12/14, W. Germany.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fere parallelis anulis tenuibus praedita, 1.7–2.5 μ diametro. Catenae conidiorum divergunt. modice intricatae, ad 60 μ longae.

Typus CBS 682.70, isolatus a D. S. Malla, Statens Forstlige Forsøgsvaesen, Springforbi, Dania, 1970, a superficie radicum *Piceae abietis* in silva Danica, prope Lövenholm, Jutland.

Colonies on Czapek agar growing very restrictedly, attaining a diameter of about 1 cm in two weeks at 25 °C; central areas generally raised, mostly somewhat wrinkled and buckled, consisting of a tough, close-textured felt of hyphae, lightly sporing. Surface of central areas almost white, the very narrow plane marginal areas showing pale olivaceous to buff shades near Deep Olive-Buff (Ridgway, 1912: pl. 40; Rayner, 1970, 21‴b). Exudate lacking or in limited amount and then collecting in very small pale orange droplets. Margin abrupt. Reverse of the colonies pinkish to orange-brown from Light Pinkish Cinnamon to Cinnamon (Ridgway, pl. 29; Rayner 15″d to 15″), sometimes showing a small brown zone.

Colonies on malt agar growing slightly more rapidly than those on Czapek agar, attaining a diameter of 2.5 cm in two weeks at 25 °C; plane, slightly raised and furrowed in the centre of the colonies, velvety at the margin, becoming looser-textured in the submarginal and central areas, consisting of a thin network of trailing hyphae; slightly zonate in age; sporulating well. Surface showing greyish to olivaceous shades ranging from Light Grayish Olive to Grayish Olive (Ridgway, pl. 46; Rayner, 21⁗b to 21⁗). Reverse of the colonies yellowish brown.

Vegetative hyphae hyaline, branched, 1.5–4 μ in diameter, the submerged hyphae often showing inflations up to 8 μ in diameter. On malt agar conidiophores arising at the margin from submerged hyphae, terminating in penicilli, ascending at first, but with increasing length becoming procumbent and developing many short, separate side-branches with penicilli; in submarginal and central areas conidiophores arising as short branches from aerial hyphae.

Conidiophores hyaline, smooth- and thin-walled, varying greatly in length, ranging from very short when arising from aerial hyphae to 500 μ or even longer, by 1.5–3 μ in diameter; enlarged at the apex to form a vesicula-like structure 3.5–6 μ in diameter. Branches irregularly arranged along the conidiophores, measuring 5–30 × 1.5–2.5 μ, swollen at the apex to 3–4.5 μ in diameter. Penicilli biverticillate-divaricate, consisting of 2 to 10 mostly strongly diverging metulae bearing phialides; when many metulae are present they may be somewhat radiately arranged, giving the penicillus an *Aspergillus*-like appearance; also reduced forms consisting of only two metulae and monoverticillate penicilli occur; all elements of the penicillus are hyaline and smooth-walled. Metulae developing successively on the vesicula-like apex of the conidiophore, occasionally occurring also on its subterminal portion; club-shaped, rarely branched, 5–10 μ long, narrow at the base, 1.5–2.2 μ in diameter, broadening gradually to the swollen apex, 3–6 μ in diameter. Phialides developing successively on the swollen apex, occasionally also on the subterminal portion of the metula, occurring in small clusters of 3 to 8, slightly diverging, 5.5–7.5 × 2–3 μ, less wide at the base, narrowing at the top abruptly to a small, but definite conidium-bearing tip (0.5–1 μ long). Conidia brownish, globose to subglobose, slightly roughen-

EXPLANATION OF FIGURE 1

Text-fig. 1. *Penicillium inflatum*, CBS 682.70 — a. Vegetative hypha with inflated part. — b. Habit sketches of conidiophores bearing penicilli and branches with penicilli. — c. Different types of penicilli. — d. Development of penicilli, showing successive development of metulae. — e. Conidia.

ed, provided with mostly two roughly parallel, very thin bands, 1.7–2.5 μ in diameter. Conidial chains diverging, somewhat tangled, short, uo tp 60 μ long.

Minimum temperature 5°, optimum temperature 20–25 °C, maximum temperature 30°.

TYPE STRAIN: CBS 682.70 (S 13–105) isolated from the root surface of *Picea abies*, Lövenholm district, Jutland, by D. S. Malla, Statens Forstlige Forsøgsvaesen, Springforbi, Denmark, 1970.

ADDITIONAL STRAINS: CBS 132.70 (S 8–25), CBS 133.70 (S 10–4), CBS 134.70 (S 10–6), CBS 135.70 (S 10–22), all isolated from root surfaces of *Picea abies* by D. S. Malla in the Hörsholm district in the northern part of Sjaelland, Denmark, 1969, and CBS 817.70 isolated from forest soil under *Quercus rubra*, Spaanderswoud near Hilversum, Netherlands, by R. A. Samson, C.B.S. Baarn, October 1970.

The additional strains agree very well with the type strain. The specific epithet refers to the inflated apices of conidiophores, branches, and metulae.

Because of the swollen apices of its conidiophores and its many strongly diverging metulae, which in large heads may be radiate, the habit of this new species suggests a species of *Aspergillus*. It differs, however, from this genus in some important characters. No definite foot-cells are present, the metulae do not develop simultaneously on the apex of the conidiophore as is known to be the case in true *Aspergillus*, but they develop successively. Moreover the conidiophore wall is thin, whereas most *Aspergilli* have thick walls. The species shows much closer affinities to the genus *Penicillium*, especially to the *P. nigricans* series. Its cultures are greyish to olivaceous-buff like in this series, the conidia are brownish coloured, while the structure of the colony agrees completely with *P. nigricans* Bainier ex Thom (Raper & Thom, 1949: 325). Besides in *P. nigricans* metulae are strongly diverging and the apices of the metulae of this species are commonly inflated. However, *P. inflatum* differs from *P. nigricans* in its much larger number of metulae and in the structure and size of its conidia. In *P. daleae* Zaleski (Raper & Thom, 1949: 296)—a species that could be placed much better in the *P. nigricans* series than in the *P. janthinellum* series—the conidia are coaresly roughened in winding bands, but they are much larger than those of *P. inflatum* and besides of quite different shape.

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NOTES ON EUROPEAN POLYPORES—VIII [1]

M. A. DONK
Rijksherbarium, Leiden

In an analysis of the history of the names *Polyporus frondosus* (Dicks.) per Fr. and *P. intybaceus* Fr. the author delves back as far as 1552; he concludes that the two taxa were introduced for a single species. — The genus *Oligoporus* Bref. is restored and its type species (*O. farinosus* Bref.) identified with both *Polyporus rennyi* B. & Br. and *Ptychogaster citrinus* Boud. — One new specific combination is made in each of the following genera: *Oligoporus* Bref., and *Pycnoporellus* Murrill. — 15 specific names are discussed for different reasons.

References to literature citations listed at the end of this paper are by means of year dates printed in italics. Nomenclative details about generic names of polypores were given in previous papers (Donk, *1960*, *1962*).

I am grateful to Drs. F. Kotlaba and Z. Pouzar, Praha, for loan of material as well as for their comments in connection with *Oligoporus*; to Dr. J. A. Nannfeldt, Uppsala, for his comments on the discussion on *Grifola frondosa*; and to Dr. H. Jahn, Detmold, for the donation of an extremely fine set of collections of *Oligoporus farinosus*.

To Dr. Elizabeth Helmer van Maanen I am indebted for improving the English text.

Fomes

foliaceum. — *Agarico-igniarium foliaceum* Paul. *1793*: 87 (descr.), Index (Latin name) (devalidated name).

It is evident that *Agarico-igniarium foliaceum* Paulet is hopelessly confused. Its author cited as synonyms *Arborum fungi auriculae Iudae facie* Lobel (*1581*: 308 *fig.*) and *Lignosus aureus querci Fungus* van Sterbeeck (*1675* & *1712*: 245 *pl. 27 f. B*, Gout geile houte eycke Fungi). The story of misunderstanding and misstatement aroused by the former name is briefly touched upon in the discussion on *Grifola frondosa* (p. 207). It is likely that Paulet's use of the epithet "foliaceum" was inspired by the figures just cited. The personal part of Paulet's description however is concerned with the context of a polypore fruitbody stripped of its crust and tubes, as is expressly

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stated on the plate (Paulet, *1812–35*: *pl. 7 fs. 2, 3*) where the name *Pyreium fomentarium* replaces the earlier Latin name *A.-i. foliaceum*. It looks as though Paulet did not realize that when he wrote the text he was describing an incomplete fruitbody. The colour of the artifact as rendered on the plate is too dark for the natural context of *Fomes fomentarius* but it is quite likely that it was chemically treated before it reached Paulet. I would conclude that the name *A.-i. foliaceum* should be cited in the synonymy of *Fomes fomentarius*. Compare also Donk (*1960*: 178).

Grifola

f r o n d o s u s. — *Boletus frondosus* Dicks. *1785*: 18 (devalidated name), not *B. frondosus* Schrank 1789 (devalidated name); *Polyporus frondosus* (Dicks.) per Fr. *1821*: 355, 518 ("Schrank" in error), not *P. frondosus* Secr. 1833 (not validly published), not *P. frondosus* Fr. 1838; *Grifola frondosa* (Dicks. per Fr.) S. F. Gray *1821*: 643.

["*Polyporus* (*Boletus*) *imbricatus, squamosus* . . . Gleditsch Meth. fung." (unpublished) *apud* Boehm. *1750*: 325; ≡ *IX. Boletus*; *imbricatus, squamosus* . . . Gled. *1753*: 75;] ≡ *Boletus f r o n d o s u s* Schrank *1789*: 616 (devalidated name); ≡ *Boletus i n t y b a c e u s* Baumg. *1790*: 325 (devalidated name), not *Polyporus intybaceus* Fr. 1838.

Polyporus f r o n d o s u s Secr. *1833*: 56–57 (as a species of *Boletus*: not validly published), not *P. frondosus* (Dicks.) per Fr. 1821, not *P. frondosus* Fr. 1838.

Polyporus f r o n d o s u s Fr. *1838*: 446, not *P. frondosus* (Dicks.) per Fr. 1821.

Polyporus i n t y b a c e u s Fr. *1838*: 446, not *Boletus intybaceus* Baumg. 1790 (devalidated name).

The early history of the several binomials *Polyporus frondosus* is complicated and difficult to rationalize. Fries (*1821*: 355, 518) ascribed the basionym *Boletus frondosus* to "Schrank" without supplying any bibliographic reference to complement the author's citation. This is a strong indication that he copied it from the author he mentioned next, and whom he emphasized above the others: "Schrad. p. 159!" (observe the exclamation point!). The species that Schrader (*1794*: 159) had in mind was *Boletus frondosus* Dicks. 1785, to which he had reduced *B. frondosus* Schrank 1789 as a mere synonym. These last two specific names are apparently homonyms, published independently of each other (see below). By accepting that the reference to Schrader was in reality the principal one I suggest changing the author's citation of the name *Polyporus frondosus* from "(Schrank)" per Fr. to "(Dicks.)" per Fr. This obviates a great deal of trouble that harnassing the nomenclature might otherwise have caused.

Schrader's conception of *Boletus frondosus*, to which Fries referred in 1821, may perhaps be too broad but in my opinion it certainly included the modern interpretation of *Grifola frondosa*. Schrader cited not only Dickson but also von Haller no. 2276, *Florum fasciculus* Sterb., and *Fungi esculenti. Genus XXI* Clus. When Fries in 1838 redefined *Polyporus frondosus* (see also below) he expressly stated, "Hic est primarius *B. frondosus* et Clus. esc. g. 21. 5. Bauh. hist. XL. c. 46." He also wrote "Sterb. t. 28.

A. *optima*." Although he entered simultaneously "*B. frondosus* Schrad. spic. n. 21 aliorumque" under *Polyporus intybaceus* (see below), the just-mentioned facts could be taken as supporting the following partly hypothetic synonymy, which would logically lead to selecting the plate to be mentioned presently as the ultimate (lecto)type of the name *Polyporus frondosus* (Dicks.) per Fr. 1821:

Fungi esculenti. Genus XXI Clus. *1601:* cclxxv

≡ *Fungus maximus Ungaricus*; *multis laciniis squamatim incumbentibus* C. Bauh. *1623*: 372

≡ *Florum fasciculus* Sterb. *1675* & *1712*: 269 *pl. 28 f. A* ("*faciculus*")

≡ *Agaricus esculentus* Tourn. *1700*: 562

≡ (by lectotypification) *Polyporus frondosus, cespitosus, imbricatus, spadiceus, poris albidis* Haller *1768*: 139 (no. 2276) & *1769*: 202 (in both works citing *Florum fasciculus* Sterb.)

≡ (by lectotypification) *Boletus frondosus* Dicks. 1785

≡ *Polyporus frondosus* (Dicks.) per Fr. 1821.

The 'type specimen' I have in mind is represented by a beautiful plate that is part of the "Codex Clusii", which is in the possession of the Library of the University at Leiden. van Sterbeeck had the plate at his disposal and he was the first to publish it in the the form of the copperplate that was cited by Fries as "*optima*"! (Note the italics!) An excellent reproduction in colour of the original plate will be found in Istvanffi's book on Clusius's "Fungorum . . . historia" [*1900:* 79 (original description reproduced), Codex *pl. 67*]. The reproduction of the plate is an only very slightly reduced version; the colours in the original are somewhat less dark and more greyish. The copy published by van Sterbeeck is a strongly reduced one and by its size could perhaps suggest *Grifola frondosa* of modern authors rather than *Polyporus* [*Meripilus*] *giganteus* (Pers.) per Fr. That the plate belongs to Clusius's "Codex" and that it corresponds to '*Fungi esculenti. Genus XXI* Clus.' can hardly be doubted.

When Dickson introduced the binomial *Boletus frondosus* he gave a brief phrase ("cespitosus fuscus frondibus imbricatis planiusculis reflexis, poris albis") and three references, one of which is to "*Polyporus frondosus* . . . Haller". This last citation is of the phrase-name that supplied the epithet of Dickson's binomial. The other references are to Schaeffer's plates 128, 129; and to *Agaricus intybaceus* Tourn. as treated by Ray (*1724*: 23), the latter is a mixture of two or more species. Dickson's conception may not have been 'pure' but in any case he also cited van Sterbeeck's figure, which was the only illustration retained by von Haller in his strongly condensed and abbreviated "Nomenclator" (*1769*: 202, no. 2276). By taking this plate as representing the 'lectotype' of von Haller's and Dickson's names, the connection with Clusius's fungus would remain unbroken.

However, this solution which urges itself upon the mind would not serve stability in nomenclature. There can be no doubt at all that Clusius's text deals with *Meripilus giganteus* (Pers. per Fr.) P. Karst.; and although the plate has been traditionally referred to '*Polyporus frondosus*' there can be no doubt either that it represents also *M. giganteus*. The dimensions of the fruitbody as it appears on the plate (39 cm wide,

29 cm high, tuberous base 9 cm across) and of some of the separate caps (6.5, 6.5, 9, and 12 cm across) are telling enough to support this conclusion, even if it is assumed that the plate shows the fruitbody at a strongly reduced scale. The net outcome of accepting the preceding hypothetic lectotypification would be reducing the name *Polyporus frondosus* (Dicks.) per Fr. 1821 to the synonymy of *Meripilus giganteus*.

This unexpected result prompted another approach to the selection of the type of *Polyporus frondosus* as revalidated by Fries in 1821. Although von Haller cited van Sterbeeck's figure it would appear that he confused two species, *Meripilus giganteus* and *Polyporus frondosus* of modern authors; for instance, the remark in his description "Caro succulenta, fragilis, Fungorum lamellatorum" favours this conclusion. "Succulentus" might perhaps agree better with *M. giganteus* but "fragilis" can hardly be taken to stand for 'fissilis, with tough fibers', especially in view of the addition ". . . Fungorum lamellatorum." Dickson is less verbose but he maintained "Caro succulenta, fragilis" in an observation. This points to *P. frondosus* of modern authors.

When Schrader accepted Dickson's taxon and name he did not want to admit *Meripilus giganteus* to his conception. He excluded it as *Boletus elegans* Bolt. and characterized it with remarkable explicitness ". . . poris tamen contactu ex albido in sordide fuscum colorem transeuntibus et substantia a pilei margine ad basin usque facile in fibras tenacissimas irritabiles separanda . . .." He was also careful to exclude *Boletus ramosissimus* Scop. = *Grifola umbellata* (Pers. per Fr.) Pilát.

In my opinion it is preferable to typify the name *P. frondosus* as re-validated by Fries (1821) by a specimen of the current conception which I identify with Schrader's who remarked, "Schaefferi icon. [pl. 128, 129] habitum optime refert".

In later work Fries (*1838*: 446) broke up his *Polyporus frondosus* into two species, *P. frondosus* and *P. intybaceus*. Under *P. frondosus* he neither retained nor mentioned any citations of the binomials of 1821 except one, "Fl. Dan. t. 952". This plate (as *Boletus frondosus* Dicks.; no description) could be the fungus that is currently called *P. frondosus*. Although Fries cited "*B. frondosus* Schrad. spic. n. 21 aliorumque" under *P. intybaceus* he retained the binomial *Polyporus frondosus* for a revised taxon for which he emphasized Clusius's plate: "Hic est primarius *B. frondosus* et Clus. esc. g. 21. s. Bauh. hist. XL. c. 46." By acting in this manner Fries actually changed the application of the name *Polyporus frondosus* which he revalidated in 1821, and he misapplied it with exclusion of the type if the second typification suggested above is accepted. This would make *Polyporus frondosus* Fr. 1838 a 'new' but homonymous (and impriorable) name. Fries himself provided a sound basis for this line of reasoning by emphatically transferring to *Polyporus intybaceus* the crucial references (and with that the 'type'), viz. "Schrad. spic n. 21. aliorumque" which in my opinion also comprises 'Dickson' (not cited by Fries) and 'Schrank', both mentioned by Schrader who excluded the *M. giganteus* element from Dickson's taxon (although his synonymy was insufficiently purified, for instance by still citing van Sterbeeck's *Florum fasciculus*).

In the interest of stability in nomenclature I prefer to follow the second typification of the name *Polyporus frondosus* Fr. 1821. This not only rescues the current application

of the name *P. frondosus* and its isonyms but also prevents the possibility that the generic name *Grifola* has to be redefined to equal *Meripilus* and which in its turn would necessitate the re-introduction of an other name for *Grifola* in the present sense; these would not be the only consequences of a typification by a specimen belonging to *M. giganteus*.

I am at a loss to suggest what fungus Fries had in mind when he published his revised conception of *P. frondosus*, which was stated to be common ("saepissime"). There are several indications that point to *Meripilus giganteus*: (i) "fibroso-carnosus, tenacellus" and (ii) the citation "Rostk. t. 18" (= Rostkovius, *1830*: 39 *pl. 18*, as *Polyporus frondosus*), a plate that certainly represents *Meripilus giganteus*. (iii) Later Fries (*1863a*: 28 *pl. 44*) published as *Polyporus frondosus* a plate that could have been drawn rather schematically after a not too big fruitbody of *Meripilus giganteus*. (It is not unlikely that Fries did not see the fruitbody itself. The plate was produced under the supervision of O. Robert Fries; it is doubtful whether both the plate and the accompanying descriptive text were drawn up from the same material.)

Fries credited Secretan as being the first author in his time to distinguish correctly between *Polyporus frondosus* and *P. intybaceus*. What Secretan (*1833*: 56–57) actually did was to introduce a *Polyporus frondosus* of his own (as a species of *Boletus*) by excluding the type, which he cited as "Dickson fasc. 1, p. 18" under his (erroneous) conception of *P. ramosissimus*. As a curiosity it may be recalled that he cited Schaeffer's plate 128 for his *P. ramosissimus* and Schaeffer's plate 129 for his *P. frondosus*. Both plates seem to have been drawn from a piece of a bigger specimen (as Fries concluded), one showing the upper surface, the other the lower. Fries thought that both plates should be referred to *P. intybaceus*. As to *P. frondosus* Secr. I am not prepared to suggest its identity should it prove to be different from the true *P. frondosus* and not to represent a small fruitbody of *Meripilus giganteus*.

When Fries (*1838*: 446–447) published *Polyporus intybaceus* he had seen it in the flesh only once, in contradistinction to his revised version of *P. frondosus* ("saepissime"). The collection was found in the south of Sweden, in Halland (Fries, *1849*: 319; *1863b*: 252). He was never to come across a second collection: "Unicum in vivo trunco vidimis formae a" (Fries *1874*: 539; for the form "b. truncigenus. . ." he merely cited an old Italian author, Boccone, without supplementary details). He concluded his account with the statement, "Hic est verus *Fung. intybaceus* Bauh. [hist. XL.] c. 45 et Veter." This claim will be discussed below. He did not specify any particular binomial basionym but confined himself to the indefinite reference, "*B*[*oletus*] *intyb*. Auctt. pr. p." In later work he was sufficiently consistent to cite himself as the author of the name *Polyporus intybaceus*; therefore the type of this name ought rather to be the single (lost) collection mentioned above which he had seen himself.

Fries did not separately cite the much earlier published binomial *Boletus intybaceus* Baumg. 1790 which was introduced for a taxon previously defined under a non-binomial name by Gleditsch (*apud* Boehmer 1750; Gleditsch 1753). Like Fries these

authors identified their taxon with *Agaricus intybaceus* Tourn. 1700, Dill. 1719 ≡ *Fungus intybaceus* Bauh. & Cherl. 1651, both non-binomial names.

In the quest for the correct interpretation of *Polyporus intybaceus* Fr. (exclusive of "b. truncigena") a careful inspection of the plates and descriptions cited by Fries was thought to be possibly helpful.

(i). "*B. frondosus* Schrad. spic. n. 21 aliorumque" [Schrad. *1794*: 159]. I cannot see why this should not be the *Grifola frondosa* of modern mycology.

(ii). "*P. giganteus*. Fl. Dan. t. 1793" [Hornem. *1823*: 12 *pl. 1793*]. This is a copy of a plate by Schumacher; it is to be interpreted in connection with that author's text (*1803*: 383, as *Boletus giganteus*). There is little doubt in my mind that Schumacher's plate was correctly named and represented *Meripilus giganteus*; compare, *inter alia*, "Grex hujus fungi ad latit. 2 ped. & ultra altitudin. 1–1½ ped. crescit. Singulus pileus 3–5–6 poll. latus." Such a fungus had of course to be depicted on a reduced scale (which may have misled Fries) and to be drawn somewhat schematically. The caps show no zonation, but this is accounted for in Schumacher's description. Schumacher referred here *Clavaria aequivoca* Holmskj., a name also listed by Fries as a synonym of *Polyporus* [*Meripilus*] *giganteus*.

(iii). "Secr. n. 7" (*Polyporus ramosissimus*, Secr. *1833*: 56, citing "Schaeff. t. 128. *Bol. ramosissimus*"). The plate referred to by Secretan is to me a good illustration of *Grifola frondosa*. In Secretan's description however there is too much that does not agree with that of Fries, like for instance: "La chair . . . est filamenteuse, humide, molle et cependant élastique, ferme, cassante". Fries wrote, "carnosus, subfragilis", a qualification that must be understood in contrast to "fibro-carnosus" in the revised description of 1838 of *Polyporus frondosus* preceding that of *P. intybaceus*. Much in Secretan's account suggests *Meripilus giganteus* rather than a species of *Grifola* but I am not prepared to be more positive.

It is difficult to evaluate these references. The last two especially are no aid in evoking a species that is different from but nevertheless similar to both *Grifola frondosa* and *Meripilus giganteus*. If such a fungus really exists, I do not know it or have not recognized it as such.

Fries (*1838*: 447) identified his *Polyporus intybaceus* with a fungus (or rather, fungi) described in the pre-Linnean era: "Hic est verus *Fung. intybaceus* Bauh. [hist. XI.] c. 45 et Veter." The 'name' referred to is *Fungus intybaceus, et alius interaneis vituli similis, cinereus* J. Bauhin & Cherler (*1651*: 839 with *fig.*), a denomination later altered into *Agaricus intybaceus* Tournefort (*1700*: 562). Bauhin & Cherler's phrase strongly calls to mind Tragus's brief description (*1552*: 562) of his "Hasenörlin", which they included in their conception: ". . . forman interaneorum vituli representans, incani & plumbeicoloris . . .." Tragus (= Bock) gave no figure. In addition it may be pointed out that Bauhin & Cherler's phrase clearly indicates that they had in mind not a single fungus but rather a group of fungi (". . . *et alius* . . .").

Is Fries's identification correct? The word "intybaceus" is an allusion to the chicory plant, particularly to the vegetable with strongly lobed and waved to twisted

leaves; the words "interaneis vituli" invoke the convolutions of the intestines of a calf. The accompanying woodcut in Bauhin & Cherler's herbal is in agreement and shows a strongly lobed and convoluted membrane, reminiscent of the fruitbody of one of the foliaceous species of *Tremella* but then on a gigantic scale if it is compared with the tree trunk on [!] which it is shown to grow. If the fruitbody was not drawn entirely out of proportion however a species of *Tremella* is to be excluded; in view of its size another genus comes to mind, viz. *Sparassis* Fr. (*Masseeola* O.K.), particularly specimens with a very loosely built fruitbody of *S. laminosa* Fr. If this second guess should be correct it must be assumed that the artist of the woodcut gave an oversimplified version of what he saw—if it was really drawn at all from an actual fruitbody. Bauhin & Cherler's figure in no way suggests a species of *Grifola* or *Meripilus*.

Actually their figure was an altered version of an earlier published woodcut accompanying a paragraph in a work by Lobel (*1581*: 308 with *fig.*) [2] dealing cursorily with an assemblage of very different tree fungi; the paragraph is captioned, "Boom-Campernoellë Judas-ooren gelijckende", *Arborum fungi auriculae Iudae facie*. Lobel's figure was carefully reproduced by Clusius (*1601*: *fig.* on p. ccxlii, with a Latin translation of a good portion of the Dutch text). Especially the upper two-thirds of the fruitbody depicted by Lobel is reminiscent of the one in Bauhin & Cherler's figure. Inexact copying was not rare at that time. In this connection I would call to mind van Sterbeeck (*1675* & *1712*: 124 *pl. 15 f. E*), who published a figure of *Fungus intybaceus* stated to be drawn from nature ("hier naar het leven in print staet"). The fruitbody itself however is obviously copied from Lobel's woodcut while the tree trunk is a modified rendering adapted from Bauhin & Cherler's woodcut. The artistic addition of a few oak leaves seems therefore to be wholly original.

The question now arises as to how this convoluted, continuous and membranous fruitbody could have been taken as representing a polypore of the genera *Grifola* or *Meripilus*. The preceding analysis leads inevitably to the conclusion that Bauhin & Cherler's "*Fungs intybaceus, et alius* [!]. . ." is a mixture. One of its elements is in any case a polypore; it is Tragus's "Hasenörlin", which I would prefer to identify with *Grifola frondosa*. Of the rest an important constituent is the fungus rendered in Lobel's figure. As discussed above this is difficult to place.

I have looked into the possibility of interpreting *Boletus frondosus* Schrank 1789 as an application of *B. frondosus* Dicks. 1785 but have found no evidence for such a solution. On the contrary von Schrank's German phrase points in a different direction; it is only too evident that it is a translation from the one in Latin published by Gleditsch (*1753*: 325) and cited in his synonymy. *Boletus intybaceus* Baumg. 1790 is another binomial introduced for Gleditsch's taxon. The epithet chosen by Baumgarten

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[2] Following the reference "An arborum Fungi Auriculae Judae facie, Lobelio?", Bauhin & Cherler wrote, "Eius Iconem nimis imitatus est pictor, nostrâ plantâ neglectâ cui cristatae & crispae orae."

was apparently suggested by Gleditsch's mention of "*Agaricus intybaceus* Tourn." as a synonym.

It is not surprising that after Fries had split up his *Polyporus frondosus* into two taxa European mycologists have tried to account for both of them. It may be said that at present continental mycologists rarely record *P. intybaceus* and seem either to have abandoned the idea that it really exists or else regard it as no more than a form of *P. frondosus*. British mycologists, on the other hand, usually record *P. intybaceus* and say little about *P. frondosus*. *Polyporus intybaceus* is said by them to have a smell of mice and *P. frondosus* to differ in the larger size and greyish colour of the pilei (Wakefield & Dennis, *1950*: 228 *pl. 93 f. 2*).

Both in western Europe and the British Isles I have repeatedly collected or seen fruitbodies of what I call *P. frondosus*. These varied considerably according to age and humidity and after drying they all smelled of mice. The colour is a saturated soot-colour (fuligineous) when fresh and moist but upon drying it often changes to lighter colours, from pale brownish to light grey, especially in not completely full-grown specimens.

POSTSCRIPT.—Dr. J. A. Nannfeldt, Uppsala, has kindly read most of the preceding discussion on *Grifola frondosa*. His comment reads as follows:

I have tried in vain to find any trace of *Polyporus intybaceus* in our collections. *Polyporus frondosus*, *P. giganteus*, and *P. umbellatus* are all very rare species in Sweden and certainly were so also in Fries's time. His knowledge of them was to be sure not too good . . ..

The plate of *P. frondosum* was drawn in Femsjö, when O. Robert Fries was there accompanied by the artist, and so it is certain that Elias Fries did not see the fruitbody himself but as he published the plate as *P. frondosus* and in the text gave the differences from *P. giganteus* it is evident that he approved the plate as representing *P. frondosus*. I have no opinion myself. I have seen *P. frondosus* only once—many years ago, and have never seen *P. giganteus* in nature.

After all, I find it most probable that *P. intybaceus* was an unnecessary duplication of *P. frondosus*.

Hirschioporus

a b i e t i n u s. — *Boletus abietinus* Anon. *1790*: 19 (devalidated name).

Boletus a b i e t i n u s Pers. *apud* Gmel. *1792*: 1437 (devalidated name), not *B. abietinus* Anon. 1790, not *B. abietinus* Cumino 1805; *Polyporus abietinus* (Pers.) per Fr. *1821*: 370; *Hirschioporus abietinus* (Pers. per Fr.) Donk *1933*: 168; ≡ *Boletus p u r p u r a s c e n s* Pers. *1796*: 24 (devalidated name), not *B. purpurascens* DC. 1815 (devalidated name) per Steud. 1824, not *B. purpurascens* Hook. 1822.

It has rarely been realized that there are two names *Boletus abietinus* published for the same species, now often called *Hirschioporus abietinus*.[3]

(i) *Boletus abietinus* Anonymus 1790 was published in a paper for which no author was indicated. Since the paper was sandwiched in between two papers by von Paula von Schrank, he has occasionally been cited as the originator of the name. The association is still highly conjunctural and I shall not follow it. Dickson referred back to the anonymously published name. Citation of "Dicks." is to be regarded as an indirect reference to "Anon." and must be corrected accordingly.

(ii) *Boletus abietinus* Pers. apud Gmel. 1792 stands for the same species as (i) but it was evidently published without knowledge of the earlier name. Once Persoon was aware of this he changed the name he had introduced as a later homonym into *Boletus purpurascens* Pers. 1796. Later he concluded (Persoon, *1801*: 541) that *Boletus abietinus* Anon. as redescribed by Dickson (*1793*: 21 *pl. 9 f. 9*) and his own *B. abietinus* stood for one and the same species; for this he adopted the name "*Boletus abietinus*. . . [Pers.,] Obs. myc. 1. p. 24 *Bol. purpurascens*" [≡ *B. abietinus* Pers. 1792], citing *B. abietinus* Dicks. [≡ *B. abietinus* Anon. 1790] as a synonym.

When Fries published the recombination *Polyporus abietinus* he cited both Dickson and Persoon ("Obs. 1 p. 24. [*1796*] Syn. p. 541. [*1801*]") but in the index (*1821*: 518) he made it clear that of the two he considered "Pers." as the author of the basionym; his citation was "[*Polyporus*] *abietinus* Pers. sub *Boleto*". Hence, *Polyporus abietinus* "(Pers.)" per Fr. 1821, rather than *P. abietinus* "(Dicks.)" per Fr. 1821.

I do not believe that any later mycologist has ever fully realized that there were two taxa with the same (devalidated) basionym involved. Apparently, even Fries lost sight of the complication when, many years later, in the index (p. 55) to the completed "Systema" (*1832*) he cited only *B. abietinus* "Dicks." as synonym of *Polyporus abietinus*. This might be taken as the publication of a later homonym "*P. abietinus* (Anon.) per Fr. 1832, not *P. abietinus* (Pers.) per Fr. 1821". Sorting out the recombinations in order to refer each of them to the correct basionym is therefore a hazardous task and no two mycologists will ever completely agree. A proposed solution is that if an author cites only Dickson directly after, or in conjunction with, his recombination, this is to be associated with *B. abietinus* Anon.; if he cites only Persoon, or only Fries, his recombination is to be associated with *B. abietinus* Pers.; if he cites "Dicks. ex Fr." "Dicks." should be considered the less important of the two and taken as an error to be dropped, which leaves "Fr." and the recombination is also to be associated with *B. abietinus* Pers.

Inonotus

r u b i g i n o s u s. — *Polyporus rubiginosus* Fr. *1838*: 460, not *P. rubiginosus* Wallr. 1833, not *P. rubiginosus* Berk. 1839.

[3] The foot-note appended to this name by Donk (*1960*: 227) is an error, caused by telescoping inadvertently two remarks, one dealing with *Polyporus frondosus*, the other with *P. abietinus*.

When Fries introduced the name *Polyporus rubiginosus* for *Polyporus cuticularis* sensu Rostkovius (*1830*: 67 *pl. 32*) he had thought of *Boletus rubiginosus* Schrad. but did not definitely include it: "Schrad. sp. p. 168 bene convenit, praeter substantiam pallidam quae sq. [*Polyporus resinosus* (Schrad.) per Fr.] sitaneum indicat." When typifying the name *Polyporus rubiginosus* Fr., Schrader's species should therefore be left out of account. The name is clearly based on Rostkovius's interpretation of *P.* [*Inonotus*] *cuticularis* (Bull.) per Fr., although Fries assumed that he had collected the same species: compare, "etiam a me lectus, sed ex Rostk. recipio, cum induratum pro *P. dryadei* forma neglexerim." No material collected by Rostkovius is now known to be in existence so that for an interpretation attention is forced to his (poor) plate.

Romell (*1912*: 636) mentioned an "authentic" specimen from Fries in Kew Herbarium; he thought that it represented *Polyporus* [*Amylocystis*] *lapponicus* Romell. Bresadola (*1897*: 72) identified *P. rubiginosus* Fr. "nec. Schrad." with what is now called *Polyporus* [*Tyromyces*] *fissilis* B. & C. Lloyd (*1915*: 284) thought that the "type" from Fries at Kew was *Polyporus* [*Inonotus*] *cuticularis*.

I would advance a still different suggestion: *Inonotus rheades* (Pers.) P. Karst. [*I. vulpinus* (Fr.) P. Karst.]. The arguments in favour of this are (i) the shape of the fruitbody depicted by Rostkovius; it shows two caps sessile on a tuberous body. Although this tuberous part and the caps in section show no difference in substance in the figure nevertheless the whole strongly suggests *I. rheades*. Compare, for instance, Overholts figures (*1953: pl. 50 fs. 302, 303*) of *Polyporus* [*Inonotus*] *dryophilus* Berk., a closely related species. (ii) The indicated colours agree with those found in the European species of *Inonotus;* this would exclude both *Amylocystis lapponica* and *Tyromyces fissilis* but it might indicate that Lloyd's determination comes nearest the truth. (iii) Rostkovius mentioned, "Die Haut welche den Hut überzieht, ist sehr dick, und wird beim trocknen hart." This is a condition also encountered incidentally in old and weathered, poorly conserved specimens of *Inonotus vulpinus*. This implies that the original strigose hirsuteness of the cap had already disappeared as such when the plate was drawn. Fries's figure of what he called *Polyporus fulvus* (*1884*: *pl. 184 f. 3*, now taken to represent *I. vulpinus* = *I. rheades*), shows a well developed core with three sessile fruitbodies on it, and the strigose indumentum still intact. The sectioned fruitbodies drawn by Rostkovius and Fries show an undeniable similarity. (iv) Rostkovius gave beech (*Fagus*) as the substratum ("an alten Buchenstubben"), which would exclude *I. dryophilus*. In this case I distrust the habitat indicated but if it is taken to be correct (instead of dead *Populus* stumps) it is most likely that *Polyporus cuticularis* Fr. sensu Rostk. is the same as *Inonotus rheades*.

Oligoporus

r e n n y i. — *Polyporus rennyi* B. & Br. *1875*: 31; *Poria rennyi* (B. & Br.) Cooke *1886*: 112; *Strangulidium rennyi* (B. & Br.) Pouz. *1967*: 206.

Ptychogaster c i t r i n u s Boud. *1887*: 8 *pl. 1 f. 1* (nomen anamorphosis).

Oligoporus f a r i n o s u s Bref. *1888*: 118 *pl. 7 fs. 12–22.*

Polyporus rennyi B. & Br. (the original specimens of which came from Scotland) had long been insufficiently known; recently Pouzar restored it as a distinct species. The original description runs:

"Subiculo crasso, pulvinato, pulverulento; poris parvis, elongatis; dissepimentis tenuibus. / On wood, and running on to the ground. . . . / Forming a thick, at first somewhat frothy, then pulverulent mass, white turning to lemon-coloured when dry; pores sparingly produced, white elongated. . . ." — Berkeley & Broome (*1875*: 31).

According to Reid & Austwick (*1963*: 310), "the type material is an imperfect fungus producing an abundance of subglobose or oval chlamydospores measuring 5–6(–7) × 4–4.5 *μ*. The fructification consists of a thin membranous film spreading over soil and vegetal débris. There is no indication of the development of pores." A still more recent examination of the type by Kotlaba & Pouzar (*1965*: 76) led to the conclusion that it was identical with the acystidiate fungus that Romell had confused with the true *Polyporus sericeo-mollis* Romell. Recently Pouzar (*1967*: 208) gave some additional details: "the type is a very small fragment and only a few tubes have been observed. But the tubes have the essential characters of the acystidiate species: there are thick-walled, dextrinoid chlamydospores, no cystidia and a few typical basidiospores."

It is perfectly evident that Pouzar does not hesitate to identify *Polyporus rennyi* with the element formerly included in *Polyporus sericeo-mollis* that is normally accompanied by a citrin-yellow chlamydosporous state and which is different from the species represented by the type of this specific name (cystidia-bearing; no chlamydosporous state known).

This conception of *Polyporus rennyi* provides a name for a species that has been found sporadically all over northern Europe and was recently reported from Germany by Jahn (*1970*) who stated that the fungus "wächst offenbar recht häufig im Herbst und Spätherbst bis zum ersten Frost in geschlossenen, feuchten Fichtenforsten des Teutoburger Waldes und Egge-Gebirges." A still earlier record of this species from Germany was published by Kallenbach (*1934*: 66 *pl. 10*) under the incorrect name *Polyporus apalus* Lév. He arrived at this name because he thought his material agreed with Bourdot & Galzin's interpretation of Léveillé's species but I have no doubt that *Polyporus rennyi* is specifically distinct from the original species and from Bourdot & Galzin's interpretation of it, both of which I know only from their published descriptions. The popular German name proposed by Kallenbach is "Mehlstaub-Porling", an excellent suggestion.

The publication of *Polyporus sericeo-mollis* Romell (*1911*: 20 *f. 7*) covered several elements which during the last decennium have been disentangled. The type specimen with which the specific name must remain associated represents a species with a (mostly) effused fruitbody, hymenial cystidia and as far as is known lacking a chlamydosporous state accompanying it in nature: compare Lowe (*1959*: 107; *1966*: 84 *f. 66*) and Kotlaba & Pouzar (*1965*: 76).

A second element was mentioned in Romell's protologue: "Some specimens which seem to belong to this plant are partly or totally reduced into a floccose-pulveraceous state of sulphureous or pallid color, which contains abundant . . . chlamydospores. . ., not unlike those of *Ptychogaster albus*, though more hyaline." In a later publication Romell (*1926*: 17) thought that "The specimens [of *P. sericeo-mollis*] accompanied by sulphurous conidia . . . should probably be referred to *Ptychogaster citrinus*." I would suggest that Romell hooked this imperfect state to *P. citrinus* Boud. In any case it is this element that was identified by Pouzar with *Polyporus rennyi*. More will be said about Boudier's species below.

In passing it may be mentioned that Romell (*1911*: 22) included still a further element in his original conception. Material collected at Femsjö, and which he referred to as a variety, was associated with "a fibrous-pulveraceous *Ptychogaster* of about isabelline color, still more like small specimens of *Ptychogaster albus*." Moreover in a later publication he introduced a fourth element which ultimately he segregated under the name *Polyporus subsericeo-mollis*. These last two elements will be left out of discussion here.

The fungus described by Boudier as *Ptychogaster citrinus* consisted of a chlamydospores-producing state that also formed a polyporoid perfect state. Boudier himself expressed the view that the polypore looked like *Polyporus* [*Skeletocutis*] *amorphus* Fr. per Fr. Brefeld however emphatically denied this identification. I agree that Boudier's description and figures contain no evidence to support his view. On the contrary he recorded the basidiospores as ovoid, 4–4.5 × 2.5 μ; this does not agree with the narrow-cylindrical, slightly curved spores of *Skeletocutis amorphus* (Fr. per Fr.) Kotl. & P. On the other hand they do agree with the spores of *Polyporus rennyi*, or at least with material associated with a chlamydosporous state and erroneously referred to *P. sericeomollis*.

Above I have listed *Ptychogaster citrinus* Boud. as a nomen anamorphosis because in the formal Latin diagnosis of the protologue no mention was made of the basidiferous state; what Boudier wished to name was clearly the imperfect state in order to contrast it with the perfect state. Of the latter he remarked in the French text following the Latin diagnosis that the species may form portions with tubes "ayant bien l'aspect général du *Polyporus amorphus*, dont il est probable [!] qu'elle est l'état conidifère." In Boudier's opinion it was likely that the perfect state had already been provided with a name.

It is now none too soon to introduce into this discussion an at present much neglected fungus that was described as *Oligoporus farinosus* Brefeld (*1888*: 118 *pl. 7 fs. 12–22*) and which is the lectotype of the generic name *Oligoporus* Bref. (cf. Donk, *1960*: 248). It was found in the Teutoburger Wald, the same region from which Jahn recently reported *Polyporus rennyi* as "offenbar recht häufig" (see further the quotation near the beginning of this discussion). There can be little doubt about the correctness of Brefeld's identification with *Ptychogaster citrinus* Boud. The section of a fruitbody of *Oligoporus farinosus* depicted by Brefeld (*1888*: *pl. 7 f. 14*: *2*) is somewhat

reminiscent of the sectioned fruitbodies depicted for *Leptoporus revolutus* (Bres.) Bourd. & G. by Bourdot & Galzin (*1928*: *f. 157*) but a study of the accompanying description of the latter leaves little doubt that the two species are different. It must now be decided whether Brefeld's fungus is to be identified with *Polyporus rennyi*.

On the basis of the available material and descriptions of the taxa reviewed above I find it impossible to suggest any distinguishing characters in connection with the imperfect states. The same is true for the perfect state. There is, for instance, much agreement on habitat: "on wood, and running on to the ground" (*Polyporus rennyi*); "Ad cortices emortuos *Pini sylvestris*. . . . s'étend aussi sur les feuilles et la terre avoisinant les souches de pins" (*Ptychogaster citrinus*), "in einem Nadelholzwalde auf der Erde, wo er mit Fichtennadeln, einigen Laubblättern und etwas Moos zusammengewachsen war. Bei näherer Besichtigung ergab sich ein abgehauener Stumpf von *Abies excelsa* als Unterlage . . . . Auf dem Stumpfe, sowie auch an der seitlich noch erhaltene Rinde der Fichte zeigte sich der Pilz in zusammengehangende Partien. . ." (*Oligoporus farinosus*).

The general shape of the spores seems to offer little if any variation, although if all taxa are taken together there is rather wide variation in size. However, all the following measurements combined result in 3–6 × 2–3.5 μ.

Bourdot & Galzin (*1928*: 548), for "*Leptoporus destructor* subsp. *sericeo-mollis*", 4–5(–6) × 2–3(–3.5) μ;

Wakefield & Pearson (*1918*: 75), for "*Poria sericeo-mollis*" (Romell) Lloyd, 4–6 × 2–3 μ;

Boudier (*1887*: 10), for *Ptychogaster citrinus* Boud., 4–4.5 × 2.5 μ;

Litschauer *apud* Jahn (*1970*: 15), for "*Polyporus sericeomollis*" with *Ptychogaster citrinus* "Romell", 4–5(–5.5) × 2.5–2.75 μ;

Kallenbach (*1934*: 66), for *Polyporus apalus* Lév. sensu Kallenb., 3–5 × 2–3 μ.

The agreement between the shape, colour, and size of the chlamydospores as given by various authors is really surprizing: Reid & Austwick (*1963*: 310) for the type of *Polyporus rennyi*, 5–6(–7) × 4–4.5 μ; Boudier (*1887*: 9) for *Ptychogaster citrinus*, 6–7 × 4–5 μ; Romell (*1911*: 22) for the sulphur-coloured chlamydospores mentioned in the original description of *Polyporus sericeo-mollis*, 5–7.5 × 4–5 μ; Wakefield & Pearson (*1918*: 75) for "*Poria sericeo-mollis*", 5–7.5 × 4–5 μ; Litschauer *apud* Jahn (*1970*: 15) for "*Polyporus sericeo-mollis*" with *Ptychogaster citrinus*, 5–7 × 3–5 μ; Kallenbach (*1934*: 66) for *Polyporus apalus* Lév. sensu Kallenb., 4–8 × 4–5 μ.

In one respect a significant difference may exist between *Polyporus rennyi* and *Oligoporus farinosus* (inclusive of *Ptychogaster citrinus* Boud.). The former has been described as resupinate, while according to the figures of it published the latter forms cap-like portions. I have been able to study the three collections studied by Dr. Z. Pouzar and now in PR; in this set no indications of cap-like portions were evident. In the very fine set of specimens kindly submitted by Dr. H. Jahn, however, there are certain fruitbodies intimately associated with the imperfect state that possess narrow cap-like rims of chlamydospore-forming tissue with tubes formed below the rims,

precisely matching the depiction by Boudier for *Ptychogaster citrinus* except that these characteristics are not so strongly developed.

Although we do not know whether or not the wall of the basidiospores of the original collections of *Oligoporus farinosus* and *Ptychogaster citrinus* Boud. are cyanophilous (as they are in *Polyporus rennyi*), with our present knowledge I have little hesitation in assuming that at least all three are congeneric and that *Polyporus rennyi* may well be entitled to be placed in a distinct genus. This view requires the following new combination: **Oligoporus rennyi** (B. & Br.) Donk, *comb. nov.*, basionymum, *Polyporus rennyi* M. J. Berkeley & C. E. Broome *in* Ann. Mag. nat. Hist. IV **15**: 31. 1875. In addition I shall assume for the present that unless they can be adequately separated again all three taxa are conspecific.

Strangulidium Pouzar (*1967*: 206) was published for a genus with two species, viz. *Polyporus sericeo-mollis* Romell sensu stricto (type) and *P. rennyi*. Both are usually considered to be consistently effused and are then placed in the genus *Poria* but in both narrow cap-like portions have been reported. The main features of *Strangulidium* are the 'resupinate' (or, rather, effused) fruitbody, the 'suburniform' basidia (apparently, rather, 'utriform') and the cyanophilous walls of the spores. In this circumscription and if the identity of *O. farinosus* with *Polyporus rennyi* be accepted *Strangulidium* must be considered synonymous with *Oligoporus*.

After a careful study of good material of the two original species of *Strangulidium* however I hesitate to accept them as congeneric. *Polyporus rennyi* I would refer to *Oligoporus* as discussed above; *P. sericeo-mollis* would then become the only species of *Strangulidium* or, if more inclusive genera are preferred, for the time being it could be left in either *Poria* sensu lato or *Tyromyces* P. Karst. sensu lato.

POSTSCRIPT.—The following annotations were received from Drs. F. Kotlaba & Z. Pouzar after they had kindly read the above discussion on *Oligoporus*.

We received from Dr. Jahn (Heiligenkirchen über Detmold, West Germany) new rich material collected [last] autumn in Westfalen, Teutoburger Wald (the type-region of *Oligoporus farinosus*). The material is very variable in size and shape of the fruitbodies and includes very small and thin as well as thick and big ones—therefore very useful for comparative study. We compared this material with Brefeld's plate 7 and arrived at the conclusion that these fungi may well be identical (especially in regard to figures 12–16). As to figure 14: 2, the section of the fruitbody shown has tubes—up to 11 mm! This is too long for *Strangulidium rennyi* in which we have found in Dr. Jahn's material (as well as in other material previously studied) that the tubes reach at most 5 mm in length.

The identity of *Oligoporus farinosus* with *Strangulidium rennyi* may be admitted provided that the magnification of figure 14: 2 on page 300 was indicated incorrectly (viz. not "Nat. Grösse"!) and should really be 1.5–2 times enlarged. Perhaps Brefeld omitted to indicate the correct magnification of figure 14: 2. The artist (Istvánffy) liked to magnify the sections of polypore fruitbodies, see e.g. in the same volume, plate 9

figure 2: 3 (*Heterobasidion annosum*) where the magnification was correctly stated ("$\frac{3}{1}$"). If the above suggested rectification is correct, then we can admit the identity of *Strangulidium rennyi* with *Oligoporus farinosus*.

Polyporus

e l e g a n s. — *Boletus elegans* Bull. *1780*: *pl. 46* (devalidated name), not *B. elegans* Bolt. 1788 (devalidated name), not *B. elegans* Schum. 1803 (devalidated name) per Fr. 1838; *Polyporus elegans* (Bull.) per Trog *1832*: 553.

The name *Polyporus elegans* was discussed in a previous note (Donk, *1969*: 248), where it was considered to belong to *Polyporus varius* (Pers.) per Fr.

At first glance it looks as though the name *Boletus elegans* Bull. was first validly published by Purton (*1821*: 524). The epithet will be found in the index of the cited work, not printed in italics, followed by the reference "ii. 668" (= Purton, *1817*: 666). This reference revealed that the page-number should be "666"; there *Boletus calceolus* Bull. is treated, with *B. elegans* cited as a synonym. Since in the above-mentioned index "calceolus" is printed in italics, it would seem as though Purton had changed his mind and in the index restored *B. elegans* as the correct name with *B. calceolus* as a synonym. However, I believe that it was due to a typographical error that "elegans" was not printed in italics; in the same volume he (Purton, *1821*: 437) in fact listed both *B. calceolus* and *B. elegans* as synonyms of *B. nummularius* Bull.

Poria

l i n d b l a d i i. — *Polyporus lindbladii* B. & Br. *1865*: 319 (nomen provisorium) ex Berk. *1872*: 54; *Poria lindbladii* (B. & Br. ex Berk.) Cooke *1886*: 111.

Polyporus c i n e r a s c e n s Bres. *apud* Strass. *1900*: 361, not *P. cinerascens* (Schw.) Steud. 1824, not *P. cinerascens* Lév. 1844; *Poria cinerascens* (Bres. apud Strass.) Sacc. & Syd. *1902*: 161 ("*cinerescens*").

Polyporus lindbladii originally received its name provisionally. When recording *Polyporus* "*subfuscus-flavidus*" Rostk. for Great Britain Berkeley & Broome remarked, "The species appears to be the same with one received from Lindblad [from Sweden], marked '*Pol.* n.s."; and if we had not a supreme dislike to alter names, we should propose the name of *P. lindbladii* instead of the barbarious name given above from Rostkovius." However this dislike was later overcome by Berkeley; he validly published the name *Polyporus lindbladii* when he believed that the same species had to be recorded from the U.S.A.: on that occasion he added the remark, "The North Carolina specimens are a little darker than those originally received from Sweden." This all goes to show that the name *P. lindbladii* was actually based on a Swedish specimen sent by Lindblad. At first English material was identified with it and later the North American material followed. The latter, which came from North Carolina (M. A. Curtis 1623), has been incorrectly used to interpret the species; Murrill

(*1919*: 244) stated, "It is only a resupinate form of *Polyporus floridanus* Berk., which is a small-pored variety of *Coriolus* [*Hirschioporus*] *sector* [(Ehrenb.) per Fr.]", a non-European species. Lowe (*1959*: 111) concluded from an "isotype" (FH) that it was a pileate species and later referred it (Lowe *1966*: 134, K, FH) to resupinate *Polyporus* [*Hirschioporus*] *versatilis* (Berk.) Romell, another extra-European species.

Accepting Lindblad's specimen as the correct type of the name *Poria lindbladii* brings this name back into circulation; Lowe (*1966*: 134) concluded that "the Swedish specimen mentioned in the original description is *P*[*oria*] *cinerascens*", which name thus becomes a later synonym.

Pycnoporellus

f u l g e n s. — *Hydnum* Fr. *1852*: 130; Lindblad *1853*: 15; Fr. *1863b*: 278; *1867*: 10 *pl. 10 f. 2*. — Monotype: Sweden, Östergötland, Mount Omberg.

Polyporus f i b r i l l o s u s P. Karst. *1859*: 30. — *Pycnoporellus fibrillosus* (P. Karst.) Murrill *1905*: 489.

Hydnum fulgens has remained an enigmatic species for a long time. I had the type specimen on loan around 1931 but my notes on it were destroyed during the war and I forgot all about it, until my memory was refreshed by a note by Dr J. A. Nannfeldt in a letter to Maas Geesteranus (*1967*: 5) in which it was stated that the late Dr S. Lundell, upon revising the type collection, had found it to be identical with *Polyporus fibrillosus*. The literature on the species cited above (with a coloured picture) is in complete agreement with this conclusion. Hence, **Pycnoporellus fulgens** (Fr.) Donk, *comb. nov.*; basionymum, *Hydnum fulgens* E. M. Fries *in* Öfvers. K. VetAkad. Förh., Stockholm **9**: 130. 1852.

The genera *Pycnoporellus* Murrill and *Aurantioporellus* Murrill (*1905*: 489, 486) were published simultaneously. Authors wishing to combine the two should retain the name *Pycnoporellus*; *Aurantioporellus* was made a synonym of *Pycnoporellus* by Kotlaba & Pouzar (*1963*: 184–185).

Nomen dubium

m o r g a n i i. — *Trametes morganii* Lloyd *1919*: 15.

Trametes r i g i d a B. & Mont. sensu Morg. *1889*: 2.

The species that Lloyd called *Trametes morganii* was published with a description which, "excepting the spores, is largely taken from Morgan's description, [who] misreferred it to *Trametes rigida* [B. & Mont.]". It has been thought that the specimens that induced the publication of *T. morganii* were the two listed by Stevenson & Cash (*1936*: 145) from Lloyd's herbarium, "53852 (Type), 53853, A. P. Morgan, Preston, Ohio". Lloyd found no spores but on comparison he was "sure it is the same as European material which has abundant spores. . . . Romell distributed it as *Polyporus albo-carneo-gilvidus*", a (validly published) name that was not acceptable to Lloyd because, as he wrote, "we feel that such naming is a reversion back to pre-Linnean

days." Romell's species is now included in *Pachykytospora tuberculosa* (Fr.) Kotl. & P.

Bresadola (*1920*: 69) considered *T. morganii* to be a synonym of *Trametes micans*, which in Bresadola's conception was the same as Romell's species. It is practically certain that this was done on the basis of the citation of Romell's species. There can be no doubt however, that Lloyd misinterpreted the species Morgan described when he thought it to belong to the same species as that of Romell. Morgan wrote, "Pileus corky, undulate, by far the greater part resupinate . . . . Often all resupinate . . . the narrow margin seldom projecting half an inch"; this convincingly excludes *Pachykytospora tuberculosa*, which has strictly resupinate fruitbodies. Moreover Lloyd stated that "Fungi columbiani No. 5094 misnamed as *T. serialis*" was *T. morganii*. Overholts's conception (*1953*: 143) of Lloyd's species is based on this collection and "it is the plant long referred by Peck to *T*[*rametes*] *Trogii* Berk. and earlier considered by Murrill and many others, myself included, to be a thin,'light-colored, often resupinate condition of *T*[*rametes*] *hispida*." Overholts also remarked that a specimen under the name *T. morganii* at NY was sent by Morgan to Ellis from Ohio, and that it is a resupinate form of *Trametes* [*Antrodia*] *serialis*.

From this survey of the literature I would conclude that it is very likely that *Trametes morganii* as originally published by Lloyd is a thorough mixtum compositum; the validating description being taken from Morgan's work might perhaps be *Trametes trogii* sensu auctt. amer. (if it is not based on a mixture of species that includes this species and *Antrodia serialis*), to which some details of the spores of *Pachykytospora tuberculosa* ("6 × 12") were added. If this view is accepted as correct then the name *Trametes morganii* should be properly lectotypified before it can be duly relegated to the synonymy.

It is not evident that one of Morgan's specimens in the Lloyd herbarium should be selected as type, as was done by Stevenson & Cash. Since the validating description "is largely taken from Morgan's description" it would seem reasonable to select the type from material on which Morgan's description was based, viz. on specimens he collected and named before 1889.

I have not tried to understand what Baxter (*1940*: 147, in obs., *pl. 1*; *1942*: 142) called *Trametes morganii*.

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NOTES ON CLAVARIOID FUNGI—IX

Addendum to Clavulinopsis in North America[1, 2]

RONALD H. PETERSEN
University of Tennessee, Knoxville

(With Plate 8 and four Text-figures)

This paper constitutes an addendum to a previous paper by the author on the genus *Clavulinopsis* in North America. One new species is described, *Clavulinopsis subaustralis* Petersen, and one new combination made, *Clavulinopsis laeticolor* f. *coccineo-basalis* (Joss.) Petersen.

The manuscript for a monograph of *Clavulinopsis* in North America (Petersen, *1968*) was finished in early 1966, but remained in press nearly three years. During that time, and in the period thereafter, a number of field trips to the northwestern United States were accomplished and specimens were received from several correspondents. Especially collections from the upper central states and Pacific northwest have helped to clarify distributional patterns in the genus, and have produced two taxa new to the continent, and a new species. The collecting seasons of 1966, 1967 and 1969 were disappointing in the northwest, but 1968 was an extremely prolific year for Basidiomycetes. Most of the collections herein reported were collected in northern Idaho in that year.

Two patterns emerge more clearly because of these collections. First, the species shared by Europe and eastern North America are also present in the far west. Most of these represent species whose spores are prominently apiculate, including *C. laeticolor* and *C. corniculata*, as well as the somewhat anomolous *C. gracillima*. Second, the species whose spores are inconspicuously apiculate either do not occur in this region or are so rare as to be unreported. This group seems to be shared between

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[1] This represents contribution No. 355 from the Botany Department, University of Tennessee, Knoxville, Tenn., 37916, USA. Other numbers in this series appeared as follows: I, *in* Mycologia **56**: 20–28. 1964; II, *in* Bull. Torrey bot. Club **91**: 274–280. 1964; III, *in* Nova Hedwigia **10**: 261–268. 1965; IV, *in* Mycologia **57**: 521–523. 1965; V, *in* Mycologia **58**: 201–207. 1966; VI, *in* Mycologia **59**: 39–46. 1967; VII, *in* Am. Midl. Nat. **77**: 205–221. 1967; VIII, *in* Bull. Torrey bot. Club **94**: 417–422. 1967; X, *in* Mycologia **61**: 549–559. 1969; XI, (with P. D. Olexia) *in* Can. J. Bot. **47**: 1133–1142. 1969.

[2] Since the initial writing of this manuscript, Corner's (1970) 'Supplement to "A monograph of *Clavaria* and allied genera" ' has appeared. Although lengthy remarks cannot here be made, suffice to say that I consider his present treatment of the genus far less adequate than that in 1950.

eastern (predominantly southeastern) North America and Asia. All this supports the distributional patterns of higher plants and green cryptogams.

The relative abundance of the inconspicuously apiculate-spored group in the southern regions, and its rapidly diminishing occurrence northward would surely not indicate a movement from Asia to North America via a northern route. Instead it might indicate that the group entered from the south, via South and Central America. A second explanation could make use of the primary northern route, a southward compression during the ice ages, and a secondary reentry during more recent temperate times. The relatively arid climate of the southwestern United States and northern Mexico may have prevented reentry to that area or eliminated the species after their invasion. Such conjecture on fungal distribution makes study of southeastern Mexico and Central America imperative.

In the discussion of taxa below, all colors enclosed in quotes are taken from Ridgway (1912). The abbreviation RHP indicates the herbarium of the author at the University of Tennessee. Other herbarium abbreviations are taken from Lanjouw & Stafleu (*1964*). My thanks are extended to Drs. Alexander Smith and Daniel Stuntz for helping arrange the western field trips involved in this project, and to the U.S. Forest Service (especially Mr. Cal Carpenter) which made available the facilities of Priest River Experimental Forest headquarters.

The addition of taxa listed below as new for North America makes the key to North American species by Petersen (*1958*) obsolete. That key may be brought up to date as follows.

KEY TO CLAVULINOPSIS IN NORTH AMERICA

1. Individual fruit bodies usually and regularly branched; spores globose to subglobose, with prominent apiculus 2
1. Fruit bodies simple or rarely furcate toward the apex; gregarious, cespitose or fascicled, but rarely branched in the usual condition 6
2. Fruit bodies yellow to deep ochre, stem portion attenuate or fascicled; spores mostly 5–7.5 μ diam. . . . . **C. corniculata*
2. Fruit bodies not of these colors 3
3. Hymenium negative in guaiac tincture; fruit bodies white to pale yellowish; spores 4–6.5 × 3–5.6 μ . . . . . *C. subtilis*
3. Hymenium blue in guaiac tincture; spores globose 4
4. Fruit bodies white, more or less dichotomously branched. . . . . **C. dichotoma*
4. Fruit bodies not white 5
5. Fruit bodies grey to dull drab, with apices purplish; basidia 45–70 μ long; taste sweet at first, tardily bitter. . . . . **C. holmskjoldii*
5. Fruit bodies grey to pale umber; basidia 50–110 μ long; taste disagreeable, bitter to nauseating . . . . . *C. umbrinella*
6. Spores angular-warted or spinous. . . . . *C. helvola*
6. Spores smooth 7
7. Spores ellipsoid to amygdaliform, multiguttulate to uniguttulate; fruit bodies small, delicate, pinkish salmon to apricot color, single, gregarious . . . . . **C. gracillima*

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* Treated herein.

7. Spores broadly ellipsoid to subglobose or pear-shaped to subtriangular 8
8. Spores with small, abrupt apiculus 0.5 μ or less in length 9
8. Spores with large, conical apiculus usually over 1.0 μ long 13
9. Septa of tramal hyphae often without clamps; hymenium cream to creamy yellow; stipe deep ochre. . . . . *C. appalachiensis*
9. Septa of tramal hyphae invariably clamped 10
10. Hymenium hyaline, pigmentation resident in subhymenial and tramal portions of the fruit body . . . . . *C. miniata*
10. Color resident in the subhymenium and hymenium. 11
11. Hymenium clear pink; stipe orange . . . . . **C. subaustralis*
11. Fruit bodies not of two colors. 12
12. Fruit bodies clear orange to blood red . . . . . **C. aurantio-cinnabarina*
12. Fruit bodies pinkish orange to apricot . . . *C. aurantio-cinnabarina* var. *amoena*
13. Spores ellipsoid, pear-shaped or subtriangular. 14
13. Spores globose to subglobose 16
14. Septa of tramal hyphae often without clamps; basidia often 2-sterigmate; otherwise typical . . . . . **C. laeticolor* form
14. Septa of tramal hyphae invariably clamped. 15
15. Spores pear-shaped to subtriangular . . . . . *C. laeticolor* f. *bulbispora*
15. Spores ellipsoid to ovoid 16
16. Fruit bodies golden yellow, orange to orange-red, paler downward **C. laeticolor*
16. Colors same, stipe deep red to scarlet . . . . . **C. laeticolor* f. *coccineo-basalis*
17. Fruit bodies canary yellow to golden yellow, fascicled . . . . . *C. fusiformis*
17. Fruit bodies golden yellow to orange above, paler below *C. laeticolor* var. *antillarum*

CLAVULINOPSIS CORNICULATA (Schaeff. ex Fr.) Corner—Figs. 1, 3

Clavulinopsis corniculata (Schaeff. ex Fr.) Corner *in* Ann. Bot. Mem. **1**: 362. 1950.

Collections have been reported very occasionally from the northwestern states and British Columbia, but the species is abundant in that area at times, and exhibits all the variability of eastern material. Three wide variations in stature are illustrated in Figure 1, and none of these represent the fastigiate forms in which the stipes are cespitose, and which parallel the illustrated forms completely. I am informed by European mycologists that the true *C. corniculata* of northern Europe always possesses blunt, cornute branch apices, and an egg yellow coloration. Our specimens often exhibit such apices, but I have never seen such a coloration. The species passing under this name in North America, therefore, may well be a closely allied, but distinct species.

Several specimens (RHP 4072, 4075, 4136) have been collected in which well-developed gloeoplerous hyphae have been observed. These hyphae are identical to those described for certain collections of *C. laeticolor* below, and one such hypha from the latter is illustrated (fig. 2). The occasional occurence of such hyphae, up to now only reported from western material, and all collected in the same year, is unexplained, but surely is not enough on which to base a distinct taxon.

Thick-walled basidia have been noted in *C. laeticolor* in the past, but these have been quite rare. One specimen of *C. corniculata* (RHP 4075) was examined in which extremely thick-walled basidia occurred in a ratio of about 1:100—1:150 with normal

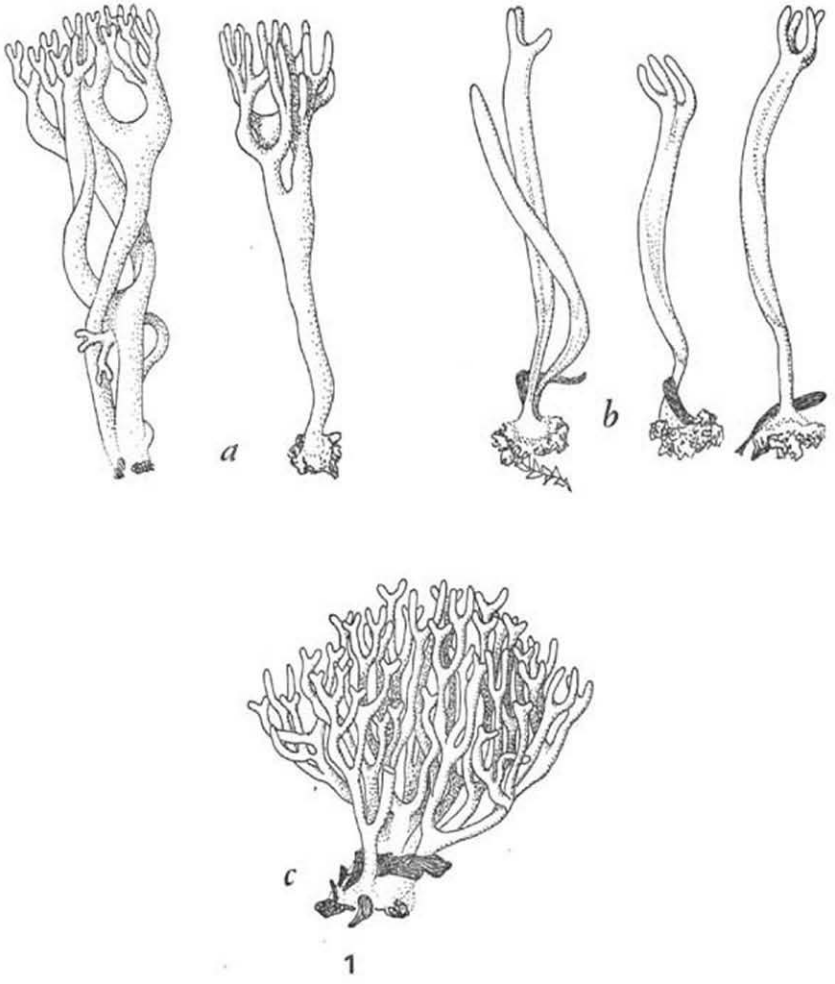


FIG. 1. — Variation in stature in *Clavulinopsis corniculata*: a, RHP 3720; b, RHP 3017; c, RHP 1645.

thin-walled basidia. These are illustrated (fig. 3) and appeared to be functional, often bearing immature spores. The thickened walls are refractile under phase contrast and yellowish under bright field making these basidia very easy to observe.

SPECIMENS EXAMINED.—Idaho: 9.ix.66, Binarch Creek, Near Nordman, *RHP 1642* (TENN); 19.ix.68, Upper Priest River area, *RHP 3720* (TENN); 25.ix.68, Upper Priest River, *RHP 3904* (TENN); 1.x.68, Upper Priest River, *RHP 4072* (TENN); 7.x.68, McAbee Falls Road, Priest River vic., *RHP 4239* (TENN). — California: 11.xi.67, Jedediah Smith Redwoods State Park, *RHP 3017* (TENN); 11.xi.67, John Stout Grove, Jedediah Smith Redwoods State Park, *RHP 2983* (TENN). — Washington: 2.xi.67, Whidby Island, *Largent*, RHP 2898 (TENN).

CLAVULINOPSIS DICHOTOMA (Fr.) Corner

Clavulinopsis dichotoma (Fr.) Corner *in* Ann. Bot. Mem. 1: 391. 1950.

Recently, Corner (*1970*) has restated that *C. dichotoma* and *C. subtilis* are distinguishable, the former bearing spherical spores, the latter ellipsoid. Although I seriously wonder whether Fries used this character in his separation, and although I can find no reliable authentic specimens on which to base this judgement, I am willing to follow Corner's opinion in this case. Moreover, because of the distinct color reaction in guaiac tincture of white fruit bodies resembling those of *C. umbrinella*, I became convinced that the species was simply very variable in this regard. I must now consider that the specimens of *C. umbrinella* with white fruit bodies reported in my summary of the genus in North America (Petersen, *1968*: 12) are really *C. dichotoma* (spherical spores; branched, white fruit bodies), and that this species also gives a blue reaction with guaiac tincture. Thus *C. umbrinella* (branched, gray or umber fruit bodies), *C. holmskjoldii* (branched, gray or umber fruit bodies with purplish apices; taste and smell of anise), and *C. dichotoma* (white, branched fruit bodies) all give this reaction. The obvious similarity in spore and basidial morphology to *C. corniculata*, as well as the absence of carotenoid pigments (Fiasson *& al.*, *1970*) in *C. corniculata* and *C. fusiformis*, make the strongly apiculate-spored group even more closely united than hitherto reported.

CLAVULINOPSIS HOLMSKJOLDII (Oud.) Corner

Clavaria holmskjoldii Oud. *in* Beih. bot. Cbl. 11: 525. 1902. — *Clavulinopsis holmskjoldii* (Oud.) Corner *in* Ann. Bot. Mem. 1: 373. 1950.

HOLOTYPE.—September and again in December. The Netherlands, Bergen op Zoom (leg. N. La Fontijn) (L!); also cited by Donk (*1933*).

Fruit bodies up to 5 cm high, branched repeatedly from very near the base, "cartridge buff" very near base, "tilleul buff" to "vinaceous buff" through the

branches, with the branch apices "vinaceous drab". Lower branches round to somewhat flattened in cross-section, somewhat lax, with hymenium minutely plushy and decurrent almost to the very base. Stipe very short, distinct, smooth to innately silky. Branch axils crescentic to lunate throughout; apices obtuse, blunt, short and somewhat cornute. Odor mild but piercing, of anise; taste mild, sweet, distinctly of anise, very pleasant, but leaving a disagreeable aftertaste in rear of mouth.

Macrochemical reactions: Branch sections including hymenium pale yellowish in $FeSO_4$, becoming pale yellow green with added ethyl alcohol; no change in KOH; blue in gum guaiac with ethyl alcohol.

Hyphae of context all hyaline, clamped, generally parallel, somewhat thick-walled toward stipe base, but all thin-walled in branches, of two widths; 5.6–10.5 μ diam., constricted at septa; 1.8–2.4 μ diam., uninflated, commonly interwoven with inflated hyphae. Hymenium thickening; basidia 45–70 × 6.5–8 μ, clavate to elongate-clavate, clamped, homogeneous in content when immature, becoming multiguttulate at maturity, 4-sterigmate; sterigmata 8.5–10 μ long, stout, straight, slightly divergent.

Spores globose to subglobose, 6.6–7.6 × 6.3–7.0 μ, smooth, hyaline, thin-walled, uniguttulate; apiculus conical, prominent.

Petersen (*1968*) conjectured that this species was quite close to *C. umbrinella*, as Corner (*1950*) had indicated before. *C. holmskjoldii* is apparently quite rare in Europe, as reported by Corner, and has never been reported from North America. It is a distinctive species in the following characters: 1) purplish branch tips; 2) odor and taste of anise; and 3) blue color reaction with guaiac in alcohol. Only *C. umbrinella* shares the latter character, so far as I know, strengthening the presumed relationship between the two species.

The discovery of this species from the northwest again ties the flora of that area to that of Europe. The species is so rare on both continents, however, that it cannot be made the basis for any generalities.

SPECIMEN EXAMINED.—I d a h o: 3.x.68, Tule Bay, Priest Lake, Idaho. *RHP 4116*, (TENN).

CLAVULINOPSIS GRACILLIMA (Peck) Petersen

Clavulinopsis gracillima (Peck) Petersen *in* Mycol. Mem. **1**: 30. 1968.

Reported from northern Europe as *Clavaria* (*Clavulinopsis*) *luteoalba* Rea, this species was included by Petersen (*1968*) as relatively common in eastern North America. Specimens have now been examined from Idaho and Washington, with the latter having been reported previously. This may be taken as a further indication that the northern European species are largely circumboreal, extending southward only where cool temperatures and lack of climatic barriers permit. Such a thrust would account for distributions into the southern Appalachian mountains.

SPECIMENS EXAMINED.—I d a h o: 25.ix.68, Upper Priest River area, *RHP 3887* (TENN); 27.ix.68, Tule Bay, Priest Lake, *RHP 3993* (TENN); 1.x.68, Upper Priest River area, *RHP 4070* (TENN). — Washington: 16.x.68, Seattle, *RHP 4317* (TENN).

Clavulinopsis subaustralis Petersen, *sp. nov.*—Plate 8

Receptacula ad 8 cm alta, 2–5 cm lata, simplicia, gregaria vel fasciculata, elongato-fusiformi vel sublanceolata; caro spongiosa, saepe cava. Clavula punicea ("safrano pink"); stipes aurantius ("orange buff"). Hymenium spissatum, hyalinum; basidia 50–68 × 6–7 μ, elongato-clavata, fibulata, 4 sterigmatibus praedita. Hyphae fibulatae, hyalinae, tenui-tunicatae, aspectu *Clavulinopsidis miniatae*. Sporae 6.6–8 × 5.5–7 μ, subglobosae vel ovoideae, hyalinae, uniguttulatae; apiculus parvulus, subitus.

HOLOTYPUS.—North Carolina: 12.vii.67, Macon Co., *RHP 2291* (TENN 29834).

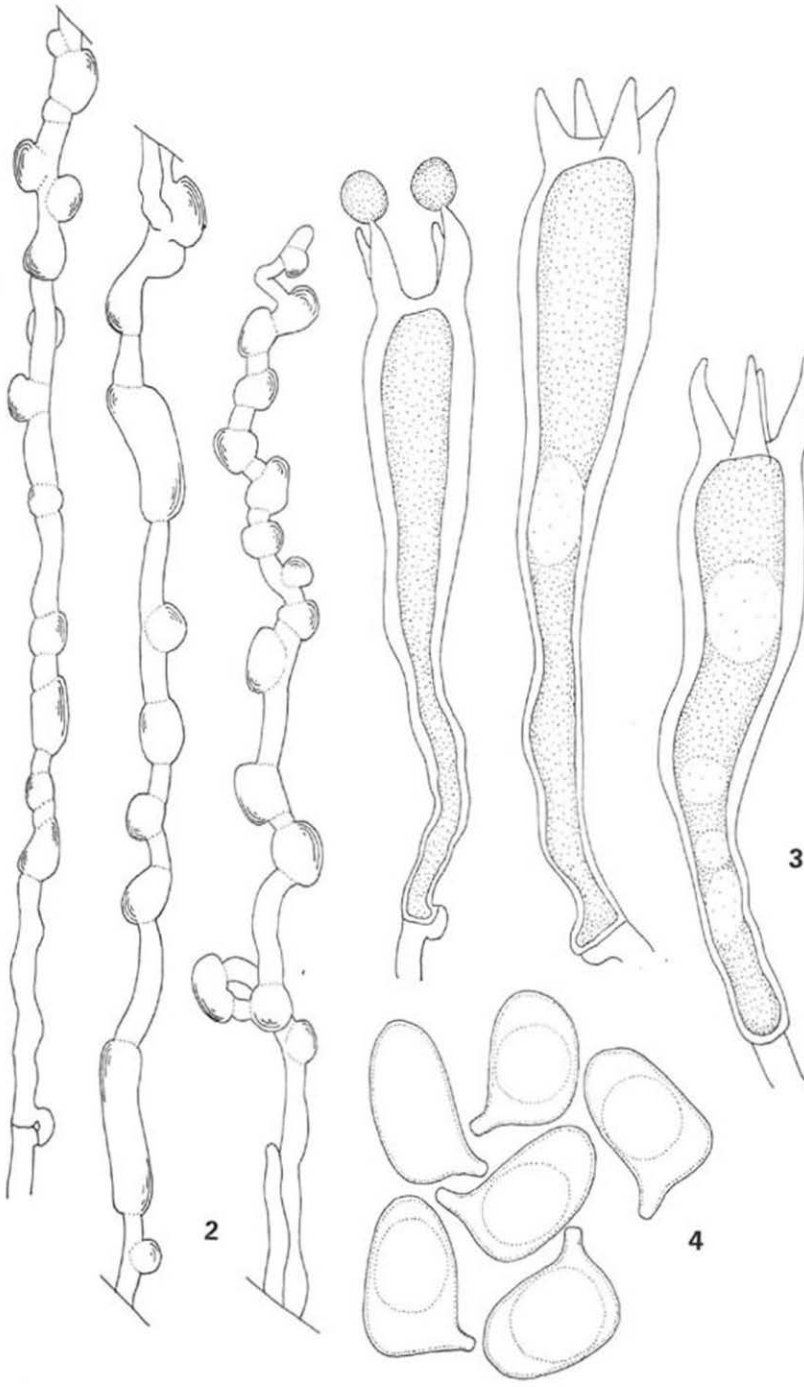
Fruit bodies up to 8 cm high, 2–5 cm broad, simple clubs, solitary, gregarious or fascicled in groups of 2–5 individuals. Stipe 1.5–3 mm thick, smooth above, but subtomentose toward the very base, disappearing into a very small white mycelial mass on insertion; "orange buff", "light ochraceous buff", or "warm buff", becoming darker (near "cinnamon buff") on handling; distinct from club portion in texture and color. Club portion 2.5–5 mm thick, smooth, minutely velvety, terete, hollow to (rarely) stuffed, the flesh white toward the center, becoming more pigmented toward the outside to "safrano pink", "vinaceous pink", "buff pink", or "light vinaceous cinnamon;" hymenium very pale pinkish; apex rounded to broadly rounded; color of club fading to "cream buff" or "cream color" in drying.

On rich humus, leaf mold and very rotten wood in deciduous or mixed *Tsuga* forests, southern Appalachian mountains of North America.

Contextual hyphae hyaline, clamped, parallel, loosely arranged, of two definite types; 5.6–12.0 μ diam, often inflated somewhat, with walls up to 0.5 μ thick; 2.1–2.4 μ diam, arising from thicker hyphae, parallel to interwoven with them, very thin-walled, long-celled. Subhymenium rudimentary; hyphae 2.4–2.6 μ diam, tortuous, generally perpendicular to the contextual hyphae, clamped, producing basidia in bouquets. Hymenium thickening; basidia 50–68 × 6–7 μ, elongate-clavate, almost invariably narrowing to a long, equal, hyphal base; clamped, hyaline, 4-sterigmate; sterigmata up to 10 μ long, very stout, somewhat divergent and incurved. Basidia hardly collapsing after spore discharge.

Spores 6.6–8.0 × 5.5–7.0 μ, subglobose to very broadly ovoid, somewhat thick-walled, hyaline, uniguttulate at maturity, and guttule highly refringent; with a small, abrupt apiculus.

The most striking characteristic of the species is its bright, contrasting coloration. The delicate bright pink of the club portion is quite distinct from the darkish yellow of the stem portion. In other features, it is quite close to *Clavulinopsis miniata*, with weakly apiculate spores, deeply pigmented flesh, light-colored hymenium and attenuate basidia (see Petersen, *1968*, for illustration of basidia and spores of *C. miniata*). *Clavulinopsis miniata* was found very commonly throughout the southern Appalachians during the same time period, and no intermediate forms were observed. *Clavulinopsis aurantio-cinnabarina* and its variety *amoena*, although much more rare, were also collected during that time, and these were also noted as very distinct in coloration. Perhaps *C. subaustralis* is an intermediate between *C. aurantio-cinnabarina* var. *amoena* and *C. miniata*, but the quality of pink coloration is not at all the same as the apricot pink shades of these two species. *Clavulinopsis subaustralis* is truly a distinctive species, very easily recognized in the field.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CLAVULINOPSIS AURANTIO-CINNABARINA (Schw.) Corner

Clavulinopsis aurantio-cinnabarina (Schw.) Corner *in* Ann. Bot. Mem. 1: 358. 1950.

A single specimen has been examined from Minnesota, extending the range of the species in North America significantly. Petersen (*1968*) reported the species only from eastern North America, although specimens from Asia were also seen. Although several hundred collections of clavarioid fungi have been seen from Minnesota, only one represents this species.

The weakly apiculate-spored group of *Clavulinopsis* seems missing from Europe. I have not seen material of *C. citrino-alba* (Moller) Corner, the spores of which are reported as weakly apiculate, but aside from *Clavaria cardinalis* Boud. & Pat., which was placed in synonymy under *Clavulinopsis miniata* by Corner (*1950*) and Petersen (*1968*), and which may well have come from Australia with an ornamental tree, no other species from Europe is reported as bearing weakly apiculate spores. The occurrence of this group in eastern North America and Asia again links the floras of these two regions, and the relative abundance of material in southern North America, in contrast to the relative rarity in the north, may indicate a northward movement of the group. The flora of southern Mexico and Central America becomes important as perhaps ancestral to that of eastern North America, therefore.

SPECIMENS EXAMINED.—Minnesota: 20.vii.62, Rice Co., *Margaret Weaver* RHP 3115 (TENN).

CLAVULINOPSIS LAETICOLOR (Berk. & Curt.) Petersen—Figs. 2, 4.

Clavulinopsis laeticolor (Berk. & Curt.) Petersen *in* Mycol. Mem. 1: 26. 1968.

This species has been discussed by me previously (Petersen *1965*, *1968*), and has held the more popular name *Clavaria* (*Clavulinopsis*) *pulchra* Peck. The species is widespread throughout eastern North America and northern Europe, but has not been reported from the northwestern United States before.

The fruit bodies are identical in habit and stature to those found in the eastern regions, and the colors, always brilliant, are also as variable. Most western specimens tend toward the bright orange to orange-red ("deep chrome", "apricot yellow", "orange chrome", "flame scarlet", "cadmium orange") with somewhat darker tips at maturity ("mars brown"). The usual dingy greenish color reaction with iron salts seems invariable.

Spores differ in shape and measurement within the same collection. Most spores are typical of the species, but in some cases, spores of narrower profile have been seen (extreme is RHP 1657, the spores of which are illustrated (fig. 4)).

A number of specimens (RHP 3964, 4137, 4141, 4263) were found to possess well-

FIGS. 2–4. — Microscopic structures in *Clavulinopsis* species. — 2. Gloeoplerous hyphae from context of *C. laeticolor*. — 3. Thick-walled basidia from *C. corniculata*. — 4. Elongate spores from *C. laeticolor*.

established glocoplerous hyphae. These oleiferous hyphae occur as hyphal tips of variable (and sometimes quite significant) length, or one or more intercalary cells, terminated by a clamped septum at both ends. The hyphae are unique in their shape, with large numbers of bulbous swellings, not unlike those seen on "puff" chromosomes. One such hypha is illustrated (fig. 2).

Petersen (*1968*) reported that *C. laeticolor* was occasionally found with 2-sterigmate basidia and clampless hyphae, and Petersen & Olexia (*1969*) equated this form with *Clavaria longispora*. Two such specimens have been seen (RHP 3118, 1817).

SPECIMENS EXAMINED.—British Columbia: 12.xi.62 Teanook Lake, near Victoria, *Kuijt*, RHP 2246 (TENN); 16.x.64, Squamish area, *Bandoni*, RHP 2248 (TENN); 16.xi.60, Goldstream park, Victoria Island, *Foster*, RHP 3357 (DAVFP 12479) (TENN). — California: 11.xi.67, Jedediah Smith Redwoods State Park, *RHP 3019* (TENN); 23.x.68, Jedediah Smith Redwoods State Park, *RHP 4263* (TENN). — Minnesota: viii.65, *Margaret Weaver*, Rice Co., RHP 3118 (TENN). — Idaho: 9.9x.66, Binarch Creek, near Nordman, *RHP 1648* (TENN); 14.ix.66, Binarch Creek, near Nordman, *RHP 1680* (TENN); 11.ix.66, Tule Bay, Priest Lake, *RHP 1657* (TENN); 1.x.66, Upper Priest River area, *RHP 1836* (TENN); 13.ix.66, Tango Creek, near Priest Lake, *RHP 1676* (TENN); 30.ix.66, Deception Creek, Coeur d'Alene National Forest, *RHP 1817* (TENN); 28.ix.66, Hughes Meadows, Upper Priest River area, *RHP 2499* (TENN); 24.ix.66, Priest River, *RHP 2500* (TENN); 15.ix.68, Caribou Creek, Priest Lake, *RHP 3622* (TENN); 19.ix.68, Upper Priest River area, *RHP 3716* (TENN); 21.ix.68, Upper Priest River area, *RHP 3757* (TENN); 24.ix.68, Granite Creek, Priest Lake, *RHP 3862* (TENN); 27.ix.68, Tule Bay, Priest Lake, *RHP 3964* (TENN); 27.ix.68, Tule Bay, Priest Lake, *RHP 3969* (TENN); 1.x.68, Upper Priest River area, *RHP 4071* (TENN); 3.x.68, Tule Bay, Priest Lake, *RHP 4137* (TENN); 3.x.68, Tule Bay, Priest Lake, *RHP 4141* (TENN); 3.x.68, Tule Bay, Priest Lake, *RHP 4142* (TENN); 3.x.68, Tule Bay, Priest Lake, *RHP 4146* (TENN); 7.x.68, McAbee Falls Road, Priest River vic., *RHP 4213* (TENN); 7.x.68, McAbee Falls Road, Priest River vic., *RHP 4234* (TENN). — Washington: Metalline Falls area, 16.ix.66, *RHP 1694* (TENN); 2.xi.67, Whidby Island, *Largent*, RHP 2896 (TENN).

CLAVULINOPSIS LAETICOLOR f. **coccineo-basalis** (Joss.) Petersen, *comb. nov.*

Clavaria pulchra f. *coccineo-basalis* Joss. *in* Bull. Soc. Myc. Fr. **53**: 224. 1937 (basionym). — *Clavulinopsis pulchra* f. *coccineo-basalis* (Joss.) Corner *in* Ann. Bot. Mem. **1**: 385. 1950.

Petersen (*1968*) stated that this was only a minor variant which regularly occurred through the southern Appalachian mountains, but the single collection made in Washington surely renders that conclusion inaccurate. The collections from the southeast consisted of fruit bodies which were orange apically, with the remainder of the hymenial portion bright red to scarlet, but with the stipe more or less normal, bright orange to golden yellow. The fruit bodies from Washington were up to 3.5 cm

high, gregarious to cespitose, simple, rounded above, "orange" toward the tip, then either concolorous or deep red below (in a ratio of about 4:1) in colors near "Nepal red", "brazil red", to "flame scarlet", through the lower hymenium and through most of the stipe. Some fruit bodies were orange at the very base ("light cadmium") while others retained the red coloration throughout. All fruit bodies arose from a small basal tomentum which was about "maize yellow." The form is very distinct, and, once collected, cannot be mistaken for normal *C. laeticolor*.

The taxon was described and transferred under the more popular name *Clavaria* (*Clavulinopsis*) *pulchra* Peck. The synonymy of this with *Clavaria* (*Clavulinopsis*) *laeticolor* Berk. & Curtis was discussed by Petersen (*1965*).

SPECIMEN EXAMINED.—Washington: x.69, Lummi Island, *RHP 4764* (TENN).

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EXPLANATION OF PLATE 8

Fruit bodies of *Clavulinopsis subaustralis* (TENN. 29834).

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STUDIES ON THE GENUS DESCOLEA SING.

E. HORAK

Swiss Forest Research Institute
Birmensdorf, Switzerland

(With ten Text-figures)

Eight species of *Descolea*, four of which—*D. pallida*, *D. majestatica*, *D. phlebophora*, and *D. pretiosa*—are new, are keyed out and fully described. The area of distribution today stretches from S. America over New Zealand and Australia to India and Japan. According to present knowledge the specific centre of the genus seems to be in New Zealand (three species), but it is presumed that more species occur in the surrounding Pacific area. The generic range of *Descolea* is discussed and compared with closely related genera belonging to the Cortinariaceae.

The genus *Descolea* Sing. is based on *Descolea antarctica* Sing. (1951: 257), a medium-sized, brown agaric which in some respects resembles *Rozites* P. Karst. or *Pholiotina* Fayod. The primarily monotypic genus has found its systematic place near *Leucocortinarius* (J. E. Lange) Sing. and *Gymnopilus* P. Karst. and despite additional data (Singer, 1962: 630) its position has remained unchanged.

During his studies on Australian types at Kew Singer (1955: 407) detected a second species, *D. recedens*, conforming to the current taxonomic concept of the genus *Descolea*. Together with another, undescribed, species from Patagonia, probably representing *D. pallida*, the area of distribution was then known to cover the southern part of S. America and the southeast corner of Australia (Victoria). This particular pattern of distribution encouraged Singer (1955: 407) to speculate: "I have no doubt that it [*Descolea*] also occurs in New Zealand." This was subsequently confirmed.

Apart from a full redescription of the type species of *Descolea* (Horak, 1968: 221) no further ecological or taxonomic information about this genus was ever published.

Inspired by Singer's remarks the author explored the *Nothofagus* forests of New Zealand in 1967–1969. Two new species of *Descolea* were recorded (*D. majestatica* and *D. phlebophora*). Thus the number of known species rose to five, all confined to the area of distribution of *Nothofagus* (Fagaceae) in the southern hemisphere.

From the descriptions of *Rozites flavo-annulata* (Moser, 1953: 169; Hongo, 1966: 58) it appeared that this species belongs to *Descolea* rather than to *Rozites*. A thorough investigation of material kindly sent by T. Hongo (Japan) verified this.

Later the author was lent excellent material of an unidentified agaric collected by R. A. Maas Geesteranus in a coniferous forest in the foothills of the Himalayas (India). It was illustrated by a water-colour and also accompanied by detailed notes

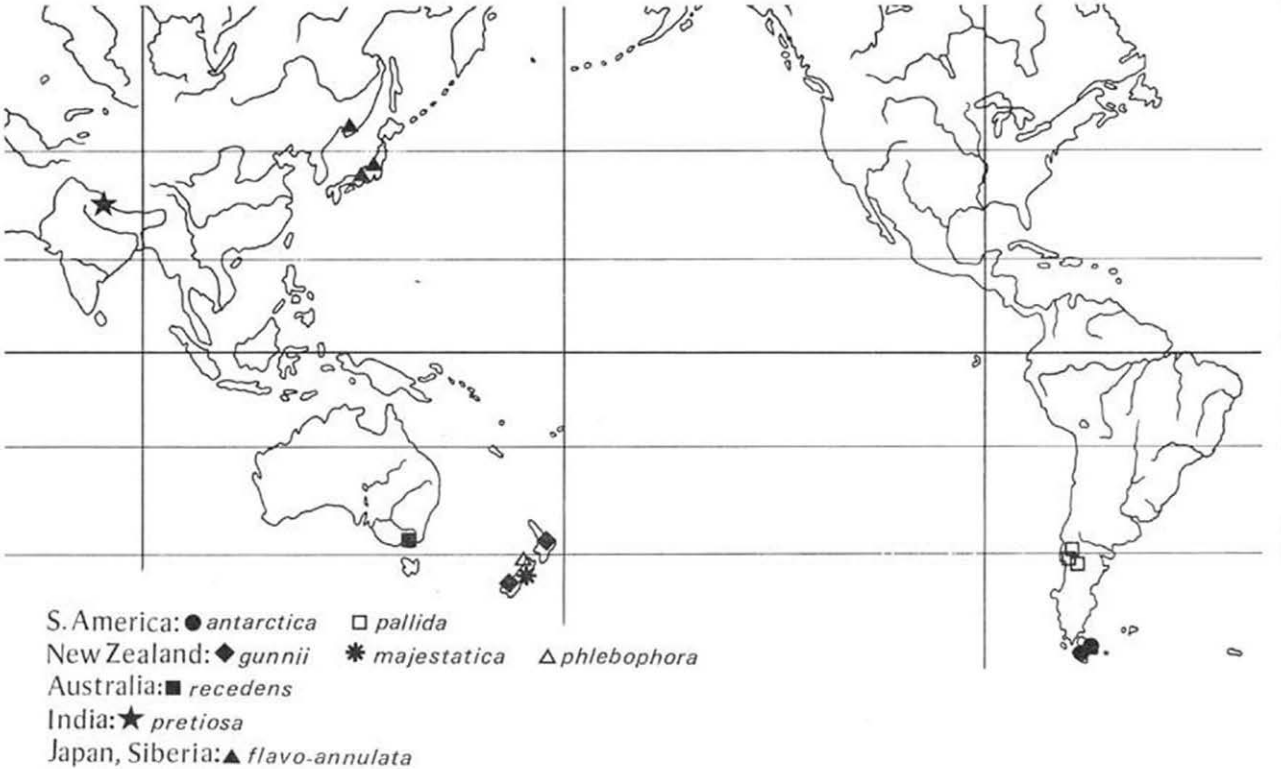

Fig. 1. Area of distribution of the species of *Descolea*.

by C. Bas; it finally permitted the taxonomic position of *Descolea* to be determined.

The above mentioned data seem to indicate that the genus *Descolea* migrated from its endemic habitat in the southern *Nothofagus* forests to the northern hemisphere (see Fig. 1).

Mycorrhizal associations

According to field observations made in S. America (Singer, l.c.; Horak, unpubl. data), New Zealand, and Australia species of *Descolea* represented in these countries seem to form a facultative mycorrhiza with different host trees. This opinion is substantiated by the finding that the same species occurs in pure stands of trees which are not closely related, for example in New Zealand *Nothofagus* (Fagaceae) and *Leptospermum* (Myrtaceae); in Japan *Pinus*, *Larix*, (Pinaceae) and *Quercus*, *Castanopsis* (Fagaceae).

No known studies on the microscopic characters of this mycorrhiza have yet been made. Nor has a synthesis of mycorrhiza in pure culture been attempted. The mycorrhizal relationships of *Descolea* species are shown best in the following table.

TABLE I

MYCORRHIZAL RELATIONSHIPS OF DESCOLEA SPECIES

Host / Country	Fagaceae *Nothofagus* (N) *Quercus* (Qu) *Castanopsis* (C)	Myrtaceae *Eucalyptus* (E) *Leptospermum* (Le)	Pinaceae *Abies* (A) *Picea* (P) *Pinus* (Pi) *Larix* (La) *Taxus* (T)
S. America	*D. antarctica* (N) *D. pallida* (N)	—	—
New Zealand	*D. gunnii* (N) *D. majestatica* (N) *D. phlebophora* (N)	*D. gunnii* (Le)	—
Australia	*D. recedens* (? N)	*D. recedens* (? E) *D.* spec. (E)	—
India	—	—	*D. pretiosa* (A, P, Pi, T)
Japan, S.E. Siberia	*D. flavo-annulata* (Qu, C)	—	*D. flavo-annulata* (Pi, La)


c
c
a
b
b
d
f
e
f

Taxonomy

Singer (1951: 555; 1962: 630) in his classification placed *Descolea* between the two cortinariaceous genera *Leucocortinarius* and *Gymnopilus*, despite the lack of any evident relationships.

Leucocortinarius and *Descolea*, although considered to have the same ochraceous colour of the spore print, differ so widely in microscopic and macroscopic characters that no connection can be shown. There is apparently also no connection between *Descolea* and *Gymnopilus*. The latter has a deep rust brown spore print, warty spores with a plage, and cheilocystidia often encrusted or filled with a brown resinous pigment. Like *Leucocortinarius* it never has a double veil. Furthermore neither of the two genera mentioned (*Leucocortinarius* and *Gymnopilus*) is characterized by a hymeniform cuticle (Horak, 1968: 222) while in *Descolea* a double veil is always clearly developed and visible, at least in young fruiting bodies.

The structure of the cuticle and the double veil are characteristic features of *Descolea*, which must accordingly be placed near *Rozites*. The data presented and further unpublished material (Moser & Horak, 1972; Horak, in prep.) show that as far as the structure of the cuticle is converned the two taxa could be linked by the intermediate species *Descolea majestatica*. This impression is also verified from data on about ten as yet undescribed species of *Rozites* occurring mainly in the *Nothofagus* forests of S. America, New Zealand, and Australia. Further proof of the relationship *Descolea—Rozites* is found in the broad, amygdaliform or limoniform spores with isolated warts; these are never found in *Gymnopilus*, *Leucocortinarius* or any other cortinariaceous genus.

The main difference separating the two genera is well revealed however in the structure of the cuticle; in (typical) *Descolea* this is epithelium-like, but in *Rozites* it always consists of repent cylindrical hyphae.

At first sight several characters in *Descolea* and *Pholiotina* Fayod are strikingly similar, e.g. the striate, permanent annulus and the hymeniform cuticle. By contrast the spores of *Pholiotina* (except for *P. verrucispora* Sing., which probably belongs to *Descolea*) are smooth and have an obvious germ pore, but there is no double veil. Paradoxically Singer (1969: 220), in spite of these data, remains inclined to place *Descolea* close to *Pholiotina* (Fam. Bolbitiaceae).

Based on the additional material gathered the genus *Descolea* can now be typified as follows:

DESCOLEA Sing. em. Horak

Descolea Sing. *in* Lilloa **23**: 256. "1950" [1951].

Spore print ochraceous; spores amygdaliform to limoniform, always distinctly mucronate, without germ pore or plage (occasionally present in *D. majestatis*),

EXPLANATION OF FIGURE 2

Fig. 2. Habit sketches of the species of *Descolea*. — a. *D. antarctica*. — b. *D. pallida*. — c. *D. majestatica*. — d. *D. gunnii*. — e. *D. phlebophora*. — f. *D. pretiosa*. (All natural size.)

warted, with well developed and coloured perispore. Basidia clavate, 4- and 2-spored. Typical cheilocystidia and pleurocystidia absent. Lamellae adnexed or emarginate-adnate. Pileus convex to expanded, dry or viscid; cuticle consisting of clavate cells forming an epithelium-like structure, covered by the cylindrical hyphae of the outer veil, strongly encrusted with pigment; clamp connections present. Stipe cylindrical or tapering upwards, central, dry; velum partiale forming a persistent, striate, rarely smooth, annulus; velum universale consisting of scaly, patchy or volva-like remnants on the lower parts of the stipe and fine floccose squamules especially near the margin of the pileus. No specific chemical reactions. Smell and taste not distinctive. On humus, rotten litter or on wood in forests. Area of distribution: S. America, New Zealand, Australia, India, southeast Siberia, Japan.

Type of the genus: *Descolea antarctica* Sing. (1951)

KEY TO THE SPECIES OF DESCOLEA

1. Pileus viscid or slimy 2
1*. Pileus dry 4
2. Pileus > 30 mm (–70 mm) diam., robust, dark brown with olive tinge; annulus well developed; spores (12–)12.5–15 × 7–8 μ; under *Nothofagus*; New Zealand 3. *D. majestatica*
2*. Pileus smaller; under *Nothofagus* in S. America 3
3. Spores 12–15 × 6.5–8.5 μ; pileus brown, with white scattered veil remnants 1. *D. antarctica*
3*. Spores 10-13 × 5–6.5 μ; pileus yellow-brown to ochraceous, often pallid; veil remnants ochraceous . . . . . 2. *D. pallida*
4. Spores > 12 μ long, coarsely warted; India, Siberia, Japan 5
4*. Spores < 12 μ long, mostly minutely warted; Australia, New Zealand . 6
5. Base of stipe with several girdles of scales; spores 12–14.5 × 7–8 μ; under *Abies*, *Picea*, *Taxus*; Himalaya (India) . . . . . 7. *D. pretiosa*
5*. Base of stipe with volva-like veil remnants; spores 14–16 × 8–9 μ; under *Larix*, *Pinus*, *Quercus*, *Castanopsis*; E. Siberia, Japan 8. *D. flavo-annulata*
6. Pileus liver brown or dark brown, conspicuously wrinkled; veil remnants white; spores 8–11.5 × 5–6 μ; under *Nothofagus* (and *Leptospermum*); New Zealand . . . . . 6. *D. phlebophora*
6*. Pileus ochraceous or yellow-brown; veil remnants ochraceous . 7
7. Base of stipe with conspicuous, sharp-pointed scales; under *Nothofagus* and *Leptospermum*; New Zealand . . 5. *D. gunnii*
7*. Base of stipe glabrous, without scales; Australia 4. *D. recedens*

1. DESCOLEA ANTARCTICA Sing.—Figs. 2a, 3

Descolea antarctica Sing. *in* Lilloa **23**: 257. "1950" [1951].

This species was fully described by Singer (l.c.) and Horak (1968: 221).

COLLECTIONS EXAMINED:

ARGENTINA

Tierra del Fuego: Estancia Nueva Argentina, 11 Feb. 1950, *R. Singer*, "sub *Nothofagis* in terra" (holotype, LIL 144a); Ushuaia, Valle del Glaciar Martial, 1 March 1963, *E. Horak*, under *Nothofagus pumilio* (Herb. HK., ZT 64/98).

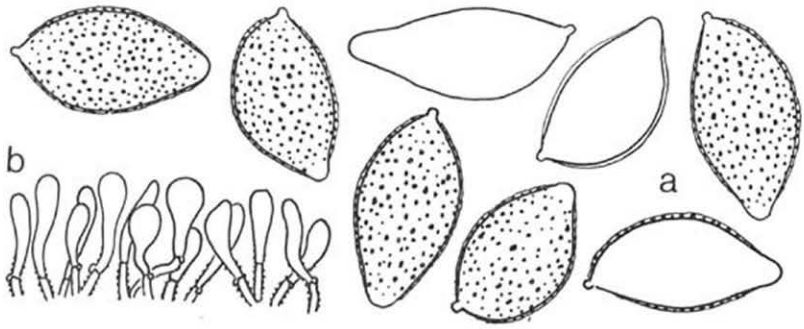

Fig. 3. *Descolea antarctica*. — a. Spores (2000 ×). — b. Cuticle (500 ×).

The two collections studied agree in all their characters. According to present knowledge *D. antarctica* is endemic to Tierra del Fuego and its microscopic features (spores 12–15.5 × 7–8.5 μ) are distinctly different from those of *D. pallida*, which is found in the north and the second species of *Descolea* known from the *Nothofagus* forests of S. America. Singer (1969: 220) originally recognized these differences but did not attempt to separate the two "infraspecific taxa", declaring *D. pallida* to be a smaller-spored form of *D. antarctica*.

2. **Descolea pallida** Horak, *spec. nov.*—Figs. 2b, 4

Pileo 10–40 mm lato ex hemisphaerico applanato-umbonato, luteo-ochraceo vel brunneolo, viscido, striato, hygrophano, glabro vel subrugoso, fragmentis veli concoloribus ornato. Lamellis adnexis vel emarginatis, ochraceis. Stipite 20–60 × 2–5 mm, cylindraceo vel superne attenuato, pileo concolori vel pallidiori, sicco, glabro, annulo amplo concolori striatoque persistenter instructo. Carne brunneola. Odore saporeque acidulis vel subfarinaceis. Sporis 10–13 × 5–6.5 μ, sublimoniformibus, minute verrucosis. Cystidiis nullis. Epicute e cellulis clavatis, 12–40 × 8–15 μ, epithelium efformantibus, pigmento brunneo incrustatis. Hyphis fibuligeris. Ad humum et inter folia deiecta in silvis, praecipue nothofagineis. Austroamerica (Argentina, Chile). Holotypus: Chile, Pucatrihue, 26. IV. 1963, *E. Horak* (herb. HK., ZT 66/332).

Pileus 10–40 mm diam., hemispherical when young, becoming umbonate-applanate, rarely expanded, concave; colour changing from yellowish to ochraceous or dark melleous, at maturity brownish or even reddish-brownish; striate at the margin, hygrophanous, distinctly slimy, cuticle folding into radially arranged wrinkles; young fruiting bodies with scattered concolorous squamules along the margin. Lamellae (L 14–22, l 3) adnate or emarginate; yellowish or buff, later turning ochraceous; edge concolorous, fimbriate. Stipe 20–60 × 2–5 mm, single, rarely clustered, central, cylindrical or attenuated upwards, fistulose; at first whitish, later coloured like the pileus; dry and glabrous, towards the base covered by silky whitish fibrils, but without any conspicuous veil remnants from the velum universale;

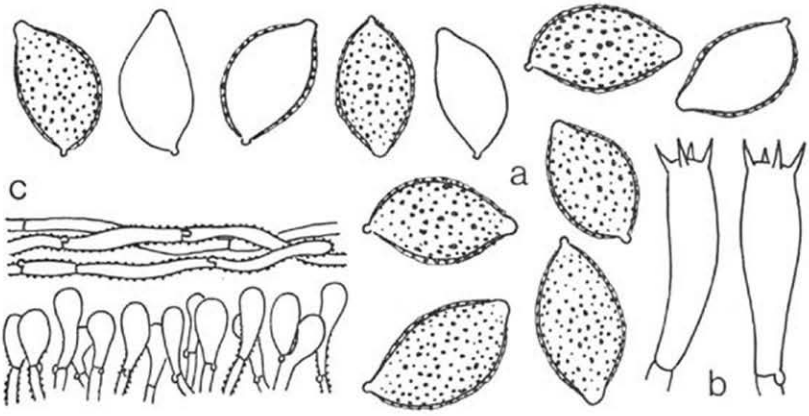

Fig. 4. *Descolea pallida*. — a. Spores (2000 ×). — b. Basidia (1000 ×). — c. Cuticle (500 ×).

ring concolorous with the stipe, strongly striate, pendent, dry, persistent. Context whitish-yellowish, brownish in old fruiting bodies. Smell and taste slightly bitter or subfarinaceous. Chemical reactions on the pileus: KOH and HCl produce no reaction.

Spores 10–13 × 5–6.5 μ, almond- or lemon-shaped, mucro prominent and smooth, for the rest covered by isolated minute warts, without germ pore. Basidia 30–38 × 6–10 μ, 4-spored, rarely 2-spored. Cystidia absent. Cuticle consisting of clavate cells, 12–40 × 8–15 μ, forming a 1-layered epithelium; membrane gelatinized and strongly encrusted with brown pigment; hyphae of veil remnants loosely interwoven, cylindrical, heavily pigmented; clamp connections present.

HABITAT: Among litter and on soil in rain forests with various Myrtaceae and/or *Nothofagus* (mainly *N. dombeyi*). Argentina, Chile.

COLLECTIONS EXAMINED:

ARGENTINA

Prov. Rio Negro: between L. Frías and Paso de las Nubes, 8 April 1962, *E. Horak*, under *Nothofagus dombeyi* (Herb. HK., ZT 62/20); Lago Nahuel Huapi, P. Manzano, 28 March 1962, *E. Horak*, under *Nothofagus dombeyi* and *Chusquea culeou* (Herb. HK., ZT 66/383); Lago Nahuel Huapi, Quetrihué, 23 April 1962, *E. Horak*, under *Nothofagus dombeyi* (Herb. HK, ZT 66/590); Lago Nahuel Huapi, P. Manzano, 26 April 1963, *M. Moser*, under *Nothofagus dombeyi* (Herb. HK, ZT 70/279).

CHILE

Prov. Osorno: Pucatrihue, 26 April 1963, *E. Horak*, on sandy soil under trees in Pacific rain forest (holotype, Herb. HK, ZT 66/332); Frutillar, Centro Forestal, Llanquihue, 5 May 1968, W. *Lazo*, "en suelo y raices semipodridas" (FRU-6; Herb. HK, ZT 70/275).

Old and degraded specimens of *D. pallida* may occasionally resemble *D. antarctica* (Singer, 1969: 220), but striking differences occur in the colour of the veil remnants at the margin of the pileus, the size of the spores, and the area of distribution. Apparently this species was at first only mentioned by Singer (1962: 630); later Singer (1969: 220) declared it to be conspecific with *D. antarctica* and *D. recedens* respectively, which see.

Some similarities also exist between *D. pallida* and *D. recedens* from Australia. It would seem that the two species are closely related but unfortunately the macroscopic characters of *D. recedens* are not completely known. Further findings may resolve this still open question.

3. **Descolea majestatica** Horak, *spec. nov.*—Figs. 2c, 5

Pileo 30–70 mm lato, hemisphaerico demum umbonato-convexo, margine incurvo, brubneo et distincte olivaceo-tincto, glutinoso, marginem versus venoso-subsulcato, striato, hygrophano, fragmentis veli universali nullis. Lamellis emarginatis, ex argillaceo ochraceo-brunneis, fimbriatis. Stipite 40–80 × 8–15 mm, cylindraceo, robusto, fistuloso, sicco, pileo concolori vel pallidiori, superne glabro, basim versus squamis squarrosis instructo, annulo albo vel argillaceo, amplo, patulo, perstriato, fixo, marginem versus partibus glutinosis brunneisque ornato. Carne obscure brunnea. Odore saporeque nullis. Sporis 12.5–15 × 7–8 μ, amygdaliformibus, grosse verrucosis, depressione suprahilari indistincta instructis. Cheilocystidiis 25–60 × 10–35 μ, conspicuis, clavatis, tenuitunicatis, fibuligeris. Epicute e cellulis clavatis, 18–45 × 12–25 μ, epithelium efformantibus, membrana glutinosa et pigmento brunneo incrustata. Inter folia deiecta in silvis nothofagineis. Novazelandia. Holotypus: Novazelandia, Lake Rotoiti, 30. IV. 1969, *E. Horak* (Herb. HK., ZT 69/277).

Pileus 30–70 mm diam., at first hemispherical with strongly incurved margin, becoming umbonate-convex, rarely expanded, fleshy; dark (date) brown, always showing a distinct olive-greenish tinge, hygrophanous; covered with a thick layer of slime (up to 3 mm), near the striate margin grooved or wrinkled, without any squamulose remnants of the velum universale. Lamellae emarginate, crowded; argillaceous to coffee brown or ochraceous-brown; gill edge whitish and fimbriate. Stipe 40–80 × 8–15 mm, cylindrical, robust, at maturity fistulose; brown or lighter than the pileus; dry, apically glabrous to longitudinally fibrillose, below the annulus with squarrose squamules; ring very conspicuous, pendent, strongly striate, immobile; whitish or concolorous with the stipe; at the crenulate margin frequently with brown, gelatinous patches (originating from the margin of the pileus). Context brown. Smell and taste not distinctive.

Spores 12.5–15 × 7–8 μ, almond-shaped, strongly warted except for the mucro, with conspicuous perispore embedding the warts, plage smooth. Basidia 35–46 × 10–14 μ, 4-spored. Cystidia at the gill edge conspicuous, 25–60 × 10–35 μ, clavate, thin-walled, partially encrusted with brown pigment, with clamp connections. Cuticle consisting of loosely arranged cells, 18–45 × 12–25 μ, more or less forming an epithelium; membrane of hyphae strongly gelatinized and covered by crusts of a brown pigment.

HABITAT: Among litter in *Nothofagus* forests (*N. cliffortioides*, *N. fusca*, *N. menziesii*). New Zealand.

COLLECTIONS EXAMINED:

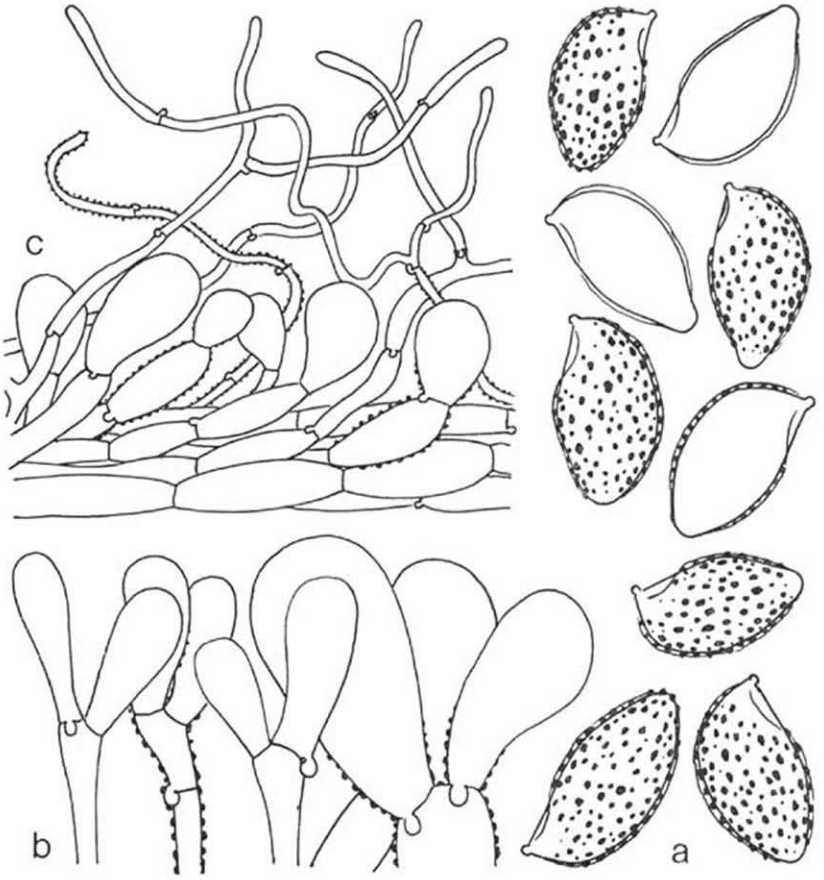

Fig. 5. *Descolea majestatica*. — a. Spores (2000 ×). — b. Cheilocystidia (1000 ×). — c. Cuticle (500 ×).

New Zealand

South Island: Maungatua, 18 April 1953, *Mrs. G. Stevenson 877*, under *Nothofagus menziesii* (K); Prov. Canterbury, Craigieburn Range, Cave Stream, 19 April 1968, *C. Baker*, under *Nothofagus cliffortioides* (Herb. HK., ZT 68/272); Prov. Nelson, Lake Rotoiti, St. Arnaud Range, 30 April 1969, *E. Horak*, in litter under *Nothofagus fusca* and *N. menziesii* (holotype, Herb. HK., ZT 69/277).

Descolea majestatica, the third member of the genus with a gelatinized cuticle, is characterized by several peculiarities which place it in a somewhat transitional taxonomic position. According to the robust and fleshy nature of the fruiting bodies and the thick gelatinous layer on the pileus, this species could be taken as related to *Rozites*. The latter genus is also known from the *Nothofagus* forests of S. America, New Zealand, and Australia, and represented by some ten species. The occurrence of articulate cheilocystidia and the generally amygdaliform spores brings out the close relationship between *D. majestatica* and southern *Rozites*. The hymeniform cuticle, the smooth mucro of the spores, and the strongly striate persistent ring are however distinct characters of *Descolea*. Therefore this species is considered to be a member of the genus *Descolea*.

4. DESCOLEA RECEDENS (Cooke & Massée) Sing.—Fig. 6

Agaricus (Pholiota) recedens Cooke & Massee *apud* Cooke *in* Grevillea **18**: 25. 1889. — *Pholiota recedens* (Cooke & Massee) Sacc., Syll. Fung. **9**: 93. 1891 — *Descolea recedens* (Cooke & Massee) Sing. *in* Sydowia **9**: 407. 1955.

A few additional observations can be added to the original diagnosis of Cooke & Massee and Singer's redescription (1955) of this Australian fungus from the type in the Kew Herbarium. The amygdaliform to sublimoniform spores measure about 10–11.5 × 5.5–6.5 μ, are minutely verrucose, and have a thin perispore and smooth mucro. The clavate cells of the hymeniform cuticle are about 20–30 × 10–15 μ, the membrane of the hyphae is not conspicuously gelatinized, is encrusted by brown pigment, and has clamp connections.

COLLECTION EXAMINED:

AUSTRALIA

Victoria: Mordiallac, 1889, *O. French* (holotype, K).

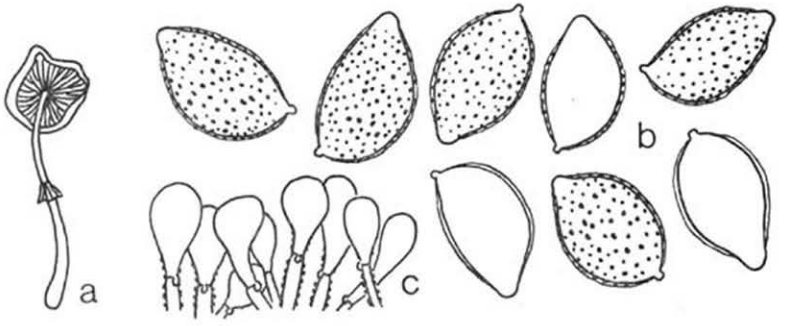

Fig. 6. *Descolea recedens*. — a. Carpophore (dried material; nat. size). — b. Spores (2000 ×). — c. Cuticle (500 ×).

Recently Singer (1969: 218) expressed the opinion that *D. antarctica* and *D. recedens* are conspecific, and are one of the first examples of a non-cosmopolitan fungus occurring on both sides of the Pacific. But the details presented in this study clearly show that the two taxa are distinct and should therefore be kept apart.

There is no doubt that *D. recedens* is not only closely related to *D. pallida* in Patagonia but also to *D. gunnii* in New Zealand. All three species have the same type of spore ornamentation (consisting of small warts) and the colours of the fruiting bodies are also quite similar. However, the macroscopic characters differ in so many ways (for example the cuticle, the presence of a velum universale and the distribution of its remnants, the occurrence of cheilocystidia, etc.) that well-established and independent taxa are defined.

5. **Descolea gunnii** (Berk.) Horak, *comb. nov.*—Figs 2d, 7

Secotium gunnii Berk. *apud* Massee *in* Grevillea **19**: 96. 1891 (basionym).

Pileus 10–45 mm diam., hemispherical when young, later becoming convex or umbonate and expanded; dark (date) brown, sometimes even umber brown but also becoming ochraceous in old fruiting bodies; always striate near the margin, hygrophanous, dry, densely and permanently covered by appressed fibrillose squamules of rusty or dark ochraceous colour. Lamellae (L 10–18, l 3) adnate or emarginate-adnexed; argillaceous, turning brown, sometimes with whitish serrulate gill edge. Stipe 15–60 × 1.5–7 mm, cylindrical, when old often subclavate, fistulose; dry, apically whitish and farinaceous, below the striate, permanent, submobile ring (sometimes attached near the base) densely covered with squarrose, upwards pointed, ochraceous or golden yellow scales from the velum universale. Context brown, not gelatinous. Smell and taste not distinctive.

Spores 9.5–12 × 6–7 μ, sublimoniform, verrucose with smooth mucro, isolated warts embedded in brownish perispore, without particular plage, germ pore absent. Basidia 30–38 × 10 μ, 4-spored, Cheilocystidia 30–60 × 7–13 μ, cylindrical or fusoid, thin-walled, forming a sterile zone at the gill edge. Cuticle consisting of clavate cells, 12–40 × 8–20 μ, forming an epithelium; hyphae thin-walled, strongly encrusted with brown pigment, not gelatinized. Hyphae of the velum universale cylindrical, thin-walled, encrusted, with clamp-connections.

HABITAT: on soil or on rotten wood in forests (various species of *Nothofagus*, *Leptospermum*, etc.). New Zealand.

COLLECTIONS EXAMINED:

NEW ZEALAND

North Island: Auckland, Titirangi Range, Atkinson Park, 8 Oct., 1967, *R. F. R. McNabb* & *E. Horak*, on soil or rotten trunks of *Cyathea dealbata* under *Agathis*, *Leptospermum*, etc. (Herb. HK., ZT 67/145); Rotorua, Te Weranga Pool, 15 July 1968, *E. Horak*, under *Leptospermum scoparium* and *L. ericoides* (Herb. HK., ZT 68/668); Rotorua, Sulphur Springs, *Gunn 257* (type, K).

South Island: Prov. Nelson, Lewis Pass, Springs Junction, 5 Dec. 1967, *E. Horak*, on rotten wood under *Nothofagus fusca* (Herb. HK., ZT. 67/208); Prov. Westcoast, Kopara, 13 Dec. 1967, *E. Horak*, among litter and on rotten wood under

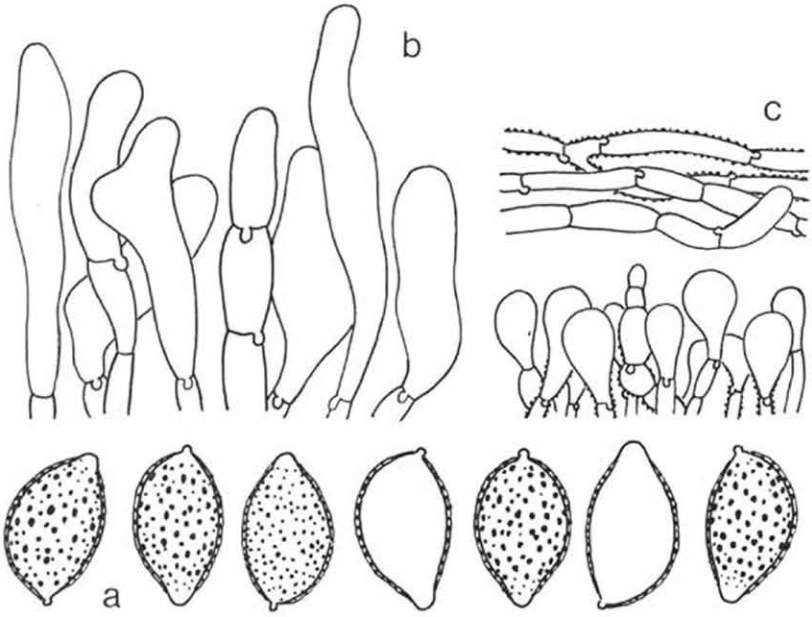

Fig. 7. *Descolea gunnii*. — a. Spores (2000 ×). — b. Cheilocystidia (1000 ×). — c. Cuticle (500 ×).

Nothofagus fusca (Herb. HK., ZT 67/251); Prov. Westcoast, Karamea, Opara Road, 30 Dec. 1967, *R. F. R. McNabb*, under *Leptospermum scoparium* (Herb. HK., ZT 68/84).

This species occurs frequently in all kinds of forests in New Zealand, probably forming a facultative mycorrhizal association with species of *Nothofagus* and *Leptospermum* as well.

Secotium gunnii Berkeley, as the examination of the type specimen showed, undoubtedly belongs to *Descolea*. The spores observed are characteristic and fragments of the obviously striate ring can still be seen in the poorly preserved collection.

6. **Descolea phlebophora** Horak, *spec. nov.*—Figs. 2e, 8

Pileo 10–30 mm lato, hemisphaerico deinde campanulato, ex carneo-brunneo hepatico, sicco, distincte rugoso. Lamellis adnexis, brunneolo-ochraceis, mox ochraceo-ferrugineis, intermixtis. Stipite 30–70 × 2–6 mm, cylindraceo vel apicem versus attenuato, fistuloso, sicco, pileo concolori vel pallidiori, annulo albo immobili striato instructo, basin versus zonis albis

nonnullis numquam squarrosis cingulato. Carne brunneola. Odore saporeque fructuolentis vel farinaceis. Sporis 8–11.5 × 5–6 μ, amygdaliformibus, minute verrucosis, subtruncatis. Cheilocystidiis clavatis vel ampullaceis, 20–35 × 5–10 μ, tenuitunicatis. Epicute e cellulis clavatis, 20–35 × 10–20 μ, epithelium efformantibus, pigmento brunneo incrustatis, fibuligeris, membrana hyphorum haud gelatinosa. Inter folia deiecta in silvis praecipue nothofagineis. Novazelandia. Holotypus: Novazelandia, Lake Rotoiti, 30. IV. 1969, *E. Horak* (Herb. HK., ZT 69/274).

Pileus 10–30 mm diam., hemispherical when young, later becoming campanulate or umbonate, rarely flat and expanded; reddish brown, liver brown or sometimes dark melleous; dry, hygrophanous, at the centre deeply wrinkled and radially veined, striate near the margin, veil remnants absent. Lamellae adnexed, crowded; pallid brownish, ochraceous or rusty brown at maturity; edge whitish, finely fimbriate. Stipe 30–70 × 2–6 mm, cylindrical or attenuated upwards, solid, later fistulose; concolorous with the pileus or lighter; dry, densely covered by white silky fibrils, towards the base with several white conspicuous bands of the velum universale, never squarrose or scaly; ring white, striate (sometimes smooth), persistent, immobile. Context brownish. Smell and taste fruity or intensely farinaceous.

Spores 8–11.5 × 5–6 μ, amygdaliform, minutely warted, warts sometimes even covering the indistinct mucro, germ pore or plage absent. Basidia 25–34 × 5–8 μ, 4-spored. Cheilocystidia 20–35 × 5–10 μ, clavate or ampullaceous, indistinct, forming a sterile zone at the gill edge. Cuticle consisting of clavate cells, 20–35 × 10–20 μ, rarely 1-layered, usually forming several horizons (see Fig. 6), strongly encrusted with brown pigment; membrane not gelatinized. All hyphae with clamp connections.

HABITAT: Among litter, mainly in *Nothofagus* forests (*N. cliffortioides*, *N. fusca*, *N. menziesii*; occasionally mixed with species of *Leptospermum*). New Zealand.

COLLECTIONS EXAMINED:

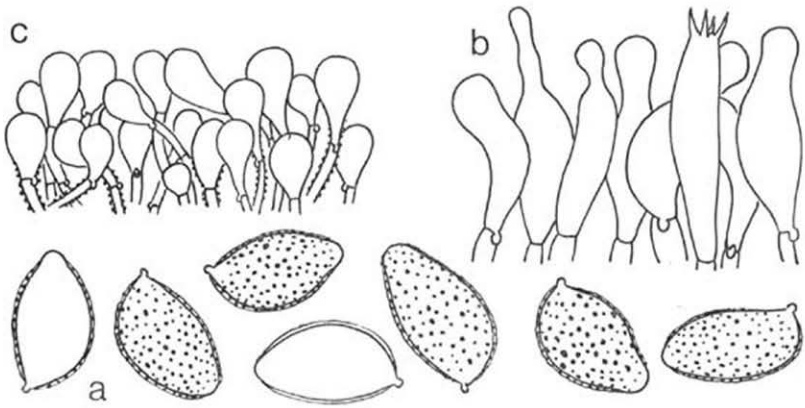

Fig. 8. *Descolea phlebophora*. — a. Spores (2000 ×). — b. Cheilocystidia (1000 ×). — c. Cuticle (500 ×).

NEW ZEALAND

South Island: Prov. Nelson, Lake Rotoiti, 23 May 1968, *E. Horak*, under species of *Nothofagus* and *Leptospermum* (Herb. HK., ZT 68/500); Lake Rotoiti, St. Arnaud, 30 April 1969, *E. Horak*, under species of *Nothofagus* (holotype, Herb. HK., ZT 69/274).

This species is easily recognizable by its deeply wrinkled and veined pileus and the conspicuous white remnants of the velum partiale and velum universale. Thus *D. phlebophora*, which has roughly the same ecological requirements as *D. gunnii* differs from it morphologically in the absence of scales towards the base of the stipe and the liver brown colour of the pileus respectively. Owing to these characters both taxa can be readily identified in the field.

7. **Descolea pretiosa** Horak, *spec. nov.*—Figs. 2f, 9

Pileo 70–85 mm lato, ex obtuso-conico plano-convexo, fusco (humido olivaceo-tincto vel spadiceo) dein bruneo-ochraceo, sicco, in centro rugoso, squamis concoloribus dense instructo, primo margine appendiculato. Lamellis adnexis, argillaceis dein tabacinis. Stipite 75–80 × 11–13 mm, cylindrico, apicem versus attenuato, stramineo vel tabacino, sicco, basin versus squamis concoloribus instructo, annulo amplo, membranaceo, perstriato et margine dentato instructo. Carne pallide straminea. Odore saporeque rancidis. Sporis 12–14.5 × 7–8 μ, sublimoniformibus, grosse verrucosis, mucronatis. Basidiis 36–40 × 8 μ, 4-sporigeris. Cystidiis nullis. Epicute e cellulis clavatis, 15–36 × 10–23 μ, epithelium efformantibus, membrana hyphorum haud gelatinosa, pigmento brunneo instructis, fibuligeris. Sub arboribus *(Abies, Picea, Taxus)*. Himalaya, India. Holotypus: India, Himachal Pradesh, Narkanda, 8. VIII. 1964, *R. A. Maas Geesteranus 14192* (L); pars holotypi (Herb. HK., ZT 70/274).

Pileus 70–85 mm diam., irregularly obtuse-conical with inflected margin at first, later becoming plano-conical to plano-convex with broad, somewhat truncate umbo, strongly rugulose; hygrophanous, dry; fuscous with slight olivaceous tinge to date brown when moist, becoming rich brownish ochraceous (with very faint olivaceous tinge) when dry, with crowded ochraceous brown to pale ochraceous yellow, small, floccose, loose scales; surface between scales somewhat furfuraceous; while pileus still closed, edge of pileus conspicuously rusty ochraceous brown dentate-appendiculate. Lamellae rather crowded, 3–7 short gills between each pair; rich tobacco brown (= rich ochraceous brown with very slight olivaceous tinge), more or less clay-coloured when young, somewhat paler near the very slightly irregular edge, densely venose transversely, adnexed to very narrowly adnate. Stipe 75–80 × 11–13 mm, attenuate upwards; at first pale stramineous buff, more brownish yellow downward and with pale tobacco brown tinge below, later entire stem tending to the same colour as the gills; near the base with some irregular girdles of appressed, felted, more or less concolorous scales, slightly appressedly and longitudinally fibrillose above the ring, more loosely fibrillose and concolorous below; ring very remarkable, felted submembranous, rather thick, persistent, pendent-patent, with sharp upper edge, strongly grooved to nearly lamellate on the upper side, with dentate edge when young; approximately concolorous with the stem. Context pallid in the pileus, pale stramineous in the stem and adjacent part of the pileus. Smell rancid when cut. Taste strongly rancid.

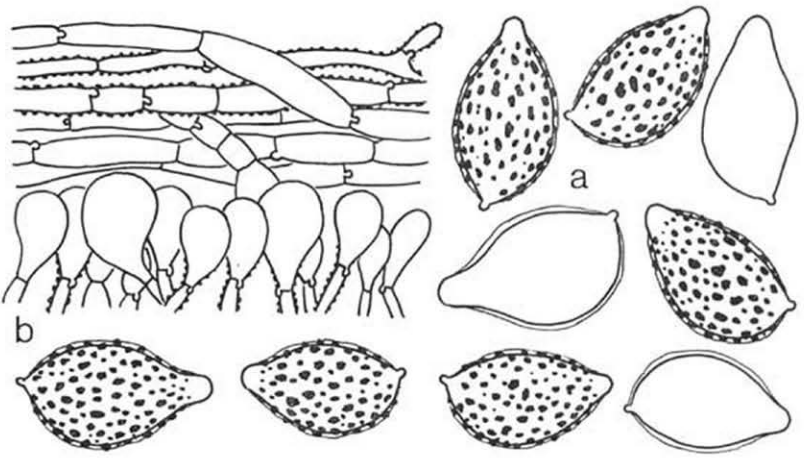

Fig. 9. *Descolea pretiosa*. — a. Spores (2000 ×). — b. Cuticle (500 ×).

Spore print light chocolate brown when fresh. Spores 12–14.5 × 7–8 μ, lemon-shaped, strongly verrucose by isolated warts, mucro distinct and smooth, germ pore and plage absent. Basidia 36–40 × 8 μ, 4-spored. Cheilocystidia absent. Cuticle consisting of clavate cells, 15–36 × 10–23 μ, forming an epithelium; hyphae thin-walled, not gelatinized, strongly encrusted with brown pigment, with clamp connections.

HABITAT: Terrestrial in coniferous forest, Narkanda, India.

COLLECTION EXAMINED:

INDIA

H i m a c h a l P r a d e s h: Simla Hills, Narkanda, 8 Aug. 1964, *R. A. Maas Geesteranus 14192*, in forest of *Abies pindrow*, *Picea smithiana*, *Taxus*, with *Fragaria* and *Prunella* covering the soil, on north-exposed slope, 2750 m alt. (holotype, L; part o holotype, Herb. HK., ZT 70/274).

Descolea pretiosa and *D. majestatica* of New Zealand are conspicuously connected by reason of the large size of their fruiting bodies, the olive tinge of the colours, the scales near the base of the stipe, and the characters of the spores.

8. **Descolea flavo-annulata** (Vasilieva) Horak, *comb. nov.*—Fig. 10

Rozites flavo-annulata Vasilieva *in* Bot. Mater. Inst. spor. Rast. **6**: 199. 1950 (basionym).

Pileus 50–80 mm broad, subglobose to convex, then expanded and obtusely umbonate; surface not viscid, radially wrinkled; melleous ocher to dark brown

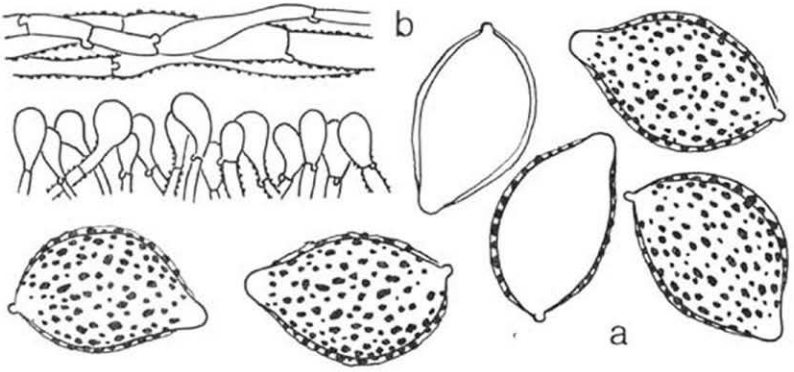

Fig. 10. *Descolea flavo-annulata*. — a. Spores (2000 ×). — b. Cuticle (500 ×).

(burnt umber or van Dyke brown); sprinkled with concentrically arranged, small, floccose, yellow fragments of the universal veil. Lamellae adnate, then separating, subdistant, broad; yellowish, then dark rusty cinnamon; edge yellow and minutely fimbriate. Stipe 60–100 × 7–10 mm, equal, with subbulbous base, ochraceous yellow, paler at the apex, somewhat brownish from the base upwards; solid; the universal veil felty and often cohering at the base in the form of a rudimentary volva; ring yellow, membranous, striate, rather fugacious. Smell and taste unknown.

Spores (11–)12–16 × 8–9 μ, lemon-shaped, coarsely verrucose, with prominent smooth mucro, perispore distinct, rust brown. Basidia 35–45 × 10–12 μ, 4-spored. Cheilocystidia 30–40 × 7–15 μ, clavate, forming a sterile zone at the gill edge. Cuticle consisting of clavate cells, 10–25 × 6–15 μ, forming a distinct epithelium; membrane of the hyphae strongly encrusted with rust brown pigment, not gelatinized. Hyphae of the remnants of the velum universale cylindrical, heavily encrusted with pigment, with clamp connections.

HABITAT: On the ground in various forest associations (under *Pinus*, *Larix*, *Quercus*, *Castanopsis*). Far eastern Siberia (type), Japan.

COLLECTION EXAMINED:

JAPAN

Kyushu: Oita Pref., Mt. Kurodake, 26 Oct. 1968, *T. Hongo*, in forest of *Quercus serrata* (Herb. HK., ZT 70/325).

The type of *D. flavo-annulata* could not be studied but a collection was examined which T. Hongo had made in Japan. A comparison of the original description of *D. flavo-annulata* (translated by Moser, 1953: 164) with the observations made on the Japanese fungi showed no apparent differences. Hence the description given by Hongo (1966: 57) is faithfully copied and some as yet undescribed microscopic data are added.

By the presence of the large, strongly warted spores *D. flavo-annulata* could be

identified with *D. pretiosa*, also occurring in the northern hemisphere, and the rather atypical *D. majestatica* from New Zealand. Like *D. majestatica*, systematically *D. flavoannulata* falls close to *Rozites*, even though the remnants of the velum universale cohere as a volva at the base of the stipe. But the characteristic spores and the structure of the cuticle clearly place this fungus in *Descolea*.

ACKNOWLEDGEMENTS

The writer is indebted to the New Zealand Forest Service for the opportunity to study the Agaricales of New Zealand and to Dr. E. H. van Maanen (Amsterdam) for suggesting many improvements of the English text. Dr. R. F. R. McNabb (Christchurch), Dr. R. A. Maas Geesteranus and Dr. C. Bas (Leiden), and Dr. T. Hongo (Ōtsu) kindly lent unidentified material and furnished useful data which in particular helped to clarify the taxonomic position of *Descolea*.

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NOTES ON THE GENUS PSATHYRELLA—I

Psathyrella gracilis and P. microrrhiza

E. KITS van WAVEREN, M. D.
Amsterdam

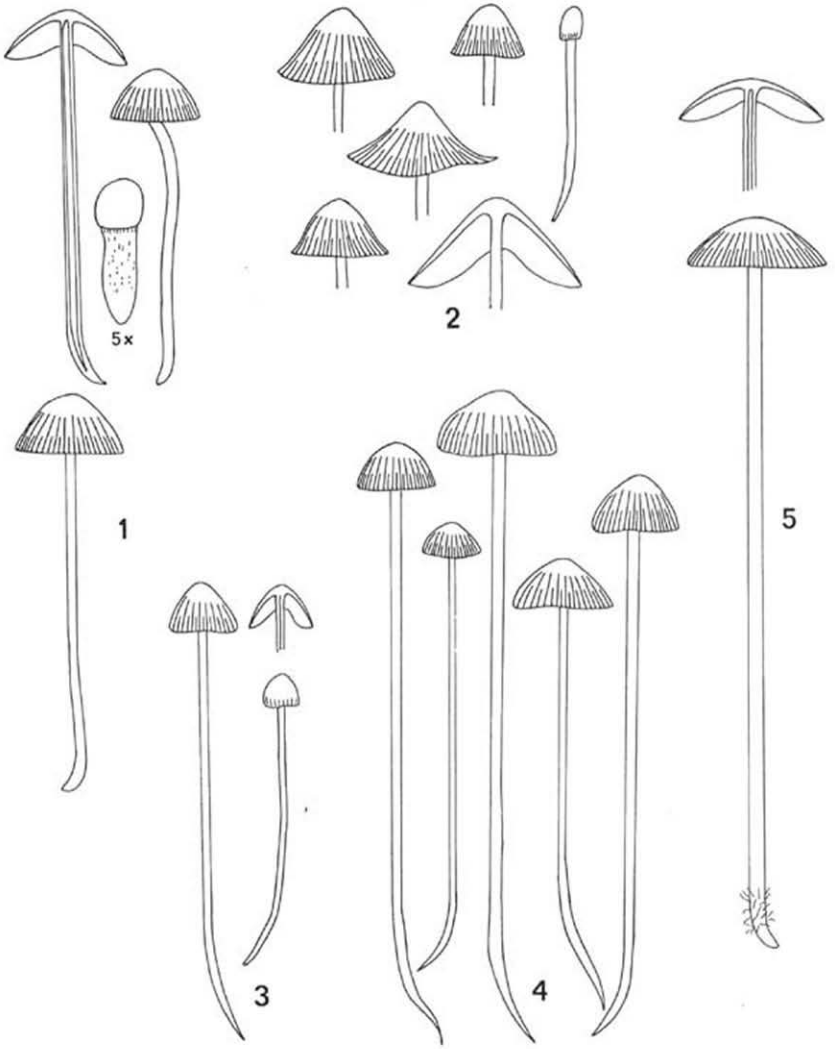
(With 62 Text-figures)

Descriptions of *Psathyrella gracilis* and *P. microrrhiza* are given. In the former the following forms are recognized: f. *gracilis*, f. *corrugis*, f. *clavigera*, f. *albolimbata*, and f. *substerilis*. The variability of both species is stressed and a new character is described that may help to distinguish between the two. Forms, indicating that intermediates between the two species exist, are discussed.

Our private herbarium containing 87 collections of *P. gracilis* and *P. microrrhiza* and their various forms, it was decided to carry out an exhaustive study of this material. All these collections are now deposited in the Rijksherbarium at Leiden (L), including the type specimens of the three new forms of *P. gracilis* to be described below.

For the description of the colours of the macroscopic structures and the spores (mounted in water and studied with oil immersion and with a rather strongly lit field of view) we used the American Munsell Soil Color Charts (abbreviated in the text to M.) and the code, designating its colours. For the methods by which we studied and depicted the microscopic structures the reader is referred to a previous paper (Kits van Waveren, 1968: 132). Spore sizes were based on samples from the gills as in the majority of cases no spore-prints were available. Great care, however, was taken to measure only mature, i.e. very dark coloured, spores. Following Pegler (1966: 74) we expressed spore measurements both as a range and with a mean value.

In order to locate the cheilo- and pleurocystidia, and particularly to examine the pigmentation of both the flesh of the cap and the hymenophoral trama, the tissue of the cap and gills was 'washed' as already described to some extent in an ealier paper (l.c. 132). From herbarium material a wedge-shaped segment of the cap, comprising four to five large gills, was cut out of the cap from margin to centre with a sharply pointed piece of a broken razor blade. The segment was then put on a slide on its 'back', i.e. gills facing upwards and the cap surface resting on the slide. The gills — very brittle, the herbarium material being very dry — were then removed by breaking them at their base from the flesh. This was done under the binocular lens with two mounted needles, one fixing the segment, the other being placed horizontally along and against the base of the gill and then gently and gradually pushing the gill from its base. All gills, large and small, having been removed in this way, a segment of the cap was obtained with the remaining 'ridges' of the gills on the upper side and also a number of full-sized gills, small and large. Both this segment and one large gill were



Figs. 1–5. *Psathyrella gracilis*, habit sketches. — 1. Denekamp, Singraven, 22 Oct. 1960. — 2. Amsterdam, Amsterdamse Bos, 7 Nov. 1959. — 3. British Isles, Scotland, Loch Lomond near Arden, 27 Aug. 1963. — 4. Nieuwersluis, Over-Holland, 8 Nov. 1962. — 5. Amsterdam, Amsterdamse Bos 19 Sept. 1961.

then placed in a large drop of 10% NH_4OH and 'washed', i.e. freed from almost all their spores by tapping the segment respectively the gill with one needle while fixing it with the other. The liquid acquired a blackish colour from the vast number of floating spores and was removed two or three times with filter paper and each time replaced by a fresh supply. In the end the remnants of the gill attachments stood out as dark coloured 'ridges' on the lighter coloured flesh of the cap between them. The gills were translucent and brown or colourless as the case may be. For the description of the colours of the flesh of the cap, the 'ridges' of the gills and the hymenophoral trama, again the Munsell Color Charts were used, the colours being observed in very bright daylight shining on a white background (white paper under the binocular lens).

Next, both the tissues of the cap segment (i.e. flesh of cap + 'ridges') and the gill were brought under a coverslip and broken up by tapping the coverslip with a hard object in order to study the pigmentation microscopically (oil immersion).

In distinguishing between *P. gracilis* and *P. microrrhiza* it proved to be important to count the number of lageniform cheilocystidia per standard (1000μ) distance along the edge of the gills. For this we isolated and washed another full-sized gill and then cut the entire edge of the gill from the remainder with a broken piece of razor blade and with the aid of the binocular lens. Shifting the edge from one end to the other under the microscope, at the same time measuring the distance over which the edge was shifted and counting the number of cheilocystidia encountered, we were practically always able to obtain a more or less accurate figure for the density of the lageniform cheilocystidia, expressed in number per 1000μ. Occasionally the marginal cells were beyond assessment, having deteriorated or even disappeared as a result of age and decay.

That part of the gill, which had been freed of its spores and also of its edge, was then teased up into very small pieces with the aid of two needles, placed under a coverslip, and the tissue was further dispersed by tapping the coverslip with a hard object. In this way the pleurocystidia (and pleurocystidia alone!) and basidia were well isolated so that they could easily be measured and drawn.

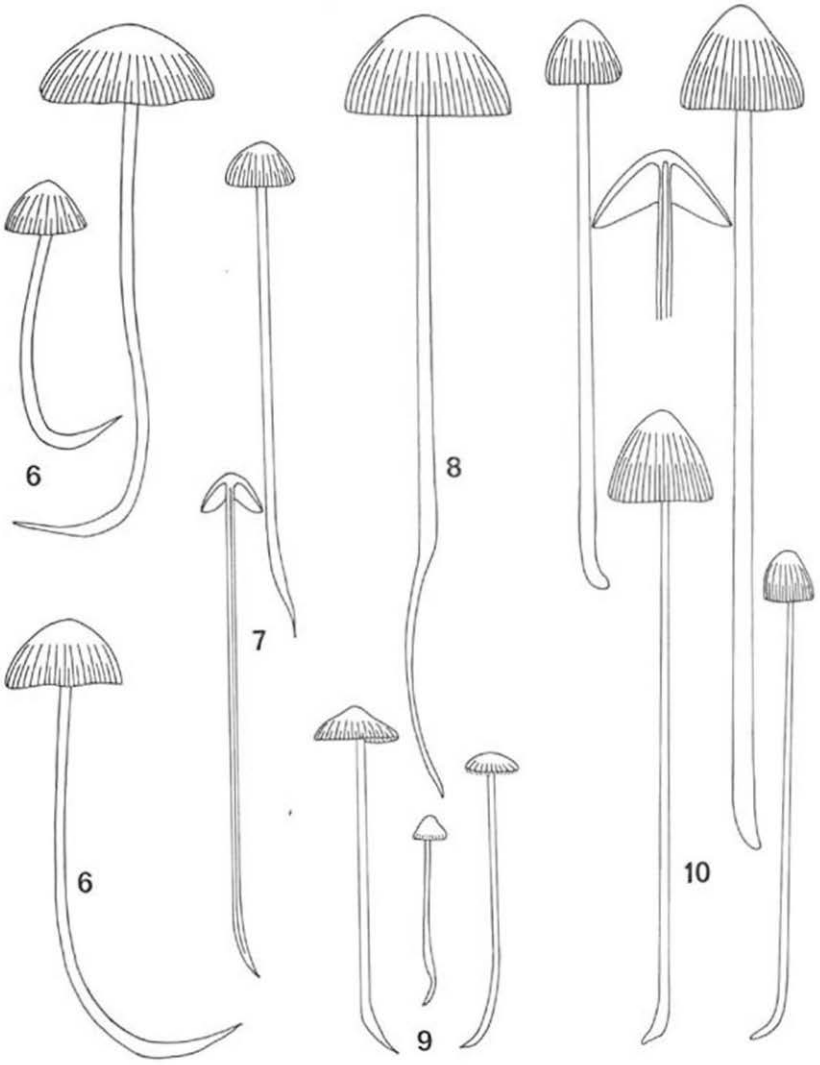
We are greatly indebted to Dr. D.N. Pegler, Kew, and particularly Dr. R.A. Maas Geesteranus, Leiden, for their very great help in correcting and reading the manuscript.

PSATHYRELLA GRACILIS (Fr.) Quél. f. GRACILIS

Figs. 1–10, 32–37, 40–42

Agaricus gracilis Fr., Syst. mycol. **1**: 299. 1821; Elench. **1**: 42. 1828; Epicr. 238. 1838; Monogr. Hym. Suec. **1**: 448. 1857; Hym. europ. 313. 1874. — *Coprinarius gracilis* (Fr.) Kummer, Führer Pilzk. 68. 1871. — *Psathyrella gracilis* (Fr.) Quél. *in* Mém. Soc. Emul. Montbél. II, **5**: 152. 1872. — *Psathyra gracilis* (Fr.) Bertrand *in* Bull. Soc. mycol. Fr. **17**: 277. 1901. — *Drosophila gracilis* (Fr.) Quél., Fl. mycol. 57. 1888. — Type locality: Sweden.

SELECTED DESCRIPTIONS AND ILLUSTRATIONS. — Cooke, Ill. Br. Fungi pl. 594/616. 1884–1886 (*Agaricus bifrons* var. *semitinctus*); Ricken, Blätterp. 264, pl. 68 fig. 2. 1913;



Figs. 6–10. *Psathyrella gracilis*, habit sketches. — 6. Amsterdam, Amsterdamse Bos, 19 Oct. 1961. — 7. Denekamp, Singraven, 14 Oct. 1961. — 8. Apeldoorn, Het Loo, 20 Oct. 1964. — 9. Ommen, Ada's Hoeve, 15 Oct. 1963. — 10. Bommerig, Elzeter Bos, 2 Oct. 1964.

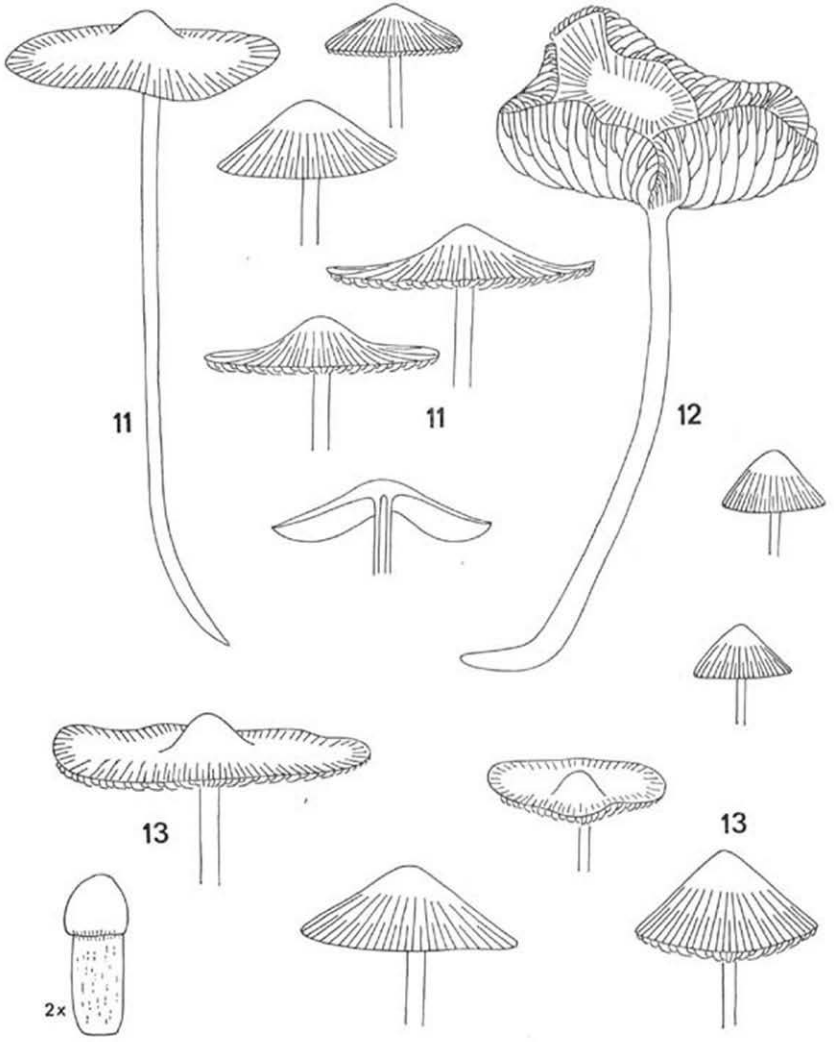
Bresadola, Icon. mycol. **18**: pl. 871. 1931; J. E. Lange, Fl. ag. dan. **4**: 100, pl. 154 B. 1939; Kühner & Romagn., Fl. anal. 357. 1953; Moser *in* Kl. KryptogFl., Ed. 3, **2** (b/2): 214. 1967 (but cap rugulose, mistakingly called "nicht runzelig").

MACROSCOPIC CHARACTERS. — *Cap* at first (primordia or slightly older specimens, cap 2–7 mm diam.) campanulate, smooth, not striate, in centre dark reddish brown (M. 5 YR 3/4) or purplish brown (M. 7.5 YR 3/2), towards the margin lighter brown (M. 7.5 YR 4/4, 5/6, 5/8, 6/4; 10 YR 4/4, 5/6, 6/6) near the margin very pale brown (M. 10 YR 7/3) and at the margin itself whitish. Cap later campanulate, conico-campanulate or conical, often in the end campanulate-convex and sometimes with umbo, 6–30 mm broad, surface smooth and strongly striate up to 1/2–2/3 from the margin inwards; centre greasy, almost translucent, at first reddish brown (M. 5 YR 3/4, 4/4) then strong brown (M. 7.5 YR 4/4), finally yellowish brown (M. 10 YR 4/3, 4/4, 5/4, 6/4); cap outside the centre at first dark and dull brown (M. 7.5 YR 4/2; 10 YR 5/4, 5/3, 4/3, 3/3, 3/4), very soon greying towards the margin and on aging (M. 10 YR 3/2, 4/2, 5/2, 6/2) these colours sometimes being mixed with a trace of purple or lilac (M. 5 YR 4/1, 5/1, 6/1; 7.5 YR 3/2). Cap finally mud-grey (M. 10 YR 4/1, 5/1) and near the margin pale grey (M. 10 YR 6/1) the centre only showing a trace of dirty brown; striae always darker and greyer than the ridges between them; margin of the cap extremely thin and white. Cap strongly hygrophanous, drying out to very pale brown, yellowish brown, alutaceous or greyish (M. 10 YR 8/2, 8/3, 8/4, 7/3, 7/4, 6/3) sometimes to almost white (M. 10 YR 7/1, 8/1) or even pure white. Almost always a slight to strong pink or red colour enters these colour shades in the peripheral 1/2–2/3 of the cap, either only in places or all over (M. 7.5 YR 8/4, 7/4, 7/2; 5 YR 8/2, 8/3, 8/4, 7/3, 7/4; 2.5 YR 6/8, 5/8, 5/6) rarely the entire cap (except for the centre which almost always remains pale yellowish brown) becomes strikingly red (M. 10 R 5/8). At some stage during the process of drying the surface of the cap becomes distinctly and often strongly micaceous and also more or less veined (rugulose).

Veil in primordia covering the stem with a dense but thin layer of white fine longitudinal fibres, reaching and inserting at the margin of the cap, not or hardly going up any further on its surface, the veil thus being reputed to be absent on the adult cap, while leaving many adpressed patches of fibres on the stem in its lower 1/2–2/3 part in adult specimens. In primordia velar fibres not infrequently occur on the surface of the cap only along and perpendicular to the margin of the cap and occasionally a few fibres or even small bundles or networks of fibres may persist on the surface of the cap very close to the margin in very or fairly young specimens.

Gills ventricose only near the margin of the cap, then ascending straight or hardly ventricose, very broadly adnate, sometimes with a small tooth, 2–4 mm broad, at first (in primordia) white but with a very distinct trace of brown at the base, later grey (M. 10 YR 6/1, 5/1) then slightly purplish grey (M. 5 YR 6/1, 5/1) then darker grey (M. 10 YR 4/1, 3/1) and purple-grey (M. 5 YR 4/1) finally dark to very dark purple-grey and purple-black (M. 7.5 YR 5/2; 5 YR 5/2, 3/2, 2/2, 3/1; 2.5 YR 2/2; 10 YR 5/1, 4/1, 3/1, 2/2), edge white in primordia and young specimens but always red in mature specimens be it occasionally only over a small stretch near the margin of the cap and in that case often not on all gills and easily overlooked, sometimes even necessitating a search under the microscope.

Stem cylindrical or very slightly and gradually thickening near the base, 20–110 × 1–3 mm (up to 140–165 mm when growing in tall grass), conspicuously white but in its lower 1/4–1/2 often slightly isabelline, apex pruinose, hollow, rooting (root measuring up to 15–50 mm and tapering towards its end, but often hardly noticeable when attached to pieces of wood). Surface of the stem covered in its lower 1/2–2/3 by a smaller or usually larger number of adpressed white and often very conspicuous



Figs. 11–13. *Psathyrella gracilis* f. *corrugis*, habit sketches. — 11. Aerdenhout, Dunes of Amsterdam Watersupply, 6 Oct. 1961. — 12. Amsterdam, Amsterdamse Bos, 29 Oct. 1963. — 13. Denekamp, Singraven, 11 Oct. 1961.

groups of white fibres (velar remnants) and base covered (sometimes very densely) over 10–20 mm with white hairs (strigose).

Flesh of cap in centre 1–2 mm thick, dark brown to dark grey-brown (M. 10 YR 4/4, 4/3, 3/3, 4/2), of stem white (sometimes isabelline at base) but grey-brown in the area where the gills are attached. Usually and practically always when the edge of the gills is conspicuously red, the flesh of the stem alongside the attachment of the gills is red and if so, often this red color is also present in a zone along the base of the gills in the flesh of the cap close to the stem.

Spore print purple in a thin, black in a thick layer.

Pigmentation under binocular lens (for technique, see p. 249). Flesh of cap between 'ridges' of gills in centre of cap pale brown (M. 10 YR 6/3, 7/3, 7/2, rarely 6/4), paler and greyer towards the margin (slightly browner than M. 2.5 Y 6/2, 7/2, 8/2), rarely pale olive-brown (M. 2.5 Y 6/4, 5/4 or 5 Y 6/3, 7/3). 'Ridges' of gills brown but practically always with a striking olive tinge (M. 2.5 Y 5/4, 5/6, 6/4; 5 Y 5/4, 6/4, 6/3; rarely 10 YR 5/4), darker towards centre, paler towards margin of the cap. Trama of gills almost but hardly ever quite colourless, very pale grey or greyish-yellow (M. 5 Y 7/1, 7/2, 7/3, 8/2, 8/3) or very pale brownish grey (M. 2.5 Y 6/2, 7/2, 8/2), at the base usually a narrow zone of pale brown (M. 10 YR 7/3, 7/2, 8/3, 8/2).

MICROSCOPIC CHARACTERS. — *Spores* ellipsoid-amygdaliform, (9.9–) 10.8–13.5 (–14.4) × (5.4–)5.9–7.2 μ (12.2 × 6.3 μ), dark reddish brown in water (M. 2.5 YR 3/4; 5 YR 3/3, 3/4), opaque to subopaque, comparatively small hilar appendix on adaxial face and large apical germ-pore (± 2 μ diam.).

Basidia 4-spored, (17.6–)19.2–32(–33.6) × 9.6–12.8 μ.

Pleurocystidia fairly numerous, sometimes either sparse or very numerous; obclavate, lageniform to fusiform, slender, often wavy, apex subobtuse, subulate or even acute; (45–)50–70(–100) × 8–15(–17.5) μ, hyaline, no crystals or mucus.

Marginal cells very densely packed, spheropedunculate, clavate, cylindrical, often elongate or irregularly shaped, very variable in size and shape, their walls often slightly thickened and not infrequently pale brown, 12.5–35(–40) × 4–15 μ. In between them erratically dispersed a very variable (also locally on one and the same edge) and fairly small number — less than 100 (e.g. 9–85) per 1000 μ gill edge — of lageniform cystidia, (20–)25–60 × (6–)7.5–12.5(–15) μ. Subhymenium at gill edge reddish.

Pigmentation under microscope. Hyphae of hypodermis moderately to strongly coloured by brownish membranal pigment, yellow hyphal septa fairly to very numerous, encrustations few to numerous. Trama of gills of primordia very distinctly brown by membranal pigment, particularly at the base and very faintly right up to the edge of the gills; of mature specimens very faintly brown at base or in basal 1/4 of the gill only, often only a few slightly yellow coloured hyphal septa, no encrustations.

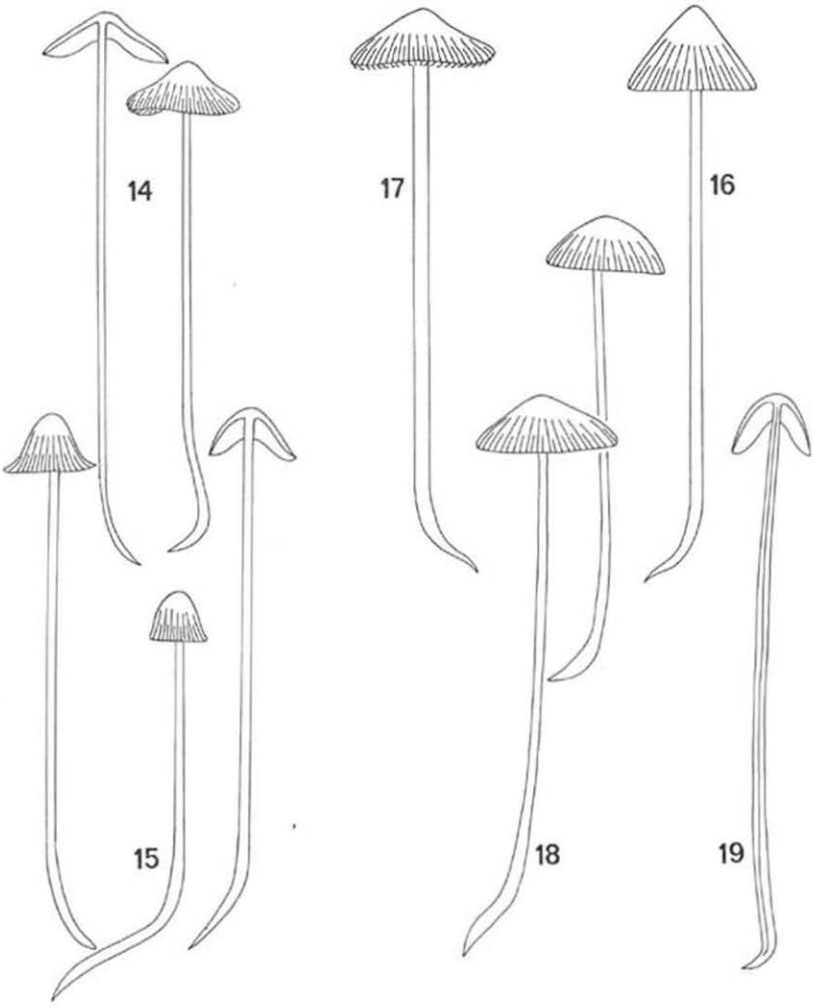
Cap cuticle cellular.

HABITAT. — In deciduous woods, parks, damp places, in rich or clayey soil, in grass by roadsides, amongst rotting leaves, on rubbish piles, on compost, the rooting stems almost always attached to dead wood or small sticks or branches just below the surface of the ground. End of August–November. Very common.

COLLECTIONS EXAMINED.

NETHERLANDS

21 collections from widely dispersed localities (Denekamp, Estate "Singraven"; Ommen, Estate "Ada's Hoeve"; Apeldoorn, Royal Estate "Het Loo"; Amsterdam,



Figs. 14–16. *Psathyrella gracilis* f. *albolimbata*, habit sketches. — 14. Linnerbroek (type), 6 Oct. 1962. — 15. Santpoort, Duin en Kruidberg, 13 Nov. 1962 — 16. British Isles, Oxford, Bagley Wood, 15 Sept. 1969.

Figs. 17–19. *Psathyrella gracilis* f. *clavigera*. — 17. Amsterdam, Amsterdamse Bos, 5 Nov. 1959. — 18. Amsterdam, Amsterdamse Bos, 27 July 1960. — 19. Ommen, Ada's Hoeve (type), 15 Oct. 1963.

Amsterdamse Bos; Overveen, Estate "Elswout"; Nieuwersluis, Estate "Over-Holland"; Mook), 1958–1969, *E. Kits van Waveren* (L); 's-Graveland, Estate "Boekesteyn", 25 Sept. 1968, *J. Daams* (L).

BRITISH ISLES

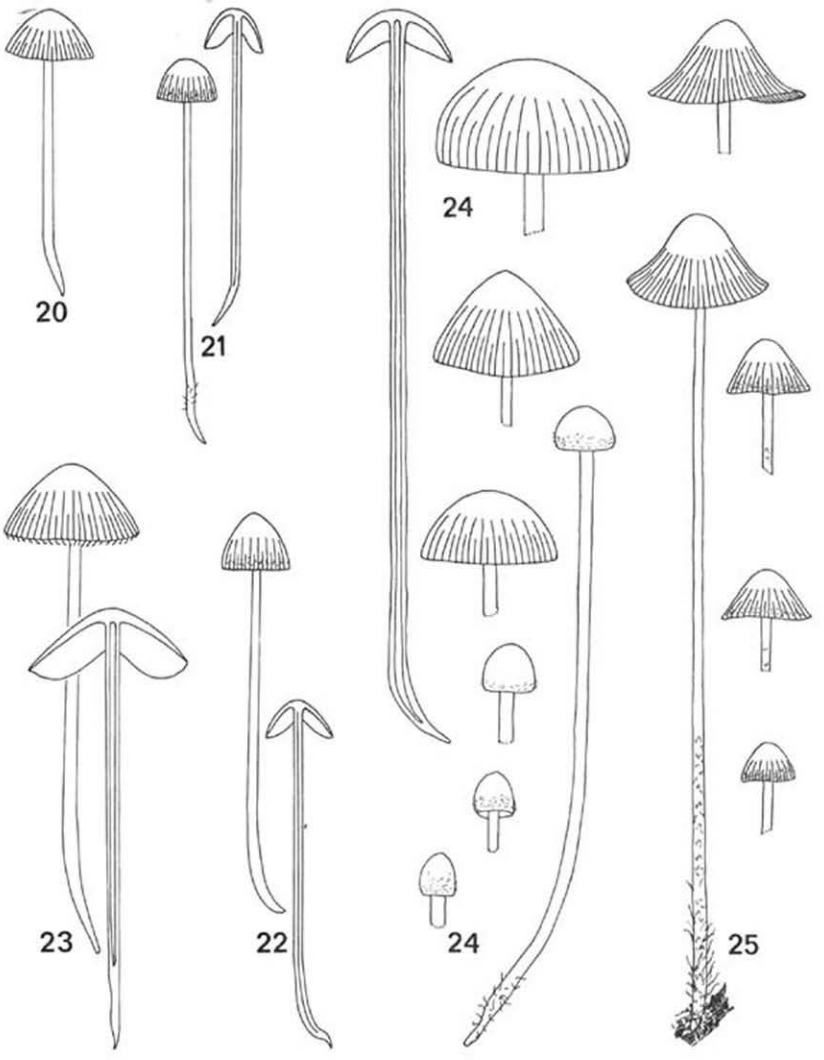
Scotland: Loch Lomond, 27 Aug. 1963, *E. Kits van Waveren* (L); Kenmore, "Taynmouth Castle", 10 Sept. 1966, *E. Kits van Waveren* (L).

Wales: Lake Vyrnwy, 15 Sept. 1967, *E. Kits van Waveren* (L).

OBSERVATIONS. — Fries apparently was not quite sure whether what he named *A. gracilis* and what indeed is the taxon described above, was conspecific with what Persoon (1801: 425) had named *A. gracilis*. Citing the latter Fries added a question mark. To us, however, it seems that Persoon's *A. gracilis* is indeed conspecific with Fries's species of that name.Technically, however, the two taxa represent two different species since they were based on different material. Fries's species of course has priority. The name given by Persoon was later validated by S. F. Gray (1821: 630) as *Prunulus gracilis*. Type material of both Persoon's and Fries's species unfortunately is lacking.

We cannot agree with Kühner & Romagnesi's (1953: 355, key to the four groups of the subgenus *Psathyrella*) statement that in *P. gracilis* the veil is "rigoureusement nul à la surface du chapeau" and that the trama is "sensiblement incolore (seulement un peu brunie sur les jeunes dans la moité supérieure de la chaire piléique, ou même uniquement dans l'hypoderme), totalement hyaline dans les lames, et, sur adulte dans le chapeau" and "chapeau n'étant jamais fauve ni rouillé avant la déhydration." As for the veil, the fibres in primordia always reach and insert at the margin of the cap. But usually, on very close examination of the primordia, they can be seen reaching just a little bit further up, forming a dense layer of white very short fibres, running perpendicular to the margin of the cap on its surface only in a very narrow zone along the margin. Occasionally, however, they even reach a little bit further up the cap, but never by any means to the extent as in *P. microrrhiza*. This being so, it is not in the least surprising that occasionally velar fibres can be found still on the cap — be it close to the margin and in very small numbers — in slightly older specimens. We came across these minute velar fibres and sometimes even small bundless of fibres on mature caps in seven out of our 24 collections.

As for the pigment, primordia of *P. gracilis* are definitely reddish brown and although in old specimens the prevailing colour is mud-grey, some shade of brown, particularly in the centre, is practically always present. On microscopical examination one never fails to find membranal pigment, yellow hyphal septa and encrustations, particularly in the hypodermis. The pigment of the trama of the gills, less influenced as it is by external conditions (rain), is of greater importance as its assumed absence serves as one of the chief characters by which *P. gracilis* is distinguished from *P. microrrhiza* (Kühner & Romagnesi, 1953: 355). In semi-mature and mature specimens we found in 18 out of our 24 collections of *P. gracilis* the trama of the gills when



Figs. 20–25. *Psathyrella microrrhiza*, habit sketches. — 20–23. Vogelenzang, Dunes of Leiduin, 25 Oct. 1963. — 24. Amsterdam, Amsterdamse Bos, 9 Oct. 1960. — 25. Aerdenhout, Dunes of Amsterdam Watersupply, 21 Nov. 1959.

studied under the binocular lens practically colourless or very pale greyish-yellow, but in six there was a distinct shade of brown at the base of the gills. In primordia, however, the entire trama proved to be slightly coloured, strongest at the base. On microscopical examination in all 24 collections but two a distinct trace of brown was seen on hyphae of the trama of the gills, particularly at the base. This fully corresponds with the 'ridges' of the gills, always standing out as brown-olive against the paler brown flesh of the cap between them when a segment of the cap is studied under the binocular lens.

In the collections studied, the numbers of lageniform cheilocystidia per 1000 μ gill edge ranged from 7–91 with a decided preponderance of the numbers between 9 and 40: 7–9–9–11–12–12–19–19–20–24–25–30–31–32–33–35–35–38–38–50–51–76 85–91.

In four collections of *P. gracilis* only we found the pleurocystidia not quite typical of that species, rather small and thick (45–65 × 9–15 μ) be it subulate or even acute but in some sub-obtuse or even mucronate.

The spore sizes in our collections turned out to vary rather considerably, the extreme mean values found among the 24 collections examined being 10.7–13.4 × 6–6.7 μ.

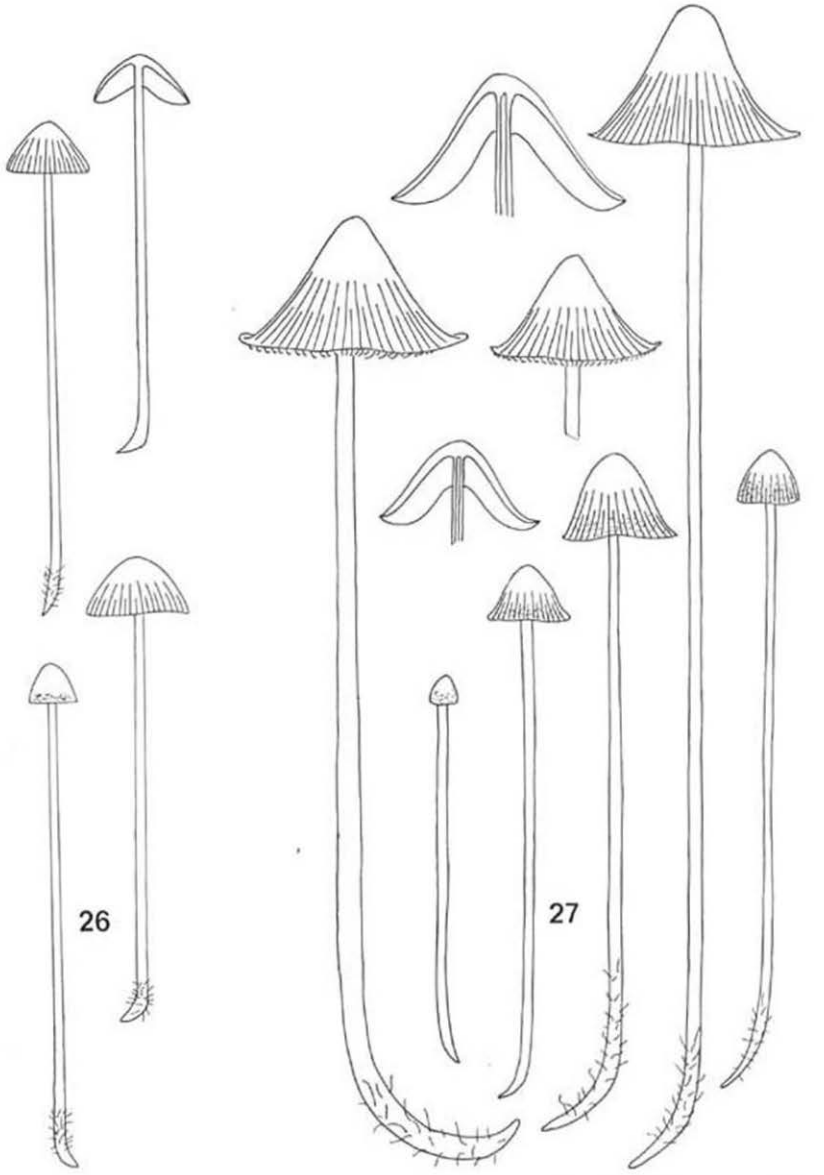
PSATHYRELLA GRACILIS f. **corrugis** (Pers. ex Fr.) Kits van Wav., *nov. comb.*

Figs. 11–13, 38, 39

Agaricus corrugis Pers. *in* Neues Mag. Bot. **1**: 104. 1794; Syn. Fung. 424. 1801; *ex* Fr., Syst. mycol. **1**: 298. 1821; Epicr. 231. 1838; Monogr. Hym. Suec. **1**: 439. 1857; Hym. europ. 305. 1874. — *Coprinarius corrugis* (Pers. ex Fr.) Kummer, Führer Pilzk. 69. 1871. — *Psathyra corrugis* (Pers. ex Fr.) Quél. *in* Mém. Soc. Emul. Montbél. II, **5**: 148. 1872. — *Drosophila corrugis* (Pers. ex Fr.) Quél., Ench. Fung. 116. 1886. — *Psathyra gracilis* var. *corrugis* (Pers. ex Fr.) J. E. Lange *in* Dansk bot. Ark. **9** (1): 15. 1936; Fl. ag. dan. **4**: 100, pl. 153 B. 1939. — *Psathyrella corrugis* (Pers. ex Fr.) Konr. & Maubl., Agaricales 123. 1948. — *Psathyrella gracilis* var. *corrugis* (Pers. ex Fr.) Pearson & Dennis *in* Trans. Br. mycol. Soc. **31**: 185. 1948. — *Drosophila gracilis* f. *corrugis* (Pers. ex Fr.) Kühner & Romagn., Fl. anal. 357. 1953 ("ss. Bres."). — Neotype (selected): "*Agaricus* (*Pratella*) *corrugis* / — *pelosporus* Bull." (L 910.258–411).

SELECTED DESCRIPTIONS AND ILLUSTRATIONS. — J. E. Lange, Fl. ag. dan. 4: 100, pl. 153 B. 1939; Kühner & Romagn., Fl. anal. 357. 1953.

This form differs from f. *gracilis* by its normally larger size (cap 15–50 mm, stem 60–150 × 2–4 mm, gills 3–6 mm broad); the cap in the final stages being more convex, often with revolute margin and large central umbo; the cap furthermore being greyer (chiefly dark grey, M. 10 YR 4/2, 3/2, 2/2), dark greyish brown (M. 10 YR 4/3, 3/3) or dark purple (M. 5 YR 3/2), centre always somewhat browner; the cap drying alutaceous, very pale brown or dirty grey (M. 10 YR 7/1, 7/2, 8/3) and usually mixed or even replaced by pink to red, centre remaining pale yellowish brown (M. 10 YR 7/3, 7/4, 7/6), the surface becoming moderately to strongly rugulose.



Figs. 26, 27. *Psathyrella microrrhiza*, habit sketches. — 26. Denekamp, Singraven, 28 Oct. 1961. — 27. Nieuwersluis, Over-Holland, 8 Nov. 1962.

COLLECTIONS EXAMINED.

NETHERLANDS

O v e r i j s e l: Denekamp, Estate "Singraven", 11 Oct. 1961 and 22 Sept. 1962, *E. Kits van Waveren* (L).

U t r e c h t: Zeist, 22 Sept. 1962, *A. F. M. Reynders* (L).

N o o r d - H o l l a n d: Amsterdam, Amsterdamse Bos, 9 Oct. 1960 and 20 Oct. 1963, *E. Kits van Waveren* (L); Aerdenhout, dunes of Amsterdam Municipal Water-supply, 6 Oct. 1961. *E. Kits van Waveren* (L); Santpoort, Estate "Duin en Kruidberg", 14 Nov. 1959. *E. Kits van Waveren* (L).

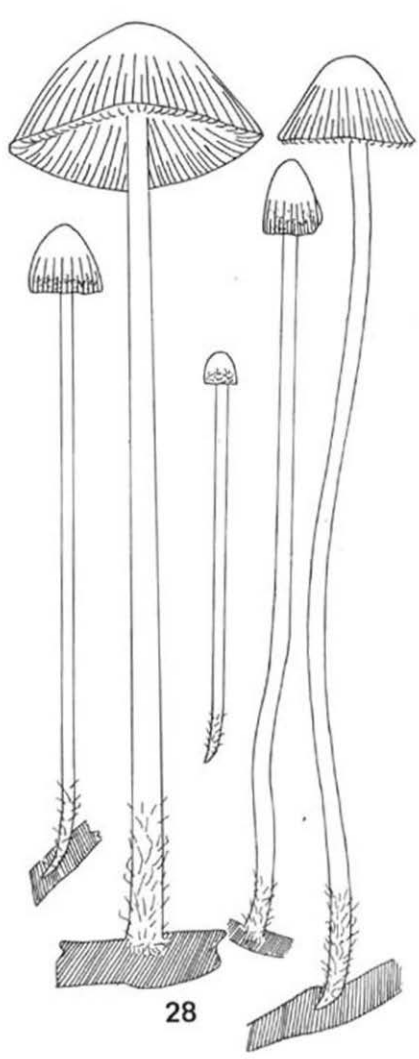
OBSERVATIONS. — There is no sharp delimitation between *P. gracilis* f. *gracilis* and f. *corrugis*, there are many intermediate forms. The two extremes, however, are easily recognisable, like both Kühner & Romagnesi (1953: 357) and J. E. Lange (1939: 100) pointed out. In summing up Kühner & Romagnesi pointedly described *P. gracilis* f. *corrugis* as a "Forme plus robuste, à st[ipe] plus épais (50–130 × 1,5–3 mm), souvent un peu flexueux ou couché, à chapeau plus étalé et fréquemment grisâtre quand il est humide, alutacé ± incarnat par le sec." Whether to raise this form to the rank of a variety or even species seems to be a matter of taste. The small and very large forms of *P. gracilis* so obviously lie in a continuum that we fully agree with Kühner & Romagnesi in distinguishing *P. gracilis* f. *corrugis* as only a form. J. E. Lange (1939: 100) shared this view. We cannot agree with Dennis, Orton & Hora (1960: 144). who raised this form to specific level.

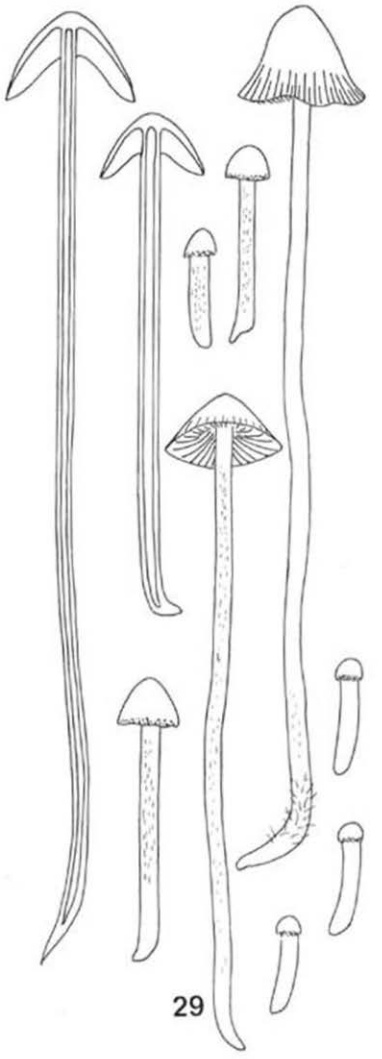
The interpretation of the species described, depicted, and called *Psathyra corrugis* Pers. by Bresadola (1931: pl. 867) seems uncertain because of the white edge of the gills and the colour of the gills of one of the specimens depicted being that of a *Rhodophyllus*.

Moser (1967: 213) stated that what he calls *P. corrugis* differs from *P. gracilis* only by the rugulose cap of the former; *P. gracilis* being believed to be "nicht runzelig". This we believe to be incorrect.

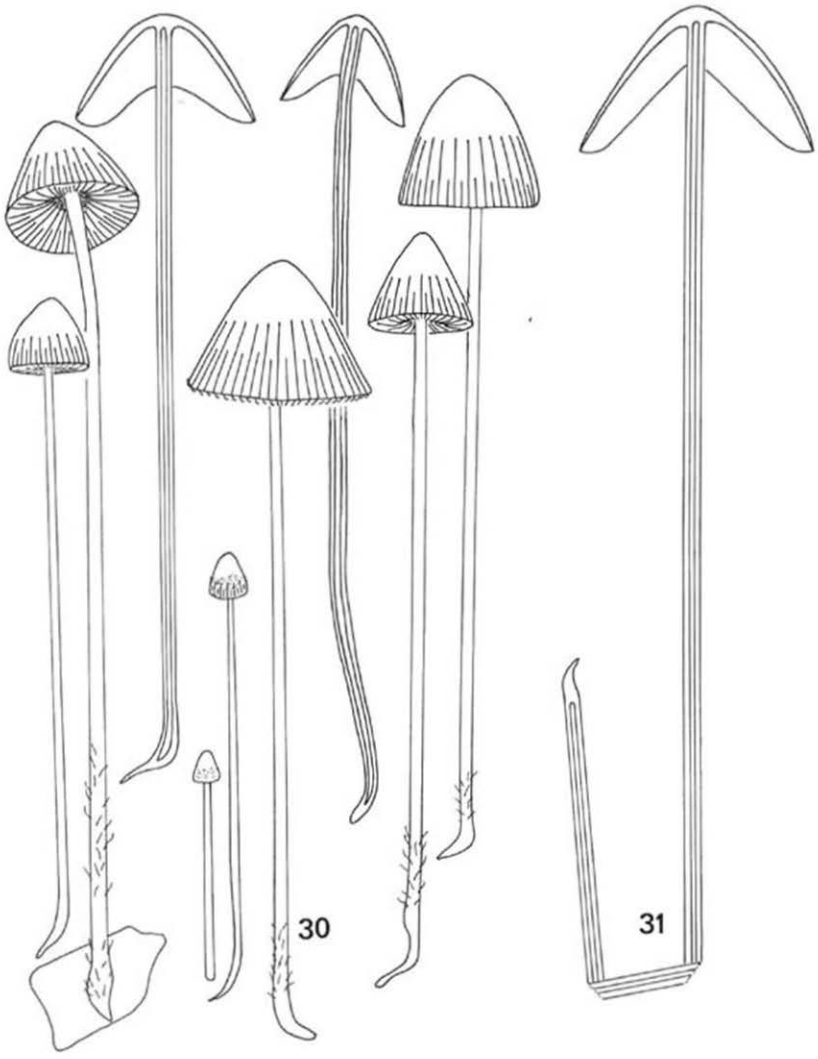
Of course, it should be recalled that the microscopic characters of f. *gracilis* and f. *corrugis* are identical.

Malençon & Romagnesi (1953: 101) made a very exhaustive effort to reveal the true identity of *A. corrugis* as described by both Persoon (1794: 104; 1797: 24, and 1801: 424) and Fries (1821: 298). They came to the conclusion that with either *Agaricus*, *Psathyra*, or *Psathyrella* the epithet "*corrugis*" was a nomen confusum and therefore should be abandoned. However, they never examined the material of *A. corrugis* in Persoon's herbarium, here chosen as neotype. Both Singer (note left with this material) and us did and found the microscopic characters fully to correspond with those of *P. gracilis* and therewith of *P. corrugis*. Because of its present fairly small size this type material might represent *P. gracilis*, but it should be realised that it is dried material. In 1797 Persoon already stated that his *A. corrugis* seemed to resemble *A. subatratus*, a conspicuously large species. Later (1801: 424) Persoon cited Bulliard's *A. pellospermus*, also a large species, and in his Synopsis (1801: 424 and 425) Persoon

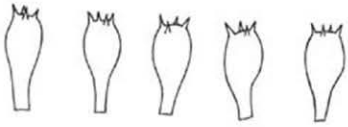




Figs. 28, 29. *Psathyrella microrrhiza*, habit sketches. — 28. Nieuwersluis, Over-Holland, 2 Nov. 1961. — 29. Amsterdam, Amsterdamse Bos, 7 Nov. 1961.



Figs. 30, 31. *Psathyrella microrrhiza*, habit sketches. — 30. Amsterdam, Amsterdamse Bos, 13 Oct. 1960. — 31. Ommen, Eerde, 17 Oct. 1969.



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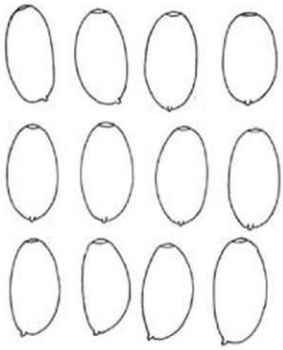

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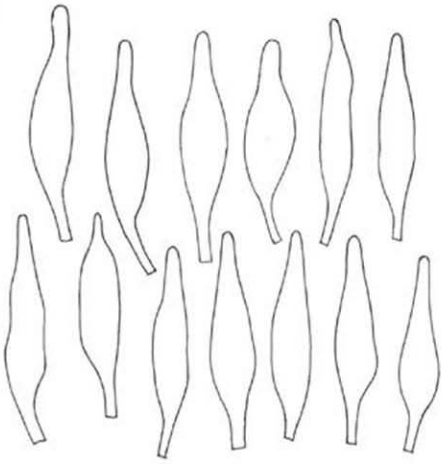

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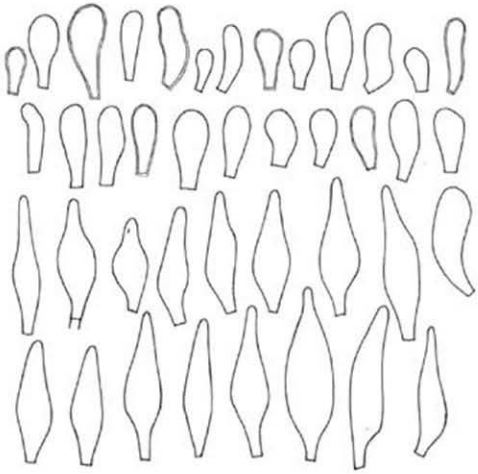

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Figs. 32–35. *Psathyrella gracilis* (Overveen, Elswout, 28 Oct. 1966). — 32. Basidia. — 33. Spores. — 34. Pleurocystidiogram. — 35. Cheilocystidiogram. (Figs. 32, 34, 35: × 575; Fig. 33: × 1212.)

separately described *A. corrugis* and *A. gracilis*, stating of the latter that it is "totus fragilis" and "*A. gracilis* ad tenerrimas et fragillimas pertinet species." He therefore must have regarded *A. gracilis* as being a much smaller and delicate species. Both from these descriptions and our own examination of Persoon's type material (that of *A. gracilis* unfortunately is lacking) the conclusion is justified that Persoon already distinguished these two taxa, which we now regard as forms.

PSATHYRELLA GRACILIS f. **clavigera** Kits van Wav., *nov. f.*

Figs. 17–19, 51, 52

A forma typica differt pleurocystidiis variabilissimis multiformibusque, clavatis, obclavatis, cylindraceis, subcylindraceis saepe in media parte constrictis, lageniformibus, subutriformibus, apice subulatis, subobtusis, obtusis, mucronatis, 40–7 × 9–15 μ.
Typus: Ommen, Ada's Hoeve, 15 Oct. 1963, *E. Kits van Waveren* (L).

This form differs from f. *gracilis* by the extremely variable and atypical shape of the rather numerous pleurocystidia on one and the same gill. They may be clavate, obclavate, cylindrical, or subcylindrical and then often are constricted in the middle, or subutriform and sometimes slightly thick-walled, lageniform. The apex of the pleurocystidia can be very obtuse to subulate or mucronate. Already under the low power microscope one immediately notices the abnormal shape of most of these cells.

COLLECTIONS EXAMINED.

NETHERLANDS

O v e r ij s e l: Ommen, Estate "Ada's Hoeve", 15 Oct. 1963, *E. Kits van Waveren* (type, L).

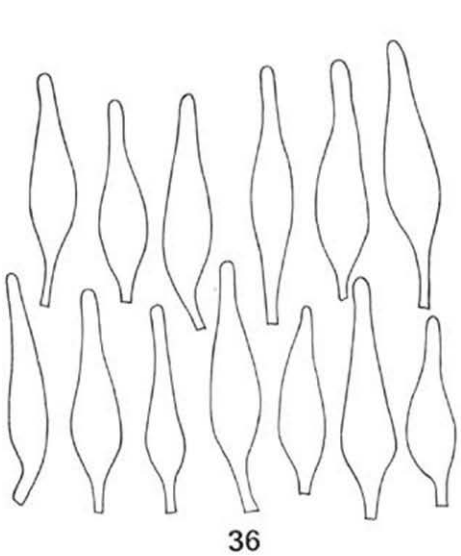
N o o r d - H o l l a n d: Amsterdam, Amsterdamse Bos, 5 Nov. 1959 (2 collections) and 27 July 1960, *E. Kits van Waveren* (L).

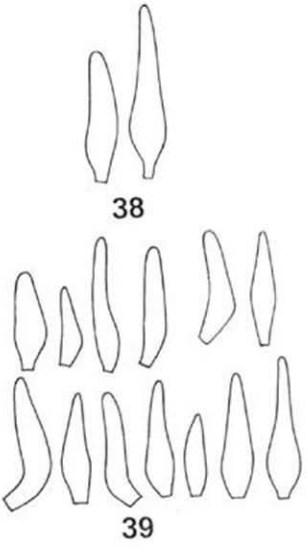
PSATHYRELLA GRACILIS f. **albolimbata** Kits van Wav., *nov. f.*

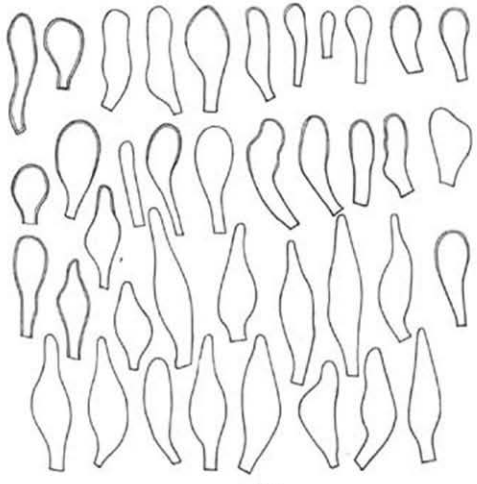
Figs. 14–16, 53–56

A forma typica differt lamellarum margine alba et pleurocystidiis variabilibus.
Typus: Linnerbroek, 6 Oct. 1962, *A. J. P. Oort* (L).

This form differs from f. *gracilis* by the entire edge being white both on macroscopical and microscopical examination of both young and mature specimens and the pleurocystidia being atypical and variable: elongate, 55–70 × 11–12.5 μ, but very obtuse (collection of 6 Oct. 1962); obtuse and on the whole rather small, 40–50 × 10–12.5 μ, only a few up to 60 μ (collection of 13 Nov. 1962); like in f. *clavigera*, 50–80 × 12.5–17.5 μ (collection of 23 Oct. 1964); very small, 30–45 × 8–11 μ (collection of 15 Sept. 1969), see Figs. 53–56.







Figs. 36, 37. *Psathyrella gracilis* (Denekamp, Singraven, 12 Oct. 1963), — 36. Pleurocystidiogram. — 37. Cheilocystidiogram. (Both figs.: × 575.)

Figs. 38, 39. *Agaricus corrugis* Persoon (lectotype). — 38. Pleurocystidia. — 39. Cheilocystidiogram. (Both figs.: × 575.)

COLLECTIONS EXAMINED.

NETHERLANDS

N o o r d - H o l l a n d: Santpoort, Estate "Duin en Kruidberg", 13 Nov. 1962, *E. Kits van Waveren* (L).

L i m b u r g: Linnerbroek, 6 Oct. 1962, *A. J. P. Oort* (type, L); Mook, near Hotel "Plasmolen", 23 Oct. 1964, *E. Kits van Waveren* (L).

BRITISH ISLES

O x f o r d s h i r e: near Oxford, "Bagley Wood", 15 Sept. 1969, *E. Kits van Waveren* (L).

PSATHYRELLA GRACILIS f. **substerilis** Kits van Wav., *nov. f.*

A forma typica differt basidiis maxime non-sporigeris; pileo luteolo vel isabellino vel rubello; lamellis candidis ad aciem roseis; sporis rarissimis, 11.7–15.3 × (6.3–)6.8–8.1(–9) μ.

Typus: Denekamp, Singraven, 12 Sept. 1963, *E. Kits van Waveren* (L).

This very striking form differs from f. *gracilis* by the complete or almost complete absence of spores (in the presence, however, of many basidia, carrying sterigmata!) but also by a conspicuous lack of pigment in both cap and gills. As a result the form, which in all other macroscopic aspects (shape, size, rooting stem, absence of veil, etc.) is identical with f. *gracilis*, looks exactly like a *Mycena*. Cap in centre fairly pale yellowish, brownish yellow or reddish yellow (M. 10 YR 7/6, 6/6; 7.5 YR 7/6, 6/6), sometimes yellowish brown (M. 10 YR 5/6, 5/4) or pale brown (M. 10 YR 6/3), towards the margin considerably paler (7.5 YR 6/4, 7/4; 10 YR 7/3, 7/2), finally even whitish. Gills white but gill edge red like in f. *gracilis*. The flesh of the cap is pale yellowish brown or pale brown, the flesh of the stem at the apex has a distinct red zone where it adjoins the gills (like in f. *gracilis*). When studied under the binocular lens the flesh of the cap between the 'ridges' of the gills is pale brown in the centre (M. 10 YR 7/3, 6/3), towards the margin very soon much paler and hardly brown (M. 2.5 Y 6/2, 7/2), near the margin almost white (M. 5 Y 8/2). The "ridges" of the gills are very distinctly olive, hardly brown near the centre of the cap (M. 2.5 Y 5/6 or paler than 5 Y 5/3 and 2.5 Y 5/4), towards the margin much paler (M. 5 Y 6/2, 6/3). The trama of the gills (no need to wash the gill here!) is practically colourless.

On microscopical examination the flesh of the cap is pale to very pale brown, yellowish hyphal septa and encrustations are scarce to even absent (fairly numerous in one of our collections). The trama of the gills is colourless and shows neither yellowish septa nor encrustations. Number, shape and size of the pleurocystidia, cheilocystidia and other marginal cells are identical with those of f. *gracilis*. Spores (if present) slightly larger than in the fertile form: 11.7–15.3 × (6.3–)6.8–8.1(–9)μ.

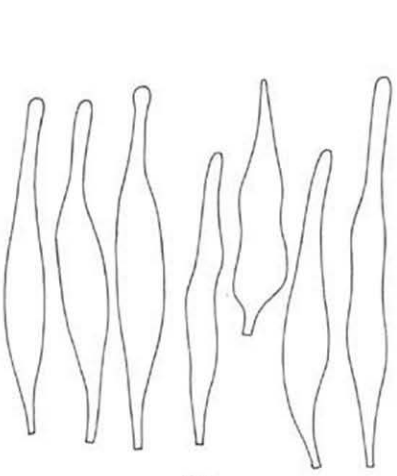
COLLECTIONS EXAMINED.

NETHERLANDS

O v e r i j s e l: Ommen, Estate "Ada's Hoeve", 26 Sept. 1964, *E. Kits van Waveren* (L); Denekamp, Estate "Singraven", 12 Oct. 1963, *E. Kits van Waveren* (type, L).

N o o r d - H o l l a n d: Amsterdam, Amsterdamse Bos, 25 Oct. 1961, *E. Kits van Waveren* (L).

L i m b u r g: Mook, 24 Oct. 1964, *E. Kits van Waveren* (L).



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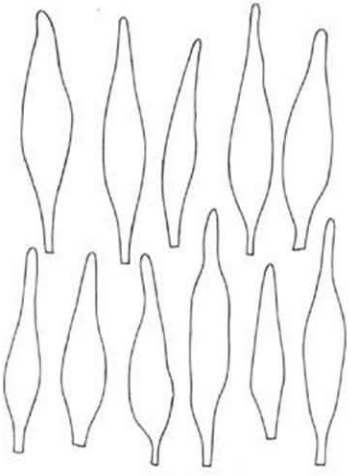

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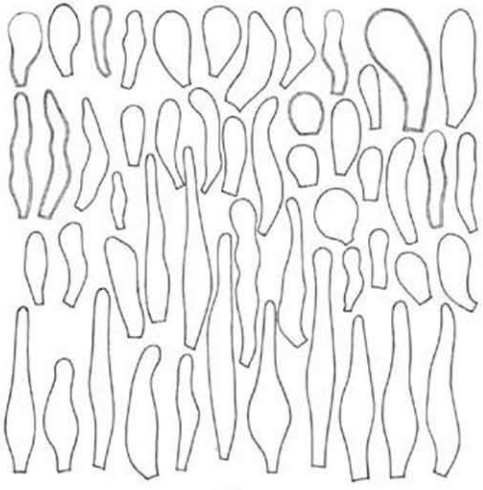

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Figs. 40, 41. *Psathyrella gracilis* (Amsterdam, Amsterdamse Bos, 20 Oct. 1958). — 40. Pleurocystidiogram. — 41. Cheilocystidiogram. (Both figs.: × 575.)

Fig. 42. *Psathyrella gracilis* (Denekamp, Singraven, 14 Oct. 1961). Pleurocystidiogram (× 575).

OBSERVATIONS. — After a long search we found two, five, and ten spores respectively in three out of our four collections and a slightly larger number in the fourth. On a gill of our collection of 12 Oct. 1963 (on which we encountered only three spores) we came across a curious triangular spore, having three germ-pores, one at each corner.

We wish to point out that we consider this form to have a different significance from that of the other forms, as it would seem to represent a non-adaptive mutation.

This rather rare form was described by J. E. Lange (1936: 15 and 1939: 100), but not validly published. He called this form rare and remarked that it "may be mistaken for a *Mycena*." This form was also mentioned by Lundell (1942: 23), whose find was growing "prolifically but only a few specimens were fertile."

PSATHYRELLA MICRORRHIZA (Lasch) Konr. & Maubl.

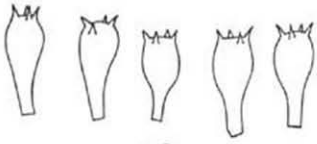
Figs. 20–31, 43–50, 57–62

Agaricus microrrhizus Lasch *in* Linnaea **3**: 426. 1828. — *Psathyra microrrhiza* (Lasch) Kummer, Führer Pilzk. 70. 1871. — *Drosophila microrrhiza* (Lasch) Quél., Ench. Fung. 118. 1886. — *Psathyrella microrrhiza* (Lasch) Konr. & Maubl., Agaricales 123. 1948; Singer *in* Lilloa **22**: 469. "1949" [1951] (preoccupied). — Type locality: Germany.

Psathyrella squamifera P. Karst. *in* Meddn Soc. Fauna Fl. fenn. **5**: 60. 1882. — Type: not examined.

SELECTED DESCRIPTIONS AND ILLUSTRATIONS. — Cooke, Ill. Brit. Fungi pl. 596/622, 1884–1886; J. E. Lange, Fl. ag. dan. **4**: 101, pl. 154. 1939 (*Psathyra squamifera*); Kühner & Romagn., Fl. anal. 358. 1953; Moser *in* Kl. KryptogFl. Ed. 3, **2** (b/2): 214. 1967.

MACROSCOPIC CHARACTERS. — *Cap* at first (primordia or slightly older specimens, cap 4–12 mm diam.) campanulate, smooth, not striate, in centre dark reddish brown (M. 2.5 YR 3/2; 5 YR 3/3, 3/4) or dark brown (M. 7.5 YR 3/2), peripheral half just brown, paler towards the margin (M. 7.5 YR 4/4; 10 YR 5/4), surface covered right up to the top with a rather thick coating (giving the impression in many places of a disrupted loose skin) of white velar fibres and patches of interwoven bundles of fibres, which become denser towards the margin. Cap later campanulate, conico-campanulate, conical, in the final stages usually with revolute margin; 7–50 mm broad; surface smooth and strongly striate to striate-sulcate up to 1/2–3/4 from margin inwards; centre greasy, translucent; in the earlier stages in centre still red-brown (M. 5 YR 3/3, 3/4, 4/4) but usually dark brown (M. 7.5 YR 3/2, 4/2, 4/4), paler and often rather dull brown towards the margin (M. 10 YR 3/4, 4/4, 3/3, 4/3, 5/4, 5/3), paler (M. 10 YR 6/4, 6/3) near the margin and in the final stages greyish brown (M. 10 YR 4/2, 5/2), sometimes even pale brownish grey (M. 10 YR 6/2). Cap hygrophanous, drying out via yellowish (M. 10 YR 7/6) in the early phases of drying to pale and usually very pale brown or grey-yellowish brown, alutaceous (M. 10 YR 6/3, 7/4, 7/3, 7/2, 8/3), these colours often to some extent mixed with pink (M. 7.5 YR 6/4 to even 2.5 YR 5/4), the centre remaining somewhat darker (M. 10 YR 6/6, 6/4, 7/6, 7/4, 7/3) the completely dry cap rarely almost white (M. 10 YR 7/1), the centre in that case very pale brown (M. 10 YR 8/4, 8/3, 8/2). During the process of drying the surface usually becomes slightly micaceous and usually also somewhat rugulose.



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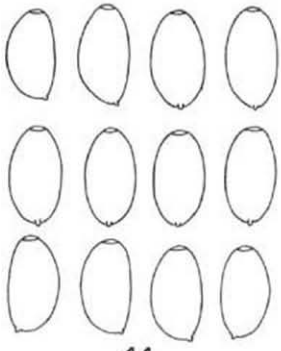

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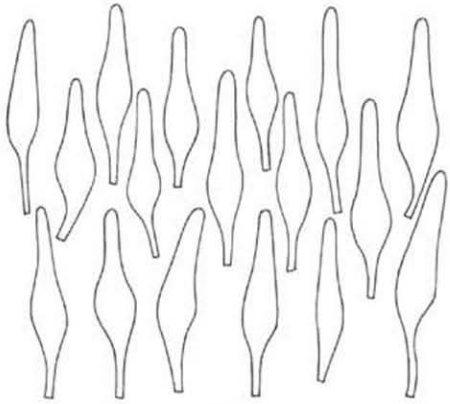

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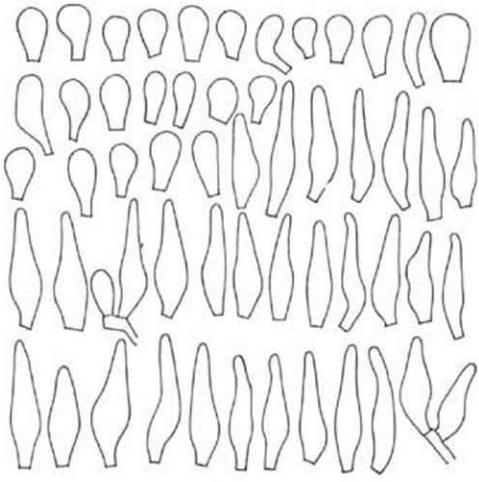

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Figs. 43–46. *Psathyrella microrrhiza* (Overveen, Elswout, 28 Oct. 1966). — 43. Basidia. — 44. Spores. — 45. Pleurocystidiogram. — 46. Cheilocystidiogram. (Figs. 43, 45, 46: × 575; Fig. 44: × 1212.)

Veil as a rule strongly developed but easily washed away by rain; remnants in mature specimens present up to 1/3–2/3 of the radius of the cap from the margin (sometimes right up to the top) as loose white fibres or bundles of fibres (radially arranged but at the margin often running parallel to it) or even flocci, particularly near and at the margin and here sometimes appendiculate as more or less triangular denticles.

Gills ventricose only near the margin of the cap, then ascending straight or almost straight, very broadly adnate, as a rule with a distinct tooth, 2–5 mm broad, in primordia and very young stages distinctly pale brown (M. 10 YR 6/3, 7/2, 7/3, 7/4) or grey-brown (M. 10 YR 5/2) in the basal 1/3–1/2 and greyish (M. 10 YR 6/2, 7/1, 6/1, 5/1) towards the edge; in semi-mature specimens grey (M. 10 YR 6/1, 5/1, 4/1) or purple-grey (M. 5 YR 7/2, 6/2, 5/2; 5 YR 6/1, 5/1); in mature specimens very dark purple-grey to purple-black (M. 10 YR 2/2; 5 YR 4/1, 3/1, 3/2, 2/2) towards the base almost always slightly to distinctly browner (M. 10 YR 5/2; 5 YR 4/2, 4/3). Edge of gills white in primordia and very young specimens, later macroscopically almost always red be it often only near the margin or not on all gills, on microscopical examination, however, always red either along its entire length or only near the margin of the cap.

Stem cylindrical or very slightly and gradually thickening near the base, 25–190 × 1–4 mm, white to whitish only in its upper part (1/3 or less), dirty white or isabelline lower down, sometimes even very pale brown in its lower 1/3; covered with scattered patches of adpressed white remnants of the veil in its lower 2/3 or less; apex pruinose; hollow; rooting (root up to 30 mm and very often quite short); base usually densely covered over 15–40 mm with white hairs.

Flesh of cap brown to dark brown (M. 10 YR 4/3, 4/4, 3/3, 3/4) or dark greyish brown (M. 10 YR 4/2), in centre 0.5–3 mm thick; of stem grey-brown adjoining the gills but otherwise whitish in upper part, isabelline or even pale brown in lower part; usually and particularly when the edge of the gills is conspicuously red, a narrow zone of the flesh, adjoining the gills is red and if so sometimes such a red zone is also present along the base of the gills near the stem.

Spore print in a thin layer purple, in a thick one black.

Pigmentation under binocular lens (for technique, see p. 249). Flesh of cap between 'ridges' of gills rather dark brown (M. 7.5 YR 5/4; 10 YR 5/3, 6/3, 6/4), in centre even darker (M. 7.5 YR 4/4), near the margin much lighter (M. 10 YR 7/3, 7/2); 'ridges' of gills dark brown and without olive tinge (M. 7.5 YR 4/4; 10 YR 3/4, 3/3, 4/3, 4/4, 5/4, rarely 5/3) hardly paler near the margin of the cap. Trama of gills very pale brown (M. 10 YR 7/3, 8/3, 8/2) and usually almost colourless near the edge, a narrow but sometimes fairly broad zone at the base being, however, distinctly brown (M. ± 10 YR 6/3, rarely towards 10 YR 6/4), more often paler (M. 10 YR 7/3 or even 8/3) rarely practically colourless

MICROSCOPIC CHARACTERS. — *Spores* ellipsoid-amygdaliform, 9.9–13.5 (-14.4) × (5.4–)5.9–7.2 μ (11.9 × 6.3 μ), dark reddish brown in water (M. 2.5 YR 3/4; 5 YR 3/3, 3/4), opaque to subopaque, with comparatively small hilar appendix on adaxial face and large apical germ-pore (± 2 μ diam.).

Basidia 4-spored, 19.2–35.2 × 9.6–12.8 μ.

Pleurocystidia fairly numerous, rarely scarce or very numerous, on the whole rather lageniform, plump with subobtuse to obtuse apex, not infrequently subcapitate, 40–70 × 8–15 μ, but not infrequently longer, (75–85 μ), rarely very long, up to 100 μ, and then slightly wavy; hyaline, no crystals or mucus.

Marginal cells chiefly lageniform and of fairly uniform shape but somewhat variable size, densely packed, more than 100 per 1000 μ gill edge, 20–55 × 5–13 μ. In between them a comparatively small number of rather small and therefore not easily detected

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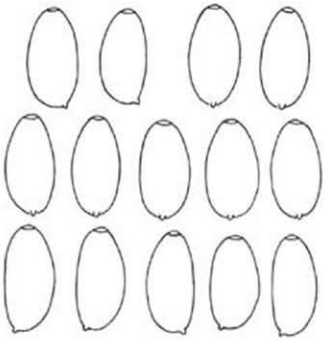

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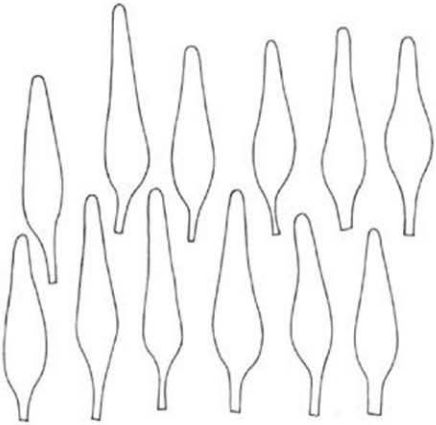

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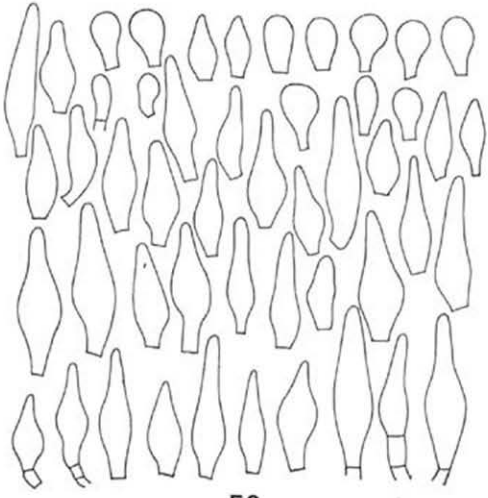

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Figs. 47–50. *Psathyrella microrrhiza* (Castricum, Dunes County Watersupply, 28 Sept. 1968), — 47. Basidia. — 48. Spores. — 49. Pleurocystidiogram. — 50. Cheilocystidiogram. (Figs. 47. 49, 50: × 575; Fig. 48: × 1212.)

spheropedunculate, clavate or subcylindric cells, 10–25(–30) × 4–12(–14)μ. Subhymenium at gill edge reddish.

Pigmentation under microscope. Hyphae of hypodermis usually strongly coloured by brownish membranal pigment with great numbers of yellow coloured hyphal septa and very numerous encrustations. Trama of gills distinctly but often not very strongly brownish by membranal pigment, always, however, distinctly and quite often fairly strongly brown in a narrow zone along the base of the gills. Always (often only a few but usually a fair number) yellow hyphal septa and usually also a few encrustations in the basal part of the gills.

Cap cuticle cellular.

HABITAT. — In deciduous woods, parks, damp places, in rich or clayey soil, in grass by roadsides, amongst rotting leaves, on compost, on rubbish heaps; roots usually attached to small pieces of dead wood or small branches, lying just below the surface of the ground. September–November. Common.

COLLECTIONS EXAMINED.

NETHERLANDS

33 collections from widely dispersed localities (Denekamp, Estate "Singraven"; Nieuwersluis, Estate "Over-Holland"; Haarzuilens, Estate "De Haar"; Amsterdam, Amsterdamse Bos; Castricum, Dunes of County Watersupply; Santpoort, Estate "Duin en Kruidberg"; Aerdenhout, Dunes of Amsterdam Municipal Watersupply; Vogelenzang, Estate "Leyduin"; Overveen, Estate "Elswout"), *E. Kits van Waveren* 1958–1969 (L).

OBSERVATIONS. — When at a fairly superficial examination the edge of the gills does not seem to be red but white, a careful search in other specimens of the collection and of all gills will reveal gills of which the edges are red, be it perhaps only near the margin of the cap of some gills. Rarely microscopical examination is needed to find traces of a red gill edge — in that case practically always near the margin of the cap. Out of 33 collections we only have one, consisting of three specimens only, in which all gill edges were pure white, even on microscopical examination, the pleurocystidia being typical of *P. microrrhiza*. Yet, we do not think it would be wise to distinguish this rare case as a separate form, like we did in the case of *P. gracilis* f. *albolimbata*, where not only the gill edge was white but also the pleurocystidia were different from those of f. *gracilis*. It would seem that *P. microrrhiza* f. *pseudobifrons* Romagn. (*apud* Kühner & Romagn., 1953: 358, not validly published) refers to an identical case.

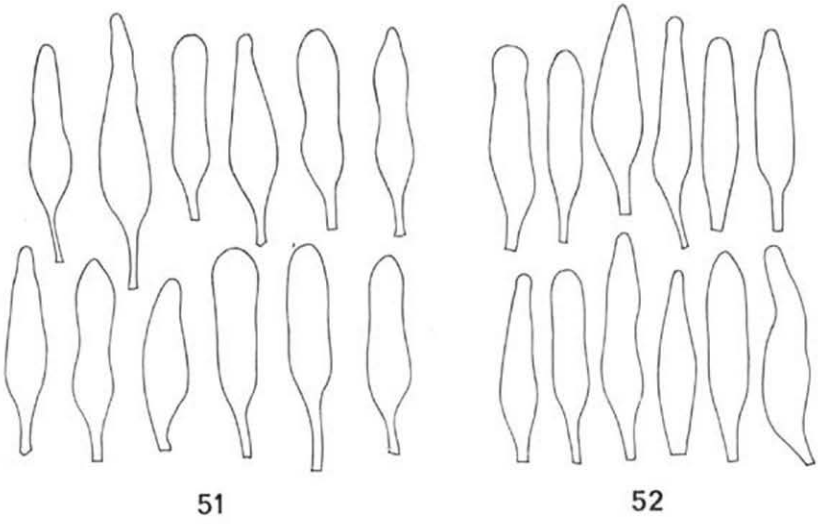
Time and again we were struck by the very large size of specimens of *P. microrrhiza* when this species was growing on very clayey soil (stems 130–190 × 2–4 mm) and the very small *P. gracilis*-like size when the species was growing on the more sandy soil of the dunes (stems 35–55 × 1–1.5 mm). At one time we even believed we should distinguish a small "forma dunensis" from the otherwise tall *P. microrrhiza*, but subsequently refrained from doing so since we found that small specimens are not exclusively connected with sandy soil, while on the other hand we found rather large specimens in fairly rich but still mainly sandy soil of the dunes.

Very rarely we found the pigmentation of the trama of the gills very slight and *gracilis*-like when studied under the binocular lens ('ridges' of the gills even very slightly olive), but on careful microscopical examination some pigmentation and also a few yellow hyphal septa were always found. Spore sizes varied considerably, the extreme mean values found among the 33 collections examined being 10.4–13.1 × 5.6–6.8 μ. In these collections, the numbers of lageniform cheilocystidia per 1000 μ gill edge ranged from 107 to 300 with a decided preponderance of the numbers between 140 and 240: 107–108–110–113–123–125–142–147–149–150–157–161–172–175–176–183–188–197–198–200–200–206–209–213–215–224–236–261–267–300 (in two cases all cells had disappeared). The cells being so very closely packed, counting them is difficult with the result that these figures are even bound to be too low.

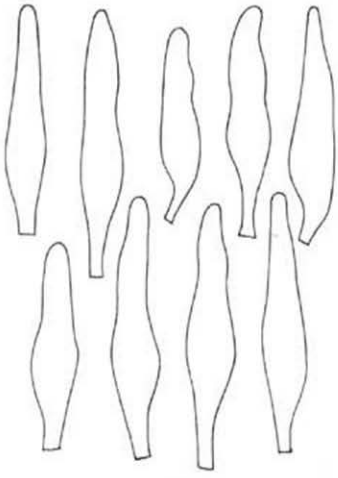
Several authors agreed to the synonymy of *P. squamifera* P. Karst. with *P. microrrhiza*. We endorse this view although we have not examined the type material.

Distinction of the two species

Although the shape and size of *P. gracilis* vary considerably (see figs.), one usually recognises this species quite easily in the field by its slender habit and normally small size, its cap being mud-grey (brown only in the early stages and particularly in the



Figs. 51, 52. *Psathyrella gracilis* f. *clavigera*. Pleurocystidiograms. — 51. Amsterdam, Amsterdamse Bos, 5 Nov. 1959. — 52. Ommen, Ada's Hoeve, 15 Oct. 1963. (Both figs.: × 575.)



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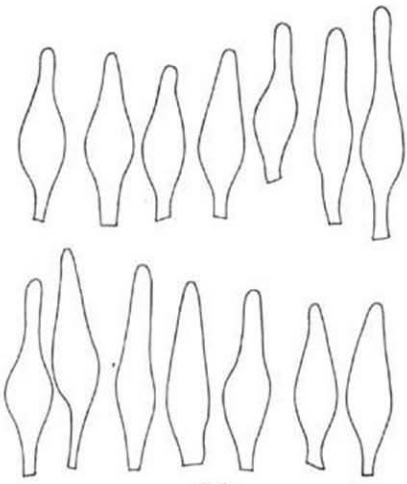

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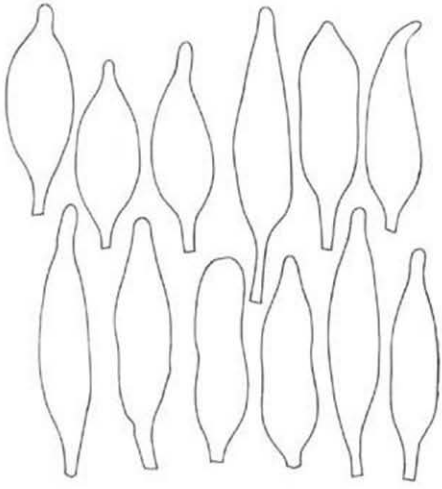

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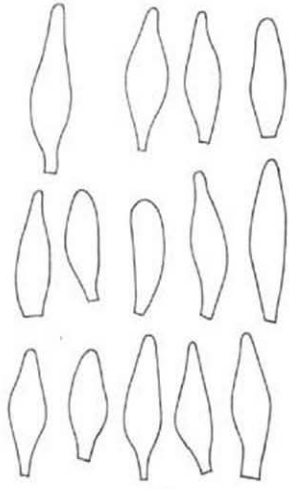

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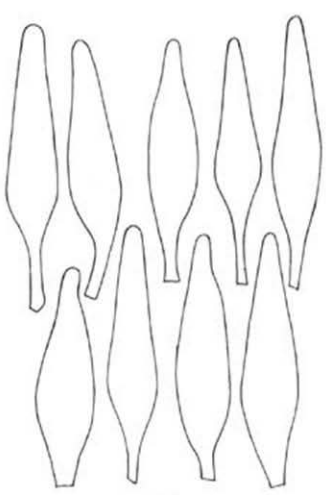
Figs. 53–56. *Psathyrella gracilis* f. *albolimbata*. Pleurocystidiograms. — 53. Linnerbroek (type), 6 Oct. 1962. — 54. Santpoort, Duin en Kruidberg, 13 Nov. 1962. — 55. Mook, near Plasmolen, 23 Oct. 1964. — 56. British Isles, Oxford, Bagley Wood, 15 Sept. 1969. (All figs: × 575.)



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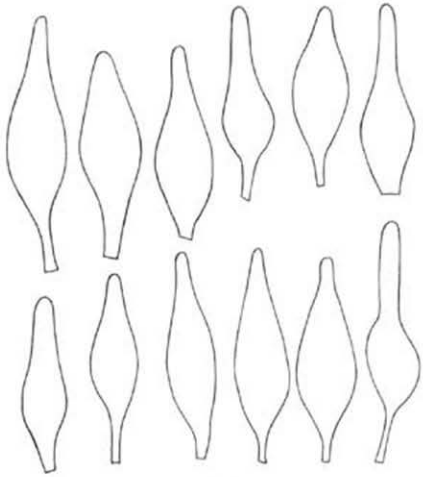

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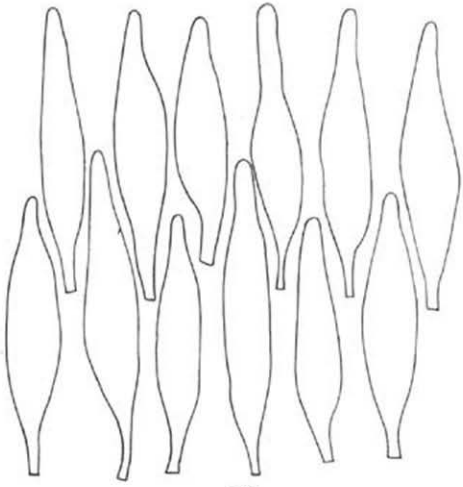

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Figs. 57–59. *Psathyrella microrrhiza*. Pleurocystidiograms (Vogelenzang, Dunes of Leyduin, 3 collections, 25 Oct. 1963). (All figs: × 575.)

centre) and turning pinkish on drying, its very dark purplish grey to almost black and very broadly adnate gills, its red gill edge, its rooting stem and the absence of a veil (for this character one should examine very young specimens). Closer and above all microscopical examination is needed to rule out *P. pseudogracilis*, *P. polycystis*, *P. caudata*, *P. gracilis* f. *clavigera* and f. *albolimbata*.

It is, however, not infrequently very difficult to distinguish between *P. gracilis* and *P. microrrhiza*, particularly so, as both species may have the same habit and habitat.

The combination of the distinct veil on the surface of the cap (to be observed in young specimens) and of a distinctly brown trama of the gills in *P. microrrhiza* are the criteria by which, according to Kühner & Romagnesi (1953: 355) this species is being distinguished from *P. gracilis*, which lacks a veil and is supposed to have a non-pigmented trama of the gills. Weather conditions (rain!) and age, however, often cause the complete disappearance of the veil and also much of the pigment in *P. microrrhiza*. On the other hand, as pointed out previously, the trama of the gills of primordia of *P. gracilis* is distinctly brown and this colour may persist to a slight extent in mature specimens, of which the 'ridges' of the gills are always brown with a distinct olive tinge under the binocular lens and usually show a trace of brown both under the microscope also.

As for the veil, sometimes (as pointed out previously) in *P. gracilis* velar fibres may be found in mature specimens at a slight distance from the margin on the surface of the cap.

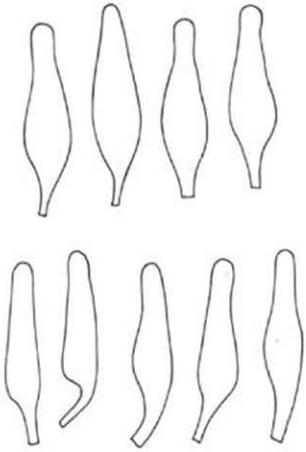
Therefore, with regard to the two decisive characters, alleged to separate the two species, some overlapping exists on the part of *P. gracilis* towards *P. microrrhiza* and — due to external conditions — vice versa.

There are a few more characters, which to some extent may help to distinguish between the two species. The pleurocystidia in *P. gracilis* usually are slender, wavy, subulate or even acute, whereas they usually are slightly smaller, plumper, not wavy, obtuse to subobtuse in *P. microrrhiza*, but the dividing line between the two kinds is not very sharp. On the whole *P. microrrhiza* — particularly when growing in clayey soil — is a larger and taller species than *P. gracilis*, but here too the overlapping is considerable. The caps of *P. microrrhiza* usually are browner when wet and they show a lesser tendency to turn pink on drying than those of *P. gracilis*, but here again considerable overlapping exists.

The same overlapping exists with regard to the micaceous and rugulose appearance of the drying and dry cap, both usually being somewhat less marked in *P. microrrhiza* than in *P. gracilis*.

Finally the stems of *P. gracilis* are beautifully white (sometimes only slightly isabelline in the lower part), whereas those of *P. microrrhiza* are usually slightly isabelline in the lower 1/2–1/3 (if not even slightly brown) and only white in the upper part, the reliability of this character again being dubious.

In contrast with the characters mentioned above, we found the different density of cheilocystidia per 1000 μ gill edge a far more reliable feature for the distinction of the two species. In *P. gracilis* the number of these cells never exceeds 100 per 1000 μ gill



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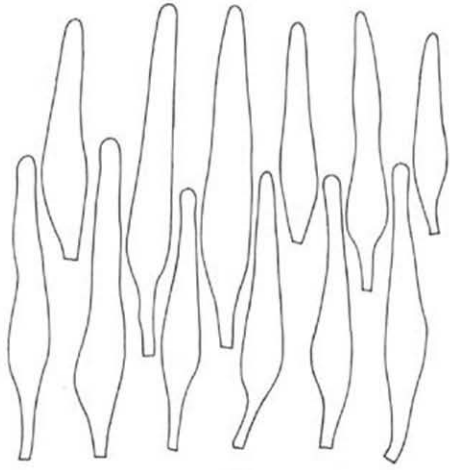

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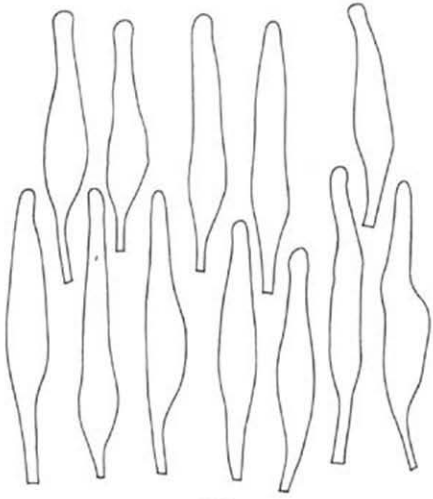

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Figs. 60–62. *Psathyrella microrrhiza*. Pleurocystidiograms. — 60. Amsterdam, Amsterdamse Bos, 9 Oct. 1960. — 61. Amsterdam, Amsterdamse Bos, 7 Nov. 1961. — 62. Amsterdam, Amsterdamse Bos, 29 Oct. 1963. (All figs: × 575.)

edge (preponderance between 9 and 40) whereas in *P. microrrhiza* this number always exceeds 100 (preponderance even between 140 and 240). Put into words, the cheilocystidia in *P. gracilis* occur more or less scattered on the edge of the gills among a vast majority of more or less spheropedunculate cells, whereas in *P. microrrhiza* they are densely packed.

In six collections primarily listed as *P. gracilis* and four primarily listed as *P. microrrhiza*, the specimens did not adequately seem to answer the diagnostic criteria mentioned above for these species. A few examples may serve to illustrate this: —

In one collection the veil of primordia did not reach any further than the margin of the cap and the pleurocystidia were typically *gracilis*-like, yet the trama of the gills was distinctly be it slightly coloured and the cheilocystidia numbered 145–213 per 1000 μ gill edge. In another collection one specimen showed velar remnants up to 1/4 of the radius of the cap and the pleurocystidia were *microrrhiza*-like but the pigmentation of the trama of the gills was practically none and could not have been washed away by rain, as the veil still was very much in evidence. In still another collection the pigmentation of the gills was practically none, the veil inserted at the margin of the cap and the pleurocystidia were *gracilis*-like but in one specimen velar remnants reached up to 1/4 of the radius of the cap. Again in another collection velar fibres reached up to halfway the apex of the cap, the pleurocystidia were obtuse or even subcapitate and the trama of the gills was slightly but distinctly pigmented, but the cheilocystidia only numbered 25 per 1000 μ gill edge. Seven fairly young specimens were collected at another occasion because of their strikingly brown caps and velar fibres reaching up to halfway the centre of the cap, so that at first they were believed to be specimens of *P. microrrhiza*, however, the trama of the gills was hardly coloured ('ridges' being distinctly olive) and the cheilocystidia numbered only 53 per 1000 μ gill edge. The trama of the gills of three specimens of yet another collection was decidedly pigmented, but the specimens did not show the slightest trace of a veil, the caps were mud-grey and the cheilocystidia numbered only 84 per 1000 μ gill edge.

It cannot be denied therefore that in this group of very closely related species, like in any such group, puzzling and seemingly intermediate forms occur. This should not, however, keep us from maintaining the two taxa *P. gracilis* and *P. microrrhiza* as different species.

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Author's address: Koninginneweg 136, Amsterdam-Z.

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OBSERVATIONS ON THE BOLBITIACEAE—IV

Developmental studies on Conocybe with particular reference to the annulate species[1]

ROY WATLING
Royal Botanic Garden, Edinburgh

(With one Text-figure)

The macroscopic characters of the pileus, veil, and stipe of members of *Conocybe* subgenus and section *Pholiotina* are related to the microscopic structure and development of the fruit-body. Differences between various authors' descriptions are explained by results from observations made in the field and in the laboratory. The colour of the pileus and the position of the veil is shown to be more variable in these same fungi than at first supposed. The development of the fruit-body in subgenus *Pholiotina* is compared with subgenus *Conocybe*.

The evaluation of the macroscopic characters utilized in distinguishing annulate members of *Conocybe* subgenus *Pholiotina* outlined in an earlier paper by Kits van Waveren (1970) is fully supported by the observations which have been made on over one hundred and fifty British collections of this same group and certain other closely related North American members of the Bolbitiaceae.

PILEUS COLOUR

Usually in agaric taxonomy great emphasis is placed on the colour of the fruit-body, particularly that of the pileus, so much so that it would be certainly rebellious to suggest otherwise. Kits van Waveren's and my ideas do not strictly oppose this view but observations indicate that a rather more careful appraisal is required, as to when and under what conditions the colour of the pileus is considered significant. Over several collecting seasons now, specimens have been found which differ one from the other simply in the colour of the pileus; field observations and experimentation have led to the belief that this is simply a reflection of the environmental conditions rather than of differences in genotype.

The development of the fruit-body, from before the veil begins to fragment until full maturity, has been studied in several species but most extensively in *Conocybe aporos* Kits van Wav. and *C. teneroides* (J. E. Lange) Kits van Wav. Under field conditions the colour of the pileus varied between rich red-brown or chestnut to

[1] Some of the results in this paper are taken from a thesis accepted for the degree of Ph. D. in the University of Edinburgh.

bay when fresh but due to the hygrophanous nature of the pileus these colours soon pale, changing to ochraceous honey, clay-buff, etc.; the rich red-brown colours can, however, be retained if the fruit-body is transferred to a damp-chamber immediately on collecting and allowed to develop to maturity there. Frequently under dry weather conditions specimens of members of subgenus *Pholiotina*, indeed many species in other subgenera of *Conocybe* are found dry, non-striate, and ochraceous honey to dark straw-colour. Fruit-bodies of all species of *Conocybe* so far studied appear to be unusually sensitive to changes in their water balance and this appears also to be applicable to all the species so far fructified in culture, or brought to maturity in damp-chambers. It has been found that if water is withheld, either by accident or under controlled conditions, by restricting or damaging the mycelium about the base of the stipe, the colour of the pileus soon fades; similar results are obtained by partially severing the stipe and keeping the cut ends apart by using a glass cover-slip. This damage one does, unconsciously it is true, when collecting a specimen; after all one cannot help but sever the multitude of fine mycelial connections between the base of the stipe and the substrate even though great care is taken when collecting to remove some of the substrate along with the specimen. Even the few hours in which a specimen may be in transport to the laboratory is sufficient time to allow distinct colour changes to take place.

Hora (1957) in *Panaeolus* revived the colour of the pilei of his specimens simply by placing the base of the stipe of an intact fruit-body in water in a closed container and allowing the water to be taken up by the hyphae of the stipe and transferred to the pileus trama; he considered that the final colour obtained in this group of agarics by this method was a true record of the original colour. It can be easily demonstrated that water is transported to the pileus tissue by using a hypodermic syringe and injecting a vital stain such as Janus green into the liquid column in the stipe cavity. Similarly an aqueous solution of Eosin can be located in the pileus trama and certain cells of the hymeniderm when it is placed in the medulla of the stipe. The stain may also be found at the tips of the cheilocystidia often in the small cap of mucus (possibly mucopolysaccharide) which is frequently present there in members of the Bolbitiaceae. However, whenever Hora's technique was applied to the annulate species of *Conocybe*, and to a lesser extent to some of the other species of *Conocybe*, the pileus never seemed to return to the bright rich red-brown colour found in the fresh fruit-bodies or primordia, the colours found after treatment were more 'greyed'. There is little doubt that in the field under drying conditions water tensions are set up between substrate and fungus such that the cells of the pileus trama are not fully saturated and so the colour of the pileus begins to pale; this process is continued if the tension is not released. When the soil becomes moist and the conditions in the soil more favourable water is once again taken up by the fruit-body, but the colour does not return to the original intensity and clarity. Thus it would appear in the field that a single mycelium could produce fruit-bodies with pileus colour red-brown (under ideal conditions), ochraceous brown (under drying conditions) and snuff-brown (under the re-establishment of more favourable conditions after an initial,

short period of drying); surely *C. filaris* var. *ochracea* Singer (1955) is a reflection o this phenomenon. If the length of the drying period is over a certain value, perhaps only a few hours for some delicate species of agaric, the fruit-bodies never revive. These observations might well explain the discrepancies in and differences between some of the descriptions of our common annulate species of *Conocybe* which appear in various texts, indeed between some of the illustrations which have been discussed at some length by Kits van Waveren (1970).

By using dyes directly injected into the stipe trama movement of water can be demonstrated but Schutte (1956) has carried out many more extensive experiments and these would lead one to believe that water is transported to and lost from the entire surface of the pileus. During unfavourable conditions probably due to the thinness of the pileus trama in species of *Conocybe* and due to the pileal surface being made up of large, thin-walled cells, a rapid loss of water is experienced such that basidia begin to collapse; however, under exactly similar conditions or even more stringent ones species of *Agrocybe*, which normally have a much thicker pileus trama and therefore larger source of water, continue to disperse spores.

STRIATION OF THE PILEUS

The pileus becomes striate in the annulate species of *Conocybe* as soon as the veil breaks and the pileus commences to expand, for it is then that the pileus trama thins sufficiently to show the base of the gills visibly through the tissue; this character is lost as the pileus dries out but on reviving as described above the striations may return, but are never exhibited as strongly as when the fruit-bodies are freshly picked, perhaps due to the development of air pockets within the pileus tissue. In some robust specimens the striation never seems to return and this may be due to nothing more than that the pileus which is a little thicker in these specimens contains such an extensive net-work of air-spaces that the movement of water through the tissue is so hindered that complete saturation never takes place.

RUGULOSITY OF THE PILEUS

Rugulosity of the pileus only occasionally enters descriptions of annulate European species of *Conocybe* but when one examines the literature pertaining to foreign representatives of the same group it is a prominent character; however it is certainly not because the character is absent in European material, indeed *C. filaris* (Fr.) Kühner is frequently rugulose, at the disc anyway. Mycologists are more conscious of this character in the related genus *Bolbitius*, for some specimens of *B. vitellinus* (Pers. per Fr.) Fr. growing on dung or straw may be strikingly wrinkled and rugulose at the pileus disc. Atkinson (1918) described an olivaceous coloured species of *Bolbitius*, *B. variecolor*, which was marked by the strongly veined pileus, but collections of even this fungus may be found completely, or almost completely, smooth; much discussion

has been conducted on the real differences, if any, between *B. reticulatus* (Pers. per Fr.) Ricken (with reticulate-veined pileus) and *B. aleuriatus* (Fr. per Fr.) Singer (with smooth pileus). Thus it would seem that under favourable environmental conditions the pilei in some species may become wrinkled or even rugulose but there appears little or no other difference between these rugose-capped specimens and those that would be considered normal, i.e. smooth.

The rugulose nature of the pileus can be related to its structure and development. The 'cuticle' of species of *Conocybe* consists of a palisade of stalked vesiculose, pyriform to ellipsoid cells. Although these cells are very variable in size and originate at quite different levels in the hypoderm (Kühner, 1935; Disbrey & Watling, 1967), the pileal cells of members of the subgenus *Pholiotina* originate at a greater number of levels than those of members of the *Conocybe tenera* group. However, both groups are marked by the development of pockets of similar, but smaller, cells below the hymeniderm surface which expand during maturation and push up into the limiting layer of the pileus to increase its surface area; this increase in the cell number which makes up the surface allows the pileus to expand but if the change of shape of the pileus is not rapid enough, or the differentiating parts are not in phase, then the cells throw the pileus surface into small irregularities. These irregularities are composed of thin ridges of stalked, vesiculose to pyriform cells of the hymeniderm; a complexity of these irregularities gives the rugulose surface. A similar pattern is seen in some members of the genera *Coprinus* and *Psathyrella* and is accentuated when the fruit-bodies dry. Extensive cracking exhibited in *Agrocybe* can also be related to the hymeniform structure of the pileal surface.

The cells of the hymeniderm in *Conocybe* are variable in size even in a single pileus, generally those at the margin being slightly smaller than those at the disc; this may be related to the age of the cells and the availability of water. The size of the cell in no way seems to be related to the size of the fruit-body.

Colour of the stipe

Maturation of the fruit-body is also of importance when one considers, in the annulate species of *Conocybe*, the colour of the stipe base and the colour of the stipe flesh, for although commencing dark ochraceous in the primordium and young fruit-body, the flesh in the stipe base gradually darkens to become cigar-brown or snuff-brown, even umber; during maturation not only is there a darkening but there is an extension of that tissue which becomes darkened (metachroic), so that in fully and over mature specimens all the tissue below the ring is dark brown. Thus in a single collection individuals with dark and light stipe bases can be found growing together in juxtaposition. Also during maturation the silky covering to the stipe breaks up or separates to expose the darker 'context' and this shows through more and more strongly with age.

VELAR CHARACTERS AND THEIR RELATION TO DEVELOPMENT

The veil when present in *Conocybe* is formed as part of the paravelangiocarpic development, a type of development which appears to typify all the members of the Bolbitiaceae so far studied, but as in other agarics with this type of development e.g. *Panaeolus semiovatus* (Sow. per Fr.) Lundell, the veil may be completely annulate, or annulate and dentate, or only dentate. True the *Conocybe arrhenii–blattaria* group is normally thought of as a complex of annulate species but specimens can be found with a distinct marginal veil, with or without accompanying remnants of a ring on the stipe; it is only when in some individuals remnants are present on the stipe one receives clues as to where the veil originated. A similar and parallel phenomenon is found in the *Agrocybe praecox* and *Agrocybe erebia* complexes.

Whether the veil is marginal or annulate may be considered an expression of the environment for if the fruit-bodies develop rapidly, they tear the veil into fragments and these are either all left on the pileus or some are left on the pileus and some on the stipe. Damage to the veil and repositioning of the veil may result when during development the fruit-body rubs against vegetation, soil particles, etc.

Little is known about the stimulus required to initiate fruit-body development, the first signs of which to the naked eye are small loose knots of hyphae. These structures are found at the junctions of those groups of hyphae which come into close proximity to one another during growth. Lateral branches branch rapidly by what appears to be a simultaneous, yet random, system to form a tight group of hyphae, the innermost of which divide more regularly and become much more compacted than those towards the outside. Finally a pseudoparenchymatic tissue is formed and it is from this tissue that the fruit-body develops.

In culture hyphae of members of the Bolbitiaceae frequently grow in close contact with each other, indeed the intertwining to form small knots is common. In these intertwining hyphae the cells close together divide transversely and then branch, later branching again but at right angles. The fruit-body at its earliest stage is covered by these loosely branched and irregularly arranged hyphae and to the naked eye the primordium appears to be enveloped in a mass of pale ochraceous or dirty whitish hyphal strands often giving the primordium a woolly appearance when seated on the substrate. If more than one primordium develops in close proximity usually all but one abort early in development, or they remain checked in formation at this same stage until those close-by have matured. Often it is these primordia which are found after careful searching in the field and it is they which act as suitable material for study. They are particularly important in the study of the annulate species of *Conocybe* which have not been cultured. There is no indication that these primordia are either different in structure or will develop differently from the mature fruit-bodies.

Some of the loose hyphae on the primordia branch sympodially, the tips balooning out to form drumstick-shaped terminal cells. The apical button in these cases frequently resembles the apical proliferation found in the lecythiform cheilocystidium

which characterizes many species of *Conocybe*. By subterminal branching larger, more inflated cells are formed from the pseudoparenchyma beneath the filiform, capitate or subcapitate cells. During further expansion of the primordium these former cells inflate still further and become fully exposed and rapidly form a continuous layer; this is the hymeniderm. The capitate cells wither and may become sloughed off, some remain attached to the base of the stipe, margin of the pileus and randomly, yet frequently, on the pileus disc; such cells may remain on the pileus until the fruit-body is fully mature. The presence of such cells may explain why Kühner (1935) recorded colourless filaments and capitate cells on the pilei in some of his collections of *C. spicula* (i.e. *C. rickeniana* Orton, 1960). It is here suggested that the clamp-connected hyphae with capitate end-cells and/or capitate lateral branches found in the *C. brunnea* group are formed in this way; similar hyphae appear to be

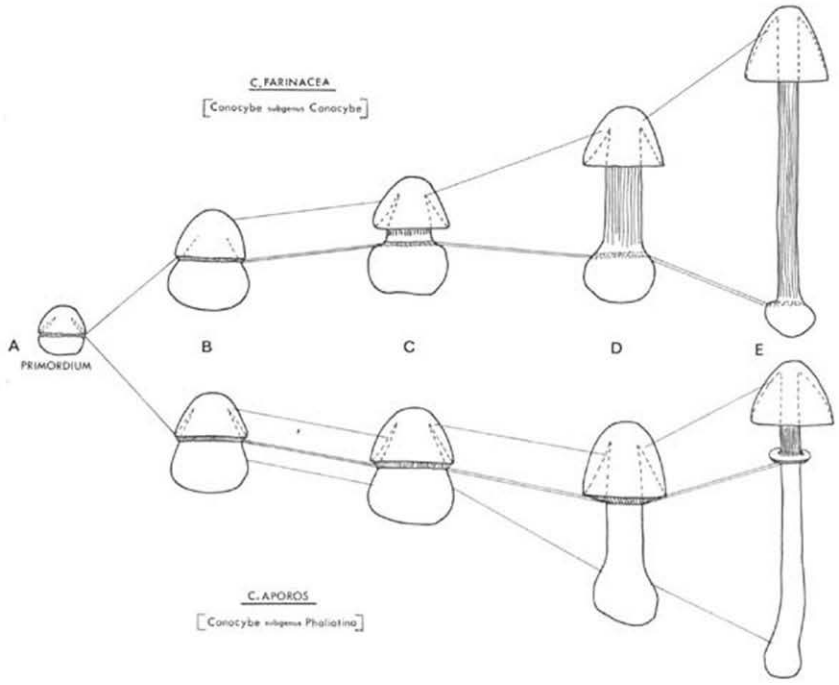

Fig. 1. Median sections of primordia and developing fruit-bodies showing diagrammatically the original and final positions of the caulocystidial zone in *Conocybe* (subgenus *Pholiotina*) *aporos* and *C.* (subgenus *Conocybe*) *farinacea*.

rare in *C. aporos*, *C. arrhenii* (Fr.) Kits van Wav., *C. blattaria* (Fr.) Kühner, and *C. filaris*.

In addition to such cells in *Conocybe* subgenus *Piliferae* and *Conocybe laricina* (Kühner) Kühner, as well as *C. brunnea*,[2] some of the hymeniform units are also converted into dermatocystidia (= pileocystidia). The development of members of *Conocybe* subgenus *Pholiotina* has not been studied in as great detail as other members of the genus *Conocybe* because of difficulties in culture but many observations indicate that in *C. aporos* and *C. filaris*, as well as *C. coprophila* (Kühner) Kühner in subgenus *Piliferae* the picture during the early stages of development of the fruit-body is very much the same as in *C. farinacea* Watling.

However, in later stages of development it is found that in primordia of *C. aporos* and several other members of the subgenus *Pholiotina* the stipe of the fruit-body is not completely homologous to the stipe in *C. farinacea*. In the former group the basal part of the primordia elongates to form the greater part of the stipe (see diagram); this is in contrast to *C. farinacea* where the expanding tissue which ultimately forms the stipe is that tissue at first hidden from sight above the junction of the margin of the immature pileus and stipe. This would explain why in *C. aporos* groups of cystidia analogous to the cheilocystidia are not found below the ring, for the cystidia on both stipe and gill-margin are formed in association with the lipsanenchyma which does not envelop the basal area of the primordia. The stipe in the lower region in subgenus *Pholiotina* is ornamented simply with long, clamp-connected hyphae with cystidioid tips; at most these end-cells are clavate to torpedo-shaped. True caulocystidia are found above the ring and in sections of primordia and young fruit-bodies they can be actually found on the ridges of the upper surface of the ring. In fact there appears to be a positive correlation between the ridges or striations on the ring and the number of secondary gills, for as far as field observations allow the number of ridges on the ring equals the number of gaps between the major gills. The development in *C. farinacea*, *C. tenera* (Schaeff. per Fr.) Fayod, *C. pubescens* (Gillet) Kühner, and *C. subpubescens* P. D. Orton, etc. observed in culture is parallel to that described above but the striations of the stipe in these species are due to the development of lines of caulocystidia; these striations are in fact analogous to the ridges above the ring in the annulate species, and those on the basal area of the stipe equivalent to those actually on the ring. Although this can be confirmed in culture for exannulate members of *Conocybe* subgenus *Conocybe*, fructification in pure culture of annulate members of subgenus *Pholiotina* has not as yet been achieved and observations are based on material collected in the field.

The type of veil produced during the paravelangiocarpic development of an agaric fruit-body is dependent on at least two factors: (1) the degree of mutual adherence of the individual hyphal elements constituting the velar tissue and (2) the

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[2] Nomen nudum which will be validated in a later paper in this series.

degree of adherence of the velar tissue, lipsanenchyma, and associated tissue to the pileus and/or stipe. Thus from (1) one can obtain different textures of veil, e.g. filamentous, membranous and from (2) different positionings of the veil. If adherence to the pileus is strongest then a marginal veil is formed, whereas if adherence to the stipe is greatest an annulate veil results; intermediate types might be expected and are indeed found in the field. It is felt that mycologists incorrectly have tended to think only in terms of the extremes of the morphological series existing between annulate and exannulate specimens; perhaps this is left over from Elias Fries' classification where the presence of a ring is of paramount importance.

Conocybe peronata Kühner & Maire remains an anomaly; Maire's description in Kühner's monograph (1935) is based on a single collection from near Blida, Algeria (8 xii 1932, under *Cedrus atlantica*). The cheilocystidia are close to those found in *C. blattaria* and *C. filaris* but the spore dimensions are wrong for the former and the spore shape slightly different from that of the latter; there are also differences in veil pattern, stature, etc. It appears to be a good species but it is unfortunate that no more information on microscopic characters is available other than that in Kühner's original account because it would be most interesting to observe whether cystidia are present all down the stipe to the top of the peronate ring, as they should be if the observations discussed above are general, or whether cystidia cease to develop below a certain point; the actual development of this species would be intriguing to study.

In our studies the character of the presence or the absence of a veil in a single species of *Conocybe* has always been found to be constant, although its position may be variable, and in some cases its development may be reduced; cultural conditions are ideal for examining these characters. Even when fully annulate the adherence of the veil to the stipe is often tenuous, at first being superior or median on the stipe, although later during maturation it may well become inferior; such a veil is called mobile and may even fall to the bottom of the stipe and appear volvate (see above under *C. peronata*) or be lost altogether, particularly when badly collected. Herbarium material itself may be deceptive because the very act of collecting these annulate species of *Conocybe* may alter the position of the ring; certainly drying can modify the position even further by destroying the tenuous connection between ring and stipe.

The one factor however, which does remain constant is the character of the hyphae which make up the veil; unfortunately as yet no anatomical differences can be seen to distinguish the veils of the more critical species. Some species can be separated by their hyphal characters but these can also be separated on other more easily observable characters, e.g. on basidiospore shape and structure in *C. vestita* (Fr.) Kühner and *C. brunnea*.[3]

When a veil in an annulate species develops under very favourable conditions it may fragment, the remnants becoming irregularly distributed on the pileus margin;

[3] Nomen nudum which will be validated in a later paper in this series.

they do not appear to form a distinct series of denticles. In contrast when fruit-bodies of typically marginal-veiled species develop, the veil splits up more regularly to give a distinctive and regular pattern; however, suspected annulate forms of *Conocybe appendiculata* are recorded (Kühner 1935)) as are similar forms of *Conocybe brunnea* (see below). It must at this point be strongly stressed that veils formed in other agarics during other types of development (e.g. bivelangiocarpic development, see Reijnders, 1967) do not have the same type of structure as those found in the Bolbitiaceae and may be much more constant in their external appearance. Thus although the presence of a veil is important as a character in *Conocybe* the position of the ring is of less importance in this same group,whereas in another group of agarics the presence and position of the veil may be equally important.

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REVIEWS

R. W. RAYNER, *A mycological colour chart* (Commonwealth Mycological Institute, Kew, Surrey & British Mycological Society, 1970). Pp. 34, Chart I (9 sheets), II (8 sheets). Price £ 2.

Good colour naming and colour coding are essential and also a good colour system. Once such a system has been adopted by an International Botanical Congress it is highly desirable that it be employed universally.

To my way of thinking the author of this work is correct in assuming that the system most suitable for this purpose is the Munsell system. I myself used it in describing the colours of *Taraxacum* achenes. Its three "co-ordinates", hue, value and chroma, are in agreement with psychological experience and can be translated in physical unities, as is done by the I.S.C.C. (Inter Society Color Counsel) and the N.B.S. (National Bureau of Standards) (America). This is a requisite of normalization.

In order to achieve as precise a perception of the differences in colours as possible the general Munsell charts are very extensive and they should be available in every botanical institute. Unfortunately they are too costly for the average private person. This is probably the reason why the Mycological Colour Chart has been published.

The author of the present chart has selected 128 colours, giving them the names introduced by Dade (1949). Unfortunately Dade defined his terms according to Ridgway's colour system while for several reasons this could better be dropped. The author's presentation according to the Ridgway system seems to me a pity. This, however, is not an essential point. Rayner has given each of the colours a number. In Table I he compares the colour names, with their numbers and their Latin equivalents, with the I.S.C.C.–N.B.S. names (not practical for the botanist) and the Munsell "mid-point". Table 2 gives the Latin names and their English equivalents. Table 3 gives the list of Ridgway names. The introduction of numbers for the 128 colours is practical for use with the chart but should not lead to some sort of "code" in itself. In my opinion use of the Munsell notation is necessary for the sake of uniformity.

The author and his wife have unquestionably done an immense amount of work but most of it is suitable only for documentation. For anyone wishing merely to compare colours it is sufficient to recognize a given colour of Chart I. After that he can find the English or Latin name and then the Munsell notation. Vice versa, he can find out what a colour mentioned in literature looks like on the chart. For those who desire to dig through the older literature and systems use of Chart II is recommended.

Since inevitably users of the chart will find the disparity between certain colours too great they will have to fill the gap with the general Munsell charts or else turn to the Commonwealth Mycological Institute for further advice.

A set of loose colour chips would provide the most practical way of comparing colours. If the appropriate chip is laid on the object to be compared the colour could be determined free of disturbance from any surrounding colour whatsoever.

J. L. VAN SOEST

D. M. HENDERSON, P. D. ORTON & R. WATLING, *Introduction. In* British Fungus Flora. Agarics and Boleti. (Her Majesty's Stationery Office, Edinburgh, 1969). Pp. 1–58, 50 figs., 1 colour identification chart. Price 12 s.

R. WATLING, *Boletaceae*: *Gomphidiaceae*: *Paxillaceae. In* British Fungus Flora. Agarics and Boleti. 1 (Her Majesty's Stationery Office, Edinburgh, 1970). Pp. 1–125, 108 figs. Price £ 2 10s. (= £ 2.50).

Mycology these days is receiving its full share of interest—introductions, text-books, illustrated works, monographs, or their reprint editions being published in an ever growing stream. But floras for some reason are slower in coming. 1953 was the year when mycologists looked incredulously and admiringly at Kühner & Romagnesi's masterpiece. In 1967 Moser obliged (at least a part of) the mycological world by the publication of the third and greatly enlarged edition of his "Röhrlinge und Blätterpilze." Now it is gratifying to see that work is under way for a British flora, indeed, the Introduction and the first instalment have been distributed.

The running title of the Introduction reads "Introduction and Keys," and it is obvious that these keys constitute the most important part.

Assuming that a perfect ignoramus got interested in fungi and brought a bolete home for closer inspection, he would very naturally try his skill with the first key he came across, the key on p. 9. There he would read couplet 1, proceed to couplets 2 and 30 respectively, feel somewhat puzzled about the indication "(29)", then decide his specimen [*Boletus rubinus*] did not belong in Pleurotaceae because of the soft flesh and the ellipsoid spores, and finally conclude he had collected some Tricholomataceae.

Of course, all beginnings are difficult, and there is no doubt that much later and after a great deal of practical experience the same student will readily agree that the "Artificial key to genera" (pp. 17–38) works smoothly, although he may admit that he was at first at a loss as to how to visualize colours like grey-clay or ochre-buff, not matched in the colour chart.

Part 1 requires some more comments, but it may be pointed out that these should merely be seen as an attempt to brush off specks of dust. These specks do not affect the value of Part 1 as a flora.

Microscopic elements, still measured in μ in the Introduction, are indicated as μm in Part 1. The spores of *Boletus pinicola* (p. 30) are 13–17 × 4.0–5.0 μm, those of *B. piperatus* (p. 31) 8–11/3–4 μm.

In *Aureoboletus* (p. 5) the Imler reaction is negative. Imler's reaction is mentioned on p. 1, but not explained.

In most species the basionym, if any, is duly cited, but it is omitted in *Gomphidius glutinosus* (p. 83), *G. roseus* (p. 85), *Paxillus atrotomentosus* (p. 89), *P. involutus* (p. 90), and *P. panuoides* (p. 91).

The gender of *Leccinum* is neuter; this is important to remember when correctly spelling *L. roseofracta* (p. 53) and *L. roseotinctus* (p. 53).

The iconography of *Boletus appendiculatus* (p. 16) should have come after the synonymy.

Instead of "uniform colour" (p. 17, line 17 from below), "homogeneous colour" is suggested.

In Enchiridion Fungorum I: 162, 1886 (p. 75) the "I:" is superfluous.

Opatowski's work was published in Wiegmann's Archiv für Naturgeschichte; this was variously abbreviated as "Weigmann's Arch". (p.7), "Weigm. Arch. f. Nat." (p. 50), "Archiv für Naturgeschichte" (p. 34).

The author of *Boletus grevillei* (p. 68) is Klotzsch, not Klotsch. The authors Haas and Hvass are frequently misspelled Hass and Hvaas (pp. 17, 19, 80, 89, 90). Svreck (p. 65) and Sverck (p. 91) refer to the same mycologist Svrček by name.

The valid publication of *Xerocomus porosporus* Imler, basionym of *Boletus porosporus* (p. 32), is not in Bull. Soc. mycol. Fr. 71: 21. 1955. *Gomphidius gracilis* (p. 85) was published in vol. 13 of the second series of Ann. Mag. nat. Hist. *Boletus edulis* subsp. *reticulatus* (p. 14) is a recombination published by Konrad & Maublanc on 23 March 1926, not 1937. The recombination *Boletus edulis* subsp. *pinicola* (Vitt.) Konr. & Maubl., according to a note in their "Icones", was printed in December 1936, but the pages were not released for distribution before April 1937. This is the date to be taken as the effective date of publication, not 1935 (p. 30). *Xerocomus boudieri* Sing. (p. 27) was published in 1942, not 1943. *Boletus pseudosulphureus* (p. 33) was published in Z. Pilzk. 2: 225 (not 255). 1923. Miller's monograph of *Chroogomphus* (p. 79) was published in the 56th (not 54th) volume of Mycologia. The generic name *Chroogomphus* was proposed on p. 529, not 526. *Gomphidius helveticus* (p. 79) was published in the 28th (not 21st) volume of the Schweiz. Z. Pilzk. "*Flammula aldrigei*" (p. 94) was published in 1891, not 1892, and it did not appear under that name, being published as *Agaricus (Flammula) aldridgei*.

The alphabetical arrangement of Part 1 makes it an easy matter to find the name of a species, but an index for the synonyms would have its merits.

The habit sketches of the species are downright disappointing.

The specific descriptions are adequate and the comments accompanying them indicate that the author is intimately acquainted with his species.

R. A. Maas Geesteranus

John Webster, *Introduction to fungi* (Cambridge University Press, 1970). Pp. viii + 424, 244 figures. Price £ 3; $ 10.50.

The author, seeking to justify the publication of yet another text-book, pointed out the desirability of "an introduction to fungi which are easily available in the living state" and of "original illustrations of the kind that a student could make for himself."

There is a third justification. Leafing through the chapters one soon realizes that

an author, whether or not he is aware of it, creates an atmosphere of his own. It is in the way he approaches his subject and manipulates his idiom that he greatly influences the reader's attention. The reader may be profoundly impressed by the book of one author, and yet prefer using another author's book, because the latter appeals to him, coincides with his own mental disposition. This being so, there is no doubt but that Webster's book will collect its own circle of readers.

This text-book is in marked contrast to many others in that it presents only a restricted number of examples, but gives ample compensation for this economy by furnishing a wealth of information on biology, cultural characteristics, pathogeneity, reproduction, and genetics.

It is not the reviewer's intention to discuss the various groups treated, but he may be allowed to make one or two comparisons, even if the author has warned that "no attempt will be made to treat each group in equal detail" (p. 4). It would seem, however, that some genera do get rather less than their share, see e.g. *Peziza* (p. 267) as against *Pleospora* (p. 278), or *Lepiota* (p. 310) and *Cortinarius* (p. 312) as against *Lycoperdon* (p. 345).

As an introduction the book is well balanced and sufficiently detailed. For students who desire further information there is an ample list of references.

The drawings are good to excellent, but Fig. 207 looks decidedly unconvincing. Unfortunately many of the photographs cannot win the reviewer's admiration.

R. A. MAAS GEESTERANUS