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CONTENTS

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[*] The number in the title on p. 197 should be read XIII instead of XII.

NOTES AND BRIEF ARTICLES

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Part 1, pp. 1–136, 30 June 1986
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(Photo J. van Brummelen)

DRS. H. S. C. HUIJSMAN

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Drs. H. S. C. Huijsman

(1900–1986)

With the death on 24 September 1986 of Drs. H. S. C. Huijsman the Dutch mycologists lost one of their ablest and internationally known fellow members as well as a rich source of agaricological information and inspiration.

In the early beginning of his professional medical life as an oculist, Huijsman became spellbound by agarics and boleti and their wealth of taxonomical, morphological and biological problems. By dedicated studies in the field and at home with microscope and rapidly growing library, he soon became the leading agaricologist in the Netherlands. Frequently he put his increasing knowledge to the test at mycological forays abroad, particularly in France, where he got acquainted with several of the great mycologists as Maire, Heim, Konrad, Maublanc, Kühner, Romagnesi, Malençon, Josserand, Singer, Pearson, and others.

His large medical practice was often difficult to combine with mycological activities, but could not keep Huijsman from becoming a kind of mycological oracle, frequently consulted by amateurs and professionals alike.

An early retirement in 1953 made it possible for him to spend a much greater part of his time on his beloved mycology and soon afterwards he became a very welcome honorary associate of the Rijksherbarium. It was also then that he and Mrs. Huijsman started to spend most mushroom seasons in rich parts of France of Switzerland. In 1958 they choose their permanent domicile in the Swiss Jura, where for a period of eleven years the mycoflora was extensively explored, but afterwards they returned to the Netherlands. Particularly in the Swiss period Huijsman's knowledge of agarics and herbarium increased considerably. Few could measure with him in field-experience.

During almost all his life Huijsman's activities were tempered by a regularly returning illness making him incapable of working for several periods each year. This and his immense scientific curiosity which made him enter every seemingly promising path that opened up to him, are the reasons that his mycological production measured in publications has not been much larger yet. Once, before the electron microscope came into use in mycology, Huijsman started a comparative study on spore-wall structures in brown-spored agarics, but his efforts finally got frustrated by the limitations of his light microscope.

Huijsman's greatest (albeit indirect) contribution to mycology in the Netherlands probably has been his constant call, particularly in his early mycological years, for improvement of mycological exploration and observations.

Persoonia Vol. 13 Part 2 was issued 16 Dec. 1986

Besides his publications Huijsman left a large herbarium and boxes full of notes sometimes accompanied by water-colours by Mrs. Huijsman, all accommodated now in the Rijksherbarium, Leiden.

Huijsman was a corresponding member of the Société mycologique de France and an honorary member of the Dutch Mycological Society. He is also honoured in some names of species, viz.: *Lepiota huijsmanii* Wichanský (1960), *Entoloma huijsmanii* Noordel. (1984), *Hebelomina huijsmaniana* Sing. (1986; a synonym of *H. neerlandica* Huijsman, 1978), and *Inocybe huijsmanii* Kuyper (1986).

C. Bas

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1936: Korte aantekeningen over paddestoelen I. In Fungus 7: 72–74.
1936: Ditto II. In Fungus 8: 11–15.
1937: Ditto III. In Fungus 8: 50–55.
1937: Met de Franse mycologen op stap. In Fungus 9: 23–24.
1938: Over *Lepiota*'s en nog wat. In Fungus 9: 50–52.
1939: De afgebroken excursie te Spa. In Fungus 10: 30–32.
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1943: Observations sur le 'genre' *Lepiota*. In Meded. Ned. mycol. Vereen. 28: 3–60.
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1954: Over boleten. In Coolia 1: 5–16.
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NOTULAE AD FLORAM AGARICINAM NEERLANDICAM–XV

Marasmius, Marasmiellus, Micromphale, and Hohenbuehelia

MACHIEL E. NOORDELOOS

Rijksherbarium, Leiden

The present paper gives descriptions and notes on various white-spored agarics. Two species are new to science, viz.: *Marasmius cornelii* and *Marasmiellus ornatissimus*. *Micromphale bisporigera* is provisionally described as new. The following new combinations are made: *Marasmius setosus* (Sow.) Noordel. to replace *M. recubans* Quél., and *M. bulliardii* forma *acicola* (Lundell) Noordel. to replace *M. wettsteinii* sensu auct. eur. *Hohenbuehelia culmicola* is described as new to the mycoflora of the Netherlands. Type-studies are made of *Marasmius pruinatus* Rea and *M. suaveolens* Rea. A key is given to the European species of *Marasmius* sect. *Gloiocephala* and sect. *Epiphylli*. Some critical species, viz. *Marasmius saccharinus*, *M. siccus*, *M. anomalus*, *M. buxi*, *M. hudsonii*, *Marasmiellus tricolor*, and *Marasmiellus rosellus*, are fully described and illustrated.

I. MARASMIUS

Section Gloiocephala

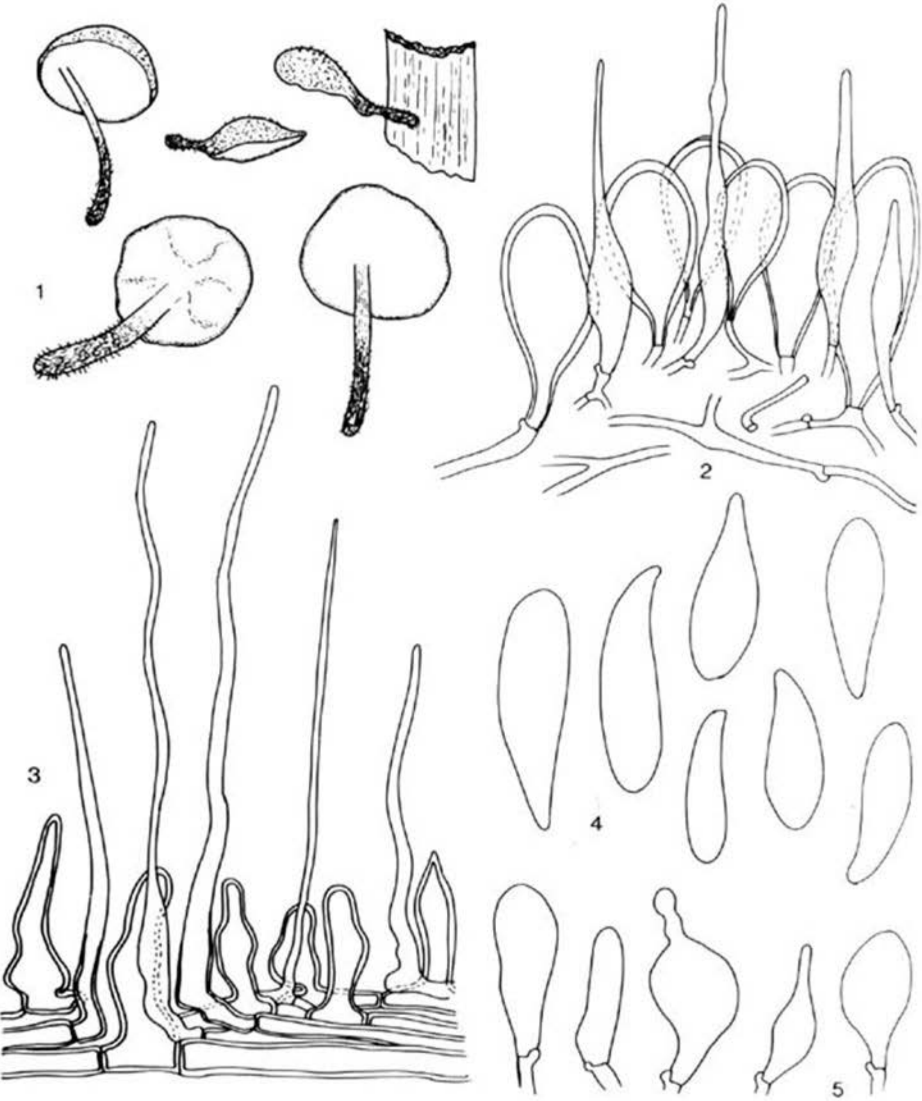
1. **Marasmius cornelii** Laessöe & Noordel., *spec. nov.*—Figs. 1–5

Gloiocephala spec. Bas in Persoonia 2: 86. 1962.

Misapplied name.—*Marasmius menieri* sensu Corner in Trans. Br. mycol. Soc. 19: 285. 1934.

Description & illustration.—Bas in Persoonia 2: 86–87, figs. 26–30. 1962.

Basidiomata parva. Pileus convexus vel applanatus, albidus vel cremeus, versus margine brunneus, leviter rugosus, pruinosus. Hymenium glabrum vel leviter rugosum, griseo-album. Lamellae absentes. Stipes excentricus vel lateralis, raro subcentralis, apicem albus, basim brunneus vel atrobrunneus, toto hirtus. Odor nullis. Sporae 12.5–18 × 3.5–6.5 μm, ellipsoidae vel lacrymoidae, tenuiparietales, inamyloideae. Basidia 35–52 × 10–12.5 μm, tetrasporigera, clavata, fibulata. Cystidia hymenii clavata, vesiculosa vel lageniformia, 20–35 × 6–20 μm, sparsa prope marginem pilei. Pileipellis hymeniformia elementis clavatis vel vesiculosis 22–50 × 11–30 μm, crassiparietalibus. Pileocystidia 55–90 (-110) × 7–15 μm ad basim et 2–4.5 μm ad apicem, lageniformia, tenuiparietalia. Pileitrama gelatinosa. Caulocystidia diversa, clavata vel vesiculosa vel cylindracea usque ad 110 μm longa, ad apicem 1.5–5 μm crassa. Fibulae presentes. Habitat ad vaginis foliorum putridis Cladii mariscus in palude. — Holotypus: *Thomas Laessöe 0981*, 15 Oct. 1984, 'Keldsnor, Lunden, Island Langeland, Denmark' (C, isotypus in L).



Figs. 1–5. *Marasmius cornelii*. — 1. Fruitbodies (× 5). — 2. Pileipellis (× 500). — 3. Stipitispellis (× 500). — 4. Spores (× 1500). — 5. Cheilocystidia (× 1000). (All figs. from holotype.)

Basidiocarps very small. Pileus 1–2.5(–4) mm broad, relatively robust, tough, convex to applanate, white to cream colour, turning brown at margin, discolouring reddish brown on drying several hours after collecting, sometimes wrinkled, with scattered short hairs all over. Lamellae absent. Hymenium smooth, in some specimens wavy to grooved, pale gray white. Stipe up to 4 × 0.3 mm, lateral or excentrical, rarely almost central, white at apex, reddish brown below to blackish brown at base, entirely white pubescent hairy, at base with some hairs attached to substrate. Smell absent.

Spores 12.5–18 × 3.5–6.5 μm, average 15 × 5 μm, Q = 2.3–3.4, average Q = 2.75, slenderly ellipsoid to lacrymoid, thin-walled, colourless, inamyloid. Basidia 35–52 × 10–12.5 μm, 4-spored, slenderly clavate, clamped. Hymenial cystidia 20–35 × 11–30 μm, slenderly clavate to broadly vesiculose or lageniform, thin-walled, very scarce and most frequently found near margin of pileus. Pileipellis a hymeniderm of clavate to vesiculose elements, 22–50 × 11–30 μm with thickened, colourless or yellow walls. Pileocystidia 55–90(–110) × 7–15 μm at base and 2–4.5 μm at apex, numerous, slenderly lageniform, thin-walled, colourless. Pileitrama distinctly gelatinized, made up of more or less radially orientated, 2.5–7 μm wide cylindrical to inflated hyphae. Stipitispellis a cutis. Caulocystidia very abundant, of two types, one 25–60 × 8–20 μm, clavate to vesiculose, thick-walled with yellowish walls, the other type 60–120 × 3–10 μm at base and 1.5–5 μm at apex, with thin or slightly thickened walls, colourless or pale yellow. Clamp-connections abundant in all tissues.

Habitat & distribution.—On rotten leaf sheets of *Cladium mariscus* in marshes, just above the water line. United Kingdom and Denmark. Rare.

Collection examined.—DENMARK, Langeland, Keldsnor, Lunden, 15 Oct. 1984, *Thomas Laessöe 0981* (holotype, C; isotype, L).

Marasmius cornelii is named after Dr. Cornelis Bas, curator of Agaricales at the Rijksherbarium, Leiden for his great stimulance of Agaricology, and for being the nestor of many young Dutch Mycologists.

Bas (1962) in his excellent monograph of the genus *Gloiocephala* in Europe, described an unnamed species on account of manuscript notes and drawings by Corner, who recorded the species for the first time (Corner, 1934) under the misapplied name *Marasmius menieri*. Bas (l.c.) suggested that Corner's species most likely represented a taxon new to science, but since dried material was lacking, it was impossible to give a formal description of the species.

During a collecting-trip of some Danish mycologists to the island of Langeland in the late autumn of 1984, Thomas Laessöe and Steen Elborne collected a fairly great number of small basidiocarps of Corner's species on *Cladium mariscus* in a marsh, a habitat quite comparable with that of Corner. They sent it to the Rijksherbarium for confirmation, where it came under the present author's attention. It was decided to name the new species after C. Bas, and in accordance with the author's view on the status of the genus *Gloiocephala* (Noordeloos, 1981), it was placed in the genus *Marasmius* section *Gloiocephala*.

Marasmius cornelii is distinguished from the other species in sect. *Gloiocephala* by the rather long, narrow pileo- and caulocystidia (see also the key below). The species of sect. *Gloiocephala* show a strong resemblance with those of sect. *Epiphylli*, from which they mainly differ by having reduced basidiocarps with excentric, lateral, or absent stipe and vein-like or wanting lamellae.

Section **Epiphylli**

2. **Marasmius saccharinus** (Batsch: Fr.) Fr.—Figs. 6–9

Agaricus saccharinus Batsch, Elench. Fung. cont. primo: 93. 1786. — *Agaricus pterigenus β saccharinus* Batsch: Fr., Syst. mycol. 1: 160. 1821. — *Marasmius saccharinus* (Batsch: Fr.) Fr., Epicr.: 386. 1838.

Selected literature.—Orton in Trans. Br. mycol. Soc. 43: 304, fig. 434. 1960.

Pileus 9 mm broad, expanded slightly umbonate, white, pellucidly striate at margin when moist, dull, opaque on drying. Lamellae distant, free, subventricose, rather thick, white with entire, concolorous edge. Stipe up to 9 × 1.5 mm, slightly swollen above base, white above, pale tawny rusty at base, scattered white pruinose under lens, fistulose. Context concolorous with surface, rusty tawny in stipe base. Smell slightly acrid.

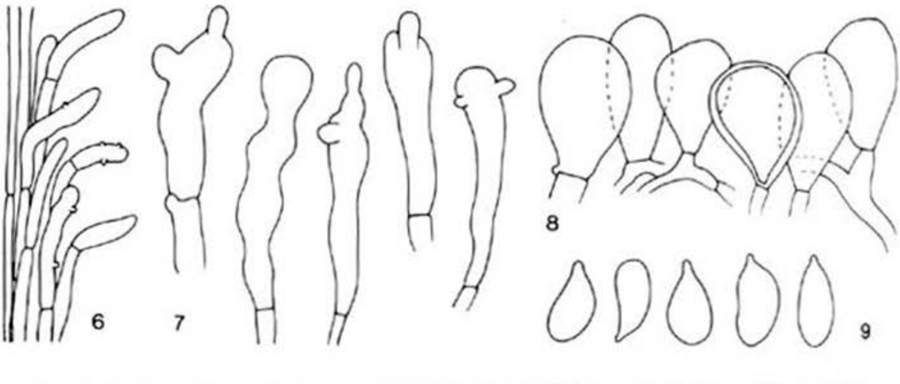
Spores 6.0–7.5 × (3.0–)3.5–4 μm, average 6.5 × 3.5 μm, Q = 1.6–2.0, ellipsoid to somewhat lacrymoid in side view. Basidia 4-spored, clamped. Lamella edge almost sterile. Cheilocystidia 15–35 × 5–10 μm, irregularly clavate with one or more finger- or bladder-like excrescences at the top. Pileipellis a hymeniderm, made up of clavate, vesiculose or semiglobose elements, 10–30 × 7.5–16 μm with colourless, hyaline, sometimes thickened walls. Pileocystidia not found. Stipitispellis a cutis with transitions to a trichoderm with clustered caulocystidia. Caulocystidia 10–50 × 2–10 μm, irregularly coralloid, colourless. Clamp-connections numerous in all tissues.

Chemical reactions.—No part of basidiocarp amyloid nor dextrinoid in Melzer's reagent.

Habitat & distribution.—In forest on *Fagus* leaves. Europe. Very rare.

Collection examined.—UNITED KINGDOM, England, Surrey, Glenrose, Mickleham, 19 Nov. 1954, *P. D. Orton 240* (E).

Marasmius saccharinus has often been cited in literature, but poorly known until recently. Orton (1960) gave a redescription of this taxon, but on account of this description I was unable to place this tiny white *Marasmius* in one of the sections of the genus.



Figs. 6–9. *Marasmius saccharinus*. — 6. Stipitispellis (×500). — 7. Cheilocystidia (×1000). — 8. Pileipellis (×1000). — 9. Spores (×1500). (All figs. from *Orton 240*.)

Therefore the collection was asked on loan for closer study. On account of the white pileus, hymeniform pileipellis with smooth, hyaline elements, insititious stipe, and chemical reactions *Marasmius saccharinus* has to be placed in sect. *Epiphylli* subsect. *Epiphylli*. The small spores and size and shape of cheilocystidia distinguish it from all other species of that section in Europe: *M. epiphyllus* and *M. tremulae*. Macroscopically *M. saccharinus* resembles *M. setosus* (= *M. recubans*), that grows also on leaves of *Fagus*, but that species clearly differs in having long hairs on the stipe and by the larger spores.

The distribution of *M. saccharinus* in Europe is not well known. Besides the recent find in England it was listed by Clémençon (1982), who did not give information on distribution. It will probably be clear in future that *M. saccharinus* is a rare, but overlooked species.

3. **Marasmius setosus** (Sow.) Noordel., *comb. nov.*

Agaricus setosus Sow., Col. Figs. Engl. Fungi 3: 25, pl. 302. 1801 (basionym). — *Mycena setosus* (Sow.) Gillet, Hymenomyc. Fr.: 281. 1876.

Marasmius recubans Quél. in Mém. Soc. Emul. Montbéliard, ser. II, 5: 355. 1873 (Champ. Jura Vosges 2).

Androsaceus eufoliatus Kühner in Bull. trimest. Soc. mycol. Fr. 43: 111. 1927. — *Marasmius eufoliatus* (Kühner) Kühner in Botaniste 25: 94. 1933.

Misapplied name.—*Marasmius saccharinus* (Batsch: Fr.) Fr. sensu Quél. in Mém. Soc. Emul. Montbéliard, sér. II, 5: 224. 1872 (Champ. Jura Vosges 1).

Selected descriptions & illustrations.—J. Lange, Fl. agar. dan. 2, pl. 48E. 1937. — Sowerby, l.c. pl. 302. 1801. — Kühner, in Bull. trimest. Soc. mycol. Fr. 43: 111–112. 1927. — Kühner, in Botaniste 25: 93–94. 1933.

Characteristics.—Fruitbodies small, growing on dead leaves of *Fagus*; pileus purely white, lamellae well developed; stipe with long, hyaline hairs; pileipellis with smooth elements.

While looking for old names for Mycenoid fungi, Dr. Maas Geesteranus, emeritus staff-member of the Rijksherbarium, drew my attention to the plate and description of *Agaricus setosus* Sow. He definitively felt that Sowerby's fungus had to be excluded from the genus *Mycena*, and asked me to give my opinion. Considering the habit with long hyaline hairs on the stipe, and the habitat on leaves of *Fagus sylvatica*, I have no doubt that Sowerby depicted a *Marasmius* that long has been known as *M. recubans* in European literature. Since Sowerby's name is older, it has priority, and the new combination has been made.

KEY TO THE SPECIES OF MARASMIUS SECTIONS GLOIOCEPHALA AND EPIPHYLLI IN EUROPE

1. Pileus white or almost white.
   2. Basidia 2-spored.

      3. Clamp-connections present; stipe excentrical, sometimes lacking; hyphae of pileipellis with gelatinized walls; spores (14.5–)17.5–21.5 × (4.5–)5.5–6.0 μm; on dead leaves of *Carex* in swamps (Persoonia 2: 82. 1961) . . . . *M. caricis*
      3. Clamp-connections absent; stipe excentrical or central: spores 11.0–14.0 × 2.5–4 μm; on dead leaves of *Populus tremula* . . . . *M. tremulae*
   2. Basidia 4-spored.
      4. Stipe central or excentrical: lamellae absent; pileus and stipe with up to 120 μm long, slenderly lageniform cystidia; spores 12.5–18.0 × 3.5–6.5 μm; on stem of *Cladium mariscus* in swamps . . . . *M. cornelii*
      4. Stipe central; lamellae present.
         5. Lamellae well developed.
            6. Spores more than 10 μm long; stipe with up to 1 mm long, hyaline hairs; on dead leaves of *Fagus sylvatica*, rarely on other substrates (*Betula*, *Fraxinus*) . *M. setosus*
            6. Spores 6.0–7.5 μm long; stipe without long hairs; on *Fagus* leaves . *M. saccharinus*
         5. Lamellae poorly developed, usually only ridges or wrinkles at underside of pileus, often forked and/or anastomosing.
            7. Pileipellis with smooth elements; spores 8.5–9.5(–11.0) × 3.5–5.0 μm; on branches, leaves etc. . . . . *M. epiphyllus*
            7. Pileipellis with elements 'en brosse'; spores 11.0–15.5(–18.0) × 2.0–3.5 μm; on dead leaves of *Hedera helix* . . . . *M. epiphylloides*
1. Pileus distinctly coloured, at least at centre.
   8. Pileus pale brown to reddish/ochraceous brown; stipe reduced, almost always excentric or lacking; pileipellis with two types of elements, and with capitate pileocystidia; on leaf-sheats of *Typha* in swamps (Persoonia 2: 78. 1961) . . . . *M. menieri*
   8. Pileus pinkish/ochraceous; stipe almost always central, sometimes slightly excentrical, never lateral or lacking; pileipellis with one type of elements and fusiform to lageniform cheilocystidia; on *Carex* in swamps (Persoonia 11: 373. 1981) . . . . *M. pseudocaricis*

Section **Marasmius**

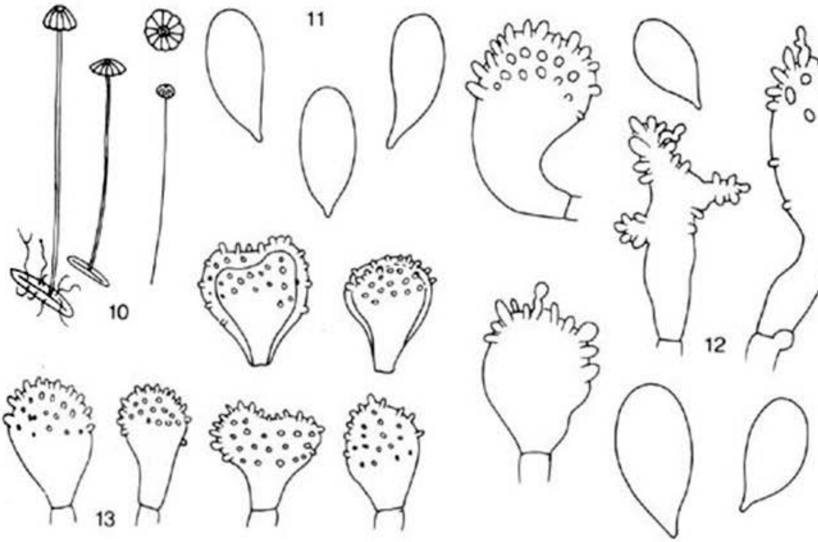
4. **Marasmius bulliardii** Quél. forma **acicola** (Lundell) Noordel., *comb. nov.*—Figs. 10–13

Marasmius rotula forma *acicola* Lundell, Fungi Exs. Suec. 49–50: 39. 1957 (basionym). Holotype.—*S. Lundell*, 3 Oct. 1935, Bondkyrka, E. slope of Åsen towards the river Fyris, Uppsala, Uppland, Sweden (Fungi Exs. Suec. 431, UPS).

Misapplied name.—*Marasmius wettsteinii* Sacc. & Sydow sensu Favre in Ber. schweiz. Bot. Ges. 62: 408–410. 1952; sensu Ryman & Holmåsen, Svampar: 327. 1984.

Pileus 1–6 mm broad, convex or hemispherical, usually umbilicate, sometimes with small papilla within umbilicus, radially grooved to sulcate on back of the lamellae, dark beige or brown (10 YR 6/6–7/4) with slightly to distinctly darker (blackish) brown centre, slightly granulose under lens. Lamellae (L = 12–20, l = 0) with wide, distinct collarium, pale cream almost white (10 YR 8/4) with concolorous or white, entire edge. Stipe 20–60 × 0.2–0.5(–1) mm, filiform, white or pale brown at apex, downwards via dark red-brown to blackish brown (7.5 YR 3/2 to 10 YR 2/1), polished, shining, smooth, with fine longitudinal grooves lengthwise. Smell none.

Spores 6.5–10.0(–11.5) × (2.5–)3.5–5.5(–6.5) μm, average 7.2–8.6 × 4.0–4.5 μm, Q = 1.4–2.2, average Q = 1.7–2.0, ellipsoid to lacrymoid, thin-walled, hyaline, inamyloid. Basidia 24–35 × 6–9 μm, 4-spored, clamped. Lamella edge sterile. Cheilo-



Figs. 10–13. *Marasmius bulliardii* forma *acicola*. — 10. Fruitbodies (×1). — 11. Spores (× 1500). — 12. Cheilocystidia (×1000). — 13. Pileipellis (×1000). (All figs. from *Bendiksen*, 18 Aug. 1986.)

cystidia 15–35 × 5–20 μm, clavate with numerous 1–3 μm long wart-like projections in apical part ('en brosse'). Hymenophoral trama irregular, made up of 2.5–6 μm wide, inflated hyphae. Pileipellis hymeniform, made up of clavate elements, 10–30 × 5–17 μm, with 1–4 μm long brown wart-like projections ('en brosse'). Clamp-connections numerous in all tissues.

Habitat.—On needles of *Picea*, rarely *Pinus* in oligotrophic to mesotrophic coniferous or mixed coniferous-deciduous forest.

Distribution.—Wide spread in boreal and montane/subalpine regions in Europe.

Collections examined.—FINLAND, Tavastia australis, Korpilahti, Rimminjärvi, 18 Aug. 1986, *E. Bendiksen* (L). — GERMAN FEDERAL REPUBLIC, Bayern, Bayerisches Wald, Bodensee, Schwarzbach, 11 Sept. 1978, *C. Bas 7313* (L). — FRANCE, dept. Ain, Hauteville, 19 July 1957, *H. S. C. Huijsman* (L). — SWITZERLAND, kanton Neuchatel, near Couvet, 16 Aug. 1966, *H. S. C. Huijsman* (L); kanton Bern, Emmental, Schüpfheim, 13 Aug. 1955, *H. S. C. Huijsman* (L). — AUSTRIA, Tirol, Paznauntal, Ischgl, 16 July 1960, *R. A. Maas Geesteranus 13161* (L). — CZECHOSLOVAKIA, Slovenia, Low Tatra, Bystrá Dolina, N. of Brezno, 7 Sept. 1960, *C. Bas 2104* (L).

Favre (1952) described a small *Marasmius* from the rotula group growing on *Picea* needles as *M. wettsteinii*. I have seen this taxon in abundance in Scandinavia, and studied in addition some collections from central Europe, and come to the conclusion that Favre's taxon is very similar to *M. bulliardii*. The only differences found are the absence of sterile side-branches on the stipe and the substrate. *Marasmius bulliardii* forma *bulliardii* grows on leaves of deciduous trees, mainly *Fagus*, and has almost always small side-branches bearing a sterile pileus at the end. Consequently I came to the conclusion, like Moser (1983), that *M. wettsteinii* sensu Favre is a synonym of *M. bulliardii*. I prefer, however, to give Favre's taxon the rank of forma. Lundell (1957) considered the same taxon as a form of *Marasmius rotula*.

The identity of *Marasmius wettsteinii* is a bit obscure: it was described by Saccardo & Sydow (1899) to replace *Marasmius tenerrimus* Wettstein (non *M. tenerrimus* Berk. & Curt.). The original diagnosis clearly indicates that Wettstein's taxon belongs to section *Marasmius:*

'Pileus membranaceous, convex or almost hemispherical, 2–4 mm broad, umbilicate, plicate, glabrous, whitish-ochraceous; lamellae few (10–16), broad, distant, united in a collarium, concolorous with pileus; stipe straight, with black rhizomorphs, 16–35 mm long, tough, glabrous, brown-black, apex whitish; spores globose or ellipsoid, 5–7 µm diameter, hyaline, smooth. On cones of *Abies pectinata* in Austria. *M. rotula* and *M. graminis* affinis.'

The small, globose spores make clear that, if Wettstein's observations were right, his fungus is not identical with ours and remains doubtful until it has been rediscovered.

Section **Sicci**

5. **Marasmius siccus** (Schwein.) Fr.—Figs. 14–22

Agaricus siccus Schwein., Schrift. Nat. Forst. Ges. Leipzig 1: 84. 1822. — *Marasmius siccus* (Schwein.) Fr. Epicr.: 382. 1838.

Misapplied name.—*Marasmius borealis* sensu Moser in Windahlia 14: 65. 1984.

Selected literature.—S. Jacobsson & S. Muskos in Jordstjärnan 6(3): 24–26. 1985.

Pileus 5–25 mm broad, campanulate, conical or hemispherical, expanding with age to plano-convex, with slightly truncate, papillate or depressed centre, with deflexed or straight often crenate margin, rather strongly radially sulcate from margin almost up to centre, vividly orange to ochraceous or yellowish ochraceous (centre 5 YR 5/8, rest 7.5 YR 6–7/8, when old more like 7.5 YR–10 YR 8/4–6), minutely pruinose all over (sub lente). Lamellae (L = 10–20, l = 0–1(3)) distant, almost free, thickish, narrowly ventricose, white to cream colour (10 YR 8/6), sometimes with brownish edge, particularly in dried specimens. Stipe 15–70 × 0.2–1 mm, cylindrical, tough, pale yellow at apex, below via red brown to blackish brown at base, smooth, glabrous, shining. Context white in pileus, brown in stipe. Smell none. Taste mild.

Spores 15–23 × 4–5 µm, average 16–18.5 × 4–5 µm, Q = 2.4–5, average Q = 3–5, fusiform, thin-walled. Basidia 20–30 × 5–6 µm, 4-spored, clamped. Lamella edge sterile. Cheilocystidia 8–20 × 3–10 µm, clavate to vesiculose, en brosse with numerous, 3.5–6 µm long, yellow brown excrescences. Hymenial cystidia 25–70 × 5–10 µm, clavate to

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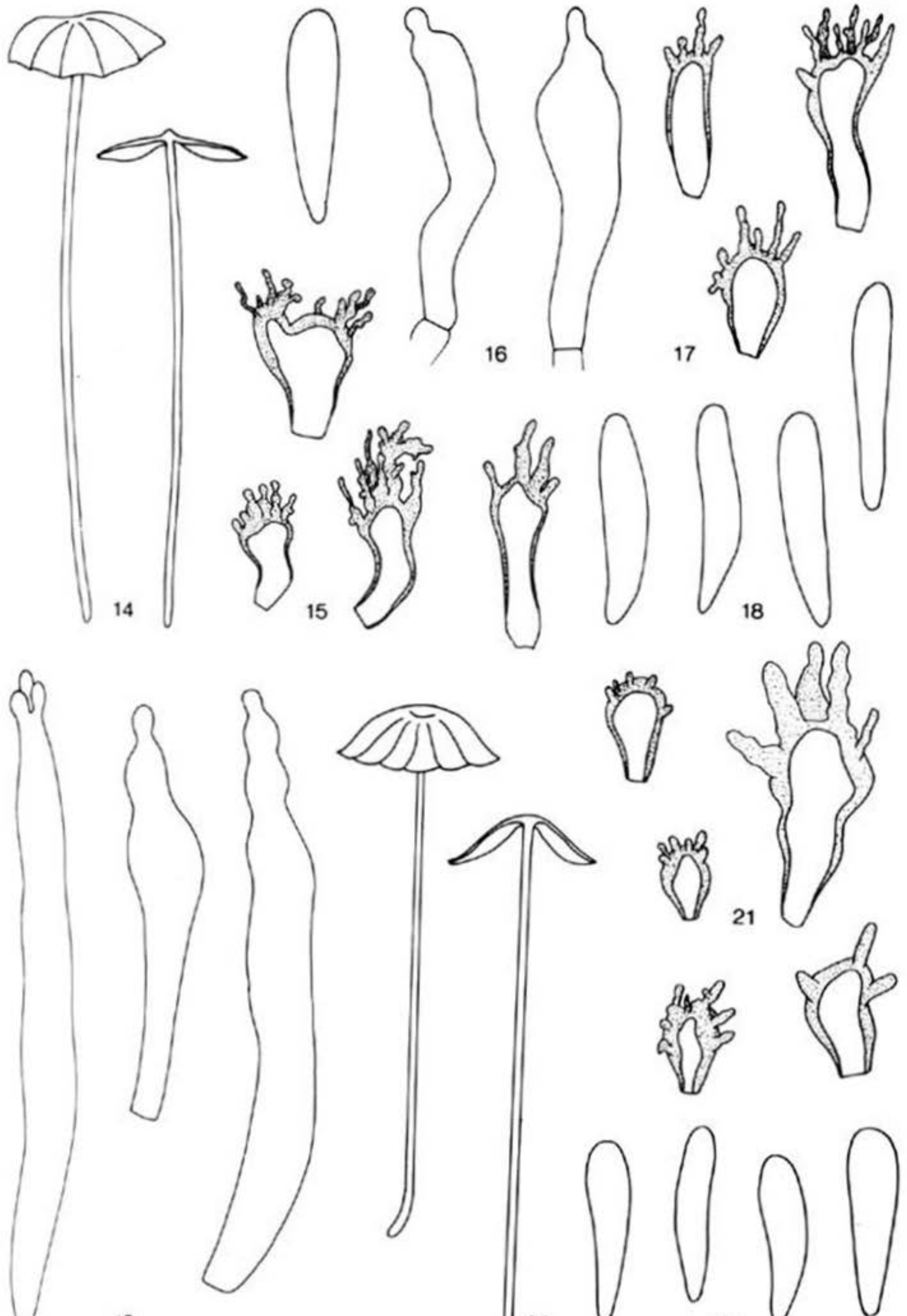
Figs. 14–22. *Marasmius siccus*. — 14. Fruitbodies (× 1). — 15. Elements of pileipellis (× 1000). — 16. Pleurocystidia (× 1000). — 17. Cheilocystidia (× 1000). — 18. Spores (× 1500). — 19. Pleurocystidia (× 1000). — 20. Fruitbodies (× 1). — 21. Cheilocystidia (× 1000). — 22. Spores (× 1500). (14–18 from *Muskos*, 28 Aug. 1985; 19–22 from *Noordeloos 84301*.)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fusiform or lageniform, thin-walled, with yellowish contents, scattered to fairly abundant. Subhymenium branched, made up of 2.5 µm wide hyphae. Pileipellis a hymeniderm, made up of broadly clavate to vesiculose elements 'en brosse' with numerous 2–7 µm long, brown-coloured finger-like excrescences in upper part. Pileocystidia absent. Pileitrama subregular to irregular, made up of 3–10 µm wide, branching, inflated hyphae. Stipitispellis a compact cutis of brown-coloured, cylindrical, 2–7 µm wide hyphae. Caulocystidia absent. Clamp-connections abundant.

Habitat.—Gregarious on litter, sometimes on wood, in mixed boreal and subarctic forest, usually with *Betula*, *Alnus* and *Picea*.

Collections examined.—FINLAND, Oulu district, Oulu, Pirkkarala, Turkansaari, 30 July 1981, *T. Ulvinen* (OULU); Muhos, Poikajoki, Isterinkoski, 8 Aug. 1966, *T. Ulvinen* (OULU), Muhos, Suokylä, 25 Sept. 1971, *E. & M. Ohenoja* (OULU); Muhos Muhosperä, Pekkala, 18 Aug. 1967, *M. Ohenoja* (OULU); Muhos, Muhosperä, Poikajoki, 18 Aug. 1967, *M. Ohenoja* (OULU); Yli-Ii, Yli-Tannila, Kynkäänniemi, Siuruanjoki, 15 July 1974, *T. Ulvinen* (OULU); Kliminki, Huttukylä, Kiiminkijoki, Hevossaari, 21 Apr. 1968, *M. Ohenoja* (OULU); Inari Lapland, Utsjoki, Kevo, Tsharsjoki, 24 Aug. 1961, *L. Harmoinen* (OULU); ditto, 16 Aug. 1965, *T. Ulvinen* (OULU). — NORWAY, Finnmark, Alta, Kåfjord, Sakkobadne, 22 Aug. 1966, *T. Ulvinen* (OULU); Troms, Storfjord, Skibotn, 24 Aug. 1966, *T. Ulvinen* (OULU). — SWEDEN, Medelpad, Borgsjö, S. Sillre, 28 Aug. 1985, *Siw Muskos* (L). — CANADA, Quebec, Gatineau National Park, 11. Sept. 1984, *M. E. Noordeloos 84301* (L).

6. **Marasmius anomalus** Lasch—Fig. 23–27

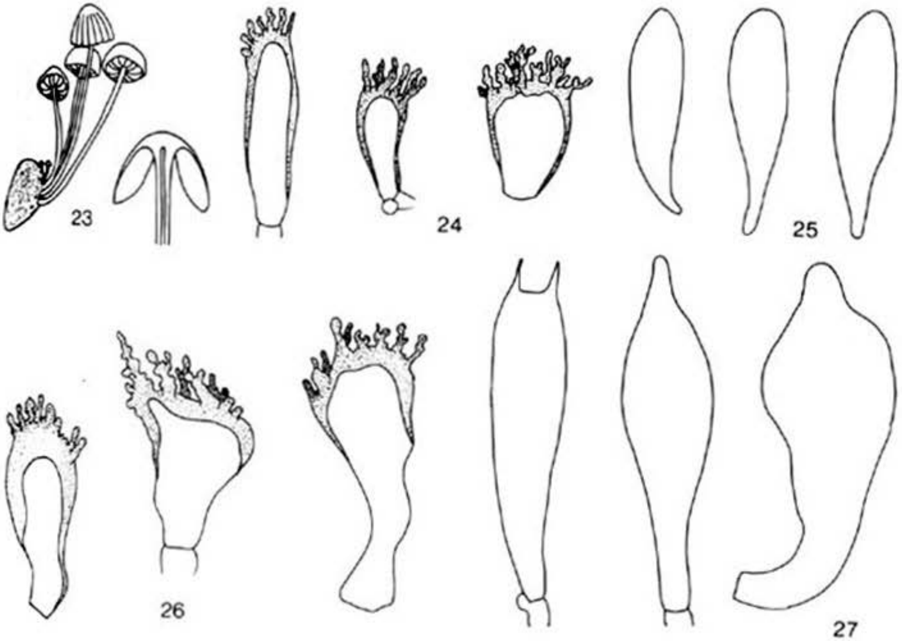
Marasmius anomalus Lasch in Klotzsch Herb. vivum mycol. 1806, pl. 17, fig. 97. 1854; not *Marasmius anomalus* Peck in Rep. N. Y. State Mus. nat. Hist. 24: 72. 1872.

Marasmius littoralis Quél. in Bull. Soc. Amis Sci. nat. Rouen, ser. II, 15: 169, pl. 3, fig. 11. 1880.

Selected descriptions & illustrations.—Battetta in Bull. trimest. Soc. mycol. Fr. 50: 67–71, fig. 1. 1934 (as *M. epodius*); Benkert in Mykol. MittBl. 22(2/3): 50–52. 1978; Kuhner in Botaniste: 101–102. 1933 (as *M. epodius* var. *microsporus*); Pearson in Trans. Br. mycol. Soc. 35: 104–105. 1952 (as *M. littoralis*); Singer in Sydowia 18: 288. 1964.

Pileus 4.5–10(–15) mm broad, broadly hemispherical or conical at first then convex, usually with distinct papilla, finally plano-convex with small papilla; translucently striate and grooved to sulcate on back of lamellae from centre to margin, pale orange, ochraceous or brown with darker centre (7.5 YR 5–6/6–8), pallescent with age (10 YR 8/3), glabrous or subpruinose (lens). Lamellae (L = 10–20, l = 0(1)) equal, rarely 1 or 2 lamellulae per fruitbody, distant, free or narrowly adnexed, broadly ventricose, usually extending under pileus, pale cream to pale brown with distinctly darker brown, granulose edge. Stipe 15–30 × 0.2–0.5(–1.0) mm, filiform, cylindrical, tough, at apex pale cream to lemon yellow, then passing through yellow or orange to red-brown or blackish brown towards base (base 5 YR 3/2), glabrous, shining, finely grooved lengthwise, attached to substrate with red-brown, hairy disc. Context thin, concolorous with surface in cortex of pileus and stipe, pallid in inner part of pileus. Smell none. Taste mild. Spore print white.

Spores 12.0–19.5(–22.0) × 4.0–6.5(–7.0) µm, average 15–17.5 × 4.9–5.4 µm, Q = 2.7–4.0, average Q = 2.9–3.5, ellipsoid to fusiform with long apiculus, thin-walled, colourless, hyaline, inamyloid. Basidia 25–36 × 8.5–10 µm, 4-spored, clavate. Lamella edge sterile. Cheilocystidia 15–30 × 5–10 µm, clavate to broadly clavate or obpyriform,



Figs. 23–27. *Marasmius anomalus*. — 23. Fruitbodies (×1, section ×2). — 24. Cheilocystidia (×1000). — 25. Spores (×1500). — 26. Elements of pileipellis (×1000). — 27. Pleurocystidia (×1000). (All figs. from *Bas 4025*.)

with numerous warts and finger-like protuberances at apex, with brown, often thickened wall, especially in upper part, warts massif, brown. Pleurocystidia 40–60 × 12–14 μm, fusiform to clavate, often constricted or moliniform at apex, with colourless, granular content, rare to frequent. Subhymenium ramose, made up of 2.5–5 μm wide hyphae. Hymenophoral trama subregular, made up of inflated, often anastomosing or branched hyphae, 3–12 μm wide. Pileipellis a hymeniderm, made up of broomcells, 6–15 × 5–10 μm, with thin or thickened, brown walls and warts. Pileitrama compact in upper layer, made up of rather thick-walled, brownish hyphae, 2–8 μm wide, in lower part irregular, made up of inflated, hyaline, colourless, 3–10 μm wide hyphae. Stipitispellis a cutis of narrow, brown, thick-walled hyphae, 3–6 μm wide, at apex with some patent 5–10 μm wide, hyaline, colourless terminal elements. Stipitistrama regular, made up of cylindrical to slightly inflated hyphae, 5–12 μm wide. Clamp-connections abundant in most tissues, but rare in stipitistrama.

Chemical reactions.—Walls of hyphae in stipe strongly dextrinoid and metachromatic. All other parts inamyloid, not metachromatic.

Habitat.—On grass and grass debris, sometimes also on roots, frequently found on rabbit dung, in rather dry, open vegetations like dune-grasslands, xerophytic grasslands, sometimes in rather saline habitats, often gregarious, sometimes caespitose.

Distribution.—Europe. Fairly common in the coastal dune area in the Netherlands. July–November.

Collections examined.—THE NETHERLANDS, prov. Friesland, Isl. Schiermonnikoog, Nov. 1975, *E. J. M. Arnolds* (L); prov. Noord-Holland, Isl. of Texel, Hoorn, 27 Oct. 1968, *P. B. Jansen* (L); Amsterdam, 15 Sept. 1951, *W. J. Reynders* (L); Castricum, 10 Nov. 1954, *G. D. Swanenburg de Veye* (L); ditto, 6 Oct. 1967, anon. (L); Santpoort, 9 Nov. 1963, *C. Bas 4025* (L); Bloemendaal, 30 Sept. 1967, *C. de Boer* (L); Vogelenzang, 20 Oct. 1973, *C. Bas 6220* (L) & 24 Oct. 1967, *J. Daams* (L); prov. Zuid-Holland; Wassenaar, Meyendel, 8 & 28 Oct. 1954, *Fehr de Wal* (L); ditto, 2 Nov. 1957, *C. Bas 1356* (L); Isl. of Voorne, Oostvoorne, 20 Oct. 1963, *P. B. Jansen*; ditto, 31 Oct. 1967, *F. Benjaminsen*; ditto, 20 Oct. 1968, *E. J. M. Arnolds*; Isl. of Goeree, 13 Oct. 1973, *C. Bas* (L); prov. Zeeland, Isl. of Schouwen, 22 Oct. 1966, *C. Bas 4840* (L); Isl. of Noord-Beveland, Onrustpolder, 15 Sept. 1958, *W. G. Beeftink*; Isl. of Walcheren, Vrouwenpolder, 18 Aug. 1963, *P. B. Jansen* (L). — GERMAN FEDERAL REPUBLIC, Klotzsch Herb. viv. mycol. 1806 (Isotype of *M. anomalus*). — GERMAN DEMOCRATIC REPUBLIC, Fährinsel, 9 Nov. 1973, *J. J. Barkman 9716* (WBS).

Marasmius anomalus belongs to a group of rather closely related species that are widely distributed in boreal and temperate regions of Europe and North America. Gilliam (1975) described a number of new species in this group, mainly based on microscopical differences, such as thick- or thin-walled elements in pileipellis and presence or absence of coloured pleurocystidia. In Europe at least two species are known, viz. *M. siccus* and *M. anomalus*, that are very closely related, and distinguished mainly on habit and habitat characters: *Marasmius anomalus* is the smallest of the two with well developed lamellae, growing on grasses, and *M. siccus* is usually more luxurious, has less broad, sometimes slightly reduced lamellae, and grows on forest litter. Some more species appear in the European literature, viz. *Marasmius epodius* Bres., *M. littoralis* Quél., and *M. ventallonii* Sing. The latter seems to be well characterized by the green tinges in the stipe and habitat on needles of *Pinus pinaster* in Mediterranean areas. *Marasmius littoralis* is usually considered as a synonym of *M. anomalus*, but the original diagnosis of Quélet is somewhat aberrant, since it describes a fungus with a pale, almost white pileus and red-brown stipe, growing on sticks. Without Quélet's notice of large spores (15–20 µm), it could easily have been *Marasmius epiphyllus*. *Marasmius epodius* Bres. remains somewhat doubtful. Jacobsson (1985) studied some original collections of Bresadola's a species in the Stockholm herbarium, and reports spores 14–20 × 3–4 µm, and pleurocystidia similar to those of *M. siccus*.

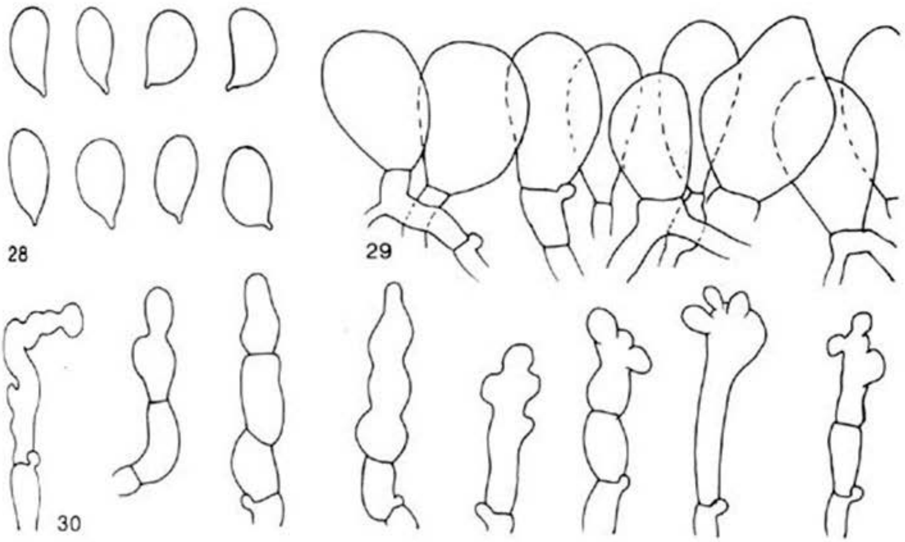
Section **Globularini**

7. **Marasmius suaveolens** (Rea) Rea.—Figs. 28–30

Marasmius argyropus var. *suaveolens* Rea in A. L. Smith & Rea in Trans Br. mycol. Soc. 2: 129. 1906. — *Marasmius suaveolens* (Rea) Rea, Brit. Basidiom. 523. 1922.

Pileus 45–60 mm broad, convex then applanate or depressed, flesh colour becoming paler on drying, striate at margin. Lamellae crowded, adnexed, separating, 6–8 mm broad, ventricose, pallid then fuscous. Stipe 60–70 × 2–3 mm, cylindrical, twisted, reddish, paler at apex, covered with a white tomentose pruina. Context tough. Smell pleasant, like that of *Marasmius oreades*.

Spores 6.5–7.5(–8.5) × 3.5–6.0 µm, average 7 × 4 µm, Q = 1.4–1.7, ellipsoid to pip-shaped, colourless, inamyloid. Basidia 4-spored with clamp. Lamella edge hetero-



Figs. 28–30. *Marasmius suaveolens*. — 28. Spores (× 1500). — 29. Pileipellis (× 1000). — 30. Cheilocystidia (× 1000). (All figs. from holotype.)

geneous. Cheilocystidia 22–35 × 10–15 µm, irregularly cylindrical to coralloid, scattered among basidia. Pileipellis hymeniform, made up of globose, thin-walled elements, 35–50 × 10–30 µm. Stipitispellis a trichoderm, made up of cylindrical, colourless hairs. Clamp-connections abundant in all tissues.

Chemical reactions.—No part of basidiocarp amyloid of dextrinoid in Melzer's reagens; stipitistrama metachromatical in cresyl-blue.

Habitat.—On leaves of *Fagus* in deciduous forest.

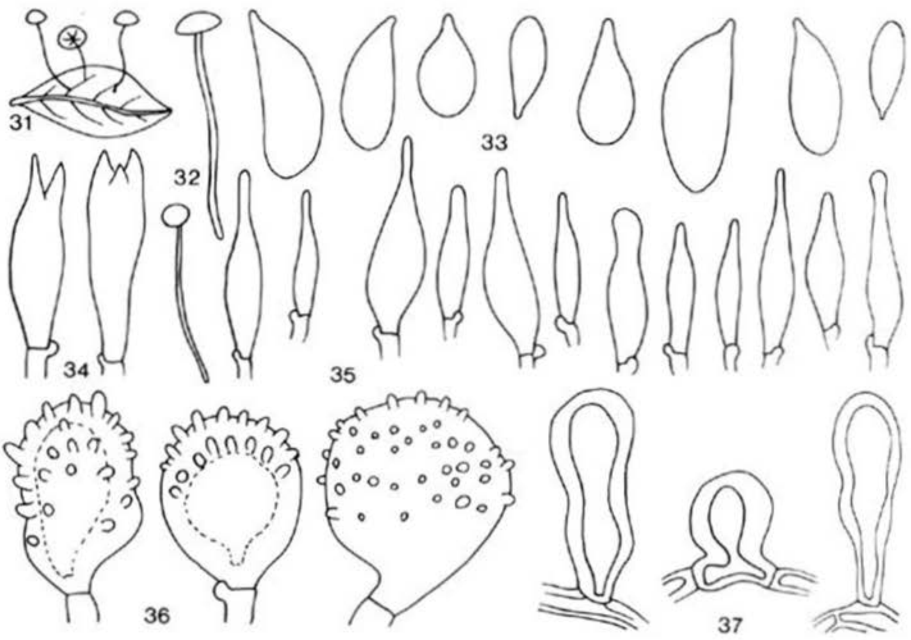
Collection examined.—UNITED KINGDOM, England, Hantshire, Swarraton, Grange Park, 30 Oct. 1904, *C. Rea* (holotype, K).

Rea (l.c.) described the spores as 'globose, 3–4 µm across', but I found larger, ellipsoid spores in the holotype. On account of this, all other microscopical characters, and the type-plate at Kew, I am convinced that *Marasmius suaveolens* is a later synonym of the well-known and wide-spread *M. wynnei* Berk. & Br. (= *M. globularis* (Quél.) Kühn. & Romagn.

Section **Hygrometrici**

8. **Marasmius buxi** Fr.—Figs. 31–37

Marasmius buxi Fr. in Quél. in Mém. Soc. Emul. Montbéliard, sér. II, 5: 224. 1872 (Champ. Jura Vosges I). — *Androsaceus buxi* (Fr. in Quél.) Pat., Essai taxon.: 141. 1900.



Figs. 31–37. *Marasmius buxi*. — 31. Fruitbodies (× 1). — 32. Fruitbodies (× 2). — 33. Spores (× 1500). — 34. Basidia (× 1000). — 35. Cheilocystidia (× 1000). — 36. Elements of pileipellis (× 1000). — 37. Caulocystidia (× 1000). (All figs. from *Noordeloos 84337*.)

Selected descriptions & illustrations.—Favre in Schweiz. Z. Pilzk. 11: 7–9. fig. 1. 1933; Malençon & Bertault, Fl. Champ. sup. Maroc 2: 352–354. fig. 73. 1975.

Pileus 0.5–4 mm broad, convex with straight margin, not hygrophanous, not translucently striate, dark red brown at centre (7.5 YR 4/4), almost white at margin, minutely pruinose or rugulose under lens. Lamellae (L = 3–7, l = 0–1) distant, adnate to adnexed, well developed, sometimes anastomosing, white with entire, concolorous edge. Stipe 2–15(–20) × 0.1–0.2 mm, filiform, white at apex, rest blackish brown, finely hairy at first, glabrescent, finally polished. Smell none, even when crushed. Taste mild.

Spores 7.0–12.5(–13.0) × 3.5–4.0(–4.5) μm (incl. apiculus), average 9.5 × 4.0 μm, Q = 1.8–3, average Q = 2.2, narrowly ellipsoid to almost cylindrical with long apiculus, thin-walled, colourless. Basidia 20–30 × 6–9 μm, 2- and 4-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 10–35 × 3–10 μm, lageniform, rarely more or less tibiiform, fairly abundant but mixed with basidia. Pleurocystidia none. Hymenophoral trama subregular to irregular, made up of 2–15 μm wide, cylindrical hyphae. Pileipellis a hymeniderm, made up of clavate to globose broom-cells, 10–35 × 5–25 μm with thin, colourless and thick, brown walls and brown warts. Pileocystidia scattered, and usually only present near margin of pileus, similar to cheilocystidia. Pileitrama similar to hymenophoral trama. Clamp-connections abundant.

Habitat.—On dead leaves of *Buxus sempervirens* (also recorded from *B. balearica* in Maroc) (Malençon & Bertault, l.c.).

Distribution.—Wide-spread but apparently very rare in the natural distribution-area of its host in middle and southern Europe. The northernmost limit of *Buxus* reaches southern Belgium. *Marasmius buxi* has never been found on cultivated *Buxus* north of this limit.

Collection examined.—BELGIUM, prov. Namur, Nismes, 30 Sept. 1984, *M. E. Noordeloos 84377.*

Marasmius buxi is a nice little *Marasmius*, that can easily be recognized with its reddish pileus and habitat on *Buxus* leaves. Although I have been looking for this mushroom during the last 15 years, I never succeeded in collecting it on cultivated *Buxus* in the Netherlands. The locality in Belgium mentioned above probably is the northernmost place where natural *Buxus* occurs. During the forays of the Netherlands' Mycological Society in 1984 and 1986 *Marasmius buxi* was found in abundancy on dead leaves that still were on the *Buxus* bushes.

Our collection agrees well with the description of Favre (l.c.), except for the well-developed lamellae. Favre described a form with more reduced, vein-like lamellae or even a smooth hymenium.

9. **Marasmius hudsonii** (Pers.: Fr.) Fr.—Figs. 38–43

Agaricus hudsonii Pers. — *Agaricus hudsonii* Pers.: Fr., Syst. mycol. 1: 139. 1821. — *Marasmius hudsonii* (Pers.: Fr.) Fr., Epicr.; 386. 1838. — *Androsaceus hudsonii* (Pers.: Fr.) Pat., Essai Taxon.: 141. 1900.

Agaricus pilosus Huds., Flora anglica 2: 622. 1778. — *Marasmius pilosus* (Huds.) Quél., Fl. mycol. Fr.: 314. 1888.

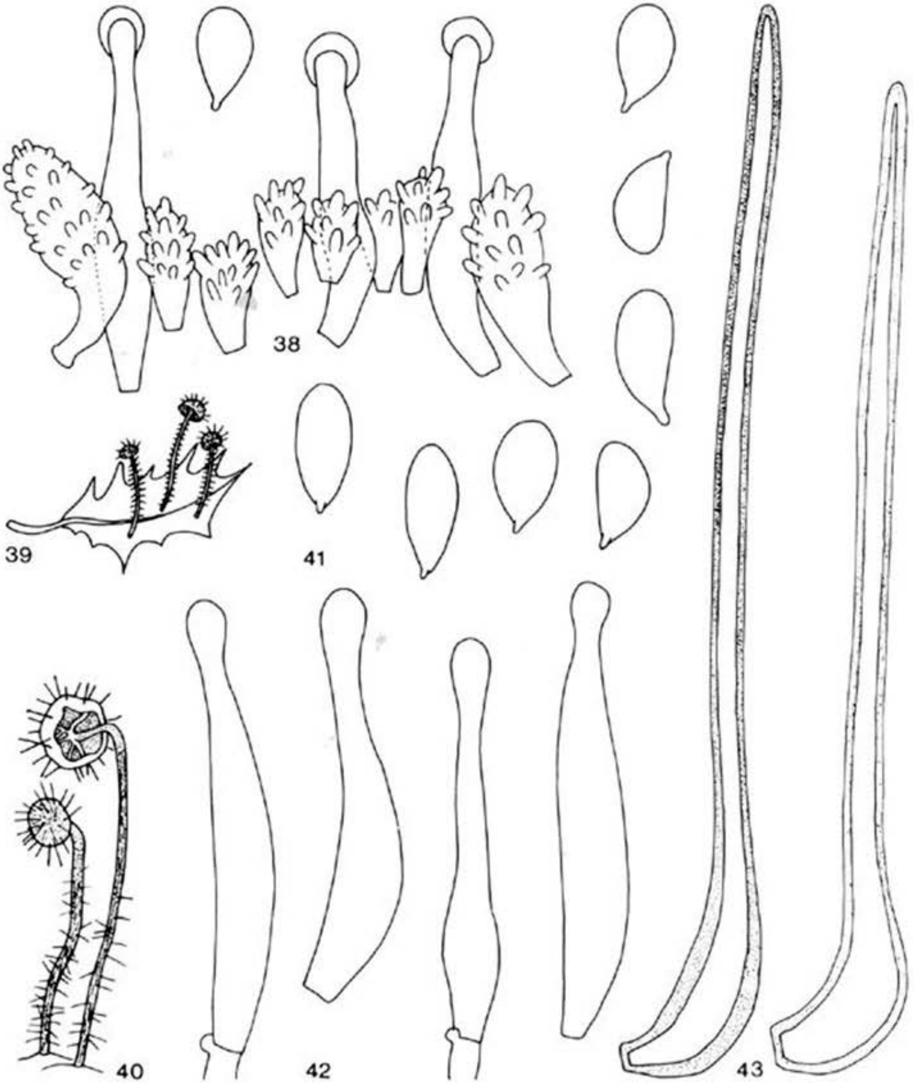
Selected descriptions & illustrations.—Cooke, Ill. Brit. Fungi, pl. 1086 (1135). 1884. — Flora Batava, pl. 2228. 1934. — Kühn. & Romagn., Fl. anal. Champ. sup.: 83, fig. 139. 1953.

Pileus 1–6 mm broad, convex, with involute or deflexed margin, sometimes weakly translucent-striate, membranaceous, white then flesh coloured, densely hairy to strigose with up to 1 mm long, brown-purple hairs. Lamellae distant, venose, not well-developed, often anastomosing and/or forked, absent in small specimens, white, with entire, concolorous edge. Stipe 115–45 × 0.1–0.5 mm, filiform, white at first then red-brown from base upwards, apex remaining white, finely pruinose all over, lower part with long, setose, red-brown hairs like those on pileus. Context very thin, concolorous with surface. Smell and taste inconspicuous.

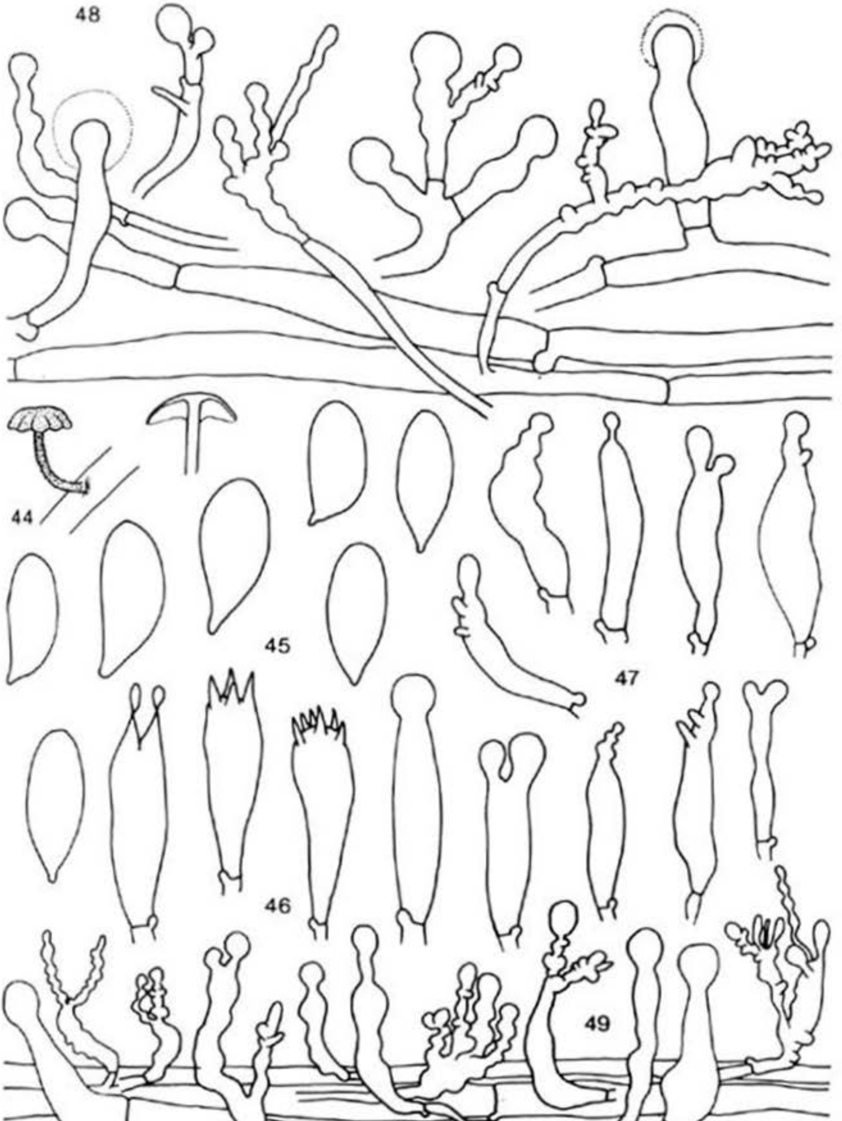
Spores 7.5–13.0 × 5.0–6.5 μm, average 9.7 × 5.7 μm, Q = 1.35–2.0, average Q 1.75, broadly to narrowly ellipsoid, sometimes pip-shaped, thin-walled, colourless. Basidia 22–30 × 5–9 μm, 4-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 30–50 × 5–12 μm, lageniform to slenderly tibiiform, thin-walled, colourless, sometimes with hyaline slime-cap on top, scattered among basidia. Pileipellis hymeniform, made up of globose to clavate broom-cells, 12–30 × 5–12 μm with 0.5–2 μm long finger-like excrescences. Pileocystidia 20–50 × 4–14 μm, lageniform to slenderly tibiiform, more or less similar to cheilocystidia, fairly abundant. Hairs on pileus and stipe 150–750 × 5–20 (base) × 2–6 μm (apex), setiform with thick, red-brown walls. Clamp-connections abundant.

Habitat.—On dead leaves of *Ilex aquifolium* in deciduous forest.

Distribution.—Wide-spread, extremely rare in the Netherlands, seemingly common in England.



Figs. 38–43. *Marasmius hudsonii*. — 38. Pileipellis (× 1000). — 39. Fruitbodies (× 1). — 40. Fruitbodies (× 2.5). — 41. Spores (× 1500). — 42. Cheilocystidia (× 1000). — 43. Setae from stipe (× 500). (39, 40 after Flora Batava, pl. 2228; all other figs. from *Clark*, 29 Oct. 1975.)



Figs. 44–49. *Marasmiellus ornatissimus*. — 44. Fruitbodies (× 2). — 45. Spores (× 1500). — 46. Basidia (× 1000). — 47. Cheilocystidia (× 1000). — 48. Pileipellis (× 1000). — 49. Stipitispellis (× 1000). (All figs. from holotype.)

Collection examined.—UNITED KINGDOM, England, Devonshire, Slapton near Nature reserve, 29 Oct. 1975, *M. C. Clark* (K).

Marasmius hudsonii has been recorded once from the Netherlands by Lütjeharms (Warmond, 8 Nov. 1930, on dead leaves of *Ilex aquifolium*) and depicted in the Flora Batava, pl. 2228. No material is left of this collection. Since then it has been impossible to detect this little *Marasmius* again. While studying the collections at Kew I came across a fairly large number of records of *Marasmius hudsonii* from England where it occurs frequently.

II. MARASMIELLUS

10. **Marasmiellus ornatissimus** Noordel. & Barkman, *spec. nov.*—Figs. 44–49

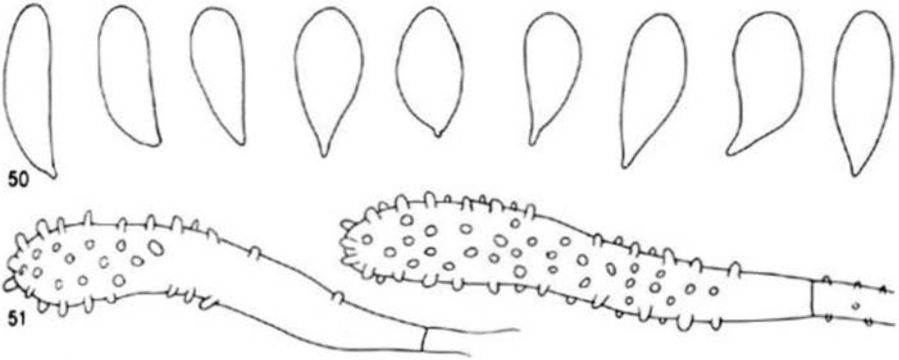
Basidiomata parva. Pileus 2–3 mm latus, campanulatus demum convexus, radialiter plicatus, haud hygrophanus nec translucido striatus, albus centro brunneolus, toto pruinosus. Lamellae distantes, adnato decurrentes, roseae. Stipes 2–5 × 0.3 mm, cylindraceus, curvatus, cremeus, basim brunneus, toto albo pruinosus, basim strigosus. Odor nulla. Sporae 11–13 × 4.5–6.5 µm, ellipsoidae vel lacrimoidae, tenuiparietales, inamyloidae. Basidia 27–40 × 9–12.5 µm, 4- raro 2- vel 6-sporigera. Acie lamellarum sterilis. Cheilocystidia 25–50 × 5–11 µm, versiformia, coralloideae vel cylindraceo-capitata. Pileipellis cutis elementis inflatis cellulis terminalibus coralloideis vel capitatis. Stipitispellis similis. Fiblae presentes. Habitat ad lignum Callunae. Holotypus: *J. J. Barkman 10500*, 25 Oct. 1984, 'Dalerpeel, prov. Drenthe, The Netherlands' (WBS; isotypus in L).

Basidiocarps small, dwarfish. Pileus 2–3 mm broad, campanulate then convex, sometimes slightly umbilicate, radially plicate, not hygrophanous, not translucent-striate, white at centre sometimes tinged brown, dull, entirely pruinose. Lamellae (L = 7–12, l = 1–3) distant, adnate-decurrent, sometimes loosening from stipe forming a pseudocollarium, segmentiform, pale pink. Stipe 2–5 × 0.3 mm, cylindrical, curved, cream coloured more brown at base, entirely white pruinose, white strigose at base with white radiating hairs. Context concolorous with surface. Smell none. Taste not known.

Spores 11–13 × 4.5–6.5 µm, average 11.7 × 5.5 µm, Q = 2–2.4, average Q = 2.1, ellipsoid to lacrymoid, thin-walled, colourless, inamyloid. Basidia 27–40 × 9–12.5 µm, 4-, rarely 2-spored, clavate, clamped. Lamella edge sterile. Cheilocystidia 25–50 × 5–11 µm, versiform from cylindrical capitate to irregularly coralloid with finger-like excrescences or one or more bladder-like heads at apex. Pleurocystidia absent. Hymenophoral trama regular, made up of inflated hyphae, elements 30–90 × 8–20(–25) µm, intermixed with 4–10 µm wide cylindrical hyphae. Pileipellis a cutis of 4–12(–18) µm wide, inflated hyphae with coralloid to diverticulate endings, mixed with pileocystidioid capitate elements, 2–10 µm wide. Pileitrama regular, made up of inflated hyphae, similar to hymenophoral trama. Stipitispellis a cutis with numerous cylindrical and capitate or coralloid to diverticulate caulocystidia, 20–45 × 2–8 µm. Clamp-connections abundant in all tissues.

Habitat & distribution.—On branchlets of *Calluna vulgaris* in open *Betula* forest on dry, peaty soil. Only known from the type locality.

Collection examined.—THE NETHERLANDS, prov. Drenthe, Dalerpeel, 25 Oct. 1984, *J. J. Barkman 10500* (holotype, WBS; isotype, L).



Figs. 50, 51. *Marasmius pruinatus*. — 50. Spores (×1500). — 51. Hyphae of pileipellis (×1000).

Marasmiellus ornatissimus keys out in sect. *Tricolores* Sing. on account of the distinctly coralloid to diverticulate hyphae of the pileipellis ('ramealis-structure'), and the large spores (Singer, 1973). In this section only a few species are known from Europe. *Marasmiellus tricolor* comes very close, especially with regard to the pink lamellae, but the microscopical characters, e.g. the structure of the covering layers, are completely different, as is the habitat. *Marasmius pruinatus* Rea shows superficial resemblance with its pruinose, white basidiocarps, but that species differs in a number of characters (see type-study below). The tropical members of sect. *Tricolores*, viz. *M. caesioater*, *M. berkeleyi*, and *M. cubensis*, all differ in a considerable number of characters such as colour of pileus and stipe, structure of pileipellis, size and shape of spores.

11. **Marasmius pruinatus** Rea—Figs. 50–51

Marasmius pruinatus Rea in Trans. Br. mycol. Soc. 5: 435, pl. 8. 1916.

Pileus 5–10 mm broad, obtusely convex or obsoletely papillate with thin, encurved margin, white becoming tinged with yellow, fleshy horny, pruinose. Lamellae decurrent, subdistant, very narrow, 1 mm broad, shining, white. Stipe 15–30 × 1–2 mm, equal, rigid, white, pruinose base white villose.

Spores 9.0–11.5 × 3.5–5.5 μm, average 10.4 × 4.9 μm, Q = 2.0–2.4, average Q = 2.2, ellipsoid, slightly broader at apex. No intact basidia nor cystidia seen. Pileipellis a cutis with transitions to a trichoderm, made up of radially arranged cylindrical hyphae with strongly developed ramealis structure. Clamp-connections not seen with certainty.

Chemical reactions.—No part of basidiocarps amyloid or dextrinoid in Melzer's reagent.

Collections examined.—UNITED KINGDOM, England, Somerset, West Prolock, 14 Oct. 1916, *G. Hadden* (holotype, K).

According to Orton (1960) and Singer (1973) *Marasmius pruinatus* is a synonym of *Marasmiellus tricolor* (Alb. & Schwein.: Fr.) Sing. My observations on the holotype of

Marasmius pruinatus show slightly different spores. Furthermore the basidiocarps of *M. pruinatus* are entirely white, whereas those of *M. tricolor* have a dark coloured stipe and pinkish lamellae. For those reasons I do not believe that *Marasmius pruinatus* Rea is a synonym of *M. tricolor* but a species in its own right, that should be placed, however, in the genus *Marasmiellus*. Because of the base state of the holotype, however, *M. pruinatus* is considered a nomen dubium.

12. **Marasmiellus tricolor** (Alb. & Schwein.: Fr.) Sing.—Figs. 52–57

Agaricus tricolor Alb. & Schwein., Conspect. fung.: 228. 1805. — *Agaricus tricolor* Alb. & Schwein.: Fr., Syst. mycol. 1: 166. 1821. — ***Marasmius tricolor*** (Alb. & Schwein.: Fr.) Kühn. in Botaniste: 25: 89. 1933. — ***Marasmiellus tricolor*** (Alb. & Schwein.: Fr.) Sing. in Pap. Mich. Acad. Sci. 32: 128. 1948.

Agaricus languidus Lasch in Linnaea 3: 385. 1828. — *Agaricus languidus* (Lasch) Fr., Epicr.: 379. 1838. — ***Marasmiellus languidus*** (Lasch) Sing. in Lilloa 22: 300. 1951.

Excluded: ***Marasmius languidus*** sensu Kühn. & Romagn., Fl. anal. Champ. sup.: 86. 1953 (= *M. vaillantii*).

Selected description & illustration.—Kühner in Botaniste 25: 89. 1933.

Pileus 2–11 mm broad, convex, usually with small, conical papilla, expanding with age to plano-convex or applanate, with enrolled margin, not hygrophanous, not translucent-striate, white or cream-coloured, minutely pruinose under lens, later sometimes more or less tomentose. Lamellae (L = 10–17, l = 0–2) distant, broadly adnate to deeply decurrent, triangular, or arcuate, white or cream-coloured, often turning flesh-pink with age or when dried, with entire, concolorous edge. Stipe 8–20 × 0.5–1.0 mm, cylindrical, sometimes broadened towards base or apex, sometimes tapering towards base, white to cream at apex, brown to black towards base, pruinose to tomentose all over. Context thin, concolorous with surface. Smell and taste inconspicuous.

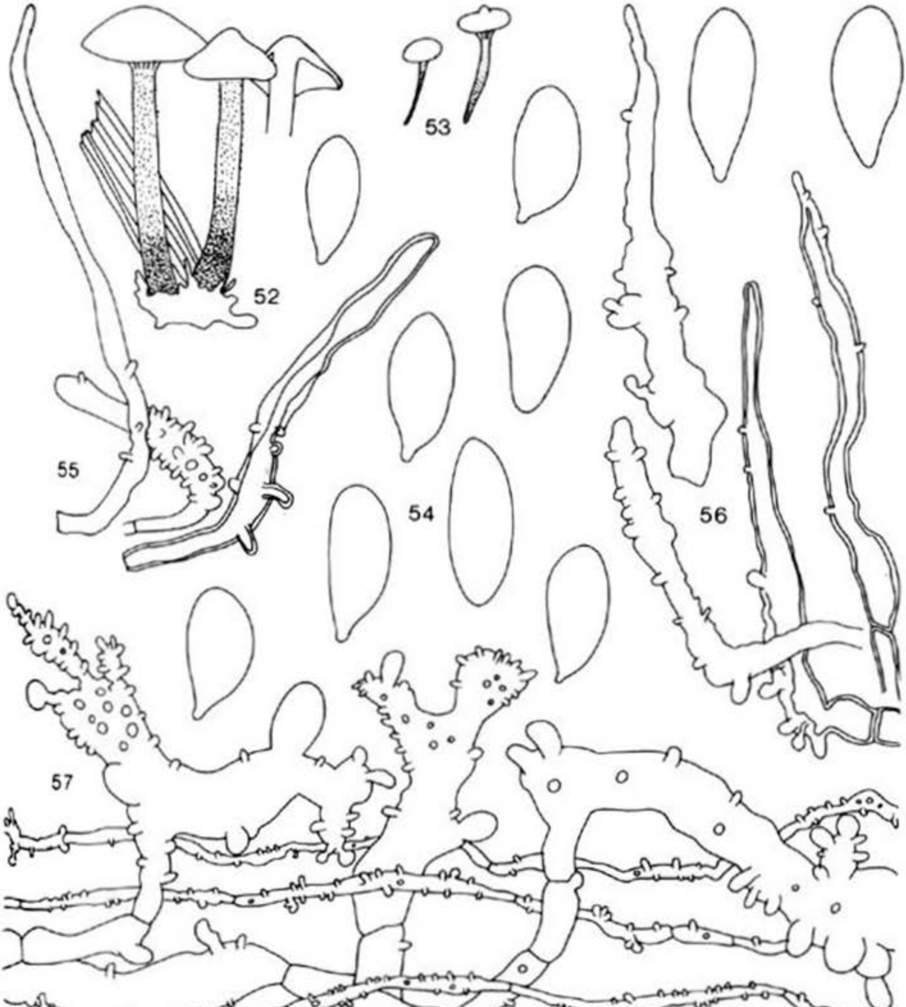
Spores (8.5–)9.0–13.5 × 3.5–6.0(–6.5) μm, average 10.0–11.2 × 5.0–5.6 μm, Q = 1.5–2.5, average Q 1.8–2.2, ellipsoid to narrowly ellipsoid, or pip-shaped, thin-walled, colourless. Basidia 25–40 × 8–11 μm, 4- and 2-spored, clamped. Lamella edge fertile or heterogeneous. Cheilocystidia absent or present, then very sparse, cylindrical to sublageniform, 20–35 × 4–10 μm. Pileipellis a cutis of inflated hyphae, 2–15 μm wide with strongly developed ramealis-structure, viz. ascending, inflated terminal elements with numerous finger- and bladder-like excrescences, with pale yellow not encrusted walls. Caulocystidia numerous along whole length of stipe, about 40–120 × 4–15 μm with ramealis-structure. Clamp-connections abundant in all tissues.

Habitat.—On roots of grass and grass-debris in grasslands of grassy spots.

Distribution.—Rare and wide-spread in Europe. Summer–Autumn.

Collections examined.—NORWAY, Vestfold, Nøtterøy, Teie, Rosanes, 6 Aug. 1985, *A. Aronsen 6/85* (L). — THE NETHERLANDS, prov. Gelderland, Groesbeek, 1 June 1937, *A. C. S. Schweers* (L); Hatert, Hatertse Vennen, 29 July 1972, *G. A. de Vries* (L); prov. Zuid-Holland, Alphen aan de Rijn, Zegerplas, 31 July 1985, *C. Uljé* (L).

Figs. 52–57. *Marasmiellus tricolor*. — 52. Fruitbodies (×5). — 53. Fruitbodies (×1). — 54. Spores (×1500). — 55, 56. Caulocystidia (×100). — 57. Pileipellis (×1000). (52, 55 from *de Vries*, 29 July 1972, all other figs. from *Aronsen 6/85*.)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Marasmiellus tricolor is a very rare, and probably also overlooked species. The only 'modern' description of European material is that of Kühner (1933), and since I recently got two well-preserved and annotated collections from Norway and the Netherlands, I decided to give a full description and illustration of this species. A character that always has been considered important, viz. the pink lamellae, is not always very clear. Cheilocystidia are usually absent, rarely present, but then very sparse. This is a good character, together with the size and shape of the spores, and the growth on grasses, to distinguish *Marasmiellus tricolor* from *M. trabutii* and *M. candidus*. *Marasmiellus ornatissimus* comes also close, but grows on *Calluna*, has well-developed cheilocystidia and different structure of the covering layers of pileus and stipe.

13. **Marasmiellus rosellus** (J. Lange → Mos.) Kuyper & Noordel.—Figs. 58–61

Omphalia rosella J. Lange in Dansk bot. Ark. 6: 14. 1930. — ***Clitocybe rosella*** J. Lange → Moser in Sydowia 4: 100. 1950. — ***Omphalina rosella*** (J. Lange → Mos.) Moser, Blätter- und Bauchpilze, 1. Aufl.: 58. 1953. — ***Marasmiellus rosellus*** (J. Lange → Mos.) Kuyper & Noordeloos in Proc. Int. Symp. Tricholomataceae, Borgo Taro: 100. 1986.

Mycena carnicolor P. D. Orton in Trans. Br. mycol. Soc. 43: 178. 1960.

Selected description & illustration.—Malençon & Bertault, Fl. Champ. sup. Maroc 2: 207–209, fig. 35. 1975.

Characteristics.—Pileus about 10 mm broad, plano-convex, umbilicate, shortly translucently striate or not, pink or pinkish lilacinous, somewhat tomentose. Lamellae arcuate-decurrent, pinkish like pileus. Stipe 10–30 × 1–2 mm, cylindrical, white or with pink tinge. Spores 8–11 × 4–6 µm, ellipsoid or lacrymoid, thin-walled, colourless, inamyloid. Basidia 2- and 4-spored, clamped. Cheilocystidia present, lageniform, 30–50 × 4–10 µm. Pileipellis a cutis with transitions to a trichoderm, of repent and ascending hyphae with modified terminal elements (pileocystidia), 30–70 × 5–15(–20) µm, somewhat lageniform or clavate. Pigment membranal and encrusting in pileipellis and upper pileitrama. Clamp-connections abundant.

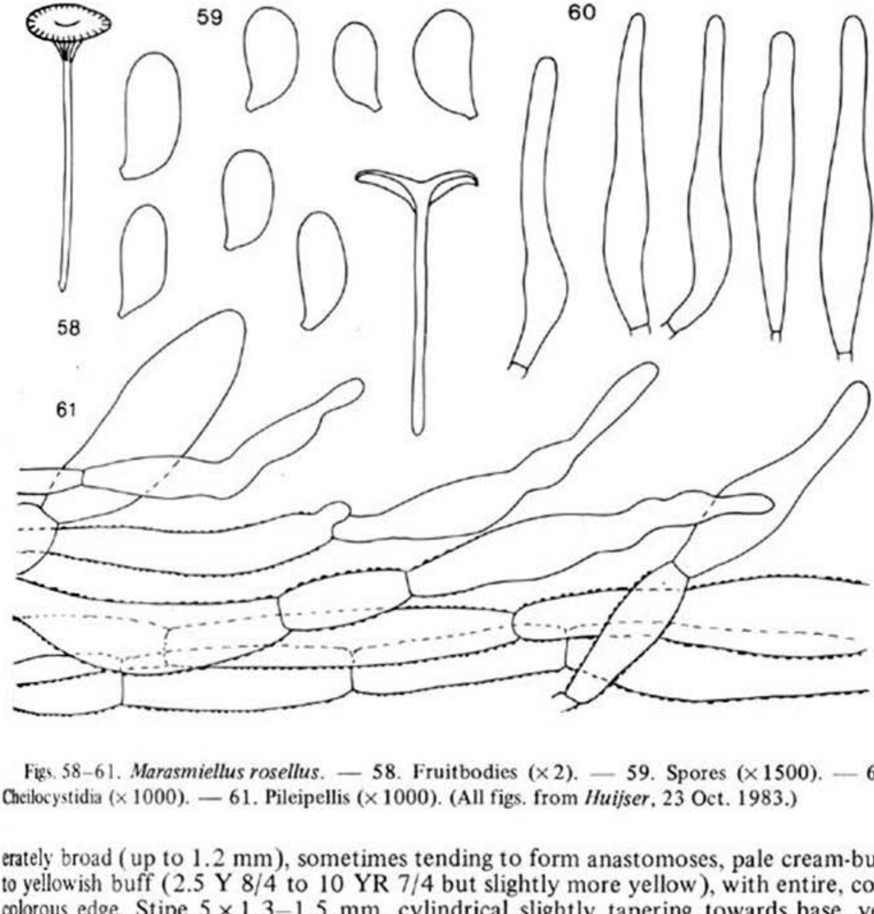
Collection examined.—THE NETHERLANDS, prov. Noord-Brabant, along Drongelens Kanaal between Helvoirt and Drunen, 23 Oct. 1983, *H. Huijser* s.n. (L).

Marasmiellus rosellus is placed in the genus *Marasmiellus* on account of the pileipellis that shows strong resemblance to that of *M. vaillantii* and *M. candidus*, and the well-differentiated cheilocystidia.

III. MICROMPHALE

14. **Micromphale bisporigera**, ad int.—Figs. 62–67

Basidiocarps small. Pileus 6–8 mm broad, irregularly convex to plano-convex with only the outermost margin inflexed, not distinctly hygrophanous, when moist dark yellowish brown (Muns. 10 YR 5/6), slightly paler towards margin (10 YR 6/6) and slightly darker at centre (10 YR 4/4 to 4/6), slightly translucently striate at margin (up to 1/3 of radius), colliculose at centre, glabrous, making a greyish impression. Lamellae (L = about 17, l = 1–3) rather crowded, free or very narrowly adnate, adnexed, mod-

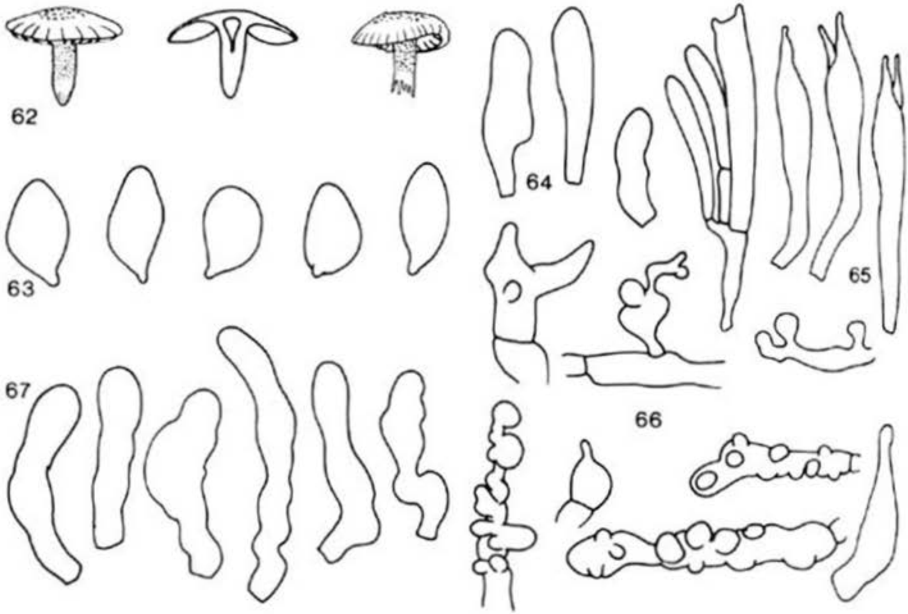


Figs. 58–61. *Marasmiellus rosellus*. — 58. Fruitbodies (×2). — 59. Spores (×1500). — 60. Cheilocystidia (×1000). — 61. Pileipellis (×1000). (All figs. from *Huijser*, 23 Oct. 1983.)

erately broad (up to 1.2 mm), sometimes tending to form anastomoses, pale cream-buff to yellowish buff (2.5 Y 8/4 to 10 YR 7/4 but slightly more yellow), with entire, concolorous edge. Stipe 5 × 1.3–1.5 mm, cylindrical slightly tapering towards base, yellow-brown (10 YR 6/8–6/6), slightly more red at base, very minutely granular or pruinose in same colour, fistulose. Context pale yellow-brown with darker zone under pileipellis. Smell not remarkable. Taste not tried.

Spores 7.0–8.5 × 4.0–5.0 µm, broadly ellipsoid, thin-walled, inamyloid. Basidia 29–39 × 5–65 µm, 2-, rarely 1- or 3-spored, clampless. Lamella edge heterogeneous. Cheilocystidia 15–25 × 5–6 µm, clavate, rare and scattered. Subhymenium ramose, probably not gelatinized. Hymenophoral trama strictly interwoven in upper part near pileus becoming more irregular downwards to perfectly regular near lamella edge. Pileipellis a 20–40 µm thick ixocutis of 5–12 µm wide, nodulose, thin-walled hyphae embedded in a gelatinous matrix, subpellis made up of inflated hyphae, up to 25 µm wide. Stipitispellis a cutis with dense clusters of caulocystidia. Caulocystidia 20–40 × 4–8 µm, cylindrical to clavate. Stipitistrama regular, made up of cylindrical elements up to 160 × 10 µm, not constricted at septae. Clamp-connections absent.

Habitat & distribution.—On bark of deciduous tree, only known from one locality in the Netherlands.



Figs. 62–67. *Micromphale bisporigera*. — 62. Fruitbodies (× 2). — 63. Spores (× 1500). — 64. Cheilocystidia (× 1000). — 65. Basidia (× 1000). — 66. Elements from pileipellis (× 1000). — 67. Caulocystidia (× 1000). (All figs. from *Uljé*, 20 Nov. 1984.)

Collection examined.—THE NETHERLANDS, prov. Zuid-Holland, Alphen aan de Rijn, near Zegersplas, 20 Nov. 1984, *C. Uljé* (L).

The tiny basidiocarps, gelatinized pileipellis with nodulose hyphae, and clampless, 2-spored basidia make this taxon a good species of *Micromphale*. The material is too scanty for designation of a holotype and therefore no formal description of a new species has been made.

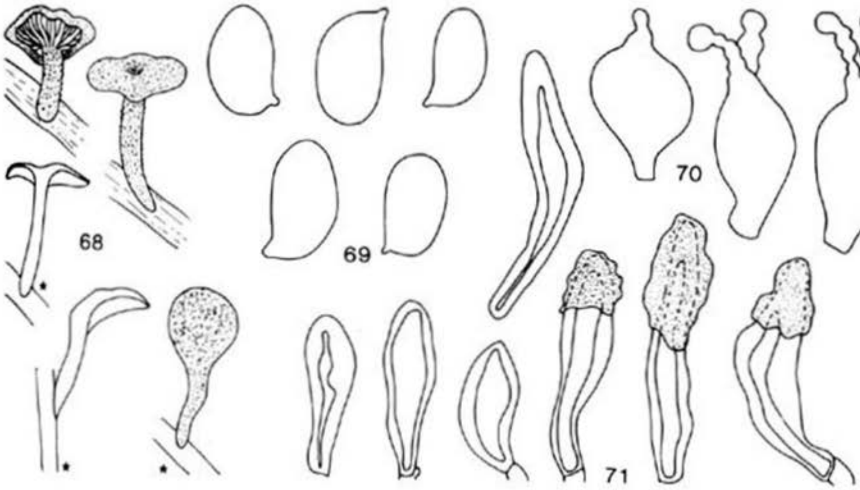
IV. **HOHENBUEHELIA**

15. **Hohenbuehelia culmicola** Bon—Figs. 68–71

Hohenbuehelia culmicola Bon in Docum. mycol. 10(37–38): 89. 1979.

Selected description & illustration.—Bon in Docum. mycol. 11(41): 51–53, fig. 3. 1980.

Pileus 9–25 mm broad, spathulate to reniform or convex with involute margin and irregularly lobed, undulating marginal zone, usually depressed at centre, not hygrophanous, not translucent-striate, densely villose all over with grey hairs on grey-black



Figs. 68–71. *Hohenbuehelia culmicola*. — 68. Fruitbodies (× 1). —69. Spores (× 1500). — 70. Cheilocystidia (× 1000). — 71. Pleurocystidia (× 1000). (68 with * from *Vellinga 741*; all other figs. from *Noordeloos 84398*.)

background (Muns. 10 YR 3/1–2, K & W 6E4), pallescent (10 YR 4/1–2) and sulcate on drying. Lamellae (L up to 50, l = 1–5) moderately crowded, decurrent, narrowly segmentiform, creamish white when young then greyish to brownish (10 YR 6/4) with brown, more or less entire edges. Stipe 8–20 × 3–4 mm, central or slightly excentrical, cylindrical, sometimes broadened towards base, concolorous or paler and more brown than pileus, covered in grey villose surface. Context pallid in pileus and stipe, with darker gelatinous layer under surface of pileus. Smell somewhat sourish fungoid. Taste mild.

Spores 9.0–11.0 × 5.5–7.0 μm, average 9.5–6.5 μm, Q = 1.35–1.7, average Q = 1.5, ellipsoid, thin-walled, inamyloid. Basidia 22–40 × 7–11 μm, 4-spored, clamped. Lamella edge sterile or heterogeneous. Cheilocystidia 15–40 × 8–25 μm, very irregular in shape, basal form usually clavate to lageniform, but apex often moliniform/capitate or with two or three apical, moniliform appendages, thin-walled, colourless. Pleurocystidia 35–70 × 5–15 μm (wall up to 4 μm thick), numerous, clavate to fusiform, thick-walled, metuloid, often with mucous mass covering the apex. Pileipellis a trichoderm of dense fascicules of 2.5–8 μm wide, cylindrical hyphae with yellow, thin or thick, often encrusted walls. Clamp-connections very numerous in all tissues.

Habitat.—Close to the ground on culms and leaf-sheats of *Leymus arenarius* in the outermost zone of coastal sand-dunes.

Distribution.—Known from France and two localities in the Netherlands. Nov.

Collections examined.—THE NETHERLANDS, prov. Friesland, Isl. of Schiermonnikoog, outer dunes, 19 Nov. 1984, *E. C. Vellinga 741* (L); ditto, 10 Nov. 1985, *E. C. Vellinga (& J. H. Ietswaart) 866* (L); prov. Zuid-Holland, Isl. of Goeree, Kwade Hoek, 11 Nov. 1984, *M. E. Noordeloos 84398* (L).

Hohenbuehelia culmicola is a very remarkable member of the genus *Hohenbuehelia* because of the habit, habitat and substratum. Most species of *Hohenbuehelia* grow on wood in deciduous or coniferous forest. It comes close to *H. atrocoerulea*, but that species never has a well-developed stipe, and the ecology is completely different.

ACKNOWLEDGEMENTS

Thomas Laessöe is gratefully thanked for providing the material of *Marasmius cornelii*. The curator of the herbarium at Oulu is acknowledged for the loan of specimens. The director of the Royal Botanic Gardens, Kew, is greatly thanked for hospitality and providing working space.

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ASORDARIA, A NEW GENUS OF THE SORDARIACEAE, AND A NEW SPECIES OF MELANOCARPUS

J. A. VON ARX*, J. GUARRO** and H. A. VAN DER AA*

Asordaria gen. nov. is introduced for Sordariaceae with ovate or broadly ellipsoidal, smooth ascospores without gelatinous sheath. The genus is based on *Asordaria tenerifae* spec. nov. Seven species of *Sordaria* are reclassified in *Asordaria* and a further species is described as *A. islandica*. *Asordaria* is considered to be more closely related to *Boothiella*, *Neurospora*, *Gelasinospora*, and *Melanocarpus* than to *Sordaria*, which is restricted to species with elongate ascospores with a gelatinous sheath. *Melanocarpus oblatus* spec. nov. is described.

An ascomycetous fungus was isolated from droppings collected by the first author in March 1986 in Las Cañadas on Tenerife (Canary Islands) at an altitude of about 2300 m. The droppings were incubated on moist filter paper in Petri dishes at room temperature. The fungus represents a Sordariaceae sensu Lundqvist (1972) and differs from *Sordaria humana* (Fuckel) Winter by smaller ascospores and from *S. arctica* Cain and *S. conoidea* Cailleux by larger, especially broader ascospores (Cain, 1957; Cailleux, 1971).

Sordaria fimicola (Rob.) Ces. & de Not., the type species of the genus, is characterized by ellipsoidal or nearly cylindrical ascospores with a distinct gelatinous sheath surrounding each ascospore but leaving clear its base with a protuberant germ pore (Fig. 1C). Such a sheath is absent in the species mentioned above, which therefore are classified in a separate genus.

ASORDARIA v. Arx, Guarro & v.d. Aa, *gen. nov.*

Coprophila; coloniae celeriter crescunt, cum hyphis radiantis, latis, crassis, septatis; ascomata erumentia vel superficialia, ampulliformia vel pyriformia, ostiolata, crasse tunicata, pigmentata; asci cylindracei, sursum truncati, unitunicati, cum refringente structura apicali, octospori; ascosporae ovatae vel ellipsoideae, aseptatae, glabrae, brunneo-nigrae, cum poro germinationis distincto praedito, sine vagina glutinosa; paraphyses absunt; anamorphosis abest. Species typica: *Asordaria tenerifae* v. Arx & Guarro.

Colonies expanding, with broad and regularly septate expanding hyphae; ascomata erumpent or superficial, large, ampulliform or pyriform, with a thick wall of dark cells (textura angularis in surface view) and a beak-like, cylindrical or conical ostiolum; asci cylindrical, unitunicate, 8-spored, with a non-amyloid ring in the truncate apex; ascospores ovate or broadly ellipsoidal, aseptate, smooth, dark brown or nearly black when mature, without gelatinous sheath, with a distinct germ pore at the attenuated end; paraphyses absent; anamorphs absent.

Type species.—*Asordaria tenerifae* v. Arx & Guarro.

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*Centraalbureau voor Schimmelcultures, Baarn, The Netherlands.

** Biology Department, Faculty of Medicine, Barcelona University, Reus, Spain.

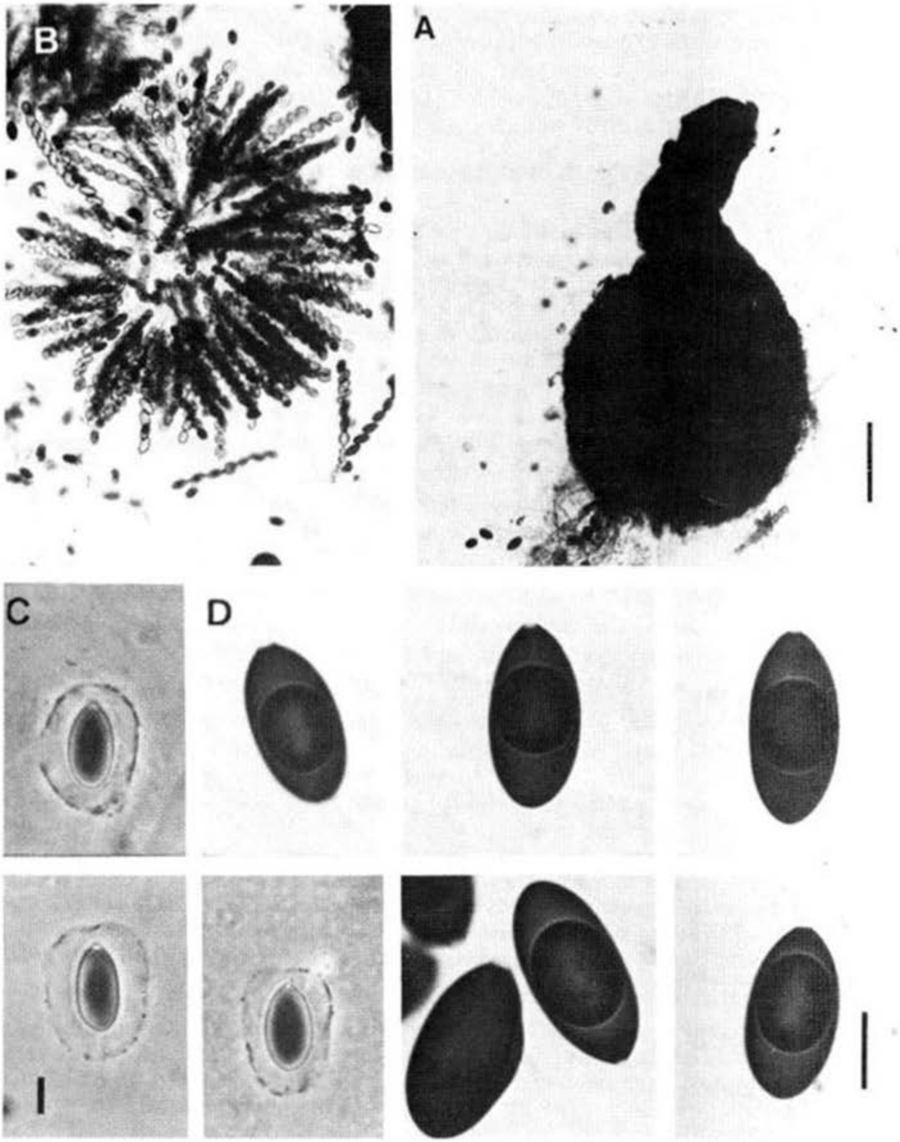

Fig. 1. *Sordaria fimicola*. — A. Ascoma. — B. Asci (bar = 100 μm). — C. Ascospores mounted in water. — D. Ascospores mounted in lactophenol (bar = 10 μm).

Species of *Asordaria* have been isolated from dung of carnivores and herbivores, mainly collected in arid and arctic regions (Sahara, Northern Canada, Iceland). They can easily be isolated, because the expanding hyphae grow quickly on wet filterpaper, on which the glossy and black ascomata develop within a few days.

The fast growing colonies with broad expanding hyphae and the unsheathed ascospores of *Asordaria* species indicate a closer relationship to *Boothiella*, *Melanocarpus*, *Gelasinospora*, and *Neurospora* than to *Sordaria* s.str. *Gelasinospora* species differ by pitted, reticulate, or alveolate ascospores with two or more or occasionally with a single germ pore. The ascomata may be ostiolate or non-ostiolate. In one and the same species, ostiolate and non-ostiolate ascomata occur in the same colony (von Arx, 1982). *Neurospora* species have longitudinally striate ascospores with two germ pores, one at each end. *Boothiella tetraspora* Lodhi & Mirza (1962) is characterized by pale, expanding hyphae, non-ostiolate ascomata with a wall of angular, unpigmented cells and by 4-spored asci without apical ring. The ascospores are similar to those of *Asordaria tenerifae* in size, shape, structure, and pigmentation.

Melanocarpus albomyces is thermophilic and has fast growing expanding hyphae. The ascomata are dark, thick-walled, non-ostiolate; the asci are cylindrical or saccate, evanescent and the ascospores are ovate or nearly spherical, usually bilaterally flattened, with a germ pore at the attenuated end.

Neurospora and *Melanocarpus* species include anamorphs with relatively large arthroconidia, which develop from branched hypha by the formation of double, bulging septa with disjunctives.

Asordaria resembles in some respects *Apodospora* Cain & Mirza (1970), which includes species with aseptate ascospores with an apical germ pore. *Apodospora*, however, differs in that the ascospores are surrounded by a gelatinous sheath. The ascomata have a thin wall composed of small cells, the asci are surrounded by filamentous paraphyses, and spherical spermatia are formed basipetally at the apex of ampulliform cells. *Apodospora* is closely related to *Podospora*, *Lasiosphaeria*, and other genera of the Lasiosphaeriaceae sensu Lundqvist (1972).

Achaetomium may also be confused with *Asordaria*. The ascomata of *A. globosum* Rai & Tewari, the type species, are ostiolate, thick-walled and covered with pale hyphae. The asci are cylindrical and evanescent. The ascospores are extruding as a dark, sticky mass. They are dorsiventrally flattened, round in face view, ellipsoidal in lateral view, with a basal germ pore. *Achaetomium* has to be restricted to the type species, the other species have been reclassified in *Chaetomium* by von Arx (1985) and Cannon (1986).

KEY TO THE SPECIES

1a. Ascospores ovate or nearly spherical 2
b. Ascospores broadly ellipsoidal, attenuated, and rounded at both ends 6
2a. Ascospores 20–25 × 16–19 µm . . . . *A. humana*
b. Ascospores smaller 3
3a. Ascospores 17–21 × 14–18 µm, expanding hyphae 15–20 µm broad . . . . *A. tenerifae*
b. Ascospores smaller, expanding hyphae 8–15 µm broad 4

4 a. Ascospores 15–18 × 13–15 µm, good sporulation at 18–22°C . . . . *A. arctica*
  b. Ascospores narrower, good sporulation at 25–30°C 5
5 a. Ascospores 16–19 × 11–13 µm . . . . *A. goundaensis*
  b. Ascospores 12–15 × 9–12 µm . . . . *A. prolifica*
6 a. Ascospores 25–29 × 16–19 µm; ascomata ampulliform, with a long, often curved beak *A. islandica*
  b. Ascospores smaller 7
7 a. Ascospores 21–25 × 12–14 µm, ascomata pyriform . . . . *A. sibutii*
  b. Ascospores smaller 8
8 a. Ascospores 17–21 × 10–13 µm, ascomata conical . . . . *A. conoidea*
  b. Ascospores 17–21 × 11–13 µm; ascomata spherical, with a short cylindrical beak *A. mabokeensis*

Asordaria tenerifae v. Arx & Guarro, *spec. nov.*—Fig. 2

Ascomata 280–400 µm diam., 350–500 µm alta; asci 105–150 × 13–16 µm; ascosporae 17–21 × 13–18 µm. Typus ex fimo in herb. e cultura CBS 264.86.

Colonies at 28°C on cornmeal agar with a daily growth rate of more than 10 mm, filling the Petri dish within 3–4 days, becoming dark brown or nearly black; expanding hyphae regularly and closely septate, rather thick-walled, pale brown, 15–20 µm broad; aerial hyphae floccose, much branched, septate, pale or brown, 2–5 µm broad; ascomata formed from coiled hyphae, maturing within 10 days, ampulliform or pyriform, with a spherical body and a conical or cylindrical beak, smooth or nearly so, often glossy and black in surface view, 280–400 µm in diameter, 350–500 µm high; the beak 80–120 µm broad and 80–250 µm high; ascomatal wall 35–45 µm thick, composed of several layers of isodiametrical, thick-walled, brown cells, 12–17 µm diameter, textura angularis in surface view; asci cylindrical, 8-spored, 105–150 × 13–16 µm, with a thin but rather persistent wall, with a disc and a non-amyloid ring at the truncate apex; ascospores uniseriate, ovate, aseptate, smooth, greenish brown or nearly opaque when mature, without gelatinous sheath, with a distinct germ pore at the attenuated apex, 17–21 × 13–18 µm; paraphyses absent, ostiolar pore lined with short, hyaline periphyses; anamorphs absent.

Type.—Canary Islands, Tenerife, Las Cañadas, on rabbit (?) droppings, March 1986, *J. A. von Arx* (in herb. CBS, dried cultures and slides).

Living cultures were incorporated in the CBS culture collection (CBS 264.86).

The top three ascospores in the ascus are apically attenuated with an apical germ pore. The ascospores in the basal part of the ascus are usually attenuated and porate at the base.

Asordaria arctica (Cain) v. Arx & Guarro, *comb. nov.*
Sordaria arctica Cain in Can. J. Bot. 35: 262. 1957 (basionym).

Asordaria conoidea (Cailleux) v. Arx & Guarro, *comb. nov.*
Sordaria conoidea Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971 (basionym).

Asordaria goundaensis (Cailleux) v. Arx & Guarro, *comb. nov.*
Sordaria goundaensis Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971 (basionym).

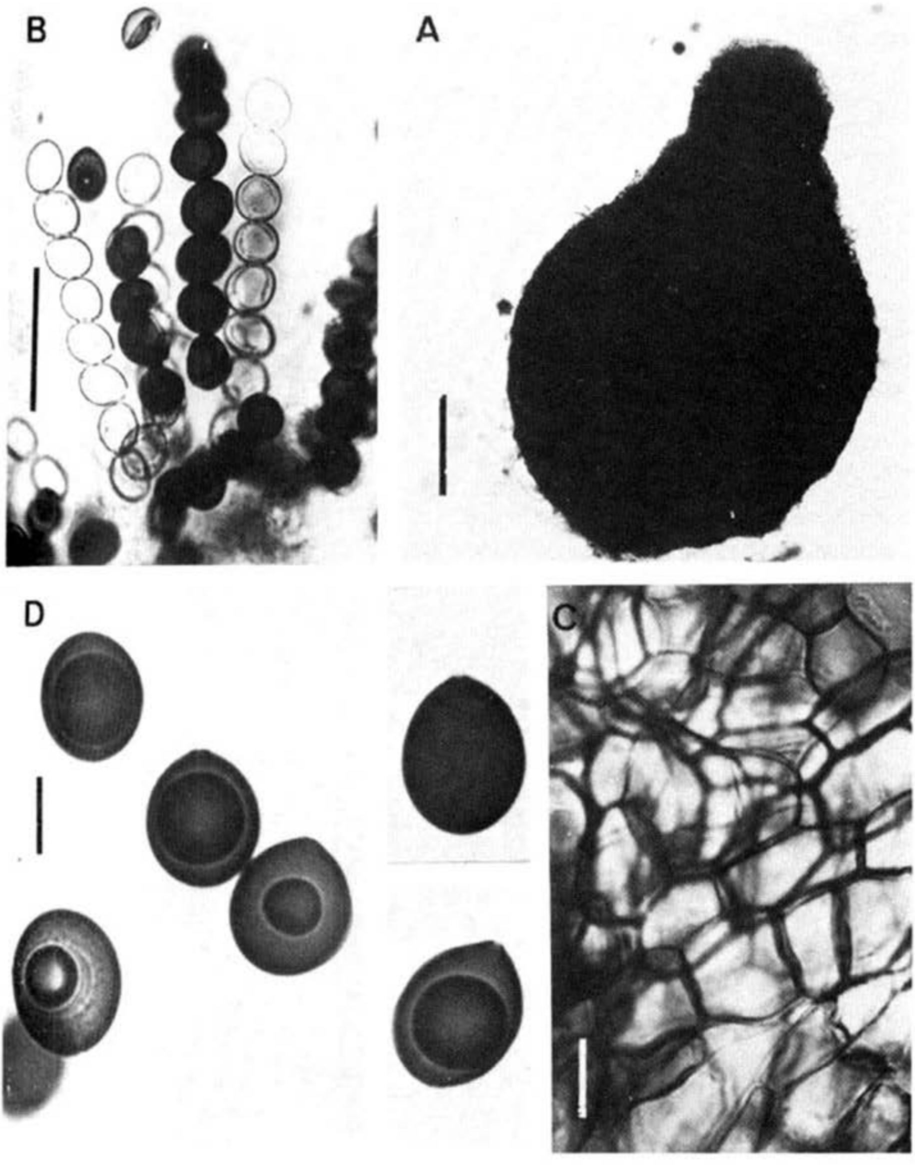

Fig. 2. *Asordaria tenerifae*. — A. Ascoma (bar = 100 μm). — B. Asci (bar = 50 μm). — C. Ascomatal wall in surface view (bar = 10 μm). — D. Ascospores (bar = 10 μm).

Sordaria goundaensis var. *latispora* Cailleux is similar to *A. arctica*, probably indistinguishable.

Asordaria humana (Fuckel) v. Arx & Guarro, *comb. nov.*

Sphaeria humana Fuckel, Fungi Rhenani no. 1801. 1866 (basionym). — *Sordaria humana* (Fuckel) Winter in Bot. Ztg 30: 835. 1872.

For further synonyms see Lundqvist (1972).

This species seems to be rather common. Eight strains maintained in the CBS Culture Collections as *Sordaria humana* have been examined. Only CBS 416.83, received from J.C. Krug and collected in Venezuela was correctly identified. The other isolates have been reidentified as *Sordaria fimicola* and *S. lappae* Potebnia.

Asordaria islandica Guarro & van der Aa, *spec. nov.*—Fig. 3

Ascomata superficialia, ampulliformia, nigra, 300–440 μm diam., collo longo, curvato praedita; asci cylindracei, unitunicati, 180–230 × 19–22 μm, octospori; ascosporae late ellipsoideae, aseptatae, glabrae, brunneo-nigrae, 25–29 × 16–19 μm, cum poro germinationes praedito, sine vagina glutinosa. Typus ex fimo ovis in herb. CBS, e cultura CBS 512.77.

Colonies at 28°C on cornmeal agar with a daily growth rate of more than 15 mm, filling the Petri dish within 3–4 days, becoming dark brown or nearly black; expanding hyphae septate, rather thick-walled, pale brown, 10–14 μm broad, aerial hyphae floccose, branched, hyaline or pale, 2–4 μm broad; ascomata formed from hyphal coils, maturing within 8 days (at 22°C), ampulliform or pyriform, with a spherical body and a long conical or cylindrical, often recurved or irregular beak, smooth or nearly so, glossy and black in reflected light, 300–440 μm in diameter, the beak 80–130 μm broad near its base and 300–550 μm long; ascomatal wall 30–40 μm thick, composed of several layers of irregular, flattened, 12–18 μm broad cells (textura angularis in surface view); asci cylindrical, with a short stalk and a truncate apex, 8-spored, 180–230 × 19–22 μm, with a persistent wall and a non-amyloid ring at the apex; ascospores uniseriate, ovate or broadly ellipsoidal, aseptate, smooth, greenish-brown or black when mature, without gelatinous sheath, with a distinct germ pore at the base, 15–29 × 16–19 μm; paraphyses absent; anamorphs absent.

Type.—Iceland, near Reykiavik, on sheep dung, August 1977, in herb. H.A. van der Aa (CBS, dried culture). Living cultures: CBS 512.77.

Asordaria mabokeensis (Cailleux) v. Arx & Guarro, *comb. nov.*

Sordaria mabokeensis Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971 (basionym).

Asordaria prolifica (Cailleux) v. Arx & Guarro, *comb. nov.*

Sordaria prolifica Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971 (basionym).

Asordaria sibutii (Cailleux) v. Arx & Guarro, *comb. nov.*

Sordaria sibutii Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971 (basionym).

In the course of this study, a further undescribed ascomycetous fungus was encountered in the CBS culture collection. This was maintained as *Achaetomium globosum*

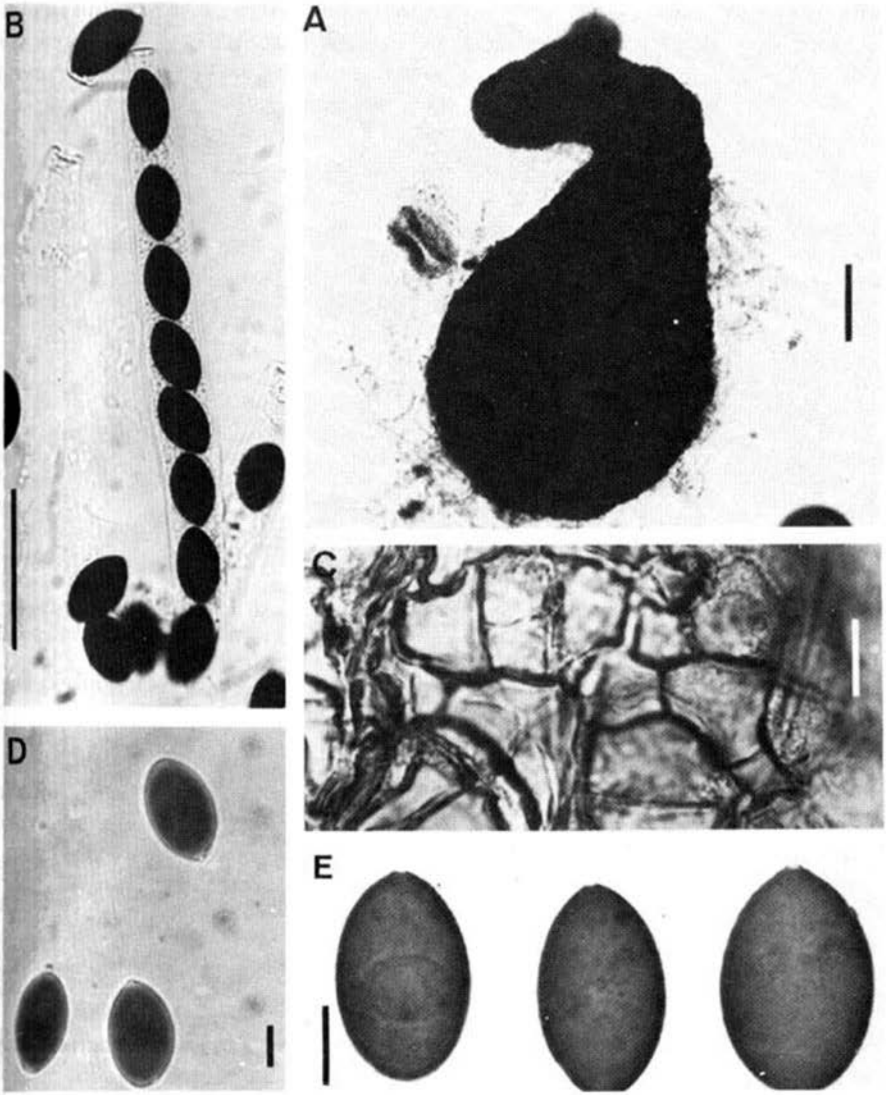

Fig. 3. *Asordaria islandica*. — A. Ascoma (bar = 100 μm) — B. Ascus and apical part of an ascus (bar = 100 μm). — C. Ascomatal wall in surface view (bar = 10 μm). — D, E. Ascospores (bar = 10 μm).

(CBS 775.85). It differs from the type of this species (CBS 332.67) in non-ostiolate ascomata, immersed in the agar medium, in bilaterally flattened, oblate ascospores and in other characters. It shows affinities to *Melanocarpus albomyces* (Cooney & Emerson) v. Arx and represents a further species of the genus *Melanocarpus* v. Arx.

Melanocarpus oblatus Guarro & v. d. Aa, *spec. nov.*—Fig. 4

Ascomata globosa vel subglobosa, immersa vel erumpentia, brunneo-nigra, crasse tunicata, 160–260 μm; asci cylindracei vel saccati, unitunicati, octospori, 50–70 × 10–15 μm; ascosporae oblatae, bilateraliter depressae, aseptatae, brunneo-nigrae, poro germinationes distinctis praeditae, 10–12 × 8–9 μm; arthroconidia cylindracea vel ellipsoidea, utrinque truncata, aseptata, hyalina, 9–18 × 3.5–6 μm. Typus: CBS 775.85, cultura exsiccata in herb. CBS.

Colonies on cornmeal agar at 28°C with a daily growth rate of 11–12 mm, producing a red exudate and a pale aerial mycelium composed of mainly hyaline, septate, 2.5–3.5 μm broad hyphae; ascomata maturing within 14 days, immersed or semi-immersed, covered with yellow hyphae when erumpent (seen in reflected light), spherical or nearly so, discrete or aggregated, non-ostiolate, 160–260 μm in diameter; ascomatal wall dark brown, composed of flattened, 7–12 μm broad cells (textura angularis in surface view), often surrounded by brown, septate, 3–5 μm broad hyphae; asci cylindrical or obovate-saccate, evanescent, 8-spored, 50–70 × 10–15 μm; ascospores oblate, bilaterally flattened, round in face view, ellipsoidal in lateral view, dark brown when mature, smooth, unsheathed, 10–12 × 8–9 μm, with a distinct, basal (lateral) germ pore; arthroconidia occasionally formed in the aerial mycelium in short, often branched chains, cylindrical or barrel-shaped, aseptate, hyaline, 9–18 × 2.5–6(–8) μm.

Type.—The type strain CBS 775.85 was received from Upper Volta (Africa) without any data.

This fungus is mesophylic, such in contrast to *M. albomyces*, which is highly thermophilic. The anamorphs of *Melanocarpus* species are reminiscent of the *Chrysonilia* anamorphs of *Neurospora* species. They differ by small, uncoloured conidial pustules and by shorter chains of more elongate conidia. The conidia of *Chrysonilia sitophila* (Mont.) v. Arx and of other species develop in sporodochium-like, orange or red pustules and are short cylindrical.

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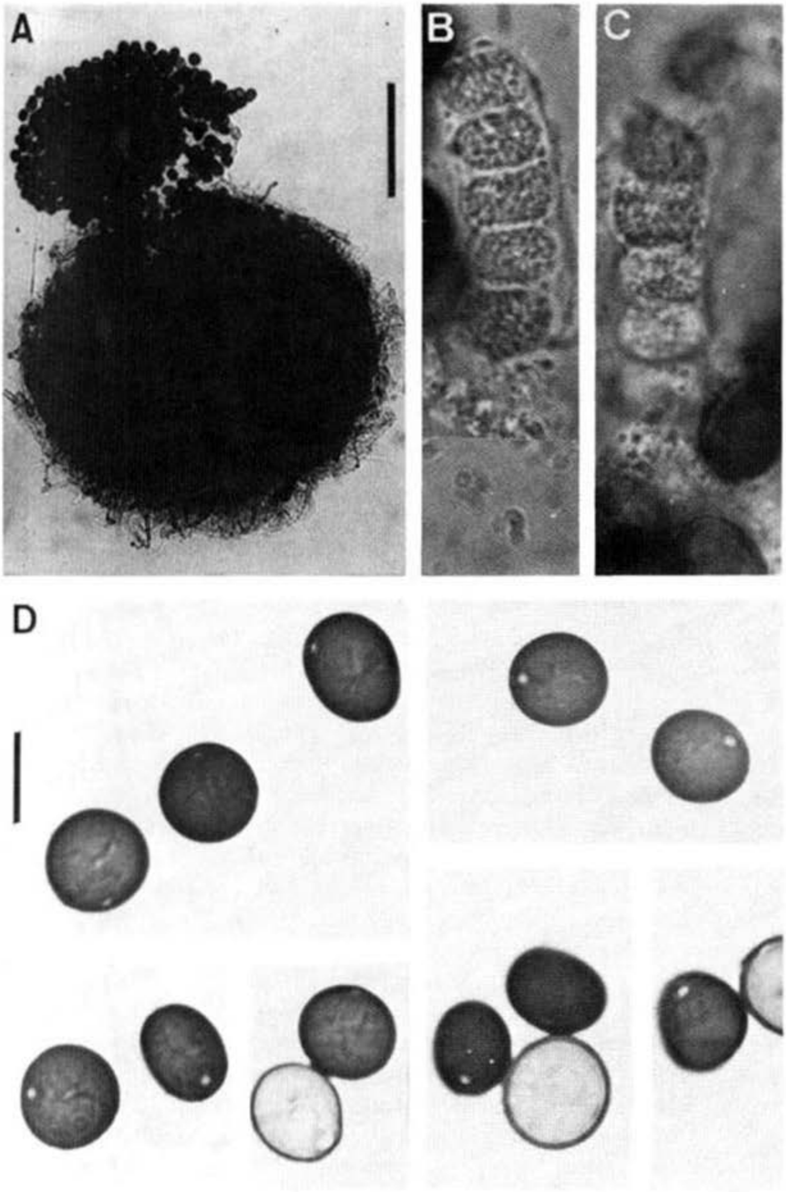

Fig. 4. *Melanocarpus oblatus*. — A. Ascoma (bar = 100 µm). — B, C. Asci. — D. Ascospores (bar = 10 µm).

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A RE-EVALUATION OF THE EUROTIALES

J.A. VON ARX*

Centraalbureau voor Schimmelcultures, Baarn

The Ascomycota classified in the Eurotiales, Gymnoascales, and Onygenales are considered to belong to a single order Eurotiales, which includes 4 families, based on the shape, size, and symmetry of the ascospores. The Eurotiaceae and Gymnoascaceae have dorsiventrally flattened ascospores, the Onygenaceae have elongated ascospores, and those of the Amauroascaceae are spherical or nearly so. Spherical or obovate-saccate, thin-walled, unitunicate asci, aseptate, hyaline, or pale ascospores without germ pores, and the absence of ostiolate or discoid ascomata are characteristic of all Eurotiales (and the Erysiphales and Dipodascaceae). Anamorphs are often predominant; the conidia develop from meristematic hyphae, are often catenate and separate from each other or from the supporting hypha by two septa, usually with disjunctives. Terms such as phialide, separating cell, schizolytic, or rhexolytic are considered to be misleading and superfluous.

In a synopsis of the orders and families of Plectomycetes, Benny & Kimbrough (1980) accepted 6 orders, the Elaphomycetales, Onygenales, Eurotiales, Ascosphaerales, Microascales, and Ophiostomatales, which were separated from each other mainly by the structure of the centre of the ascomata (the arrangement of the asci within the cavity). All orders exclusively contain species with spherical or ovate, evanescent asci, and aseptate ascospores. The size, shape, symmetry, and pigmentation of the ascospores was neglected. The Erysiphales, which are also characterized by non-ostiolate ascomata, spherical or obovate asci, and aseptate ascospores, were excluded. The Eurotiales and Onygenales (incl. Gymnoascales) are characterized by spherical asci borne throughout the ascomatal cavity and are distinguished from each other mainly by the structure of the ascomatal wall and by the anamorphs, which are described as phialo-conidial for the first order and for the second order as arthro- or aleurio-conidial.

Von Arx (1971, 1974, 1977b) paid particular attention to the size and shape of the ascospores when he delimited the genera of the Gymnoascaceae. Three groups of genera were distinguished, one with dorsiventrally flattened, another with elongate, and a third with spherical or nearly spherical, often reticulate ascospores. Von Arx & van der Walt (1986) showed that the conidiogenesis of species of both Eurotiales and Onygenales (Gymnoascales) is similar: the conidia develop in basipetal sequence or at random from meristematic (or conidiogenous) hyphae by the formation of two usually adjacent septa. Occasionally an empty part of the conidiogenous hypha is present between the two

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* Present address: Bruglaan 7, 3743 JB Baarn, The Netherlands.

septa. This is often described as a separating cell, even though contents and cell walls are lacking. The conidia are arranged in 'true', dry chains and separate by disjunctive structures (disjunctors) and by rupture or lysis of the hyphal wall. The seccession is termed 'schizolytic', when the two septa are adjacent. It is often considered to be a single, splitting septum. TEM micrographs, however, show, that the septa never have a central pore, but are often thickened and include disjunctives at an early state (von Arx & van der Walt, 1986). The seccession is termed 'rhexolytic', when the two septa are separated by shorter or longer, empty parts of the conidiogenous hypha. Both 'schizolytic' and 'rhexolytic' seccession have been observed within a single conidiogenous hypha, e.g. in the anamorphs of *Byssoascus stratisporus* (Barron & Booth) v. Arx and *Xylogone sphaerospora* v. Arx & Nilsson, in several species classified in the genera *Chrysosporium*, *Coremiella*, and *Oidiodendron*, in *Malbranchea arcuata* Sigler & Carmichael and in *Hormographis ramirezii* Guarro & al. (Martinez & al., 1986; Guarro & al., 1986). In species of *Aspergillus*, *Paecilomyces*, and their relatives, it is difficult to determine the 'rhexolytic' or 'schizolytic' nature of the conidial seccession, because the narrow septa become swollen.

It also may be noted that unthickened hyphal septa with central pores have never been observed to split. A true 'schizolytic' seccession apparently does not occur within the Eurotiales.

The 'phialide' in *Aspergillus, Paecilomyces*, and related genera in fact forms a meristematic filament, in which 'arthroconidia' are delimited in basipetal sequence by the formation of double septa with disjunctives. The ampulliform cells of *Aspergillus* or the subuloid cells of *Paecilomyces* therefore should not be compared with the 'phialides' of *Trichoderma, Gliocladium, Verticillium*, or *Fusarium*. Species of these genera form conidia at or in the apex of the conidiogenous cells by budding in basipetal or sympodial sequence. The conidia are usually mucoid and never have disjunctives. Species of *Chalara* form conidia inside a tube-like cell from a basal meristematic zone by the formation of endogenous, cylindrical cells.

The heterogeneity (diversity) of the structures called 'phialides' has been recognized by Subramanian (1979) and by Minter & al. (1983). These authors compared also the 'true' chains of conidia in *Aspergillus* and other members of the Eurotiales with the catenate conidia of *Oidium* (Erysiphales), *Geotrichum candidum* (Endomycetales), and *Oidiodendron*, which are formed from meristematic hyphae and also separate by disjunctives.

Both the Onygenales and Eurotiales sensu Benny & Kimbrough (1980) include genera characterized either by elongated (ellipsoidal, fusiform, or cylindrical), spherical, or dorsiventrally flattened (bivalvate, Saturn-shaped, discoid, or lenticular) ascospores. Von Arx & van der Walt (1986) therefore suggested that the Eurotiales and Onygenales should not be separated. They considered the Eurotiales (incl. Onygenales) to be related to the Endomycetales (the ascomycetous yeasts), and to the Erysiphales (powdery mildews). The latter also have non-ostiolate ascomata, spherical or obovate asci, aseptate ascospores and also form aseptate conidia from meristematic hyphae.

Currah (1985) restricted the Onygenales to Ascomycetes with 'rhexolytic' separation of the conidia. He distinguished four families, the Onygenaceae, Gymnoascaceae, Myxotrichaceae, and Arthrodermataceae, of which the two last mentioned are new. Currah placed relatively little emphasis on characters such as symmetry and pigmentation of ascospores, and the structure of the ascomatal initials and asci.

In the following treatment, the subdivision of the Eurotiales is based mainly on the shape and structure of the ascospores. All Eurotiales with ellipsoidal, fusiform or cylindrical ascospores are classified in the Onygenaceae. The Eurotiaceae are characterized by equally bivalvate, often Saturn-shaped and ornamented ascospores and by ascomata with a well-developed peridium. They include taxa with *Aspergillus* or *Penicillium* anamorphs and some taxa without known anamorphs. The Gymnoascaceae are characterized by discoid, lenticular, or unequally bivalvate, smooth ascospores. The family Amauroascaceae is erected for taxa with spherical, occasionally ovate-oblate (apparently bilaterally flattened) ascospores with an ornamented, often reticulate or pitted wall. Dorsiventrally flattened, aseptate ascospores occur only in Eurotiales and Endomycetales. Both are considered to have common ancestors, because such peculiar ascospores are likely to have evolved only once. Some members of the Pezizales may have the same ancestors, from which the Erysiphales also evolved (Müller & von Arx, 1962; von Arx & van der Walt, 1986). Some members of the Onygenaceae have also been linked with the Dipodascaceae by Redhead & Malloch (1977): they classified *Dipodascus geotrichum* (Butler & Peterson) v. Arx in a separate genus *Galactomyces* of the Onygenaceae. In its *Geotrichum* anamorph, the catenate conidia separate by double septa with several disjunctives. Hyphal Endomycetales do not form hyphae with simple, centrally perforated septa, but all septa are double and have one or several disjunctives, which in the past have been considered to be micropores, plasmodesmata, or closure lines of the septum. Hyphae are separated sooner or later into single cells in nearly all Endomycetales.

KEY TO THE FAMILIES OF THE EUROTIALES

1a. Ascospores dorsiventrally flattened, not reticulate or pitted 2
 b. Ascospores spherical, ellipsoidal, fusiform or cylindrical, occasionally oblate-ovate or flattened, then reticulate or pitted 3
2a. Ascospores Saturn-shaped or equally bivalvate, often ornamented; ascomata usually with a distinct peridium . . . . Eurotiaceae
 b. Ascospores discoid, lenticular or unequally bivalvate, mostly smooth; ascomata without a wall of flattened cells . . . . Gymnoascaceae
3a. Ascospores usually ellipsoidal, fusiform or cylindrical, often spinulose, striate or punctulate (pitted) . . . . Onygenaceae
 b. Ascospores usually spherical or nearly so, occasionally ovate-oblate or bilaterally flattened, then with a pitted or reticulate-alveolate wall . . . . Amauroascaceae

Eurotiaceae Clem. & Shear, 1931

Ascomata superficial, often embedded in aerial mycelium or immersed in a stroma or a sclerotium-like body, occasionally reduced to clusters of asci; asci irregularly disposed, spherical or obovoid, often catenate, rarely formed from croziers; ascospores dorsiventrally flattened, mostly bivalvate or Saturn-shaped, often with equatorial frills and spinulose, aseptate, hyaline, or pale.

Anamorphs: *Aspergillus, Penicillium, Polypaecilum*, or absent.

KEY TO THE GENERA

1 a. Anamorphs absent, ascospores spiny or with crests 2
b. Anamorphs present 3
2 a. Asci formed singly or in naked clusters from conjugating hyphal tips or croziers . . *Mallochia*
b. Ascomata with a wall of flattened cells present . . . . *Cristaspora*
3 a. Anamorph *Penicillium*; ascomata usually immersed in a sclerotium-like stroma, slowly maturing . . . . *Eupenicillium*
b. Anamorph *Aspergillus* or *Polypaecilum* 4
4 a. Anamorph *Polypaecilum*: conidiogenous cells apically branched; ascomata white; asci catenate . . . . *Dichotomomyces*
b. Above characters not combined, anamorph *Aspergillus* 5
5 a. Ascomata surrounded by thick-walled 'Hülle cells' 6
b. 'Hülle cells' absent 7
6 a. Ascomata purplish; ascospores red or blue-violet . . . . *Emericella*
b. Ascomata greenish or yellow; ascospores pale . . . . *Fennellia*
7 a. Ascomata with a thin wall composed of a single layer of flattened cells, occasionally without wall when old; conidia 4–10 µm long . . . . *Eurotium*
b. Ascomata with a thicker, often tomentose wall or immersed in a stroma 8
8 a. Ascomata discrete, with a wall composed of small cells or hyphae 9
b. Ascomata immersed in a crustose or spherical-pulvinate stroma 10
9 a. Conidia spherical, small . . . . *Neosartorya*
b. Conidia clavate or obovoid . . . . *Chaetosartorya*
10 a. Ascomata immersed in a crustose stroma . . . . *Dichlaena*
b. Ascomata immersed in a spherical-pulvinate stroma 11
11 a. Conidia spherical, spiny, small . . . . *Saitoa*
b. Conidia clavate or obovoid . . . . *Hemicarpenteles*

Eurotium Link in Mag. Ges. naturf. Fr. Berl. 3: 31. 1809. — Type species: *E. herbariorum* (Pers.) Link. — Synonyms: *Edyuillia* Subram., *Gymnoeurotium* Malloch & Cain.

Anamorphs: *Aspergillus glaucus* group sensu Raper & Fennell (1965).

Eurotium was treated by Raper & Fennell (1965, as *Aspergillus*), Blaser (1976), and Pitt (1985). About twenty species have been accepted, but their delimitation is not satisfactory. *Eurotium athecium* (Raper & Fennell) v. Arx has been classified in the separate genera *Edyuillia* and *Gymnoeurotium*, because the ascomata are considered to have no peridium. A delicate, but distinct peridium of flattened cells was observed in young ascomata, when a subculture of the type was studied in 1970 in cooperation with Miss A.C. Stolk.

Emericella Berk. & Br. apud Berk., Introd. crypt. Bot.: 340. 1857. — Type species: *E. variecolor* Berk. & Br. — Synonyms: *Diplostephanus* Langeron, *Inzengaea* Borzi.

Anamorph: *Aspergillus nidulans* and its relatives.

About 25 species have been delimited by the ornamentation of the ascospores (Raper & Fennell, 1965; Samson & Mouchacca, 1974; Udagawa & Horie, 1976; Christensen &

Raper, 1978). Horie (1980) published beautiful SEM micrographs of the ascospores of all accepted species.

Fennellia Wiley & Simmons in Mycologia 65: 936. 1973. — Type species: *F. flavipes* Wiley & Simmons, the teleomorph of *Aspergillus flavipes* (Bainier & Sartory) Thom & Church.

Second species: *F. nivea* (Wiley & Simmons) Samson, the teleomorph of *Aspergillus niveus* Blochwitz (Samson, 1979).

Neosartorya Malloch & Cain in Can. J. Bot. 50: 2620. 1972. — Type species: *N. fischeri* (Wehmer) Malloch & Cain. — Synonyms: *Hemisartorya* Rai & Chowdhery, *Sartorya* auct.

Raper & Fennell (1965) treated seven species under the name *Aspergillus*. In all species the ascomata have a white or pale wall composed of filaments.

Chaetosartorya Subram. in Curr. Sci. 41: 761. 1972. — Type species: *C. chrysellus* (Kwon & Fennell) Subram., based on *Aspergillus chrysellus* Kwon & Fennell. — Synonym: *Harpezomyces* Malloch & Cain.

Second species: *C. cremea* (Kwon & Fennell) Subram., based on *Aspergillus cremeus* Kwon & Fennell (Raper & Fennell, 1965).

Hemicarpenteles Sarbhoy & Elphick in Trans. Br. mycol. Soc. 51: 156. 1968. — Type species: *H. paradoxus* Sarbhoy & Elphick (= *Aspergillus acanthosporus* Udagawa & Takada). — Synonym: *Sclerocleista* Subram.

Further species: *H. ornata* (Raper & al.) v. Arx, based on *Aspergillus ornatus* Raper & al.; *H. thaxteri* (Subram.) v. Arx (= *Sclerocleista thaxteri* Subram.).

Anamorph: *Aspergillus citrisporus* Höhnel (von Arx, 1974).

Saitoa Rajendran & Muthappa in Proc. Indian Acad. Sci., Plant Sci. 89: 185. 1980. — Type species: *S. japonica* Rajendran & Muthappa, the teleomorph of an *Aspergillus*, similar to *A. japonicus* (*Aspergillus niger* group).

The apical swelling of the conidiophore is covered with ampulliform cells, forming meristematic hyphae which are converted into chains of echinulate conidia.

Dichlaena Dur. & Mont., Fl. Alg.: 405. 1849. — Type species: *D. lentisci* Dur. & Mont.

Dichlaena lentisci was redescribed by Malloch & Cain (1972). They introduced a new genus *Petromyces* for a similar ascomycete described as *Aspergillus alliaceus* Thom & Church (Raper & Fennell, 1965). No ascomata could be found on subcultures of the type. The name *Syncleistostroma* Subram. was introduced for the same species.

Eupenicillium Ludwig, Lehrb. nied. Kryptog.: 263. 1882. — Type species: *E. crustaceum* Ludwig. — Synonym: *Carpenteles* Langeron.

Anamorph: *Penicillium.*

Eupenicillium was monographed by Stolk & Samson (1983). They accepted twenty species and some varieties and added several 'related' *Penicillium* species forming stromatic bodies (sclerotia).

Dichotomomyces Saito ex Scott in Trans. Br. mycol. Soc. 55: 314. 1970. — Type species: *D. cejpii* (Milko) Scott.

Anamorph: *Polypaecilum insolitum* G. Smith (conidiogenous cells apically branched, forming aseptate, smooth, hyaline conidia in a basipetal sequence from meristematic branches).

Cristaspora Fort & Guarro in Mycologia 76: 1115. 1984. — Type species: *C. arxii* Fort & Guarro.

The fungus is known from a single strain. No anamorph is present.

Mallochia v. Arx & Samson in Persoonia 13: 185. 1986. — Type species: *M. echinulata* (Dutta & Ghosh) v. Arx & Samson.

The genus is based on *Pseudoarachniotus echinulatus* Dutta & Ghosh. Ascomata are absent; the asci develop in clusters in the aerial mycelium from croziers or from conjugating hyphal tips. No anamorph is present.

Gymnoascaceae Baranetzky, 1872 (incl. Arthrodermataceae Currah, 1985)

Ascomata superficial, with a peridium composed of a net-work of hyphae or absent, often with appendages (setae); asci spherical or obovate, not catenate, usually clustered and irregularly disposed, 8-spored; ascospores dorsiventrally flattened, lenticular, discoid, or unequally bivalvate, aseptate, hyaline, yellow or reddish brown, usually smooth, but often with equatorial thickenings or furrows, never reticulate, alveolate, or pitted.

Anamorphs: *Chrysosporium, Trichophyton, Microsporon, Malbranchea*, or absent.

KEY TO THE GENERA

1 a. Ascospores hyaline or pale yellowish, bivalvate or discoid 2
b. Ascospores pigmented, lenticular or discoid 7
2 a. Ascomata without peridium and without appendages, often stipitate or sporodochial and larger than 0.3 mm; not keratinolytic . . . . *Narasimhella*
b. Ascomata with a peridium or with appendages, often keratinolytic 3
3 a. Ascomatal appendages comb-like, pigmented . . . . *Ctenomyces*
b. Comb-like appendages absent 4
4 a. Ascomatal appendages spirally coiled, pale 5
b. Ascomata often tomentose, without coiled appendages 6
5 a. Anamorph *Microsporum* (conidia fusiform, septate) . . . . *Nannizzia*
b. Anamorph *Trichophyton* or *Chrysosporium* (conidia cylindric-clavate, septate or aseptate) *Arthroderma*

6a. Ascospores bivalvate-lenticular, smooth; ascomata with a white peridium . . . . *Leucothecium*
b. Ascospores discoid, finely punctulate; ascomata with a pale brown peridium of flattened cells, embedded in the aerial mycelium . . . . *Xynophila*
7a. Ascomata with long and thick, apically circinate appendages; keratinolytic . . . *Uncinocarpus*
b. Ascomata without such appendages, without peridium or with a peridium of often stiff hyphae with short or no appendages; usually not keratinolytic . . . . *Gymnoascus*

Gymnoascus Baranetzky in Bot. Ztg 30: 158. 1872. — Type species: *G. reessii* Baranetzky. — Synonyms: *Gymnascella* Peck, *Arachniotus* J. Schröt., *Petalosporus* Ghosh & al., *Pseudoarachniotus* Kuehn, *Waldemaria* Batista & al., *Plunkettomyces* Orr, *Gymnoascoides* Orr, *Disarticulatus* Orr, *Acitheca* Currah.

The genus was revised by von Arx (1986b). It includes fourteen species, all with ascomatal structures embedded in the aerial mycelium, sessile, spherical asci and lenticular or discoid, pigmented ascospores. Only a few species include unnamed anamorphs.

Uncinocarpus Sigler & Orr in Mycotaxon 4: 461. 1976. — Type species: *U. reesii* Sigler & Orr.

Anamorph: *Malbranchea*.

Second species: *U. uncinatus* (Eidam) Currah (syn. *Gymnoascus uncinatus* Eidam).

Both species are keratinolytic. In culture on agar media, *U. reesii* shows a poor growth and develops only the *Malbranchea* anamorph. Ascomata may be observed from hairs mixed with soil grown in moist chambers. The fungus is common in soil and is responsible for the degradation of keratinous material. *Uncinocarpus uncinatus* has been illustrated by Benjamin (1956) under the name *Myxotrichum uncinatum* (Eidam) J. Schröt.

Ctenomyces Eidam in Cohn in Beitr. Biol. Pfl. 3: 274. 1880. — Type species: *C. serratus* Eidam.

Ctenomyces serratus occurs on feathers of birds, occasionally on hairs and is often isolated from soil. It includes an anamorph described as *Chrysosporium serratum* Dominik. The ascospores are unequally bivalvate and remain hyaline.

Leucothecium v. Arx & Samson in Persoonia 7: 378. 1973. — Type species: *L. emdenii* v. Arx & Samson.

The genus is monotypic and is known from a single strain. It forms hyaline arthroconidia which are separated by adjacent septa with disjunctives.

Arthroderma Berk., Outl. Brit. Fungol.: 357. 1860. — Type species: *A. curreyi* Berk.

Anamorphs: *Trichophyton, Chrysosporium.*

Arthroderma has been monographed by Padhye & Carmichael (1971). They accepted thirteen species, all keratinolytic and often causing dermatomycoses.

Nannizzia Stockdale in Sabouraudia 1: 45. 1961. — Type species: *N. gypsea* (Nannizzia) Stockdale.

Nannizzia is closely related to *Arthroderma* and can be distinguished mainly by the *Microsporum* anamorph with large, fusiform, ornamented and multi-septate conidia. The conidia of *Arthroderma* species are cylindric-clavate, either aseptate or with several transverse septa. Eleven species have been described, some of which are morphologically similar. All species are keratinolytic and cause dermatomycoses. Weitzman & al. (1986) synonymized *Nannizzia* with *Arthroderma*.

Narasimhella Thirumalachar & Mathur in Sydowia 19: 184. 1966. — Type species: *N. poonensis* Thirumalachar & Mathur.

Three species will have to be accepted, all of which are closely related, and some intermediates exist. *Narasimhella poonensis* has ascospores with a distinct equatorial brim, and those of *N. marginospora* (Kuehn & Orr) v. Arx have a narrow, indistinct brim. The ascospores of *N. hyalinospora* (Kuehn & al.) v. Arx have no visible brim. In all species the ascospores are unequally bivalvate and hyaline (von Arx, 1986a). Stalked, synnema-like ascomatal structures have been observed in *N. poonensis* and some strains of *N. hyalinospora*. The colonies of *N. marginospora* are usually green. All species are coprophilous or soil-borne and *N. hyalinospora* is rather common.

Xynophila Malloch & Cain in Can. J. Bot. 49: 845. 1971. — Type species: *X. mephitialis* Malloch & Cain.

The genus is monotypic. *Aphanoascus canadensis* Currah is apparently identical with *X. mephitialis* (J. Guarro, pers. comm.). *Xynophila* shows affinities to the Amauroascaceae. It is tentatively classified in the Gymnoascaceae, because the ascospores are distinctly discoid and their wall is not reticulate.

Onygenaceae Fr., 1849

Synonyms: Monascaceae J. Schröt., 1894; Trichocomaceae Fischer, 1897; Cephalothecaceae Höhnel, 1917; Eremascaceae Zender, 1923; Thermoascaceae Apinis, 1967; Myxotrichaceae Currah, 1985.

Ascomata or ascogenous structures superficial, embedded in the aerial mycelium, occasionally large, pulvinate, spherical, or stipitate, with or without peridium; asci spherical or obovate, often with a cylindrical base, usually not catenate (except in *Talaromyces*); ascospores elongate, ellipsoidal, cylindrical, or fusiform, occasionally nearly spherical, often rather thick-walled, smooth, striate, furrowed, punctulate, or spinulose, hyaline or pale brown.

Anamorphs: *Paecilomyces* (incl. *Penicillium* sect. *Biverticillata* and sect. *Sagenomella*), *Raperia*, *Coremiella*, *Oidiodendron*, *Geomyces*, *Basipetospora*, or absent.

KEY TO THE GENERA

1 a. Ascomata 1–5 mm, sometimes larger, stromatic, stipitate or columnar 2
b. Ascomata smaller or absent 5

2a. Ascomata clustered at the apex of short stalks; ascospores with longitudinal flanges; growing on seeds of tropical plants . . . . . *Penicilliopsis*
  b. Above characters not combined 3
3a. Ascomata brush-like, columnar, with a discoid base . . . . . *Trichocoma*
  b. Ascomata not brush-like 4
4a. Ascomata head-like, with a distinct stipe . . . . . *Onygena*
  b. Ascomata tuberous, pulvinate, or spherical, sessile . . . . . *Ascocalvatia*
5a. Thermophilic; ascomata pulvinate or crustose, reddish . . . . . *Thermoascus*
  b. Not thermophilic, occasionally thermotolerant; ascomata not crustose 6
6a. Ascomata spherical, 300–500 µm, with a tomentose wall with sutures (cephalothecoid) *Cephalotheca*
  b. Above characters not combined 7
7a. Ascomata covered with seta-like, often circinate or branched appendages; ascospores often finely striate due to numerous longitudinal crests . . . . . *Myxotrichum*
  b. Ascomatal appendages absent, or not seta-like when present 8
8a. Asci catenate; ascomata usually spherical and with a wall of pale hyphae . . . . . *Talaromyces*
  b. Asci not catenate 9
9a. Ascomata with a peridium composed of a network of stiff hyphae; ascospores smooth or with longitudinal crests . . . . . *Pseudogymnoascus*
  b. Ascomata without such a peridium 10
10 a. Osmophilic; ascomata absent; asci formed from two conjugating hyphal tips . . . . . *Eremascus*
  b. Asci not formed from two conjugating hyphal tips 11
11 a. Ascospores fusiform, with longitudinal furrows (stellate in transverse section); colonies green due to the anamorph forming branched chains of conidia . . . . . *Byssoascus*
  b. Above characters not combined 12
12 a. Asci obovate or clavate, clustered; anamorph absent . . . . . *Monascella*
  b. Asci spherical or obovate; anamorphs usually present 13
13 a. Asci obovate or obpyriform, borne from croziers; conidiophores coarse, apically inflated *Hamigera*
  b. Asci spherical or obovate 14
14 a. Ascomata small, with a distinct peridium when young . . . . . *Monascus*
  b. Ascomata without a distinct peridium or absent 15
15 a. Conidia relatively small, elongate, smooth, with disjunctives . . . . . *Byssochlamys*
  b. Conidia spherical, spiny, relatively large . . . . . *Renispora*

Onygena Pers., Syn. Fung.: 203. 1801. — Type species: *O. equina* (Willd.) Pers. Second species: *O. corvina* Alb. & Schw.

Onygena equina occurs on hooves, horn, and similar substrates. Its ascospores are broadly elliptical, smooth, pale brown and measure 7–9 × 4–6 µm. *Onygena corvina* has been collected on pellets of carnivores, feathers, wool (old socks), and similar substrates. Its ascospores are cylindrical, often curved and measure 6–8 × 2.5–3.5 µm. Both species form white colonies and arthroconidia with disjunctors in culture.

Ascocalvatia Malloch & Cain in Can. J. Bot. 49: 840. 1971. — Type species: *A. dura* (Zukal) v. Arx (*A. alveolata* Malloch & Cain).

The description of *A. alveolata* agrees with that of *Gymnoascus durus* Zukal (von Arx, 1986b).

Cephalotheca Fuckel in Jb. nassau. Ver. Naturk. 25–26: 297. 1871. — Type species: *C. sulphurea* Fuckel.

Anamorph: *Paecilomyces* (similar to *P. marquandii* (Massee) Hughes).

Several further species have been included in the genus, but are excluded by Malloch & Cain (1970b) (see also Chesters, 1934, Booth, 1961).

Hamigera Stolk & Samson in Persoonia 6: 342. 1971. — Type species: *H. avellanea* (Thom & Turesson) Stolk & Samson. — Synonyms: *Warcupiella* Subram., *Sporophormus* Malloch & Cain.

Anamorph: *Raperia* (von Arx, 1986a).

Hamigera avellanea is the teleomorph of *Raperia ingelheimense* (v. Beyma) v. Arx. *Hamigera spinulosa* (Warcup) v. Arx is based on *Aspergillus spinulosus*; its anamorph has been described as *Raperia spinulosa* Subram. & Rajendran (von Arx, 1986a).

Byssochlamys Westling in Svensk bot. Tidskr. 3: 134. 1909. — Type species: *B. nivea* Westling.

Anamorph: *Paecilomyces*.

Further species: *B. fulva* Olliver & Smith, *B. verrucosa* Samson & Tansey, *B. zollerniae* Ram, *B. striata* (Raper & Fennell) v. Arx (*Talaromyces striatus, Penicillium striatum*).

Talaromyces C.R. Benjamin in Mycologia 47: 681. 1955. — Type species: *T. flavus* (Klöcker) Stolk & Samson. — Synonym: *Sagenoma* Stolk & Orr.

Anamorph: *Paecilomyces* (incl. *Penicillium* sect. *Biverticillata, Sagenomella*).

The genus includes about twenty species, treated by Stolk & Samson (1972) and Pitt (1979). The following species have to be added: **Talaromyces viride** (Stolk & Orr) v. Arx, *comb. nov.* (basionym: *Sagenoma viride* Stolk & Orr in Mycologia 66: 676. 1974), and **Talaromyces ryukyensis** (Ueda & Udagawa) v. Arx, *comb. nov.* (basionym. *Sagenoma ryukyensis* Ueda & Udagawa in Mycotaxon 20: 499. 1984). The anamorph of this species is a typical *Paecilomyces* with conidiophores and chains of fusiform conidia with distinct disjunctives.

Byssoascus v. Arx in Persoonia 6: 376. 1971. — Type species: *B. striatisporus* (Barron & Booth) v. Arx.

Anamorph: unnamed, *Coremiella* or *Oidiodendron* like, forming branched chains of arthroconidia with disjunctives. The ascospores are distinctly furrowed and have five longitudinal rims (Barron & Booth, 1966).

Pseudogymnoascus Raillo in Zentbl. Bakt. ParasitKde 2, 38: 520. 1929. — Type species: *P. roseus* Raillo.

Anamorph: *Geomyces* or absent.

Geomyces pannorum is the anamorph of *P. roseus* (Samson, 1972). Species without anamorphs are *P. bhattii* Samson and *P. alpinus* Müller & v. Arx (ascospores with two or three longitudinal rims).

Myxotrichum Kunze in Mykol. Hefte 2: 109. 1823. — Type species: *M. chartarum* Kunze. — Synonyms: *Actinospora* Corda, *Eidamella* Matr. & Dassonv., *Toxotrichum* Orr & Kuehn.

Anamorphs: unnamed, *Geomyces-* or *Malbranchea*-like.

Currah (1985) accepted nine species, all closely related.

Monascus v. Tiegh. in Bull. Soc. bot. Fr. 31: 266. 1884. — Type species: *M. ruber* v. Tiegh. — Synonyms: *Allescheria* Sacc. & Syd., *Backusia* Thirumalachar & al., *Xeromyces* Fraser.

Anamorph: *Basipetospora*.

Hawksworth & Pitt (1983) accepted three species, among which was *M. purpureus* Went, but excluded *M. bisporus* (Fraser) v. Arx (as *Xeromyces bisporus* Fraser), a highly osmophilic species on dried fruits, tobacco and other substrates.

Monascella Guarro & v. Arx in Mycologia 78: 869. 1986. — Type species: *M. botryosa* Guarro & v. Arx, isolated from soil in Spain, without anamorph.

Eremascus Eidam in Cohn in Beitr. Biol. Pfl. 3: 385. 1883. — Type species: *E. albus* Eidam.

Second species: *E. fertilis* Stoppel.

Both species are highly osmophilic. The genus is related to *Monascus. Xeromyces* would be an intermediate, if it were to be accepted as a separate genus.

Renispora Sigler & Carmichael in Mycotaxon 10: 133. 1979. — Type species: *R. flavissima* Sigler & al.

Anamorph: *Chrysosporium.*

Thermoascus Miehe, Die Selbsterhitzung des Heues: 70. 1907. — Type species: *T. aurantiacus* Miehe. — Synonym: *Dactylomyces* Sopp.

Anamorphs: *Paecilomyces, Polypaecilum*, or absent.

Further species: *T. crustaceus* (Apinis & Chesters) Stolk and *T. thermophilus* (Sopp) v. Arx.

Trichocoma Jungh., Praemissa Fl. Crypt. Javae Ins. 1: 9. 1838. — Type species: *T. paradoxa* Jungh.

The fungus has been redescribed by Boedijn (1935), Kominami & al. (1952) and Malloch & Cain (1972). It includes a *Paecilomyces*-like anamorph.

Penicilliopsis Solms-Laubach in Ann. Jard. Bot. Buitenz. 6: 53. 1887. — Type species: *P. clavariaeformis* Solms-Laubach.

Anamorph: *Sarophorum, Stilbodendron* (conidiogenesis as in *Paecilomyces* or *Raperia*).

Second species: *P. africana* Samson & Seifert.

The genus has been discussed by Samson & Seifert (1985). Its species occur on the large seeds of *Araucaria*, *Diospyros*, and other plants in tropical areas. The ellipsoidal ascospores are flanged, which is uncommon in the Onygenaceae.

Amauroascaceae v. Arx, *fam. nov.*

Ascomata superficialia, globosa, non-ostiolata, hyalina vel pigmentata; asci globosi vel obovati, sessiles, plerumque octospori, tenui tunicati, evanescentes; ascosporae globosae, subglobosae vel oblatae, non septatae, hyalinae vel pigmentatae, ornamentatae (alveolatae vel punctatae) vel glabrae. — Genus typica: *Amauroascus* J. Schröt.

The Amauroascaceae include Eurotiales with spherical or nearly spherical, occasionally bilaterally flattened (oblate) ascospores with a relatively thick, often reticulate, alveolate, pitted, spinulose, crested, or sheathed wall. The ascomata are usually spherical and small or medium-sized (up to 0.5 mm in diameter). Most species are keratinolytic.

Similar asci and ascospores occur in the Pezizales, especially in the Tuberaceae and Ascodesmidiaceae. Some members of the Pezizaceae are also characterized by spherical, alveolate-reticulate ascospores, but these are formed in cylindrical asci with an operculum.

Several genera of the Endomycetales (yeasts) include species with spherical, smooth or ornamented, usually hyaline and small ascospores.

Anamorphs: *Chrysosporium*, *Malbranchea*, *Histoplasma*, *Zymonema*, *Geotrichum*-like, often unnamed.

KEY TO THE GENERA

1 a. Ascomata bearing densely coiled, pale appendages 2
b. Ascomata without coiled appendages 5
2 a. Ascomata dark, with a wall of angular cells . . . . *Pleuroascus*
b. Ascomata pale and without such a wall 3
3 a. Conidia of the anamorph spherical and warty . . . . *Emmonsiella*
b. Conidia of the anamorph smooth 4
4 a. Ascospores smooth, parasitic on man . . . . *Ajellomyces*
b. Ascospores punctulate or pitted, saprophytic . . . . *Apinisia*
5 a. Ascospores hyaline 6
b. Ascospores pigmented 8
6 a. Ascomata white or pale, with a wall of hyphal filaments . . . . *Arachnotheca*
b. Ascomata with a dark wall 7
7 a. Ascospores sheathed when young, becoming reticulate . . . . *Leiothecium*
b. Ascospores smooth or nearly so . . . . *Xylogone*
8 a. Ascomata with some long, apically circinate hairs; ascospores oblate, smooth, pale brown *Arachnomyces*
b. Above characters not combined 9
9 a. Ascomata covered with stiff, often branched appendages or setae; ascospores reticulate-alveolate . . . . *Auxarthron*
b. Ascomata without such appendages 10

10 a. Ascomata with a hyphal wall or without a wall; anamorphs absent; ascospores spherical, reticulate-alveolate . . . . *Amauroascus*
   b. Ascomata with a wall of angular or flattened cells; ascospores spherical-ovate or oblate . . 11
11 a. Ascospores 5–8 μm, reticulate-alveolate or crested . . . . *Aphanoascus*
   b. Ascospores 2–3 μm, punctulate or pitted . . . . *Xanthothecium*

Amauroascus J. Schröt. in Krypt. Fl. Schles. (ed. Cohn) 3(2): 211. 1893. — Type species: *A. niger* J. Schröt.

Further species: *A. mutatus* (Quél.) Rammeloo (*A. verrucosus*), *A. aureus* (Eidam) v. Arx, *A. kuehnii* v. Arx (*Arachniotus reticulatus* Kuehn), *A. volatilis-patellis* (Orr & Kuehn) Currah. *Amauroascus aureus* may be pathogenic on man.

Auxarthron Orr & Kuehn in Can. J. Bot. 41: 1439. 1953. — Type species: *A. californiense* Orr & Kuehn. — Synonym: *Macronodus* Orr (Currah, 1985).

Currah (1985) accepted seven species, which are distinguished mainly by the structure of the ascomatal hairs.

Aphanoascus Zukal in Ber. dt. bot. Ges. 8: 296. 1890. — Type species: *A. cinnabarinus* Zukal (*A. fulvescens* (Cooke) Apinis). — Synonyms: *Anixiopsis* Hansen, *Keratinophyton* Randhawa & Sandhu.

Anamorph: *Chrysosporium*.

Anixiopsis Hansen, with *Anixiopsis fulvescens* (Cooke) de Vries as type species, may be an alternative generic name. The identity of *Aphanoascus cinnabarinus* and *Anixiopsis stercoraria* Hansen has been questioned by de Vries (1969), because the type specimen of *Aphanoascus cinnabarinus* does not exist. A further species might be *Keratinophyton terreum* Randhawa & Sandhu. The taxon described by Currah (1985) under the incorrect name *Keratinophyton durum* (Zukal) Currah represents an undescribed species with oblate ascospores with a reticulate wall (von Arx, 1986b).

Arachnotheca v. Arx in Persoonia 6: 376. 1971. — Type species: *A. glomerata* (Müller & Pacha-Aue) v. Arx. — Synonyms: *Kuehniella* Orr, *Nanniziopsis* Currah.

Anamorphs: *Chrysosporium, Malbranchea*.

Further species: *A. albicans* (Apinis) v. Arx; *A. vriesii* (Apinis) Samson apud v. Arx (1981).

Pleuroascus Massee & Salmon in Ann. Bot. 15: 330. 1901. — Type species: *P. nicholsonii* Mass & Salm.

The fungus was redescribed by Malloch & Benny (1973). The genus is monotypic.

Apinisia LaTouche in Trans. Br. mycol. Soc. 51: 283. 1968. — Type species: *A. graminicola* LaTouche.

The fungus is known from a single specimen. It includes a *Chrysosporium*-like anamorph.

Emmonsiella Kwon-Chung in Science 177: 368. 1972. — Type species: *E. capsulata* Kwon-Chung.

Emmonsiella capsulata is the rare teleomorph of *Histoplasma capsulatum* Darling. McGinnis & Katz (1979) synonymized *Emmonsiella* with *Ajellomyces*. Both can be distinguished mainly by the much more common anamorphs.

Ajellomyces McDonough & Lewis in Mycologia 60: 77. 1968. — Type species: *A. dermatitidis* McDonough & Lewis.

Anamorph: *Zymonema dermatitidis* (Gilchrist & Stokes) Dodge.

Xylogone v. Arx & Nilsson in Svensk bot. Tidskr. 63: 345. 1969. — Type species: *X. sphaerospora* v. Arx & Nilsson.

Anamorph: unnamed, with septate, hyaline arthroconidia with disjunctives.

Xanthothecium v. Arx & Samson in Persoonia 7: 377. 1973. — Type species: *X. peruvianum* (Cain) v. Arx & Samson, without anamorph.

Leiothecium Samson & Mouchacca in Can. J. Bot. 53: 1634. 1975. — Type species: *L. ellipsoideum* Samson & Mouchacca.

Arachnomyces Massee & Salmon in Ann. Bot. 16: 68. 1902. — Type species: *A. nitidus* Mass. & Salm.

Further species: *A. minimus* Malloch & Cain, *A. sulphureus* Mass. & Salm. (Malloch & Cain, 1970a).

THE ANAMORPHS OF THE EUROTIALES

The anamorphs of the Eurotiales are similar to those of the Erysiphaceae and the Dipodascaceae and can be recognized by the formation of 'arthroconidia' or acrogenous 'aleurioconidia'. Catenate conidia develop in basipetal sequence or at random and are separated from each other by two septa. Disjunctives between the two septa are usually present, but are often not visible by light microscopy. Acrogenous conidia separate from the supporting cell by two septa, which are often not adjacent, but separated by empty parts of the conidiogenous hypha. The conidia usually separate by elongation or swelling of the disjunctives and by cleavage or lysis of the hyphal wall.

In the anamorphs of the Microascaceae, the conidia are often also arranged in basipetal chains, but the conidiogenous cells elongate percurrently and often show annellations. Disjunctives between the conidia are absent (form genera *Scopulariopsis*, *Cephalotrichum*, *Gliomastix*, and *Memnoniella*).

In the anamorphs of the Xylariaceae the conidia also separate from the supporting cell by two septa. After release frills are visible at the base of the conidia and on the conidiogenous cells. In contrast to the anamorphs of the Eurotiales, the conidia are formed singly and successively on numerous loci of the conidiogenous cell, which may elongate sympodially (form genera *Dicyma* (incl. *Hansfordia*), *Nodulisporium*, *Geniculisporium*, and *Dematophora*).

In the existing systems of the Hyphomycetes, the above-discussed relations have never been recognized. Consequently the anamorphs of the Eurotiales have been classified in the most divergent groups or families, mainly in the Aleuriosporae, Arthrosporae, and Phialosporae (compare in this respect Hawksworth & al., 1983).

Only genera known to the author from personal studies are included in the following key. Some anamorph genera of Sphaeriales and other Ascomycota are included, especially genera which often have been confused with anamorphs of Eurotiales.

KEY TO THE GENERA OF ANAMORPHS

1a. Conidia catenate 2
b. Conidia not catenate 25
2a. Conidiogenous filaments develop from ampulliform or lanceoloid cells, conidia in basipetal chains 3
b. Ampulliform or lanceoloid cells absent 10
3a. Colonies restricted, reddish; conidia short cylindrical; osmophilic . . . . *Wallemia*
b. Above characters not combined 4
4a. Conidiogenous cells ampulliform; conidia spherical or ovate 5
b. Conidiogenous cells usually lanceolate or cylindrical, or with a narrow and elongate neck; conidia cylindrical, fusiform, ellipsoidal, or occasionally nearly spherical 7
5a. Conidiophores with an apical swelling . . . . *Aspergillus*
b. Conidiophores without apical swelling 6
6a. Conidiogenous cells in an apical whorl; conidia dark, verrucose . . . . *Memnoniella*
b. Conidiophores penicillately branched or absent; conidia hyaline or pale . . . . . . *Penicillium*
7a. Conidia broadly fusiform and longer than 20 µm . . . . *Phialomyces*
b. Conidia shorter 8
8a. Conidiophores apically inflated and coarse . . . . *Raperia*
b. Conidiophores apically not inflated, often verticillately or penicillately branched, occasionally simple or absent 9
9a. Conidiophores erect, pigmented, verrucose . . . . *Acrophialophora*
b. Conidiophores pale, simple, branched, or absent . . . . *Paecilomyces*
10 a. Conidia formed in basipetal sequence, hyaline, smooth, spherical or ellipsoidal 11
b. Conidia usually formed at random in unbranched or branched chains, usually cylindrical or barrel-shaped, or becoming spherical-oblate 12
11 a. Conidiogenous cells apically inflated or forked, often with several conidiogenous loci *Polypaecilum*
b. Conidiogenous cells not inflated, not forked . . . . *Basipetospora*
12 a. Colonies unpigmented, all hyphae disarticulating by double, adjacent septa . . . *Geotrichum*
b. Colonies pigmented or unpigmented, vegetative hyphae usually not disarticulating 13
13 a. Conidial chains much branched; conidia 0- to 5-septate, hyaline; parasitic on palms, causing rot . . . . *Mauginiella*
b. Above characters not combined 14
14 a. Conidiogenous hyphae in whorls on long, erect conidiophores 15
b. Above characters not combined 17
15 a. Conidia barrel-shaped, separated from each other by empty parts of the hypha *Amblyosporium*
b. Conidia short cylindrical, separated from each other by disjunctives 16

16 a. Conidiophores and conidia hyaline, colonies pigmented . . . . *Botryomonilia*
b. Conidiophores and conidia pigmented . . . . *Staheliella*
17 a. Conidiogenous hyphae formed successively in sympodulae, conidia cylindrical, hyaline *Sympodiella*
b. Conidiogenous hyphae not in sympodulae 18
18 a. Conidiogenous hyphae much branched, forming orange, pustulate sporodochia; colonies much expanding . . . . *Chrysonilia*
b. Conidia not in orange, pustulate sporodochia 19
19 a. Pigmented, erect conidiophores usually present 20
b. Pigmented, erect conidiophores absent 21
20 a. Conidia spherical-oblate, with a darker girdle . . . . *Stephanosporium*
b. Conidia without such a girdle . . . . *Oidiodendron*
21 a. Conidia short cylindrical, not or only slightly swollen 22
b. Conidia swollen or septate, with truncate ends or a truncate base 24
22 a. Conidiogenous hyphae and conidia 4–9 μm broad . . . . *Sporendonema*
b. Conidiogenous hyphae and conidia 1.5–4 μm broad 23
23 a. Conidia usually separated from each other by empty parts of the hypha . . . . . . *Malbranchea*
b. Conidia separated from each other by two adjacent septa, often with disjunctives . *Coremiella*
24 a. Conidia thick-walled or ornamented, in short chains, separated from each other by empty parts of the hypha 25
b. Conidia thin-walled, aseptate or septate, smooth, in often branched chains; usually separated from each other by adjacent septa 32
25 a. (from 1 and 24) At least some conidia large and many-septate 26
b. Conidia aseptate (occasionally 1-septate) 29
26 a. Macroconidia fusiform 27
b. Macroconidia cylindrical or clavate-obovate 28
27 a. Macroconidia broadly fusiform, ornamented; microconidia usually present . . *Microsporum*
b. Macroconidia narrowly fusiform and smooth; microconidia absent . . . . . . *Keratinomyces*
28 a. Macroconidia clavate-obovate, microconidia absent . . . . *Epidermophyton*
b. Macroconidia cylindrical or ellipsoidal, microconidia present, often predominant *Trichophyton*
29 a. Conidia spherical, relatively large (more than 10 μm) and warty; parasitic on man *Histoplasma*
b. Above characters not combined 30
30 a. Conidia spherical or nearly so, relatively large, smooth; parasitic on man . . . . . . *Zymonema*
b. Above characters not combined, conidia when spherical smaller 31
31 a. Indistinct conidiophores often present, conidia mainly intercalary . . . . *Geomyces*
b. Erect conidiophores absent, conidia intercalary and lateral . . . . *Chrysosporium*
32 a. Conidia swollen, aseptate . . . . *Arthrographis*
b. Conidia not or only slightly swollen, septate . . . . *Hormographis*

Aspergillus Mich. ex Link in Mag. Ges. Naturf. Berlin 3: 16. 1809. — Type species: *A. glaucus* (Mich.) Link. — Synonyms: *Sterigmatomyces* Cramer, *Raedellia* Cif., *Cladosarum* Yuill.

About 150 species have been accepted by Raper & Fennell (1965) and Samson (1979). Many more are described.

Penicillium Link in Mag. Ges. Naturf. Berlin 3: 16. 1809. — Type species: *P. expansum* Link. — Synonyms: *Coremium* Link, *Citromyces* Wehmer, *Eladia* G. Smith, *Rhodocephalus* Corda, *Torulomyces* Delitsch.

About 150 species will have to be accepted, but many more are described. *Penicillium* sensu Raper & Thom (1949) and sensu Pitt (1979) is polyphyletic; the species of the section *Biverticillata* should be transferred to *Paecilomyces*. The type species of the former genus *Torulomyces* has no distinct conidiophores. *Geosmithia* Pitt is closely related to *Penicillium*.

Wallemia Johan-Olson in Forh. Christiana Vid. Selsk. 12: 6. 1887. — Type species: *W. sebi* (Fr.) v. Arx. — Synonyms: *Bargellinia* Borzi, *Hemispora* Vuill.

Paecilomyces Bainier in Bull. Soc. mycol. Fr. 23: 26. 1907. — Type species: *P. variotii* Bainier. — Synonyms: *Phialotubus* Roy & Leelavathy, *Septofusidium* W. Gams, *Sagenomella* W. Gams, *Penicillium* sect. *Biverticillata* sensu Raper & Thom (1949), *Spicaria* auct.

About 25 species will have to be accepted. The entomogenous species with swollen conidiogenous cells and conidia without disjunctors belong to *Nomuraea* Maubl. sensu Samson (1974) and represent anamorphs of Clavicipitaceae. *Mariannaea* Arnaud ex Samson (1974) is unrelated to *Paecilomyces*, but may be indistinguishable from *Clonostachys* Corda. The conidia have no disjunctors, but are arranged obliquely in 'false' chains. This genus includes anamorphs of the Hypocreaceae.

Raperia Subramanian & Rajendran in Kavaka 3: 129. 1975. — Type species: *R. spinulosa* Subramanian & Rajendran. — Synonym. *Merimbla* Pitt (von Arx, 1986a).

Second species: *R. ingelheimensis* (v. Beyma) v. Arx.

Memnoniella Höhnel in Zentbl. Bact. ParasitKde 2, 60: 16. 1923. — Type species: *M. echinata* (Riv.) Galloway.

Further species: *M. subsimplex* (Cooke) Deighton.

Teleomorphs are absent. The genus is reminiscent of *Penicillium*, but is a relative of *Scopulariopsis* (anamorphous Microascaceae). The spherical and echinulate, dark conidia have an indistinctly truncate base without disjunctors (Jong & Davis, 1976).

Phialomyces Misra & Talbot in Can. J. Bot. 42: 1287. 1967. — Type species: *P. macrosporus* Misra & Talbot.

Acrophialophora Edward in Mycologia 51: 789. 1959. — Type species: *A. nainiana* Edward.

Further species: *A. fusispora* (Saksena) Samson, *A. levis* Samson & Tariq Mahmood.

Basipetospora Cole & Kendr. in Can. J. Bot. 46: 991. 1968. — Type species: *B. rubra* Cole & Kendr.

Further species: *B. chlamydosporis* Matsushima, *B. variabilis* Matsushima.

Polypaecilum G. Smith in Trans. Br. mycol. Soc. 44: 437. 1961. — Type species: *P. insolitum* G. Smith.

Further species: *P. botryoides* (Brooks & Hansf.) Rao & Hoog.

Stephanosporium Dal Vesco in Allionia 7: 182. 1961. — Type species: *S. cerealis* (Thüm.) Swart.

Oidiodendron Robak in Nyt. Mag. Naturvid. 71: 243. 1932. — Type species: *O. tenuissimum* (Peck) Hughes.

About twelve species are described (Barron, 1962). Teleomorphs are unknown.

Coremiella Bubak & Krieger in Annls Mycol. 10: 52. 1912. — Type species: *C. cubispora* (Berk. & Curt.) M. B. Ellis.

Further species: *C. cuboidea* (Sacc. & Ellis) Cif. & Caretta.

Briosia may be an older generic name, but the type specimen of the type species is no longer adequate for study. Sigler & Carmichael (1976, 1983) and Sigler & al. (1982) classified some similar fungi in *Arthrographis* and in the new genera *Arthrocristula* and *Arthropsis.*

Geomyces Traaen in Nyt. Mag. Naturvid. 52: 28. 1914. — Type species: *G. pannorum* (Link) Hughes.

The genus can be distinguished from *Chrysosporium* only with difficulty.

Chrysosporium Corda in Sturm, Dtl. Fl., Pilze 3, 13: 85. 1833. — Type species: *C. merdarium* (Link) Carmichael.

Carmichael (1962) delimited about twenty species, some of which were transferred by van Oorschot (1980) to *Geomyces* and *Myceliophthora*. The latter genus is polyphyletic and preferably should be restricted to anamorphs of *Corynascus* (Sordariaceae). Several teleomorphs of Eurotiales include undescribed *Chrysosporium* anamorphs.

Malbranchea Sacc. in Michelia 2: 638. 1882. — Type species: *M. pulchella* Sacc.

Sigler and Carmichael accepted about fifteen species, among which the thermophilic *M. cinnamomea* (Lib.) Oorschot & Hoog (as *M. sulphurea* (Miehe) Sigler & Carmichael). The genus is similar to *Sporendonema* and its separation from the *Chrysosporium/Geomyces* complex is artificial and difficult.

Sporendonema Desm. in Fr., Syst. Mycol. 3: 434. 1832. — Type species: *S. casei* Desm.

Second species: *S. purpurascens* (Bon.) Mason & Hughes. Teleomorphs are unknown.

Zymonema Beurm. & Gougerot in Tribune Méd. 42: 503. 1909. — Type species: *Z. dermatitidis* (Gilchrist & Stokes) Dodge (*Blastomyces dermatitidis, Z. gilchristii*) (van Oorschot, 1980).

Histoplasma Darling in J. Am. med. Ass. 46: 1283. 1906. — Type species: *H. capsulatum* Darling.

Microsporum Gruby in C.r. hebd. Séance Acad. Sci. Paris 17: 301. 1836. — Type species: *M. audouinii* Gruby.

About twelve species are distinguished.

Keratinomyces Vanbreus. in Bull. Acad. R. méd. Belg. 38: 1068. 1952. — Type species: *K. ajelloi* Vanbreus. (*Trichophyton ajelloi*), a keratinolytic, apparently saprophytic soil fungus. Two further species are described (Punsola & Guarro, 1984).

Trichophyton Malmsten in Arch. Anat. Phys. Wiss., Med. 1: 1838. — Type species: *T. tonsurans* Malmsten.

About forty species are described; common on man are *T. mentagrophytes* (Robin) Blanchard, *T. rubrum* (Castellani) Sabouraud and *T. violaceum* Sabouraud.

Epidermophyton Sabour., Les maladies du Cuir Chevalu 3: 420. 1910. — Type species: *E. floccosum* (Harz) Langeron & Milochevitch.

Sympodiella Kendr. In Trans. Br. mycol. Soc. 41: 519. 1958. — Type species: *S. acicola* Kendr.

Further species are added by Matsushima (1975). Teleomorphs are unknown.

Staheliella Emden in Acta bot. Neerl. 23: 251. 1974. — Type species: *S. nodosa* Emden, without teleomorph.

Botryomonilia Goos & Piroz. in Can. J. Bot. 53: 2927. 1975. — Type species: *B. scheelcae* Goos & Piroz., without teleomorph.

Amblyosporium Fres. in Beitr. Mykol. 3: 99. 1863. — Type species: *A. spongiosum* (Pers.) Hughes.

Pirozynski (1969) delimited three further species. Teleomorphs are unknown. The cultural states are reminiscent to those of Sclerotiniaceae.

Arthrographis Cochet ex Sigler & Carmichael in Mycotaxon 4: 359. 1976. — Type species: *A. kalrai* (Tewari & Macpherson) Sigler & Carmichael.

The teleomorph has been described by von Arx (1978) as *Pithoascus langeronii* (Pithoascaceae or Microascaceae). Sigler & Carmichael (1983) classified further species in *Arthrographis*, which have to be excluded, because they form dematiaceous and more expanding colonies, and the conidia develop in unbranched chains and are short cylindrical and unswollen.

Hormographis Guarro & al. in Mycologia 78: 969. 1986. — Type species: *H. ramirezii* Guarro & al., without teleomorph, keratinolytic.

Chrysonilia v. Arx in Sydowia 34: 16. 1981. — Type species: *C. sitophila* (Mont.) v. Arx (*Monilia sitophila* Mont.).

The genus includes anamorphs of *Neurospora* species (Sordariaceae). The catenate conidia develop at random or in basipetal or acropetal sequence and separate by double septa and extending disjunctors. *Melanocarpus albomyces* (Cooney & Emerson) v. Arx has a similar anamorph with relatively large, long cylindrical conidia. This fungus is thermophilic and should also be classified in the Sordariaceae.

Mauginiella Cav. in Boll. Orto bot. Napoli 8: 207. 1926. — Type species: *M. scaettae* Cav.

A teleomorph is unknown. The fungus causes rot on date palms and apparently represents an anamorph of the Sclerotiniaceae, related to *Septotis* (teleomorph: *Septotinia*, similar to *Sclerotinia*). The septa of the vegetative hyphae have central pores, in which plasmatic strands and migrating nuclei have been observed by von Arx & al. (1981).

Geotrichum Link in Mag. Ges. Naturf. Berlin 3: 17. 1809. — Type species: *G. candidum* Link. — Synonyms: *Oosporidea* Sumstine, *Polymorphomyces* Coupin, *Blastoschizomyces* Salkin & al.

Teleomorph: *Dipodascus* Lagerh. (and *Galactomyces* Redhead & Malloch) (Dipodascaceae, Endomycetales).

Several Eurotiales include unnamed, *Geotrichum*-like anamorphs. The colonies, however, are usually pigmented and the vegetative hyphae are persistent and have septa with central pores. In *Geotrichum* species the colonies are unpigmented and all hyphae form double, adjacent septa with disjunctives and disarticulate earlier or later into single cells.

Several species of *Geotrichum* are dimorphic or even trimorphic. *Geotrichum armillariae* v. Arx for example forms arthroconidia and acrogenous, aseptate, hyaline aleurioconidia (chlamydospores), which are often predominant. *Geotrichum capitatum* (Diddens & Lodder) v. Arx forms arthroconidia and supplementary conidia with a truncate base from sympodially elongating conidiogenous cells or hyphae. Erect conidiophores may be present. A separate genus *Blastoschizomyces* Salkin & al. (type species: *B. pseudotrichosporon* Salkin & al.) has been introduced for this species. Other dimorphic *Geotrichum* species are *G. eriense* (Hedrick & Dupont) Weijman and *G. terrestre* (v. d. Walt & Johannson) Weijman.

Von Arx (1977a) delimited fourteen species; eight of which include *Dipodascus* teleomorphs. The asci develop from conjugating hyphae or hyphal tips, which arise from arthroconidia or from aerial hyphae. *Dipodascus magnusii* (Ludwig) v. Arx forms erect ascophores, on which the gametangial hyphae develop. All *Dipodascus* species have rather persistent asci and the ascospores are often extruded through an apical opening. *Dipodascus geotrichum* (Butler & Peterson) v. Arx and *D. reessii* (v. d. Walt) v. Arx have 1- or 2-spored asci with rather thick-walled ascospores. These species therefore have been classified in a separate genus *Galactomyces* of the Onygenaceae by Redhead & Malloch (1977). *Galactomyces* was synonymized with *Dipodascus* by von Arx (1977a).

The ascospores of *Dipodascus* species are reminiscent of those of the species of the yeast genera *Yarrowia* v. d. Walt & v. Arx and *Schwanniomyces* Klöcker, and of those of the Onygenaceae.

TAXA EXCLUDED FROM THE EUROTIALES

A. THE PSEUDEUROTIACEAE

The Pseudeurotiaceae are described and delimited by Malloch & Cain (1970b). They are characterized by relatively large, spherical ascomata with a distinct peridium, by spherical, oblate, or reniform, often pigmented ascospores, and by *Cephalosporium*- or *Sporothrix*-like anamorphs with aseptate, hyaline blastoconidia. One species has a *Chalara*-like anamorph with cylindrical conidia formed in a tube in basipetal sequence from a meristematic zone.

The Pseudeurotiaceae sensu Malloch & Cain (1970b) are probably polyphyletic, but all show affinities to the Sphaeriales, especially to the Ophiostomataceae, Microascaceae, and Sordariaceae.

KEY TO THE GENERA OF PSEUDEUROTIACEAE

1a.	Ascomata with a pale, fleshy wall; ascospores with a sheath or with winged appendages	2
b.	Ascomata with a dark, usually black wall; ascospores smooth, occasionally reticulate	3
2a.	Ascospores ellipsoidal, with a sheath	*Leucosphaerina*
b.	Ascospores ellipsoidal or fusiform, with winged appendages	*Emericellopsis*
3a.	Ascomata spherical, not cephalothecoid; ascomatal wall without sutures	4
b.	Ascomata cephalothecoid; ascomatal wall with sutures (lines of dehiscence)	8
4a.	Ascospores with a reticulate wall, spherical or nearly so	*Hapsidospora*
b.	Ascospores with a smooth wall	5
5a.	Ascospores hyaline	6
b.	Ascospores pigmented when mature	7
6a.	Ascospores reniform in lateral view	*Connersia*
b.	Ascospores spherical or nearly so	*Nigrosabulum*
7a.	Ascospores triangular in lateral view	*Pidoplichkoviella*
b.	Ascospores ovate or nearly spherical	*Pseudeurotium*
8a.	Ascospores hyaline, short cylindrical	*Cryptendoxyla*
b.	Ascospores not cylindrical, pigmented when mature	9
9a.	Parasitic on Polyporales; ascospores often bilaterally flattened	*Albertiniella*
b.	Saprophytic; ascospores reniform or hemispherical	*Fragosphaeria*

Albertiniella Kirschst. in Annls Mycol. 34: 183. 1936. — Types species: *A. polyporicola* (Jacz.) Malloch & Cain.

The fungus occurs on pores of members of the Polyporales. It was first described as *Cephalotheca polyporicola* Jacz., and since as *Albertiniella reticulata* Kirschst. and as *Cephalotheca splendens* Udagawa & Horie (1971). The latter authors discovered a *Cephalosporium*-like anamorph. The ascospores are slightly oblate (bilaterally flattened?) and brown when mature.

Connersia Malloch in Fungi Canadensis no. 32. 1974. — Type species: *C. rilstonii* (Booth) Malloch.

Connersia rilstonii is based on *Pseudeurotium rilstonii* Booth, which differs from typical *Pseudeurotium* species by hyaline, ellipsoidal-reniform, unilaterally flattened ascospores. Those of *Pseudeurotium* species are spherical-ovate and slightly pigmented when mature.

Cryptendoxyla Malloch & Cain in Can. J. Bot. 48: 1816. 1970. — Type species: *C. hypophloia* Malloch & Cain.

This fungus includes a *Chalara*-like anamorph with conidia formed in tube-like cells endogenously in basipetal sequence. This anamorph is similar to that of *Ceratocystis* species (Ophiostomataceae).

Emericellopsis v. Beyma in Antonie van Leeuwenhoek 6: 263. 1939. — Type species: *E. terricola* v. Beyma.

Gams (1971) accepted seven species, all with pale ascomata and ellipsoidal-fusiform, slightly pigmented ascospores with longitudinal wings and crests. All species include *Cephalosporium*-like anamorphs and are closely related, probably indistinguishable. The genus has been connected with the Hypocreaceae, but this may be questionable. The ascospores are reminiscent of those of *Penicilliopsis* species.

Fragosphaeria Shear in Mycologia 15: 124. 1923. — Type species: *F. purpurea* Shear, with a *Cephalosporium*-like anamorph.

Further species: *F. reniformis* (Sacc. & Therry) Malloch & Cain, with a *Sporothrix*-like anamorph, and **Fragosphaeria savoryi** (Booth) v. Arx, *comb. nov.* (basionym. *Cephalotheca savoryi* Booth in Mycol. Pap. 83: 12. 1961) with a *Tritirachium*-like anamorph.

Fragosphaeria may be related to *Microascus* and *Pithoascus*.

Hapsidospora Malloch & Cain in Can. J. Bot. 48: 1819. 1970. — Type species: *H. irregularis* Malloch & Cain, with a *Cephalosporium*-like anamorph.

Leucosphaerina v. Arx, *nom. nov.* (replaced synonym: *Leucosphaera* v. Arx & al. in Persoonia 10: 141. 1978; non *Leucosphaera* Gilg, 1897). — Type species: **Leucosphaerina indica** (v. Arx & al.) v. Arx, *comb. nov.* (basionym: *Leucosphaera indica* v. Arx & al. in Persoonia 10: 141. 1978).

Anamorph: *Sporothrix*- or *Cephalosporium*-like.

Nigrosabulum Malloch & Cain in Can. J. Bot. 48: 1822. 1970. — Type species: *N. globosum* Malloch & Cain.

This fungus includes a *Cephalosporium*-like anamorph. The hyaline ascospores are spherical or nearly so and often show a small lateral globule.

Pidoplichkoviella Kirilenko in Mykrobiol. Zh. 37: 603. 1975. — Type species: *P. terricola* Kirilenko.

The ascomata are spherical, smooth, dark and relatively small. The pigmented ascospores are triangular in lateral view and have no germ pore. No anamorphs could be observed in subcultures of the type. A relationship to the Pithoascaceae has to be considered. The ascospores, however, are not dextrinoid when young.

Pseudeurotium v. Beyma in Zentbl. Bakt. ParasitenKde. 2, 96: 415. 1937. — Type species: *P. zonatum* v. Beyma.

The genus includes two or three species with dark, spherical ascomata with a wall of angular cells. The ascospores are spherical or broadly ellipsoidal, smooth and pigmented when mature. All species include *Cephalosporium*-like or *Sporothrix*-like anamorphs with aseptate, hyaline blastoconidia. *Pseudeurotium ovalis* Stolk is a rather common soil fungus.

B. OTHER EXCLUDED AND DOUBTFUL TAXA

Amorphotheca Parbery in Austr. J. Bot. 17: 342. 1969. — Type species: *A. resinae* Parbery.

Amorphotheca resinae is the rarely encountered teleomorph of *Hormoconis resinae* (Lindau) v. Arx & Vries (*Cladosporium resinae*), the creosote fungus. The conidia are formed acropetally in branched chains with denticle-like, unthickened scars on erect conidiophores. The asci develop in obcampanulate or spherical ascomata with an amorphous wall, are clavate and contain ellipsoidal-reniform, aseptate, hyaline, smooth ascospores. Redhead & Malloch (1977) classified the Amorphothecaceae in the Endomycetaceae. It may be related to the Pithoascaceae and Microascaceae and consequently represent a family of the Sphaeriales.

Aporothielavia Malloch & Cain in Mycologia 65: 1074. 1973. — Type species: *A. leptoderma* (Booth) Malloch & Cain.

Aporothielavia leptoderma is known from a single isolate. It is a relative of *Zopfiella curvata* (Fuckel) Winter with aseptate ascospores without germ pores. The fungus should be classified in the Lasiosphaeriaceae (von Arx, 1975).

Eleutherascus v. Arx in Persoonia 6: 378. 1971. — Type species: *E. lectardii* (Nicot) v. Arx. — Synonym: *Hemiascosporium* Batra (1973).

Von Arx (1971) considered the fungus to be a relative of *Ascodesmis* (Pezizales) with spherical asci without operculum. Several members of the Pezizales have similar asci and ascospores, especially taxa classified in the Tuberaceae. *Eleutherascus* includes four species (van Emden, 1975; Huang, 1975; Samson & Luiten, 1975).

Ephemeroascus Emden in Trans. Br. mycol. Soc. 61: 599. 1973. — Type species: *E. verticillatus* Emden.

The fungus is known from a single isolate. It has been considered to be a relative of *Coniochaeta* with ascospores without germ slits. The ascomata are stromatic, black and a *Verticillium* anamorph with hyaline conidiophores and conidia is present.

Europhium Parker in Can. J. Bot. 35: 175. 1957. — Type species: *E. trinacriiforme* Parker.

The fungus has hat-shaped ascospores, very early-evanescent asci and includes a *Leptographium (Verticicladiella)* anamorph. It has to be classified in the Ophiostomataceae, but should not be synonymized with *Ceratocystis* or *Ophiostoma*. Robinson-Jeffrey & Davidson (1968) described supplementary species.

Faurelina Locquin-Linard in Rev. Mycol. 39: 125. 1975. — Type species: *F. fimigena* Locquin-Linard.

Further species are *F. elongata* (Udagawa & Furuya) Furuya and *F. indica* v. Arx & al. The latter species includes an anamorph with 1-septate arthroconidia. The genus has been connected with the Microascaceae, but its classification is debatable. The ascomata are hemispherical-pustulate and the ascospores are finely striate and pale brown when mature. The ascospore ornamentation and the anamorph suggest a relationship to *Neurospora* (Sordariaceae).

Leuconeurospora Malloch & Cain in Can. J. Bot. 48: 1820. 1970. — Type species: *L. pulcherrima* (Winter) Malloch & Cain.

This psychrophilic, soil-borne, or coprophilous fungus develops at temperatures of about 6°C. It forms cephalothecoid ascomata and broadly fusiform, ridged or reticulate, pale brown ascospores. Von Arx (1978) suggested a relationship to *Sphaerodes* (Ceratostomataceae, Melanosporaceae), which differs by ascospores with two prominent and protuberant, apical germ pores and by ostiolate or non-ostiolate ascomata with a pale wall.

Neogymnomyces Orr in Can. J. Bot. 48: 1061. 1970. — Type species: *N. demonbreunii* (Ajello & Cheng) Orr.

The genus is based on *Gymnoascus demonbreunii* Ajello & Cheng, which is known by a single isolate. Currah (1985) redescribed the fungus and classified it in the Onygenaceae. Subcultures of the type are sterile. The value of the genus may be questioned.

Neoxenophila Apinis & Clark in Trans. Br. mycol. Soc. 63: 263. 1974. — Type species: *N. foetida* Apinis & Clark.

Currah (1985) classified the fungus tentatively in the Onygenaceae. It is known by a single specimen, which was not available. The description is rather inadequate.

Pectinotrichum Varsavsky & Orr in Mycopath. Mycol. appl. 43: 229. 1971. — Type species: *P. llanense* Varsavsky & Orr.

Currah (1985) classified the fungus in the Onygenaceae. It may be related to *Auxarthron*, but differs by smooth and apparently oblate ascospores, a character of the Gymnoascaceae. No cultures or specimens with asci and ascospores could be studied.

Pithoascus v. Arx in Proc. K. Ned. Akad. Wet. (C) 76: 295. 1973. — Type species: *P. nidicola* (Massee & Salmon) v. Arx.

The genus includes seven species, partly with ostiolate, partly with non-ostiolate ascomata (von Arx, 1973, 1978). It differs from *Microascus* by fusiform or narrowly navicular ascospores without germ pore. A few species include *Scopulariopsis*- or *Arthrographis*-like anamorphs. Benny & Kimbrough (1980) introduced a separate family Pithoascaceae for *Pithoascus* and *Faurelina*.

Shanorella Benjamin in Aliso 3: 319. 1956. — Type species: *S. spirotricha* Benjamin.

The fungus is characterized by ascomata with a peridium composed of disarticulating hyphae and with spirally coiled, pale appendages. The ascospores are lenticular and slightly pigmented. *Shanorella* may belong to the Gymnoascaceae. Subcultures of the type are sterile. Currah (1985) observed the fungus on dung of carnivores after a long period of incubation.

Spiromastix Kuehn & Orr in Mycologia 59: 160. 1962. — Type species: *S. warcupii* Kuehn & Orr.

The genus is characterized by ascomata surrounded by arcuate, pigmented appendages and small, lenticular, yellow ascospores. It may belong to the Gymnoascaceae. Subcultures of the type are sterile.

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THE ASCOMYCETE GENUS SORDARIA

J. GUARRO* & J. A. VON ARX**

Sordaria is restricted to coprophilous, soil-, or seed-borne Pyrenomycetes with aseptate, elongate ascospores with a gelatinous, amorphous sheath. The genus is redescribed and a key to fourteen accepted species is given. A checklist of all taxa described as *Sordaria* is added.

In the course of a revision of cultures of *Sordaria* species maintained in the CBS Culture Collection, a checklist of all *Sordaria* species was compiled. The genus *Sordaria* is restricted to species with ostiolate ascomata, cylindrical asci and aseptate, elongate, cylindrical, ellipsoidal, or fusiform ascospores with a distinct gelatinous sheath. Species with ovate, broadly fusiform, or nearly spherical ascospores without sheath are classified in a separate genus *Asordaria* (von Arx & al., 1987).

Treatments on *Sordaria* have been published by Bayer (1924) for Central Europe, Cain (1934) for Ontario, Canada, Moreau (1953) for Europe, Boedijn (1962) for Indonesia, Cailleux (1972) for central parts of Africa, Lundqvist (1972) for nordic regions and by Barrasa & al. (1986) for Spain.

In this paper a new description of *Sordaria* sensu stricto is given, followed by a key to fourteen accepted species and a list of all species that have been referred to *Sordaria*.

SORDARIA Ces. & De Not.

Sordaria Ces. & De Not. in Comm. Soc. Crit. Ital. 1: 226. 1863. — Type species (lectotype): *S. fimicola* (Rob.) Ces. & De Not.

For synonyms see Lundqvist (1972).

Colonies expanding, dark, often with a pale or brown aerial mycelium, reverse brown or black; ascomata superficial, often embedded in the aerial mycelium, obovate, pyriform, or ampulliform, with a conical or cylindrical ostiolar beak; ascomatal wall pigmented, brown or nearly black, composed of 3–5 layers of rather large, slightly flattened cells, textura angularis in surface view, smooth or covered with pigmented hyphal appendages; asci cylindrical, with a short stalk, unitunicate, at the truncate apex with distinct, non amyloid, often ring-like thickenings, 8-spored; ascospores uniseriate, ellipsoidal, cylindrical, or fusiform with rounded ends, aseptate, brown or opaque when mature, with a distinct, often protuberant germ pore at base, with an amorphous, hyaline gelatinous sheath surrounding the spore except for the basal, porate part.

Coprophilous, soil- or seed-borne or isolated from plant debris.

Homothallic or heterothallic.

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* Dept. of Biology, Fac. of Medicine, University of Barcelona, Reus, Spain.

** Centraalbureau voor Schimmelcultures, Baarn, The Netherlands.

The heterothallic species can be recognized by a more abundant, often pale aerial mycelium, on which aseptate, hyaline micro-conidia (spermatia) are formed by budding.

KEY TO THE SPECIES

1 a.	Ascospores with a length/width ratio of 1.4–1.7	2
b.	Ascospores with a length/width ratio of 1.8–3	9
2 a.	Ascospores 15–24 × 9–13 µm	3
b.	Ascospores broader	5
3 a.	Homothallic; spermatia absent; ascomata pyriform, usually smooth	*S. fimicola*
b.	Heterothallic; spermatia (aseptate, small conidia) present	4
4 a.	Ascomata with a long beak, tomentose	*S. tomento-alba*
b.	Ascomata pyriform, with a broad, short beak	*S. brevicollis* *S. sclerogenia* *S. thermophila*
5 a.	Ascospores 18–23 × 12–15 µm, ellipsoidal-obovate	*S. lappae*
b.	Ascospores larger	6
6 a.	Ascospores 24–30 × 14–17 µm	*S. superba*
b.	Ascospores 28–36 × 18–25 µm	7
7 a.	Ascospores 22–25 µm broad	*S. capturae*
b.	Ascospores 18–21 µm broad	8
8 a.	Homothallic, spermatia absent	*S. macrospora*
b.	Heterothallic, spermatia present	*S. heterothallis*
9 a.	Ascospores with a rounded apex and an attenuated base	10
b.	Ascospores attenuated at both ends, fusiform	11
10 a.	Ascospores 21–26 × 9–12 µm, with a non-protuberant germ pore	*S. alcina*
b.	Ascospores 25–29 × 12–14 µm, with a protuberant germ pore	*S. papillata*
11 a.	Ascospores 25–31 × 12–14 µm	*S. baltica*
b.	Ascospores 32–40 × 12–15 µm	*S. elongatispora*

CHECKLIST

List of species that, at one time or another, have been referred to *Sordaria* (*S.*).

Names accepted in *Sordaria* Ces. & De Not., emend. Guarro & v. Arx are printed spaced.

S. alcina Lundq. in Symb. bot. upsal. 20: 326. 1972.

S. allahabadensis Srivastava & al. in Mycopath. Mycol. appl. 30: 203. 1966 = *Podospora austro-americana* (Speg.) Mirza & Cain.

S. aloides Fuckel in Jb. nassau. Ver. Naturk. 27–28: 43. 1873 = *Podospora aloides* Fuckel (Mirza & Cain, 1969).

S. alpina Griff. in Mem. Torrey bot. Club 11: 49. 1901. — The type could not be studied.

S. amphicornis Sacc., Syll. Fung. 1: 235. 1887 = *Podospora appendiculata* (Auersw.) Niessl (Mirza & Cain, 1969).

S. amphisphaeroides Ell. & Ev. in Am. Nat. 31: 340. 1897 = *Hypocopra amphisphaeroides* (Ell. & Ev.) Griff.

S. anomala (Griff.) Sacc. & D. Sacc. in Syll. Fung. 17: 603. 1905 = *Podospora anomala* (Griff.) Cain (Mirza & Cain, 1969).

S. anserina Wint. (Winter, 1873: 100) = *Podospora anserina* Niessl.

S. apiculifera Speg. in An. Mus. nac. Hist. nat. B. Aires 6: 251. 1899 = *Podospora apiculifera* (Speg.) Mirza & Cain (Mirza & Cain, 1969) or = *P. australis* (Speg.) Niessl (Lundqvist, 1972).

S. appendiculata Auersw. in Niessl in Verh. naturf. Ver. Brünn 10: 188. 1872 = *Podospora appendiculata* Auersw. ex Niessl (Mirza & Cain, 1969).

S. arachnoidea (Niessl) Sacc. & Syd. in Syll. Fung. 14: 492. 1899 = *Cercophora coprophila* (Fr.) Lundq. (Lundqvist, 1972).

S. araneosa Cain in Univ. Toronto Stud. (Biol. Ser.) 38: 52. 1934 = *Podospora araneosa* (Cain) Cain.

S. arctica Cain in Can. J. Bot. 35: 262. 1957 = *Asordaria arctica* (Cain) v. Arx & Guarro.

S. arenicola Grove in J. Bot. 66. 1930. — The type could not be studied.

S. argentina Speg. in An. Soc. ci. argent. 10: 16. 1880 = *S. fimicola* (Lundqvist, 1972).

S. argentinensis Speg. in An. Mus. nac. B. Aires 23: 49. 1912 = *Podospora argentinensis* (Speg.) Mirza & Cain (Mirza & Cain, 1969).

S. arizonensis (Griff.) Sacc. in Syll. Fung. 17: 601. 1905 = *Arnium arizonense* Lundq. & Krug (Lundqvist, 1972).

S. australis (Speg.) Sacc., Syll. Fung. 1: 239. 1882 = *Podospora australis* (Speg.) Niessl (Mirza & Cain, 1969).

S. austro-americana (Speg.) Sacc., Syll. Fung. 1: 237. 1882 = *Podospora austro-americana* (Speg.) Mirza & Cain (Mirza & Cain, 1969).

S. baltica Lundq. in Symb. bot. upsal. 20: 238. 1972.

S. barbata E.C. Hans. in Vid. Meddr dansk naturh. Foren. 1876: 21. 1877 = *Arnium macrotheca* (Crouan) Lundq. (Lundqvist, 1972).

S. bicurvata Rick in Broteria 2: 135. 1933.

S. bisporula (Crouan) Cooke & Plowr. in Grevillea 7: 86. 1879 = *Trichodelitschia bisporula* (Crouan) Lundq. (Lundqvist, 1964a).

S. bolbitoni (Quél.) Wint. in Rabenh. Kryptog.-Fl. (2. Aufl.) 1, Pilze 2: 169. 1885. — This is a doubtful species (Bayer, 1924).

S. bombardioides Auersw. ex Niessl in Verh. naturf. Ver. Brünn 10: 187. 1871 = *Bombardioidea bombardioides* (Auersw. ex Niessl) C. Moreau.

S. bosensis Das in Trans. Br. mycol. Soc. 45: 547. 1962 = *Areolospora bosensis* (Das) Hawksw. (Hawksworth, 1980).

S. botryosa Penz. & Sacc., Icon. Fung. Javan.: 9. 1904 = *Bombardia bombarda* (Batsch) J. Schroet. (Moreau, 1953).

S. bovilla (Cooke) Cooke in Grevillea 16: 55. 1887 = *Cercophora coprophila* (Fr.) Lundq. (Lundqvist, 1972).

S. brassicae (Kl.) Crouan, Fl. Finistère: 22. 1867 = *Arnium olerum* (Fr.) Lundq. & Krug apud Lundq. (Lundqvist, 1972).

S. brefeldii Zopf in Z. Naturw. 56: 539. 1883 = *Hypocopra brefeldii* (Zopf) Chen.

S. brevicaudata Speg. in An. Mus. nac. B. Aires 6: 252. 1899. — This is a nomen dubium (Lundqvist, 1972).

S. brevicollis Olive & Fantini in Am. J. Bot. 48: 124. 1961. — This species is a heterothallic relative of *S. fimicola*.

S. breviseta P. Karst. in Bidr. Känn. Finl. Nat. Folk 23: 52. 1873 = *Podospora appendiculata* (Auersw.) Niessl (Mirza & Cain, 1969) or = *P. pauciseta* (Ces.) Trav. (Lundqvist, 1972).

S. burkillii Mass. in Bull. misc. Inf. R. bot. Gdns Kew 1913: 105. 1913. — This is probably identical with *P. appendiculata* (Moreau, 1953).

S. byssiseda Petch in Ann. R. bot. Gdns Peradeniya 7: 302. 1922 = *Podospora* species (according to the description).

S. caerulea Petch in Ceylon J. Sci. (Bot.) 9: 319. 1915. — Probably a *Cercophora* species (Cain, 1934).

S. californica Plowr. in Grevillea 7: 72. 1878 = *Cercophora californica* (Plowr.) Lundq. (Lundqvist, 1972).

S. capturae Speg. in An. Soc. ci. argent. 9: 21. 1880. — Moreau (1953) considers this species to be a synonym of *S. papyricola*, but according to Lundqvist (1972) it is a good species.

S. carbonaria (Phill. & Plowr.) Sacc., Syll. Fung. 1: 233. 1882 = *Zopfiella carbonaria* (Phill. & Plowr.) v. Arx.

S. caricicola Ell. & Ev. in herb. = *S. fimicola* (Lundqvist, 1972).

S. caudata (Curr.) Sacc., Syll. Fung. 1: 236. 1882 = *Cercophora caudata* (Curr.) Lundq. (Hilber & Hilber, 1979).

S. caulicola Ces. in Atti R. Accad. Sci. Fis. Matem. 8(3): 23. 1879 = *Anthostomella caulicola* (Ces.) Sacc. (Moreau, 1953).

S. cervina Cain in Univ. Toronto Stud. (Biol. Ser.) 38: 36. 1934 = *P. cervina* Cain (Mirza & Cain, 1969).

S. cirrifera Speg. in An. Mus. nac. B. Aires 6: 253. 1899 = *Arnium cirriferum* (Speg.) Krug & Cain (Krug & Cain, 1972).

S. cirsii Crouan, Fl. Finistère: 22. 1867. — The type was not available for study.

S. citrina Petch in Ann. R. bot. Gdns Peradeniya 7: 301. 1922 = *Podospora* species (according to the description).

S. cladoniae Anzi in Atti Soc. ital. Sci. nat. 11: 179. 1868 = *Adelococcus cladoniae* (Anzi) Keissl. (Hawksworth, 1978).

S. clavariae Ces. & De Not. in Comm. Soc. critt. ital. 1: 226. 1863 = *Helminthosphaeria clavariae* (Tul.) Fuckel (von Arx & Müller, 1954).

S. clavata Pat. apud Pat. & Lagerh. in Bull. Soc. mycol. Fr. 11: 226. 1895. The description is not adequate, and the fungus has been excluded from *Sordaria* by Moreau (1953).

S. clypeata De Not., Sphaerici italici 1: 22. 1863 = *Entosordaria clypeata* (De Not.) v. Arx & Müller (von Arx & Müller, 1954).

S. comata (Kirschst.) Bayer (Bayer, 1924: 71). — This is a doubtful species. It may represent a *Podospora* species (according to the description).

S. communis (Speg.) Sacc., Syll. Fung. 1: 231. 1882 = *Podospora communis* (Speg.) Sacc. (Mirza & Cain, 1969).

S. communis var. *brachyura* = *Podospora communis* (Speg.) Sacc. (Mirza & Cain, 1969).

S. communis var. *macrura* = *Podospora decipiens* (Winter) Niessl (Mirza & Cain, 1969).

S. communis var. *tetraspora* = *Podospora anserina* (Ces. in Rab.) Niessl (Mirza & Cain, 1969).

S. conoidea Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971 = *Asordaria conoidea* (Cailleux) v. Arx & Guarro.

S. consanguinea Ces. in Rab. F. eur. extraeur., Cent. XXVII; in Hedwigia 21: 10. — This is a doubtful species (Bayer, 1924).

S. coprophila (Fr.) Ces. & De Not. in Comm. Soc. critt. ital. 1: 226. 1863 = *Cercophora coprophila* (Fr.) Lundq. (Lundqvist, 1972).

S. coronifera Grove in J. Bot. 44: 185. 1916 = *Podospora aloides* (Grove) Mirza & Cain (Mirza & Cain, 1969).

S. culmigena Sacc. & Speg. in Michelia 1: 273. 1877 = *Arnium olerum* (Fr.) Lundq. & Krug (Moreau, 1953).

S. curreyi Auersw. ex Niessl in Verh. naturf. Ver. Brünn 10: 192. 1872 = *Arnium olerum* (Fr.) Lundq. & Krug (Moreau, 1953).

S. curvicolla Wint. in Hedwigia 10: 161. 1871 = *Podospora curvicolla* (Wint.) Niessl (Mirza & Cain, 1969).

S. curvispora Cain in Can. J. Res. (Ser. C) 26: 492. 1948 = *Podospora curvispora* (Cain) Cain (Mirza & Cain, 1969).

S. curvula de Bary, Morphol. Physiol. Pilze: 209. 1866 = *Podospora curvula* (de Bary) Niessl.

S. curvula var. *coronata* = *Podospora curvula* (de Bary) Niessl (Mirza & Cain, 1969) = *Schizothecium conicum* (Fuckel) Lundq. (Lundqvist, 1972).

S. curvula var. *coronifera* = *Podospora aloides* (Fuckel) Mirza & Cain (Mirza & Cain, 1969).

S. curvula var. *tetraspora* = *Schizothecium conicum* (Fuckel) Lundq. (Lundqvist, 1972).

S. decipiens Wint. ex Fuckel in Jb. nassau Ver. Naturk. 27-28: 44. 1873 = *Podospora decipiens* (Wint. ex Fuckel) Niessl (Mirza & Cain, 1969).

S. delitschioides Speg. in An. Mus. nac. B. Aires 6: 254. 1899 = *Cercophora sordarioides* (Speg.) Lundq. (Lundqvist, 1972).

S. destruens (Shear) Hawk. in Trans. Br. mycol. Soc. 34: 174. 1951. — This includes non-coprophilous relatives of *S. fimicola*.

S. discospora Auersw. ex Niessl in Verh. naturf. Ver. Brünn 10: 192. 1872 = *Coniochaeta discospora* (Auersw.) Cain (Cain, 1934).

S. discospora var. *major* Wint. (Winter, 1873: 20) = *Coniochaeta scatigena* (Berk. & Broome) Cain (Cain, 1934).

S. dubia E.C. Hans. in Vid. Meddr dansk naturh. Foren. 1876: 337. 1877 = *Podospora dubia* (E.C. Hans.) Cain (Cain, 1962) or *Schizothecium dubium* (Hans.) Lundq. (Lundqvist, 1972).

S. elephantina P. Henn. in Bot. Jb. (ed. Engler) 22: 77. 1895 = *Cercophora coprophila* (Fr.) Lundq. (Moreau, 1953).

S. ellisiana (Griff.) Sacc. in Syll. Fung. 17: 601. 1905 = *Podospora ellisiana* (Griff.) Mirza & Cain (Mirza & Cain, 1969).

S. elongatispora Barrasa & al. in Persoonia 13: 86. 1986.

S. eminens Cain in Univ. Toronto Stud. (Biol. Ser.) 38: 51. 1934 = *Podospora eminens* Cain (Mirza & Cain, 1969).

S. equina (Fr.) Cooke in Grevillea 17: 78. 1887 = *Podospora fimiseda* (Fuckel) Niessl.

S. equina (Berk. & Rav.) Mirza & Cain apud Udagawa & Horie (Kobayashi, 1971: 524). — From the description given in Kobayashi (1971), the fungus represents a relative of *S. fimicola* with ascospores showing a thin gelatinous sheath.

S. equorum (Fuckel) Wint. (Winter, 1873: 77) = *Hypocopra equorum* (Fuckel) Wint. (Bayer, 1924).

S. erecta (Speg.) Sacc., Syll. Fung. 1: 239. 1882 = *Podospora anserina* (Ces. in Rab.) Niessl (Mirza & Cain, 1969) = *Podospora pauciseta* (Ces.) Trav. (Lundqvist, 1972).

S. erostrata (Griff.) Sacc. in Syll. Fung. 17: 604. 1905 = *Zopfiella erostrata* (Griff.) Udagawa & Furuya (Udagawa & Furuya, 1974).

S. fermenti (Fuckel) Wint. (Winter, 1873: 85) = *S. humana* (Moreau, 1953).

S. fimbriata Bayer (Bayer, 1924: 29) = *Podospora fimbriata* (Bayer) Cain (Mirza & Cain, 1969).

S. fimeti (Pers.) Wint. (Winter, 1873: 78) = *Hypocopra fimeti* (Pers.) Fr. (Bayer, 1924).

S. *fimicola* (Rob.) Ces. & De Not. in Comm. Soc. critt. ital. 1: 226. 1863.

S. fimiseda Ces. & De Not. in Comm. Soc. critt. ital. 1: 226. 1863 = *Podospora fimicola* Ces. (Mirza & Cain, 1969).

S. friesii Niessl in Verh. naturf. Ver. Brünn 3: 112. 1864 = *Coniochaeta pulveracea* (Ehrh.) Munk (von Arx & Müller, 1954).

S. gagliardi De Not., Spher. ital. 21: 23. 1863. — This is a doubtful species.

S. garhwalensis Srivastava & Bhist. in Indian Phytopath. 36: 383. 1983. — The type was not available for study.

S. gigaspora Fuckel in Jb. nassau. Ver. Naturk. 29-30: 26. 1875. — A type is not available and the description is inadequate for recognition of the fungus.

S. globosa Mass. & Salm. in Ann. Bot. 15: 334. 1901 = *Podospora globosa* (Mass. & Salm.) Cain (Cain, 1962).

S. glutinans Cain in Univ. Toronto Stud. (Biol. Ser.) 38: 40. 1934 = *Podospora glutinans* (Cain) Cain (Mirza & Cain, 1969).

S. goundaensis Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971 = *Asordaria goundaensis* (Cailleux) v. Arx & Guarro.

S. grisea Ces. in Atti R. Accad. Sci. Fis. Matem. 8(3): 22. 1879. — This is a doubtful species and was excluded from *Sordaria* by Moreau (1953).

S. hansenii Oud. in Hedwigia 21: 123. 1882 = *Coniochaeta hansenii* (Oud.) Cain (Cain, 1934).

S. heterothallis Fields & Maniotis in Am. J. Bot. 50: 80. 1963. — This is a heterothallic relative of *S. macrospora*.

S. hippica (Berk. & Rav.) Ellis & Ev., N. Am. Pyrenom.: 127. 1892 = *S. equina* (Berk. & Rav.) Mirza & Cain apud Udagawa & Horie (Kobayashi, 1971).

S. hippica (Sacc.) Cooke in Grevillea 16: 55. 1887 = *S. fimicola* (Lundqvist, 1972).

S. hirsuta (Dang.) Sacc. & Trav. in Syll. Fung. 20: 807. 1911 = *Podospora hirsuta* Dang. (Mirza & Cain, 1969).

S. hirta E.C. Hans. in Vid. Meddr dansk naturh. Foren. 1876: 336. 1877 = *Arnium hirtum* (E.C. Hans.) Lundq. & Krug (Lundqvist, 1972).

S. hispidula Speg. in An. Mus. nac. B. Aires 6: 255. 1899 = *Podospora curvula* (de Bary) Niessl (Mirza & Cain, 1969) = *Podospora pseudominuta* Speg. (Mirza & Cain, 1969).

S. humana (Fuckel) Wint. in Bot. Ztg 30: 835. 1872 = *Asordaria humana* (Fuckel) v. Arx & Guarro.

S. hyalina Griff. in Mem. Torrey bot. Club 11: 48. 1901 = *Phomatospora hyalina* (Griff.) Cain (Cain, 1934) = *Phomatospora minutissima* (Crouan) Lundq. (Lundqvist, 1972).

S. hyalopilosa (Stratton) Cain in Univ. Toronto Stud. (Biol. Ser.) 38: 45. 1934 = *Podospora hyalopilosa* (Stratton) Cain (Mirza & Cain, 1969).

S. hydrophila (Kirschst.) Sacc. in Syll. Fung. 24: 845. 1928 = *Cercophora hydrophila* (Kirschst.) Lundq. (Lundqvist, 1972).

S. hypocoproides Speg. in Boln Acad. Ci. Córdoba 11: 189. 1887 = *Hypocopra hypocoproides* (Speg.) Krug & Cain (Krug & Cain, 1974b).

S. inaequalis Cain in Can. J. Res. (Ser. C.) 26: 489. 1948 = *Podospora inaequalis* (Cain) Cain (Mirza & Cain, 1969).

S. inaequilateralis Cain in Univ. Toronto Stud. (Biol. Ser.) 38: 29. 1934 = *Arnium inaequaliteralis* (Cain) Lundq. & Krug (Lundqvist, 1972).

S. indica Srivastava & Tandon in Curr. Sci. 34: 354. 1966 = *Achaetomium globosum* Rai & Tewari (according to the description).

S. insignis E.C. Hans. in Vid. Meddr dansk naturh. Foren. 1876: 336. 1877 = *Strattonia insignis* (E.C. Hans.) Lundq. (Lundqvist, 1972).

S. iowana Ell. & Holw. in J. Mycol. 4: 65. 1888 = *S. fimicola* (Moreau, 1953).

S. kansensis (Griff.) Sacc. & D. Sacc. in Syll. Fung. 17: 602. 1905 = *Arnium kansense* (Griff.) Krug & Cain (Krug & Cain, 1971).

S. kilimandscharica A. Schm. in Jber. schles. Ges. vaterl. Kult.: 22. 1912 = *Podospora kilimandscharica* (A. Schm.) Cain (Cain, 1962).

S. lanuginosa (Preuss) Sacc., Fungi Veneti Ser. 6: 26. 1877 = *Arnium olerum* (Fr.) Lundq. & Krug (Lundqvist, 1972).

S. lanuginosa (Zopf) A. Schm. Verbreit. coproph. Pilze Schles.: 21. 1912 = *Strattonia zopfii* Lundq. (Lundqvist, 1972).

S. lappae Potebnia in Annls Mycol. 5: 13. 1907.

S. leporina Cain in Univ. Toronto Stud. (Biol. Ser.) 38: 30. 1934 = *Arnium leporinum* (Cain) Lundq. & Krug.

S. leucoplaca (Berk. & Rav.) Ell. & Ev., N. Am. Pyrenom.: 127. 1892 = *Coniochaeta leucoplaca* (Berk. & Rav.) Cain (Cain, 1934).

S. leucotricha Speg. in Michelia 1: 225. 1878 = *Zopfiella leucotricha* (Speg.) Malloch & Cain (Malloch & Cain, 1971).

S. lignicola Fuckel in Jb. nassau. Ver. Naturk. 25-26: 38. 1871 = *Cercophora caudata* (Curr.) Lundq. (Lundqvist, 1972).

S. linguiformis Cain in Univ. Toronto Stud. (Biol. Ser.) 38: 42. 1934 = *Podospora linguiformis* (Cain) Cain (Mirza & Cain, 1969) = *Schizothecium dubium* (Hans.) Lundq. (Lundqvist, 1972).

S. longicaudata (Griff.) Sacc. in Syll. Fung. 18: 601. 1905 = *Podospora longicaudata* (Griff.) Cain (Mirza & Cain, 1969).

S. longispora Batista & Pontual in Bol. Agr., Pernambuco 15: 39. 1948 = *Podospora appendiculata* (Auersw.) Niessl (Mirza & Cain, 1969).

S. lugubris Ces. & De Not. Comment. Soc. critt. ital. 1: 52. 1863 = *Anthostomella lugubris* (Rob. & Desm.) Sacc. (Moreau, 1953).

S. lutea Ell. & Ev. in J. Mycol. 3: 118. 1887 = *Cercophora lanuginosa* (Crouan) Lundq. (Lundqvist, 1972).

S. mabokensis Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971 = *Asordaria mabokensis* (Cailleux) v. Arx & Guarro.

S. macrospora Auersw. in Hedwigia 5: 192. 1866.

S. macrostoma Speg. in An. Mus. nac. B. Aires 6: 252. 1899 = *Podospora communis* (Speg.) Niessl (Mirza & Cain, 1969).

S. macrotheca (Crouan) Cooke in Grevillea 16: 55. 1887 = *Arnium macrotheca* (Crouan) Lundq. (Lundqvist, 1972).

S. macrura (Bayer, 1924: 71) = *Podospora australis* (Speg.) Niessl (Mirza & Cain, 1969).

S. malacotricha Auersw. ex Niessl in Verh. naturf. Ver. Brünn 10: 188. 1872 = *Coniochaeta malacotricha* (Auersw. ex Niessl) Trav.

S. maxima Niessl in Rab., Fungi Eur. exs. 1340. 1866 = *Bombardioidea stercoris* (DC.) Lundq. (Lundqvist, 1972).

S. merdaria (Fr.) Auersw. ex Wint. (Winter, 1873: 13) = *Hypocopra merdaria* Fries (Bayer, 1924).

S. microscopica De Not. in Comm. Soc. critt. ital. 2: 480. 1867 = *Rosellinia microscopica* (De Not.) Sacc. (Moreau, 1953).

S. microspora Ces. in Atti R. Accad. Sci. Fis. Matem. 8(3): 22. 1879 = *Rosellinia microspora* (Ces.) Sacc. (Moreau, 1953).

S. microspora Plowr. in Grevillea 6: 28. 1877 = *Coniochaeta leucoplaca* (Berk. & Rav.) Cain (Cain, 1934).

S. micrura (Speg.) Sacc., Syll. Fung. 1: 234. 1882 = *Podospora curvula* (de Bary) Niessl (Mirza & Cain, 1969).

S. millespora (A. Schm.) Cain in Univ. Toronto Stud. (Biol. Ser.) 38: 52. 1934 = *Podospora millespora* (Schmidt) Cain (Cain, 1962).

S. minima Sacc. & Speg. in Michelia 1: 373. 1878. — This is a doubtful species; Moreau (1953) excluded it from *Sordaria*; it probably is a species of *Coniochaeta*.

S. minor (Ell. & Ev.) Sacc. & Syd. in Syll. Fung. 14: 493. 1988 = *Podospora minor* Ell. & Ev. (Mirza & Cain, 1969).

S. minuta Fuckel in Jb. nassau. Ver. Naturk. 27-28: 44. 1873 = *Podospora vesticola* (Berk. & Br.) Mirza & Cain (Mirza & Cain, 1969).

S. minutella Cooke & Plowr. in Grevillea 7: 86. 1874 = *Trichodelitschia bisporula* (Crouan) Lundq. (Lundqvist, 1964a).

S. moravica (Niessl) Cooke in Grevillea 16: 56. 1887 = *Trichodelitschia bisporula* (Crouan) Lundq. (Lundqvist, 1964a).

S. multicaudata (Griff.) Sacc. in Syll. Fung. 17: 603. 1905 = *Arnium macrotheca* (Crouan) Lundq. (Lundqvist, 1972).

S. musae (Maire) Sacc. in Syll. Fung. 24: 847. 1928 = *Cercophora* spec. (according to the description).

S. myriaspora Crouan, Fl. Finistère: 22. 1867 = *Podospora myriaspora* (Crouan) Niessl (Lundqvist, 1972).

S. natalitia (Speg.) Sacc., Syll. Fung. 1: 231. 1882. — This is a doubtful species and was excluded from *Sordaria* by Moreau (1953).

S. neglecta E. C. Hans. in Vid. Meddr dansk naturh. Foren. 1876: 335. 1877 = *Arnium olerum* (Fr.) Lundq. & Krug (Lundqvist, 1972).

S. oblectans Ces. in Atti R. Accad. Sci. Fis. Matem. 8(3): 23. 1879 = *Rosellinia oblectans* (Ces.) Cooke (Moreau, 1953).

S. obliquata Ces. & De Not. in Comm. Soc. critt. ital. 1: 52. 1863 = *Rosellinia obliquata* (Somm.) Sacc. (Moreau, 1953).

S. occidentalis Batista & Pontual in Bol. Agr., Pernambuco 15: 38. 1948 = *Podospora communis* (Speg.) Niessl (Mirza & Cain, 1969).

S. ontariensis Cain in Univ. Toronto Stud. (Biol. Ser.) 38: 31. 1934 = *Arnium ontariense* (Cain) Krug & Cain (Krug & Cain, 1971).

S. oryzae Hara, Diseases of the riceplant: 132. 1918. — The type was not available and the description is not adequate for recognition of the fungus.

S. oryzeti Sacc. in N. Gior. bot. ital. 23: 201. 1916. — This is a doubtful species and has been excluded from *Sordaria* by Moreau (1953).

S. oryzina Hara, Diseases of the riceplant: 133. 1918. — The type was not available and the description is inadequate for recognition of the fungus.

S. ostiolata Ell. & Ev. in Bull. Torrey bot. Club 24: 458. 1897 = *S. fimicola* (Moreau, 1953).

S. pachydermatica Ces. in Atti R. Accad. Sci. Fis. Matem. 8(3): 22. 1879. Moreau (1953) includes this species in *Rosellinia* or *Coniochaeta*.

S. pachyspora Mout. in Bull. Soc. r. Bot. Belg. 39: 38. 1900. — This name has been excluded from *Sordaria* by Moreau (1953).

S. palmicola Auersw., Un. itin. Crypt., No. 58. 1866 = *Anthostomella palmicola* (Auersw.) Rab. (Pirozynski, 1972).

S. papillata Urries in Boln Soc. esp. Hist. nat. 32: 213. 1932.

S. papillosa Bayer (Bayer, 1924: 51) = *Sordaria humana* (Moreau, 1953).

S. papyricola Wint. (Winter, 1873: 18). — This is a nomen dubium (Lundqvist, 1972).

S. penicillata Ell. & Ev. in J. Mycol. 4: 78. 1888 = *Podospora pauciseta* (Ces.) Trav. (Lundqvist, 1972).

S. perfidiosa De Not. in Comm. Soc. critt. ital. 2: 481. 1867 = *Entosordaria perfidiosa* (De Not.) Hoehnel (von Arx & Müller, 1954).

S. perileuca Sacc. in Atti Accad. sci. ven.-trent.-istr. 10: 66. 1917 = *Cercophora sarawacensis* (Ces.) Lundq. (Lundqvist, 1972).

S. perplexans Cain in Univ. Toronto Stud. (Biol. Ser.) 38: 50. 1934 = *Podospora perplexans* (Cain) Cain (Cain, 1962).

S. philocoproides Griff. in Mem. Torrey bot. Club 11: 54. 1901 = *Coniochaeta philocoproides* (Griff.) Cain (Cain, 1934).

S. phyllogena (Sacc.) Niessl in Hedwigia 22: 155. 1883 = *S. humana*.

S. pilifera Bayer (Bayer, 1924: 62). – The type was not available. Probably a species with small ascospores (10.5 × 7 μm) was studied.

S. pilosa Mout. in Bull. Soc. r. Bot. Belg. 25: 144. 1886 = *Podospora pilosa* (Mout.) Cain (Mirza & Cain, 1969) = *Cercophora elephantina* (P. Henn.) Lundq. (Lundqvist, 1972).

S. pilosa Petch in Ann. R. bot. Gdns Peradeniya 7: 302. 1922 = *Podospora* species (according to the description).

S. platyspora Plowr. in Grevillea 6: 28. 1877 = *Coniochaeta scatigena* (Berk. & Br.) Cain (Cain, 1962).

S. pleiospora Wint. in Hedwigia 10: 161. 1871 = *Podospora pleiospora* (Wint.) Niessl (Mirza & Cain, 1969).

S. polyspora Phill. & Plowr. in Grevillea 10: 73. 1881 = *Coniochaeta* sp. (Cain, 1934).

S. potentillae Gucewiz, Plant. non vasc.: 218. 1967. — The description and illustrations are incomplete. Probably a species of *Asordaria* with small ascospores (14–15 × 8.5–10 μm) was studied.

S. prolifica Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971 = *Asordaria prolifica* (Cailleux) v. Arx & Guarro.

S. pseudominuta Speg. in Boln Acad. Ci. Córdoba 11: 57. 1887 = *Podospora curvula* (de Bary) Niessl (Mirza & Cain, 1969).

S. pumila Bayer (Bayer, 1924: 49). — The type was not available for study. The species is characterized by very small ascospores (8–9 × 5–7 μm).

S. puntiformis Ces. in Atti R. Accad. Sci. Fis. Matem. 8(3): 23. 1879. — This is a doubtful species. Moreau (1953) excluded it from *Sordaria*.

S. pyriformis Bayer (Bayer, 1924: 113) = *Podospora pyriformis* (Bayer) Cain (Mirza & Cain, 1969).

S. rabenhorstii Niessl in Rab., Fungi eur. 1528. 1872 = *Fimetariella rabenhorstii* (Niessl) Lundq. (Lundqvist, 1946b).

S. rhynchophora De Not. in Comm. critt. ital. 2: 480. 1867 = *Ceratostoma notarisii* Sacc. (Moreau, 1953).

S. rotula (Cooke) Niessl in Hedwigia 22: 155. 1883 = *Apiosordaria rotula* (Cooke) v. Arx.

S. sarawacensis Ces. in Atti R. Accad. Sci. Fis. Matem. 8(3): 22. 1879. — This is a doubtful species.

S. sclerogenia Fields & Grear. in Mycologia 58: 524. 1966. — This is a heterothallic relative of *S. fimicola* with a spermatical state.

S. seminuda Griff. in Mem. Torrey bot. Club 11: 50. 1901 = *Podospora seminuda* (Griff.) Mirza & Cain (Mirza & Cain, 1969).

S. septospora Cain in Univ. Toronto Stud. (Biol. Ser.) 38: 24. 1934. — The type could not be examined.

S. serignanensis (Fabre) Cooke in Grevillea 16: 55. 1887 = *Bombardioidea serignanensis* (Fabre) Lundq.

S. setosa Wint. (Winter, 1873: 97) = *Podospora setosa* (Wint.) Niessl (Mirza & Cain, 1969).

S. sibutii Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971 = *Asordaria sibutii* (Cailleux) v. Arx & Guarro.

S. similis E. C. Hans. in Vid. Meddr dansk Naturh. Foren 1876: 336. 1877 = *Podospora similis* (E. C. Hans.) Niessl (Mirza & Cain, 1969).

S. socia De Not. in Comm. Soc. critt. ital. 2: 480. 1867 = *Rosellinia socia* (De Not.) Sacc. (Moreau, 1953).

S. sordarioides (Speg.) Cooke in Grevillea 16: 56. 1887 = *Cercophora sordarioides* (Speg.) Lundq. (Lundqvist, 1972).

S. sphaerospora Ell. & Ev., N. Am. Pyrenom.: 128. 1892 = *Asordaria humana* (Moreau, 1953).

S. squamulosa Crouan, Fl. Finistère: 22. 1867 = *Schizothecium squamulosum* (Crouan) Lundq.

S. stercoraria (Sow.) Oud., Rév. Champ. Pays Bas: 159. 1897 = *Hypocopra stercoraria* (Sow.) Fuckel.

S. striata Ell. & Ev. in J. Mycol. 4: 67. 1888 = *Cercophora striata* (Ell. & Ev.) Lundq. (Lundqvist, 1972).

S. superba De Not. in Comm. Soc. crit. ital. 2: 479. 1867.

S. superior (Griff.) Sacc. & D. Sacc. in Syll. Fung. 17: 603. 1905 = *Podospora appendiculata* (Auersw.) Niessl (Mirza & Cain, 1969).

S. sylvatica Daszewska in Bull. Soc. bot. Genève 4: 294. 1912 = *S. fimicola* (Moreau, 1953).

S. taediosa Speg. in An. Mus. nac. B. Aires 6: 255. 1899. — This is a nomen dubium (Lundqvist, 1972).

S. taenioides (Griff.) Sacc. & D. Sacc. in Syll. Fung. 17: 602. 1905 = *Podospora australis* (Speg.) Niessl (Mirza & Cain, 1969).

S. tetraspora Wint. in Hedwigia 10: 161. 1871 = *Podospora tetraspora* (Wint.) Cain (Mirza & Cain, 1969).

S. texanica (Rehm) Doguet in Botaniste 39: 222. 1955. — The type could not be examined.

S. thermophila Fields in Mycologia 60: 1117. 1968. — This is a heterothallic relative of *S. fimicola* with thermophilic requirements.

S. tjibodiana Penz. & Sacc. in Malpighia 11: 395. 1897. — The type could not be examined. Moreau (1953) excluded the species from *Sordaria*.

S. tomento-alba Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971. — This species is a heterothallic relative of *S. fimicola*.

S. tomentosa (Speg.) Sacc., Syll. Fung. 1: 236. 1882 = *Arnium tomentosum* (Speg.) Lundq. & Krug (Lundqvist, 1972).

S. ustorum Mout. in Bull. Soc. r. Bot. Belg. 36: 11. 1897 = *Apiosordaria rotula* (Cooke) v. Arx.

S. uvicola Viala & Marsais in Annls Ins. natn. Rech. agron., Paris (C) 2: 68. 1927 = *S. destruens* (Shear) Hawk. (Lundqvist, 1972) = *S. fimicola* (Cain, 1950).

S. vagans De Not. in Comm. Soc. critt. ital. 2: 479. 1867. — The type was not available for examination. Its description is inadequate for the recognition of the fungus.

S. valsoides (Peck) Sacc., Syll. Fung. 1: 235. 1882 = *Podospora appendiculata* (Auersw.) Niessl (Mirza & Cain, 1969).

S. verruculosa (Jensen) Sacc. in Syll. Fung. 24: 845. 1928 = *Apiosordaria verruculosa* (Jensen) v. Arx & Gams.

S. vesticola (Berk. & Br.) Höhn. in Annls Mycol. 16: 45. 1918 = *Podospora vesticola* (Berk. & Br.) Mirza & Cain (Mirza & Cain, 1969).

S. vestita (Zopf) Sacc. & D. Sacc. in Syll. Fung. 18: 604. 1905 = *Podospora communis* (Speg.) Niessl (Mirza & Cain, 1969).

S. violacea Ell. & Ev. in Am. Nat. 31: 340. 1897 = *Podosordaria violacea* (Ell. & Ev.) Krug & Cain (Krug & Cain, 1974a).

S. vratislaviensis A. Schm., Verbreit. coproph. Pilze Schles.: 22. 1912 = *Podospora fimbriata* (Bayer) Cain (Mirza & Cain, 1969).

S. wiesneri Zuk. in Verh. zool.-bot. Ges. Wien 37: 41. 1887 = *Asordaria humana* (Moreau, 1953).

S. winteri P. Karst. in Bidr. Känn. Finl. Nat. Folk 23: 151. 1873 = *Podospora appendiculata* (Auersw.) Niessl (Mirza & Cain, 1969).

S. winteri Oud. in Hedwigia 21: 123. 1884 = *S. fimicola* (Moreau, 1953).

S. zygospora Speg. in Michelia 1: 227. 1878 = *Zygopleurage zygospora* (Speg.) Boed. (Moreau, 1953).

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REPLY TO SINGER & MACHOL

TH. W. KUYPER* & M. VAN VUURE**

Some additional arguments are provided for a few name changes in *Russula*. We conclude, contrary to Singer & Machol, that the 1821-starting point rules failed to put the nomenclature of the past into order and that the new sanctioning system will be better in this respect. Some dangers inherent in special provisions for particular taxonomic groups are mentioned. The disadvantage of a special typification status for sanctioned names is discussed.

We are pleased that Singer & Machol (1986) accepted the invitation to comment upon our conclusions regarding the nomenclature of the genus *Russula* (Kuyper & van Vuure, 1985). We consider their comments as a contribution to a rational discussion of the advantages and disadvantages of the sanctioning system. Only a rational discussion will help us to arrive at a deliberate judgment whether the 'Sydney Code' (Voss & al., 1983) should be set back or left unaltered.

A balanced assessment of the various nomenclatural systems can only be made on the basis of a careful study of a large number of individual nomenclatural problems. For that reason we start with a discussion of the three examples that Singer & Machol reviewed and supplement it with some general considerations concerning mycological nomenclature.

It should be noted at the outset that the introduction of the sanctioning system, after more than a decade of discussion, yielded several unforeseen but not unforeseeable difficulties. For that reason the present wording is not always unambiguous. It might therefore well be possible that our interpretation of the ICBN differs from that by Singer & Machol.

RUSSULA DELICA VERSUS R. EXSUCCA

When writing our paper we were of course aware that *Agaricus exsuccus* (Pers.) Otto could well threaten the name *Russula delica* Fr., although our wording is apparently somewhat cryptic. We also noted that such a name change could be avoided by a judicious typification of the former name.

Agaricus exsuccus is automatically typified by the type of *Lactarius piperatus β exsuccus* Pers. (ICBN, Art. 7.10). The latter taxon could be typified either by a neotype conforming to Persoon's short description or by the type of an included element. The types of the included elements can serve as syntypes, and lectotypification from syntypes takes precedence over neotypification (Art. 7.4).

Singer & Machol (1986: 190) assert that our lectotypification of Persoon's taxon by the type of *A. giganteus* is in serious conflict with the protologue and for that reason

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* Biologisch Station, Kampsweg 27, 9418 PD Wijster, Netherlands.
** Prins Willem Alexanderlaan 7, 7242 GH Lochem, Netherlands.

may be superseded (Art. 8). They therefore rejected our lectotypification and designated a neotype purported to make *A. exsuccus* a priorable synonym of *R. delica*.

However, our choice is definitely *not* in conflict with the protologue, as the protologue consists not only of the diagnosis and description, but also of its included synonymy (see definition of protologue). It is the protologue itself that contains contradictory elements, but the ICBN does not provide guidelines which element is then to be preferred for typification purposes.

Our lectotypification of Persoon's (and Otto's) taxon, purported to get rid of the name *A. exsuccus* by making it illegitimate on specific level, was the first and must hence be followed (Art. 8). The consequence of Singer & Machol's neotypification would be that if the 'Sydney Code' remains unaltered the name *R. delica* would have to make way for *R. exsucca*, a name change that neither Singer & Machol nor we want.

However, our previous analysis was incomplete, as we overlooked that Fries (1821: 77) introduced *A. vellereus β exsuccus* Fr.: Fr. with the explicit exclusion of its type (*A. giganteus* was treated on p. 80 of the same work). Fries therefore created a new name that must be ascribed solely to him (Art. 48). Singer & Machol seem to suggest that this taxon is identical with *R. delica*, but it is noteworthy that Fries (1838: 340) recognised both *R. delica* and a milkless variant of *Lactarius vellereus* and emphasized that it is extremely difficult to differentiate between both taxa. Neuhoff (1956: 94) also interpreted var. *exsuccus* as a milkless variant of *L. vellereus*.

It seems unlikely then that we can now interpret for certain what species Persoon or Fries thought to have had at hand.

RUSSULA ATROPURPUREA VERSUS R. KROMBHOLZII

Singer & Machol agree with our conclusion that *R. atropurpurea* (Krombh.) Britz. is an illegitimate homonym of *R. atropurpurea* Peck. They seem to disagree that *R. krombholzii* is the correct name, mentioning four older names that could well refer to that taxon. As all names are heterotypic, we will make only a few comments that are relevant from a nomenclatural point of view.

Russula depallens (Pers.: Fr.) Fr. has, according to our restricted interpretation of Art. 7.17, to be typified by the type of *A. depallens* Pers. Unfortunately, no authentic material of this species is found at the Persoon Herbarium (L). Persoon's description is too short in our opinion to allow a reliable interpretation. We also note that according to Romagnesi (1967: 941) the name *R. depallens* has been used for at least ten different species! This makes the name an extremely apt candidate for rejection as a nomen dubium.

Although the concepts of nomen dubium and nomen ambiguum are not any longer mentioned explicitly in the ICBN, it seems clear that no rule of nomenclature can force us to reintroduce a name of extremely dubious application.

Concerning *R. atropurpurina* (Sing.) Crawsh. and its basionym *R. emetica* subsp. *atropurpurina* Sing. we wish to draw attention to the fact that *R. emetica* var. *atropurpurea* Sing. (which is homotypic with *R. emetica* subsp. *atropurpurina*) was explicitly kept separate from *R. atropurpurea* (Krombh.) Britz. by Singer (1925)!

RUSSULA NITIDA

Singer & Machol's (1986: 190) statement that *Russula nitida* and *Agaricus nitidus* are undoubtedly superfluous names under the new Code needs some qualification. Implicit in their wording is the suggestion that sanctioning can make a name superfluous.

But sanctioning itself can never make a name superfluous; all that counts is whether *A. nitidus* Pers. was superfluous *when published* (Art. 63.1). There is no need to typify *A. nitidus* by the type of *A. purpureus* or *A. risigallinus*. Article 7.11 relates only to the status of the name when published and Art. 7.13 relates to special starting points, now irrelevant under the new rules. We could of course typify *A. nitidus* Pers.: Fr. by the type of *A. purpureus* or *A. risigallinus*, such a typification being allowed under the present wording of Art. 7.17. However, this is not obligatory.

Was *A. nitidus* (Persoon, 1801: 444) superfluous when published? It is true that Persoon included *A. purpureus* Schaeff. in it, albeit with a statement that makes it debatable whether he considered both names as simple synonyms. But under a strict interpretation of Art. 63 the name was superfluous when published. We dismissed that point too simply in our previous paper.

Sanctioning legitimises such names. Admittedly, this is not stated explicitly in the present wording, although the formulation 'treated as if conserved against competing synonyms' makes it at least implicit. We agree with Singer & Machol that it should be clarified in the next edition.

Article 7.11 deals with the typification of superfluous names and the wording of that article discriminates between true superfluous names, which are typified automatically and apparent superfluous names, which are not typified automatically because the author of the superfluous name has definitely indicated another type. Persoon divided *A. nitidus* into two subspecies, viz. α *nitidus* (not mentioned explicitly) and β *purpureo-fuligineus*. It seems likely that Schaeffer's taxon had to be referred to this latter subspecies; it is at least certain that Persoon definitely indicated a different type for *A. nitidus*.

We therefore uphold our conclusions that *A. nitidus* Pers. is not to be typified by the type of *A. purpureus* Schaeff. but has to be typified according to Persoon's diagnosis.

This technical discussion undoubtedly seems more a juridical contrivance than straightforward legislation, and one is immediately reminded of Holttum's devastating judgment about 'superfluous non-sense' (Holttum, 1961). There can hardly be any doubt that Donk (1963) was basically correct in his opposition against the ruling of superfluous names. Although it would seem the better solution to discard the concept of superfluity and illegitimacy completely, all efforts to remodel or improve Art. 63 have failed so far. Abandon of this concept would now undoubtedly lead to quite a lot of name changes. Retention of a less than perfect but stable ICBN seems in this case more worthwhile than a continuously improving but unstable ICBN.

However, is it not inconsistent to defend a stable 'Code' and at the same time be a partisan of the introduction of the sanctioning system? Is the new wording of Art.

13.1(d) really 'detrimental to stability in nomenclature', as Singer & Machol (1986: 189) state?

We should first recognise that the change in Art. 13.1(d) was not so drastic as commonly presumed, as the concept of sanctioning was incorporated in the ICBN more than 35 years ago. Sanctioning acknowledges the fact that mycological nomenclature was heavily influenced by the works of E. M. Fries ('Systema mycologicum' and 'Elenchus Fungorum') but not or hardly so by other mycological publications that happened to have appeared in 1821. We should also be aware that the 1821-starting point arbitrarily divided perfectly normal names into valid ones and invalid ones. Demoulin & al. (1981) provided ample illustrations that the old system was often difficult to work with.

It is often insufficiently realised that even after 75 years several problems associated with the 1821-starting point have not been resolved, e.g. the question what constitutes (re)validation and the typification of revalidated names. We must therefore conclude that the old rules failed to put the nomenclature of the past into order.

There is a difficulty with the sanctioning system that has hitherto been insufficiently recognised. Such a nomenclatural novelty as sanctioning might well have far-reaching ramifications for other articles. This could easily lead to a plethora of special provisions for fungal nomenclature. Greuter & McNeill (1987) warned against such a development, stating that special provisions are acceptable when they have their roots in the particular biological features of the fungi, but that they should not be extended to cases where the peculiarities are in the specialists themselves.

We should therefore resist our tendency to extend the special provision of sanctioning. In particular we should restrict sanctioning to nomenclatural protection and not extend it to typification purposes, as is now the case with Art. 7.17. The present equivocal wording of Art. 7.17, which allows even for supersession of a holotype, can lead to the persistence of ambiguous application of names. This is clearly contrary to the spirit of the ICBN, which aims at rejecting the use of names which may cause ambiguity (Preamble 1). It seems also likely that this article can have a lot of unexpected consequences (e.g. for Arts. 7.3, 7.10, 8, 46, 48, and 50), necessitating subsequent alterations in the ICBN.

Whereas the sanctioning system was discussed during more than a decade, Art. 7.17 was introduced at the last minute. It is conspicuously absent in the wording of Demoulin & al. (1981). Such last-minute legislation is apt to create new controversies and new legislation; it leads away from a stable method of naming taxonomic groups (Preamble 1).

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NOTES ON CYSTOLEPIOTA SEMINUDA

ELSE C. VELLINGA

Rijksherbarium, Leiden

A description of *Cystolepiota seminuda* (Lasch) Kumm. is given. It is shown that this name is correct, and that *C. sistrata* is not conspecific. *Cystolepiota sororia* (Huijsm.) Sing. is reduced to the synonymy of *C. seminuda*.

The genus *Cystolepiota* has been created by Singer (in Singer & Digilio, 1952) for the taxa of *Lepiota* with non-dextrinoid spores and a pileipellis made up of globose elements. Later, this concept has slightly changed for the European species (Singer & Clémençon, 1972; Knudsen, 1978, 1980; Bon, 1981).

This paper deals with one species only, belonging to *Cystolepiota* sensu stricto, with non-dextrinoid spores. An attempt has been made to study the variability of *Cystolepiota seminuda*, and the nomenclature of this taxon is elaborately discussed.

Cystolepiota seminuda (Lasch) M. Bon—Figs. 1–4, 6

Agaricus seminudus Lasch in Linnaea 3: 157. 1828. — *Lepiota seminuda* (Lasch) Kumm., Führ. Pilzk.: 136. 1871. — *Lepiota sistrata* var. *seminuda* (Lasch) Quél., Champ. Jura Vosges 1: 231. 1872. — *Cystoderma seminuda* (Lasch) Fay. in Annls Sci. nat. (Bot.) VII, 9: 351. 1889. — *Cystolepiota seminuda* (Lasch) M. Bon in Docum. mycol. 6(24): 43. 1976; Kalamees in Urbonas & al., Conspect. Fl. Agaric. Fung. Lith., Latv., Est.: 48. 1986 (superfluous comb.).

Lepiota sororia Huijsm. in Persoonia 1: 326. 1960. — *Cystolepiota sororia* (Huijsm.) Sing. in Beih. Sydowia 7: 67. 1973.

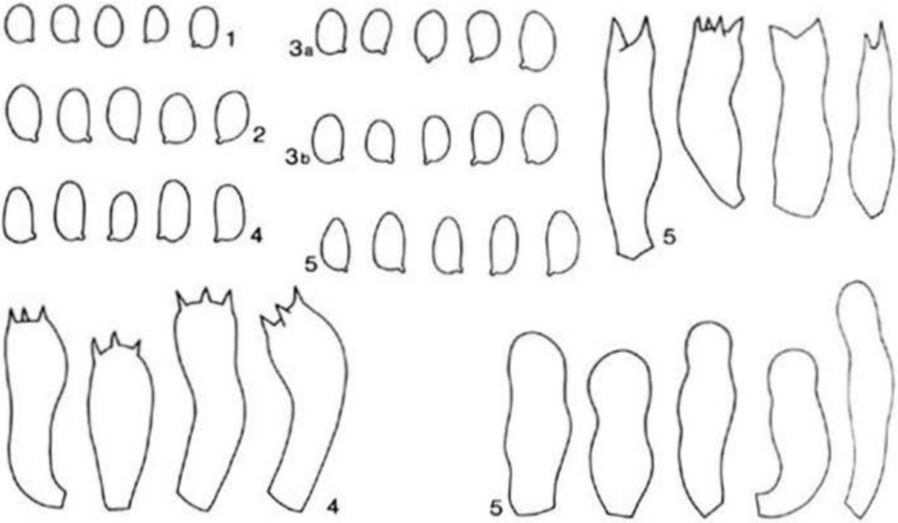
Lepiota seminuda f. *minima* J. Lange, Fl. agar. dan. 1: 36. 1935 (invalid, no Latin diagn.). — *Lepiota sistrata* f. *minima* (J. Lange) Babos in Annls hist.-nat. Mus. natn. hung. 50: 91. 1958 (invalid, basionym not valid).

Misapplied names.—*Lepiota sistrata* and *Cystolepiota sistrata* sensu auct. eur.

Selected illustrations.—J. Lange, Fl. agar. dan. 1: pl. 14A, 14B. 1935; Lanzoni & Candusso in Bol. Gruppo micol. 'G. Bresadola' Trento 26: 116. 1983 (as *C. sistrata*).

Selected descriptions.—Babos, l.c.: 81. 1958 (as *L. sistrata* f. *minima*); Huijsm., l.c.: 326–327. 1960 (as *L. sororia*); Lanzoni & Candusso, l.c.: 114–115. 1983 (as *C. sistrata*).

Pileus 3–20(–30) mm, hemispherical to obtusely conical when young, with inflexed margin, with velar remnants between margin and stipe, expanding to plano-convex with or without low umbo, white, white with cream to yellowish tinge at centre, or white with pinkish tinge at centre, when young with densely floccose-verrucose covering, later on granulose to pruinose-farinose, or even glabrous. Lamellae, L = 30–40, l = 1–3, rather crowded, free or nearly free, ventricose or subventricose, 2–3 mm wide, white, yellowish-creamy, or with pale lemon-yellow tinge, with even to finely flocculose edge. Stipe 15–50(–70) × 1–3 mm, cylindrical, fistulose, cream to pale lemon-yellow, lower down to the base mostly purplish or vinaceous pink, with age and when touched, some-



Figs. 1–4. *Cystolepiota seminuda*. — Spores (×1500) and basidia (×1500). (Fig. 1. from *C. B. Uljé 639*; Fig. 2. from *H. S. C. Huijsman 1651*; Fig. 3. from *E. C. Vellinga 1005*, a. in ammonia, b. in ammonia and acetic acid; Fig. 4. from *H. S. C. Huijsman*, 18 Oct. 1959, holotype of *L. sororia*).
Fig. 5. *Cystolepiota* spec. — Spores (×1500), basidia (×1500), and cheilocystidia (×1500) (all from *H. S. C. Huijsman*, 18 Oct. 1959).

times with greyish tinge, very rarely not reddening at all, minutely pubescent at apex, downwards whitish pruinose when young, mostly glabrescent with age. Context thin, concolorous with surfaces. Smell not distinct to fruity-fungoid. Taste indistinct. Spore print white.

Spores 3.5–5.0(–5.5) × 2.0–3.0 μm, Q = 1.35–2.1(–2.2) μm, $\bar{Q}$ = 1.45–1.95, ellipsoid, oblong, cylindrical, rather thin-walled, without germ pore or callus, not dextrinoid, not metachromatic in Cresyl Blue, slowly pink in Congo Red; wall pale blue in Cotton Blue, not swelling in ammonia and acetic acid; hilar appendage indistinct to distinct. Basidia 11–19 × 4.5–6.5 μm, 4-spored. Cheilo- and pleurocystidia absent. Pileipellis a several cells thick layer of rather thin-walled to slightly thick-walled globose, sphero-pedunculate to ellipsoid elements, 15–40 μm in diam.; inner elements thin-walled and compressed, colourless, outer elements with incrusting colourless pigment. Stipitispellis a cutis made up of cylindrical hyphae, 4–10 μm in diam., with (some) scattered globose elements similar to those on pileipellis. Clamp-connections present.

Habitat & distribution. — Mostly gregarious, rarely solitary, in various forest types: in deciduous forests on rich soil, in *Picea*-plantations, in grass lawns, on humous sandy to loamy soils; once recorded from wood. In temperate zones of the Northern Hemisphere. Not common in the Netherlands, with a slight preference for loamy soils. Aug.–Oct. (rarely in the beginning of Nov.).

Collections examined.—NETHERLANDS: prov. Gelderland, Steenderen, Baak, 22 Oct. 1974, *H. S. C. Huijsman 1651* (L); prov. Noord-Holland: Amsterdam, Amsterdamse Bos, 5 Oct. 1983, *C. B. Uljé 454* (Herb. Uljé); ibidem, 17 Aug. 1985, *C. B. Uljé 639* (Herb. Uljé); ibidem, 15 Sept.

1986, *C.B. Uljé* (E.C. Vellinga 1005, L); Bloemendaal, Koningshof, 2 Nov. 1974, *C. Bas 6505* (L); prov. Zuid-Holland, Rotterdam, Kralingerhout, 30 Sept. 1961, *C. Bas 2455* (L); prov. Zeeland, Zeeuws Vlaanderen, Aardenburg, Waterlandkerkje, Jagersbos, 19 Oct. 1982, *A. de Meyer 645* (L). — BELGIUM, prov. Limburg, Teuven, 4 Oct. 1964, *J. van Brummelen 1795* (L). — FRANCE: dpt. Moselle, Loudrefing, Forêt dominiale de Fénétrange, 20 Aug. 1955, *R.A. Maas Geesteranus 10564* (L); dpt. Oise, Compiègne, Oct. 1937, *H.S.C. Huijsman 1044 & 1045* (L). — GERMAN FEDERAL REPUBLIC, Bayern, Haspelmoor, 4 Aug. 1982, *Th. W. Kuyper 2103* (L). — SWITZERLAND: kt. Bern: Aneth, Schwarzgraben, 14 Oct. 1959, *H.S.C. Huijsman* (L); ibidem, 18 Oct. 1959, *H.S.C. Huijsman* (holotype of *Lepiota sororia*, L); kt. Aargau, Brugg, along the river Aare, 30 Oct. 1959, *H.S.C. Huijsman* (L).

This taxon, as described above, has been known in recent literature (e.g. Moser, 1983: 236) as *Cystolepiota sistrata* (Fr.: Fr.) Sing., or as *Lepiota seminuda* (Lasch) Kumm. (e.g. Kühner & Romagnesi, 1953: 395); sometimes both taxa are distinguished.

Fries (1821: 24) described *Agaricus sistratus* as a fungus with a slightly pruinose white pileus, yellowish with age, 3.7–5 cm broad and a white stipe, 5–7.5 × 0.25–0.37 cm.

Lasch (1828: 157) described *Agaricus seminudus* as a delicate fungus with a white to pale flesh-coloured pileus, 0.7–0.9 cm broad, and a white stipe, reddening when touched, 3.7–5 × 0.06–0.08 cm.

It is clear from those two (shortened) descriptions that the description given above fits excellently Lasch's description. Size and colours of the fruit-bodies agree well.

Fries' fungus is quite a different species, not reddening and with a relatively broad pileus and thick stipe. Even the stoutest specimens of *C. seminuda* are more fragile and smaller than *A. sistratus*, which possibly is identical with *Lepiota subalba* Kühner. Fayod (1889: 351) has also stressed that the two taxa are not the same, making the new genus *Fusispora* for *A. sistratus*. This genus is characterized by the spores: fusiform with a truncate apex and a suprahilar depression. If *A. sistratus* would be conspecific with *A. seminudus*, the genus *Cystolepiota* should be called *Fusispora*, a rather unpleasant situation, as the spores of the species in this genus are not fusiform, with those of *C. bucknallii* as an exception.

The confusion concerning the name and interpretation of *A. sistratus* has been started by Fries himself, who considered *A. seminudus* Lasch at one hand a synonym of his *A. sistratus*, in 1832(: 41), 1854(: 14), and 1869(: 15) — in the last mentioned publication with the addition that both taxa differ in habitus, but other distinguishing characters are not found — at the other hand, however, as a distinct species, in 1838(: 18) and in 1874(: 37, 38). Furthermore, the sizes of pileus and stipe of *A. sistratus* decrease in Fries' time: in 1854(: 14) pileus 2.5–3.7 cm, stipe as in 1821(: 24), and in 1869(: 15) pileus broader than 2.5 cm, and stipe ± 5 × 0.12 cm. On account of the differences in colour even the last mentioned description does not fit in with that of Lasch. The plate in Fries' Icones (1867–1869: pl. 15) does not depict Fries' *A. sistratus*, but as Fries states, that variant of Lasch ('formam Laschii' — compare *A. expallens* Persoonii, on page 54 in the same work). In our opinion the plate is not very typical for *A. seminudus*: Fries had not seen Lasch's fungus himself.

Bon (1981: 24) distinguished two small species, *Cystolepiota seminuda* and *C. sistrata*: the latter with the following characters: specimens not as delicate and gracile as *C.*

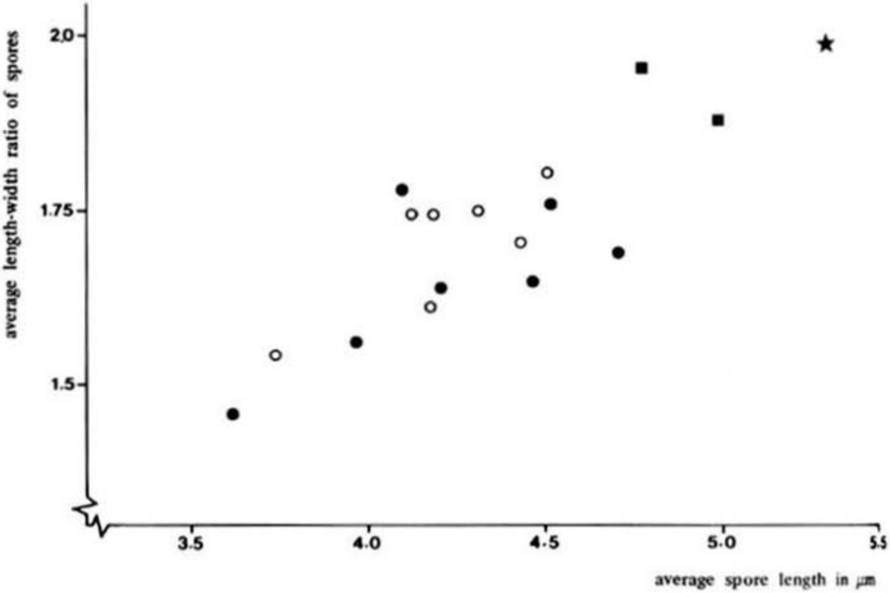


Fig. 6. *Cystolepiota seminuda* and *C.* spec. Scatterdiagram: spore-length plotted against length-width ratio of spores. Each dot represents an average of 10 measurements per collection. ○ *C. seminuda* from the Netherlands; ● *C. seminuda* from abroad; ■ holotype of *L. sororia*; ★ *C.* spec.

seminuda, pileus 1–3 cm broad, pileus and stipe pinkish, with strongly appendiculate margin; spores 4.5 × 2.5–3 μm. Bon clearly misinterprets Fries' description. He uses rather artificial characters to distinguish his two taxa, and his description of *C. sistrata* fits in with the above description of *C. seminuda* rather well.

Huijsman (1960: 326) described *Lepiota sororia*, differing from *L. sistrata* (as he called it) in the size of the fruit-bodies, the pale lemon-yellow tinges in the lamellae and the apex of the stipe, the copious velum, and the longer spores. Reexamination of the type collection revealed the spores to measure (4.2–)4.6–5.3(–5.4) × (2.1–)2.3–2.9 (–3.0) μm, Q = (1.65–)1.7–2.1(–2.2), $\bar{Q}$ = 1.88–1.95 (20 spores, 2 fruit-bodies).

Fig. 6 gives a scatter diagram of the distribution of the average spore-length plotted against average length-width ratio ($\bar{Q}$) of the spores of all collections of *C. seminuda* and *C. sororia* studied. The spores of *C. sororia* are longer and narrower than those of the *C. seminuda* collections, but the extreme values do not exceed those of *C. seminuda*. Using these characters it seems impossible to distinguish *C. sororia* as a separate species.

The other characters used by Huijsman (1960) to distinguish *L. sororia* occur all in individual fruit-bodies of *C. seminuda* as well. It is striking that this taxon, mentioned by Moser (1983: 235) and by Bon (1981: 24) in their keys, has never been found again since 1960. Both authors give the same sizes for the spores as did Huijsman. For the time being, awaiting the rediscovery of this variant, this name is reduced to the synonymy of *C. seminuda*.

Huijsman made another collection, close to *C. seminuda* from the same locality and of even date as the type of *L. sororia*. This collection also lacks pinkish colours as present in typical *C. seminuda*, and has the following microscopical characters (see Fig. 5): spores 5.0–5.8 × 2.4–3.0 µm, Q = (1.7–)1.75–2.15(–2.25), $\bar{Q}$ = 2.0; basidia 16–20 × 5–6 µm, 2- and 4-spored; cheilocystidia 11–17 × 5–6 µm, cylindrical and subcapitate, more or less utriform; pileipellis made up of globose to ellipsoid elements, 15–35 µm in diam., rather thin-walled, colourless, with scattered cylindrical elements.

This variant, with its striking features, also awaits rediscovery before being described in its own right.

Probably also the American taxa *Lepiota hemisphaerica* Murrill and *Agaricus pusillomyces* Peck belong to *Cystolepiota seminuda.*

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Thomas Kuyper and Dr C. Bas are thanked for critical reading the text. Jan van Os was so kind as to prepare Fig. 6.

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ADDITIONS TO OUR MONOGRAPH ON PSATHYRELLA

Thirteen new species, some revised keys, comments on other recently described species, and corrections and additions to our monograph

E. KITS VAN WAVEREN

Rijksherbarium, Leiden

Thirteen new species and a new variety of *Psathyrella* are described: *P. badia*, *P. bernhardii*, *P. borgensis*, *P. capitatocystis*, *P. dennyensis*, *P. minutissima*, *P. mookensis*, *P. multicystidiata*, *P. perpusilla*, *P. ploddensis*, *P. romseyensis*, *P. twickelensis*, *P. vyrnwyensis*, and *P. obtusata* var. *aberrans*. Some rectifications in the keys published in our monograph (Kits van Waveren, 1985) and some reconstructed keys necessitated by the insertion of new species are given. Recently described new species from outside the area covered by our monograph are briefly described and discussed. Corrections in and supplementary information to some of our descriptions in the monograph and a redescription of *P. obtusata* are presented.

Having brought about the manuscript of our monograph on the Dutch, French, and British species of *Psathyrella* (Kits van Waveren, 1985), we found ourselves still facing some 65 unidentified but fully described collections (dated from 1959 up till 1984) of which we started the identification in 1984. Almost all of these had been collected by ourselves.

Since 1982 we regularly received excellently documentated material from Scandinavian countries, especially from Mr. O. Weholt (Norway) who supplied us with a wealth of exsiccata, accompanied with excellent drawings and descriptions, which widened our knowledge about the awesome variability in species of *Psathyrella*, which so often leads to erroneous interpretations.

Among our 65 unidentified collections we came across a few species in which we acquired a better insight in the variability of their characters, necessitating (usually slight) alterations in or additional information to descriptions of species in our monograph. These cases the reader will find enumerated in the last part of this paper, viz. that with supplementary notes and corrections to our monograph, in the same sequence as in that work.

As expected we came across a number (in fact 13) of hitherto unknown species, which we felt had to be described as new. Their descriptions and accompanying drawings are to be found in the first part of this paper, arranged per section or subsection. In the keys to sections *Hydrophilae* and *Pennatae* and subsection *Lutenses* several new species had to be inserted which resulted in considerable alteration and reshuffling. In these cases newly constructed keys are provided.

In our monograph *P. obtusata* is dealt with in section *Hydrophilae* (and only very unobtrusively in the key to the species of section *Pennatae*), as the mean length of the spores can be 7.5 μm or less while all other macroscopical and microscopical characters are in keeping with those of the other species of that section. It is now given full value in the key to section *Pennatae* as more often the mean length of the spores is 7.6–7.9 μm. Moreover a new, distinctive and in our opinion taxonomically important microscopical feature was discovered and added to the key characters. Improved knowledge of this species made a complete redescription desirable.

The illustrations of both the macroscopical and microscopical characters for each taxon again have been taken and selected from all collections available of the taxon involved in order to demonstrate the variability of all characters. All our pictures of fruit-bodies were drawn at natural size. Spores were drawn with a magnification of × 2420 and reduced to × 1210. Basidia and cystidia were drawn at × 1150 and reduced to × 575. These magnifications are not indicated in our illustrations or legends.

DESCRIPTIONS OF NEW SPECIES

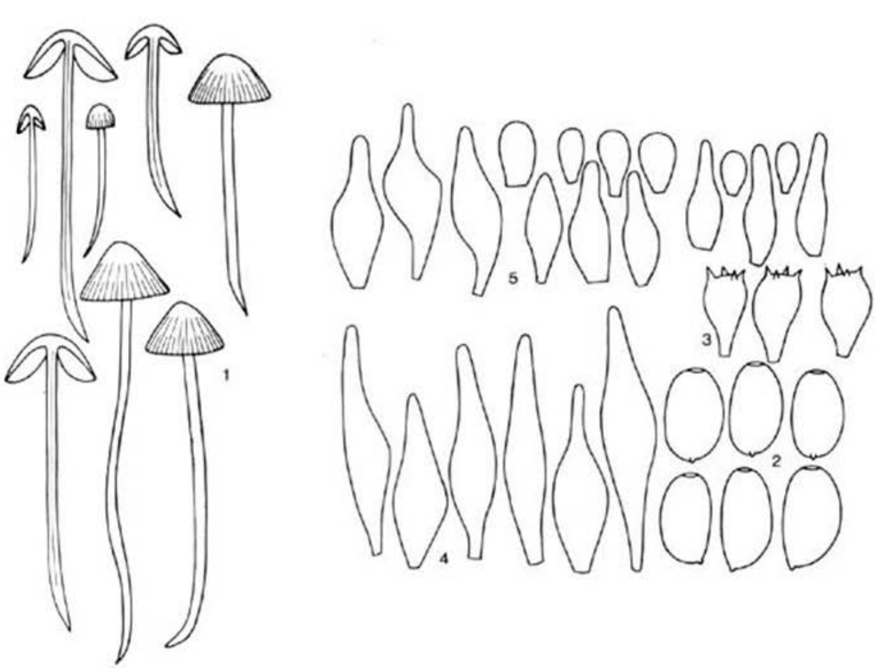
SECTION PSATHYRELLA

Psathyrella bernhardii Kits van Wav., *spec. nov.*—Figs. 1–5

Pileus primo 4–5 mm latus, parabolicus, badius, maturitate 10–16 mm, parabolicus vel conicoparabolicus, brunneus, pallidior marginem versus, dein obscure sordideque brunneus, striatus, hygrophanus, in sicco alutaceus fere albus, vel pallide cinereus, colore roseo destitutus, rugulosus, atomatus. Velum album e fibrillis et fasciculis formatum, haud appendiculatum. Lamellae 2–3 mm latae, ventricosae, anguste adnatae, primo dilute brunneae, maturitate obscure sordideque cinereopurpureo-brunneae, acie albae. Stipes 25–40 × 1–1.5 mm, cylindraceus cavus, radicatus, albidus deorsum isabellinus, apice pruinosus. Caro pilei centro 1 mm crassa, obscure brunnea, stipitis albida, deorsum dilute brunnea, basi brunnea. Sporae in cumulo purpureoatrae, (9–)10–11(–11.5) × 5.5–6.5 μm, ellipsoideae haud phaseoliformes, in aqua observatae obscure rubrae, poro germinativo magno (1.8–2 μm) munitae, non opacae. Basidia 20–25(–27.5) × 10–12.5 μm, spheropedunculata, 4-sporigera. Pleurocystidia 45–65 × 12.5–15 μm, sat numerosa, fusoidea pedicellata, collo cylindraceo vel subcylindraceo angusto praedita, tenuitunicata, subincolorata. Cellulae marginales: cheilocystidia lageniformia vel sublageniformia, collo cylindraceo praedita, 25–47.5 × 8–11 μm, numerosa, cellulis spheropedunculatis et clavatis 10–17.5 × 8–11 μm et basidiis intermixtis. Pileipellis e cellulis formata. Trama lamellarum colorata. Terrestris, in sabulo arido atro, sub Fago. Autumno. Gregaria. Typus: The Netherlands, prov. Overijssel, Delden, 17 Sept. 1972, *E. Kits van Waveren* (L).

Etymology: Named in honour of H. R. H. Prince Bernhard of the Netherlands, Founder President of the World Wild Life Fund International.

Cap in early stages 4–5 mm broad, paraboloid and reddish brown (Mu. 5 YR 4/3, 3/4), very soon centre and ridges between the striae without reddish hue and merely dark brown (Mu. 7.5 YR 4/4), striae themselves slightly paler (Mu. 7.5 YR 5/4), overall colour, dark brown (Mu. 5 YR 4/4), paler near margin, striate up to half-way from margin; at maturity 10–16 mm, paraboloid or conico-paraboloid, dark sordid, fuliginous brown (Mu. 7.5 YR 3/2; 10 YR 3/2, 3/3), striate up to 1/2–2/3 from margin, only slightly paler (Mu. 10 YR 4/3) near margin, hygrophanous, rapidly drying out to alutaceous, almost white or very pale greyish (Mu. 10 YR 7/2, 8/2), without pink but rugu-



Figs. 1–5. *Psathyrella bernhardii*. — 1. Carpophores (×1). — 2. Spores. — 3. Basidia. — 4. Pleurocystidiogram. — 5. Cheilocystidiogram.

lose and micaceous. Veil white, in early stages forming rather coarse fibrils and wickerworks of fibrils, reaching up to half-way from margin, in places rather dense at margin, not appendiculate, fugacious, at full maturity few fibrils both near margin of cap and on stem. Gills 2–3 mm broad, ventricose, narrowly adnate, at first pale brown (Mu. 10 YR 6/3), at maturity sordid greyish brown (Mu. 10 YR 5/3), finally dark sordid greyish-purplish brown (Mu. 7.5 YR 4/2), with white edge, not underlined with red. Stem 25–40 × 1–1.5 mm, cylindrical, distinctly rooting (pseudorrhiza up to 12 mm), hollow, whitish in upper part, isabelline lower down, at base brown (Mu. 10 YR 5/3), at extreme apex little pruinose. Trama of 'washed' gills pigmented, be it not strongly, in basal 1/4 of gill pale yellowish brown (Mu. 10 YR 6/4), towards edge via pale greyish brown (Mu. 10 YR 7/3) to very pale greyish brown, almost greyish (Mu. 10 YR 7/2) at edge. Spore print purplish black.

Spores (9–)10–11(–11.5) × 5.5–6.5 μm (mean values 10.4–5.8 μm: 1 collection), ellipsoid, adaxially flattened, dark, in water dark red (Mu. 2.5 YR 3/6), in NH_4OH 10% dark brown (Mu. 5 YR 4/4, 3/4), in KOH 5% very dark fuliginous brown (Mu. 7.5 YR 4/2; 10 YR 3/3), not opaque, with large germ pore (1.8–2 μm) and distinct hilar appendix. Basidia 20–25(–27.5) × 10–12.5 μm, sphero-pedunculate, 4-spored. Pleurocystidia 45–65 × 12.5–15 μm, moderately numerous, fusoid-pedicellate with narrow (3–4 μm) cylindrical to subcylindrical neck, gradually passing into ventricose cell body, thin-walled, practically colourless in NH_4OH 10%. Marginal cells: lageniform to sublageniform cheilocystidia with cylindrical neck more sharply delimited from cell body than with pleurocystidia, 25–47.5 × 8–11 μm, numerous (but not densely packed as in *P. microrrhiza*), intermixed with many unobtrusive small spheropedunculate and clavate cells, 10–17.5 × 7.5–10 μm and both immature and mature basidia; all cells thin-walled and colourless. Hymenophoral trama in basal part of gills distinctly brown from membranal pigment with few yellow hyphal septa and a fair number of minute encrustations; pigmentation decreasing towards edge and very faint in peripheral half of gill. Pileipellis a 2–3 cells deep layer of globose and subglobose colourless cells, 15–40 μm diam.

Habitat.—Terrestrial in sandy soil of a roadside of a main road under *Fagus*, some specimens attached to beech-nuts. September. Gregarious. Known only from type locality.

Collection examined.—THE NETHERLANDS, prov. Overijssel, Delden, main road Delden-Borne near ice-rink (some 40 specimens), 17 Sept. 1972. *E. K. v. W.* (type, L).

The species is close to *P. trepida* (as interpreted and described in our monograph, 1985: 74), with which it has in common the fuliginous colour of cap and gills and the relatively small spores. It is distinguished from *P. trepida* by its much smaller size (cap only up to 16 mm, stem only up to 40 mm long), its cap being paraboloid and not becoming convex, its narrowly adnate gills, its fusoid and not sublageniform pleurocystidia, its distinctly pigmented hymenophoral trama and its habitat (not in marshy area).

In our monograph *P. bernhardii* keys out in section *Psathyrella* near *P. trepida*. The following additions to the key to the species of that section (p. 41) are necessary:

21. Spores small (mean values 10.4–10.8 × 5.8–6 μm), caps fuliginous brown:
    21* Caps 12–30 mm broad, at maturity becoming convex; stem 45–80 mm long; pleurocystidia sublageniform; in marshes . . . . *P. trepida*
    21* Caps 10–16 mm broad, at maturity remaining paraboloid or conico-paraboloid; stem 20–40 mm long; pleurocystidia fusoid-pedicellate with narrow, fairly long neck, terrestrial *P. bernhardii*
21. Spores large (mean values 12–13.7 × 6.5–7.6 μm), caps not fuliginous:

SECTION HYDROPHILAE

REVISED KEY TO THE SPECIES OF SECTION HYDROPHILAE[1]

1. Spores very small, average size 5.3–6.1 × 3.4–3.6 μm:
   2. Pleurocystidia mucronate:
      3. Pleurocystidia 32.5–45 μm long, with ± plumpy rostra of 2.5–6 × 2.5–5 μm, not sharply *delimited from cell body* (rarely narrower or longer, up to 10 μm); pleurocystidioid cheilocystidia very scarce; cap smooth . . . . *P. laevissima*
      3. Pleurocystidia 40–70 μm long, with narrow rostra of 2–10 × 1.5–2.5(–3) μm, sharply delimited from cell body; pleurocystidioid cheilocystidia numerous; cap at centre minutely granular . . . . *P. subpapillata*
   2. Pleurocystidia not mucronate:
      4. Germ pore distinct; carpophores solitary, thick-set . . . . *P. hydrophiloides*
      4. Germ pore indistinct (callus) or very small; carpophores caespitose, subcaespitose, rarely solitary, rather slender:

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[1] For three extralimital species see elsewhere in this paper: *P. berolinensis* from Germany (p. 361), *P. ivoeensis* from Sweden (p. 365), *P. stigmatospora* from Switzerland and Sweden (p. 363).

5. Pleurocystidia non-capitate, mainly fusiform, ventricose or clavate, some utriform, with broad, short pedicel; germ pore indistinct (callus); smell indistinctive *P. piluliformis* (see also p. 367)

5. Pleurocystidia broadly capitate to subcapitate, mainly narrowly to broadly ventricose, more rarely utriform, slenderly clavate, with fairly narrow and somewhat longer pedicel; germ pore very small (0.5 μm); smell distinct and sweet . . . . *P. fragrans*

1. Spores larger, average size 6.8–7.5 × 3.9–5 μm (but rather frequently 7.6–7.9 μm long in *P. obtusata*):

6. Pleurocystidia (most, many to only a few) mucronate:

7. Carpophores medium-sized to fairly large; caps 30–70 mm *P. mucrocystis* (see also p. 367)

7. Carpophores small; caps 12–15 mm *P. umbrina* var. *umbrina* (see also *P. subumbrina* from Sweden, p. 362)

6. Pleurocystidia never mucronate:

8. Pleurocystidia in their upper part covered by mucoid substance, staining red in neutral red *P. pseudocasca*

8. Not as above:

9. Pleurocystidioid cheilocystidia very to moderately numerous:

10. Pleurocystidia fusoid, ellipsoid or sublageniform:

11. Many pleurocystidia with short to fairly long (sub-)cylindrical, often subcapitate apical elongation; spores distinctly phaseoliform *P. chondroderma* (see also p. 367)

11. Not as above:

12. Spores distinctly phaseoliform, in water pale brownish (Mu. 10 YR 5/6, 7.5 YR 6/6); pleurocystidia fusiform to sublageniform with subacute to obtuse apex, 40–70 × 10–16 μm; gills reddish rust-brown *P. frustulenta* (see also p. 367)

12. Spores not phaseoliform, in water dark brown (Mu. 5 YR 4/6); pleurocystidia rather narrowly fusoid to sublageniform, 32.5–55(–60) × 8–12.5 μm, with acute to subacute apex; gills dark brown with purplish hue . . . . *P. rannochii*

10. Pleurocystidia utriform:

13. Large species (cap 60 mm, stem 85 × 7–10 mm) . . . . . *P. borgensis*, p. 332

13. Small species (cap 12–19 mm, stem 30–65 × 1.5–3 mm):

14. Spores with distinct germ pore, fairly dark, in water orange-brown (Mu. 5 YR 5/6, 4/6); veil poorly developed, rudimentary *P. mookensis*, p. 333

14. Spores with indistinct (callus) or absent germ pore, conspicuously pale or distinctly dark; veil strongly developed.

15. Germ pore absent; spores conspicuously pale, in water yellow (Mu. 7.5 YR 6/6, 7/8); spore print distinctly brown *P. umbrina* var. *utriformis*

15. Germ pore indistinct (callus); spores dark, in water reddish (Mu. 2.5 YR 4/8); spore print very dusky red . . . *P. dennyensis*, p. 335

9. Pleurocystidioid cheilocystidia (very) scarce, spheropedunculate and clavate cells abundant:

16. Pleurocystidia ventricose-fusiform (or sublageniform); few to many spheropedunculate or clavate cells at their apex equipped with a short thick protuberance or somewhat longer subcylindrical or cylindrical short neck *P. obtusata* var. *obtusata*, p. 337

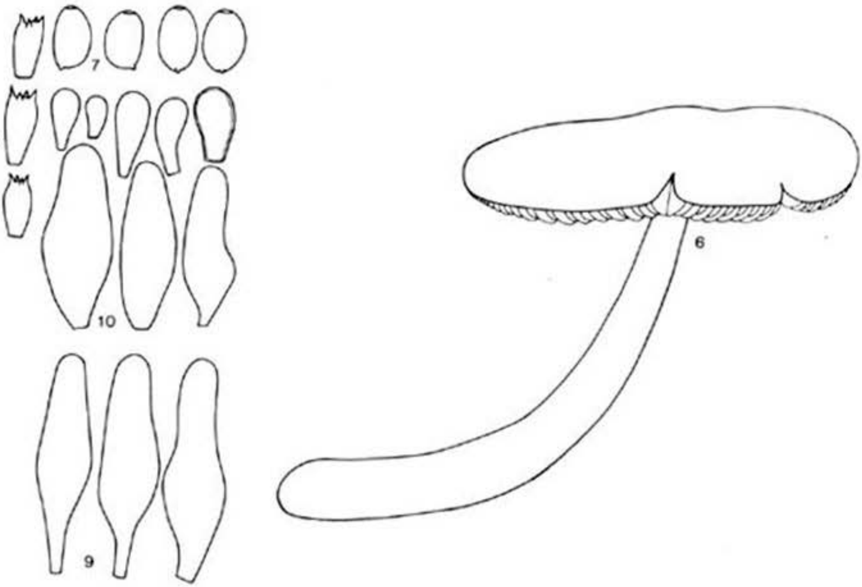
16. Pleurocystidia utriform; no spheropedunculate or clavate cells equipped with a protuberance . . . . *P. obtusata* var. *aberrans*, p. 340

Psathyrella borgensis Kits van Wav., *spec. nov.*—Figs. 6–10

Pileus maturitate 60 mm latus, subplanus, subumbonatus, badius, marginem versus pallidior, magis brunneus et leviter purpureo-tinctus, striatus, hygrophanus, in sicco pallide cinereo-ochraceus, centro ochraceo brunneus, margine distincte roseus. Velum tenue. Lamellae 4 mm latae, subconfertae, ventricosae, late adnatae, obscure brunneae et purpureo-tinctae, acie albae. Stipes 85 × 7 (apex) –10 mm (basis), cylindraceus, eradicatus, apice albus, pruinosus et striatus, albus, deorsum sordide albus, ad basim isabellinus. Caro pilei 2–3 mm crassa, concolor, stipitis alba, infra isabellina. Sporae in cumulo obscurissime purpureobrunneae, 6.5–7.0(–8.0) × (4.0–)4.5(–5) μm, ellipsoideae, saepe ellipsoideo-ovoideae, raro subphaseoliformes, in aqua observatae brunneae, poro germinativo c. 1.5 μm lato munitae. Basidia 15–17.5 × 7.5–8 μm, clavata, 4-sporigera. Pleurocystidia 50–57.5 × 12.5-15 μm, numerosa, utriformia, tenuitunicata. Cellulae marginales: cheilocystidia pleurocystidioidea similia 30–45 × 12.5–17.5 μm, numerosa; cellulae spheropedunculatae et clavatae 10–20 × 5-10 μm numerosae intermixtae, interdum subcrasse tunicata et pallide brunneae. Pileipellis e cellulis fermata. Trama lamellarum colorata. Ad terram, solitaria, in silvis frondosis. Aestate. Typus: The Netherlands, prov. Overijssel, Denekamp, Borgbosch, 11 July 1964, *E. Kits van Waveren* (L).

Etymology: Named after the type locality.

Cap at maturity 60 mm, convex to almost plane, with vague umbo (20–25 mm broad), at centre fairly dark reddish brown (Mu. 5 YR 4/3, 4/4), elsewhere less reddish and paler brown (Mu. 5 YR 5/3, 5/4) with a trace of purple, particularly in marginal area, striate up to half-way, hygrophanous, drying out to ochreous brown (Mu. 7.5 YR 5/6) at centre, elsewhere pale greyish brown (Mu. 10 YR 6/3), in c. 20 mm broad marginal



Figs. 6–10. *Psathyrella borgensis.* — 6. Carpophore (× 1). — 7. Spores. — 8. Basidia. — 9. Pleurocystidiogram. — 10. Cheilocystidiogram.

area slightly but distinctly pink, in peripheral half distinctly rugulose and slightly micaceous. Veil rudimentary, at maturity forming scattered minute fibrils along margin of cap and loose fibrils on stem. *Gills 4 mm broad, fairly crowded, ventricose, ending sharply* at margin of cap, broadly adnate without tooth, conspicuously dark brown (Mu. 7.5 YR 4/2) with purplish hue, paler and more greyish brown near edge; edge white but in some places pale brown, not red underlined. Stem 85 × 7 mm at apex, 10 mm at base, very gradually thickening towards base, fragile, not rooting, at apex white, slightly pruinose and striate over a distance of 20 mm, elsewhere sordid white and at base isabelline, very finely fibrillose striate below apex, hollow; cavity wide and penetrating into flesh of cap. Flesh of cap in centre 3 mm thick but above cavity of stem 2 mm thick, at surface of cap concolorous, elsewhere greyish brown; of stem white but near base pale brown and at base brown; smell indistinctive. Trama of 'washed' gill equally strongly pigmented from base to edge, pale brown (Mu. 10 YR 6/3). Spore print very dark purplish brown.

Spores 6.5–7.0(–8.0) × (4.0–)4.5(–5) μm (mean values 6.9 × 4.5 μm: 1 collection), ellipsoid or ellipsoid-ovoid, not phaseoliform, adaxially flattened, rarely subphaseoliform, in water dark warm brown (Mu. 5 YR 4/6), in NH_4OH 10% darker (Mu. 5 YR 4/4), in KOH 5% sordid brown (Mu. 10 YR 4/3), not opaque, with distinct germ pore (1.5 μm) and small hilar appendix. Basidia 15–17.5 × 7.5–8 μm, clavate, 4-spored. Pleurocystidia 50–57.5 × 12.5–15 μm, numerous, utriform with fairly short pedicel, the majority with subapical constriction, thin-walled, colourless or faintly brown in NH_4OH 10%. Marginal cells: pleurocystidioid cheilocystidia 30–45 × 12.5–17.5 μm, many rather thick-set as compared with pleurocystidia, numerous, quite a few pale to distinctly brown in NH_4OH 10 %, at their base intermixed with numerous, unobtrusive spheropedunculate and clavate cells, 10–20 × 5–10 μm; the (many) larger cells slightly to distinctly brown in NH_4OH 10 %, somewhat thick-walled and sometimes irregularly shaped. Hymenophoral trama in NH_4OH 10 % sub micr.: narrow hyphae distinctly, broad hyphae scarcely brown from membranal pigment with few yellow hyphal septa in basal part of gill, without encrustations. Pileipellis a 2–3 cells deep layer of colourless subglobose cells, 15–40(–50) μm diam.

Habitat & distribution.—Terrestrial, solitary, found growing *from the almost* vertical side of a small, shallow dry ditch (hence the curved stem). Known only from type locality.

Collection examined.—THE NETHERLANDS, prov. Overijssel, Denekamp, Borgbosch, 11 July 1964, *E. K. v. W.* (type, L).

We rank this species with those of section *Hydrophilae* on account of the small size of the spores, although in some respects it seems close to *P. fusca* (pink colour in the marginal area of the drying cap, rudimentary veil, gills dark brown with a purplish hue). But in *P. fusca* (mean length of the spores 7.5–8.4 μm) the cap is always conical or conico-paraboloid, never plane or vaguely umbonate, while the pleurocystidia differ in shape from those of *P. borgensis*.

Psathyrella mookensis Kits van Wav., *spec. nov.*—Figs. 11–15

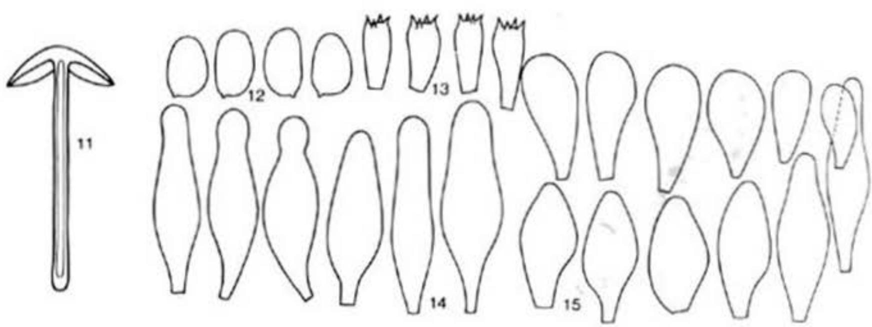
Pileus 16 mm latus, conico-convexus, striatus, griseobrunneus, centro vero flavospadiceus, hygrophanus, in sicco pallide brunneus, colore roseo destitutus. Velum tenue. Lamellae 2 mm latae, adscendentes, late adnatae, obscure purpureobrunneae, acie albae. Stipes 30 × 2 mm, cylindraceus, eradicatus, albus, infra pallide flavobrunneus apice pruinosus. Caro pilei 1.5 mm crassa, concolor, stipi-

tis alba, infra isabellina. Sporae in cumulo non observatae, 6.5–7.0 × 4.5 μm, ellipsoideae, saepe ovoideae, haud phaseoliformes, in aqua observatae aurantiacobrunneae, poro germinativo 1–1.5 μm lato munitae. Basidia 17.5–22.5 × 7.5–8 μm, clavata, 4-sporigera. Pleurocystidia 42.5–57.5 × 12.5–17.5 μm numerosa, utriformia, tenuitunicata. Cellulae marginales: cheilocystidia pleurocystidioidea similia, 30–40(–50) × 12.5–15 μm, cheilocystidia spheropedunculata et clavata, 20–30(–40) × 10–15 μm, et cellulis forma intermedia numerosis intermixtis. Trama lamellarum colorata. Pileipellis e cellulis formata. Ad terram, solitaria, in silvis frondosis. Typus: The Netherlands, prov. Limburg, Mook, 30 July 1965, *E. Kits van Waveren* (L).

Etymology: Named after the village Mook, in the area of which the species was found.

Cap 16 mm, conico-convex, striate up to half-way, greyish brown, with ochreous (Mu. 10 YR 7/6–6/6) centre, hygrophanous, drying out to very pale brown (Mu. 10 YR 8/3), without pink, not micaceous but distinctly rugulose. Veil only seen on lower third of stem as white fibrils. Gills 2 mm broad, rounded near margin of cap, then ascending, straight, broadly adnate with tooth, dark purplish brown (Mu. 2.5 YR 3/2; 5 YR 3/2), with white edge. Stem 30 × 2 mm, cylindrical, neither rooting nor bulbillate, white but in lower half pale yellowish brown, hollow, with distinctly pruinose apex. Flesh of cap in centre 1.5 mm thick, concolorous, of stem white but in lower half pale isabelline. Trama of 'washed' gills pale brownish yellow (Mu. 10 YR 7/4) from base to edge. Spore print colour not recorded.

Spores 6.5–7.0 × 4.5 μm (mean values 6.9 × 4.5 μm; 1 collection), in face view ellipsoid, but many distinctly ovoid, in profile adaxially flattened, in water not pale, (orange-) brown (Mu. 5 YR 5/6, 4/6), in NH_4OH 10% dark brown (Mu. 5 YR 4/3), in KOH 5% sordid brown (Mu. 10 YR 5/4, 4/4), not opaque, with fairly distinct germ pore (1–1.5 μm) and small hilar appendix. Basidia 17.5–22.5 × 7.5–8 μm, clavate, 4-spored. Pleurocystidia 42.5–57.5 × 12.5–17.5 μm, numerous, utriform almost always with a subapical constriction, with relatively short, fairly broad pedicel, thin-walled, colourless. Marginal cells a motley of numerous utriform cells, 30–40(–50) × 12.5–15 μm and spheropedunculate and clavate cells, 20–30(–40) × 10–15 μm, with numerous intermediate stages. Hymenophoral trama in NH_4OH 10% pale yellowish brown from membranal pigment, paler towards edge, without yellow hyphal septa, with very few minute encrustations. Pileipellis a 2–3 cells deep layer of globose, subglobose (15–30 μm) and also ellipsoid (30–50 × 15–20 μm), colourless cells.



Figs. 11–15. *Psathyrella mookensis*. — 11. Carpophore (× 1). — 12. Spores. — 13. Basidia. — 14. Pleurocystidiogram. — 15. Cheilocystidiogram.

Habitat & distribution.—Solitary in humus, found along footpath in deciduous wood. Known only from type locality.

Collection examined.—THE NETHERLANDS, prov. Limburg, Groesbeek near hotel Wolfsberg, 30 July 1965, *E. K. v. W.* (type, L).

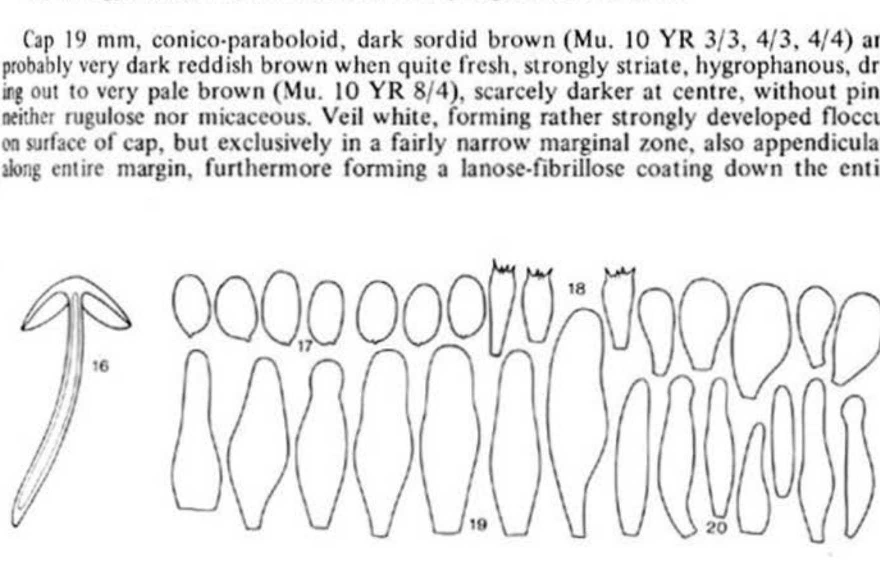
Although the colour of cap, gills, and hymenophoral trama is not conspicuously brown, this species belongs to section *Hydrophilae* because of its small spores.

Psathyrella dennyensis Kits van Wav., *spec. nov.*—Figs. 16–20

Pileus 19 mm, conico-parabolicus, obscure sordideque brunneus recens an perobscure badius, valde striatus, hygrophanus, in sicco pallide brunneus, colore roseo destitutus, haud rugulosus nec atomatus. Velum album, insigne e flocculis in zona pilei marginale sat angusta etiam appendiculatum, stipitem infra apicem pruinosum omnino fibrillis lanosis obtegens. Lamellae 2.5 mm latae, adscendentes, rectae, late adnatae, obscure tabacinae, acie albae. Stipes 40 × 3 mm, cylindraceus, albus, cavus, eradicatus, apice pruinosus. Caro pilei centro 2 mm crassa, concolor, stipitis albus. Sporae in cumulo obscure badiae, 7–8 × 4–4.5 μm, ellipsoideae, haud phaseoliformes, in aqua observata rubrobrunneae, poro germinativo indistincto instructae. Basidia 17.5–22.5 × 7.5–9 μm, clavata, 4-sporigera. Pleurocystidia 30–50(–55) × (10–)12.5–17.5 μm, utriformia, plerumque fusoideus praeditus cum apex valde obtusus, interdum sat numerosa, tenui-tunicata. Cellulae marginales: cheilocystidia pleurocystidioidia 27.5–45 × 7.5–15 μm, numerosa, cheilocystidia spheropedunculatis et clavatis 15–22.5 × 7.5–12.5 μm numerosis. Trama lamellarum paulo colorata. Pileipellis e cellulis formata. Terrestris, in ericetis, sub *Betula*, autumno. Typus: Great Britain, Hampshire, New Forest, Denny Bog, 21 Sept. 1971, *E. Kits van Waveren* (L).

Etymology: Named after the area, called Denny Bog, in the New Forest.

Cap 19 mm, conico-paraboloid, dark sordid brown (Mu. 10 YR 3/3, 4/3, 4/4) and probably very dark reddish brown when quite fresh, strongly striate, hygrophanous, drying out to very pale brown (Mu. 10 YR 8/4), scarcely darker at centre, without pink, neither rugulose nor micaceous. Veil white, forming rather strongly developed flocculi on surface of cap, but exclusively in a fairly narrow marginal zone, also appendiculate along entire margin, furthermore forming a lanose-fibrillose coating down the entire



Figs. 16–20. *Psathyrella dennyensis*. — 16. Carpophore (× 1). — 17. Spores. — 18. Basidia. — 19. Pleurocystidiogram. — 20. Cheilocystidiogram.

stem below its pruinose apex. Gills 2.5 mm broad, ascending, straight, fairly broadly adnate, dark tobacco-coloured (Mu. 7.5 YR 4/2), with white edge. Stem 40 × 3 mm, cylindrical, white, hollow, not rooting, pruinose at apex. Flesh of cap in centre 2 mm thick, concolorous, of stem white; smell indistinctive. Trama of 'washed' gill in basal 1/3 pale brown (Mu. 10 YR 7/4), paler (Mu. 10 YR 7/3) towards margin and very pale (Mu. 10 YR 7/2) near edge. Spore print very dusky red.

Spores 7–8 × 4–4.5 μm (mean values 7.3 × 4.5 μm; 1 collection), ellipsoid, not phaseoliform, in water reddish (Mu. 2.5 YR 4/8), in NH_4OH 10% dark brown (Mu. 5 YR 4/4), in KOH 5% sordid brown (Mu. 10 YR 4/3), germ pore indistinct (callus), hilar appendix distinct, not opaque. Basidia 17.5–22.5 × 7.5–9 μm, clavate, 4-spored. Pleurocystidia 30–50(–55) × 12.5–15(–17.5) μm, utriform, several cells with subcapital constriction, most cells however fusoid with very obtuse apex, rather numerous, thin-walled, very pale brown in NH_4OH 10%. Marginal cells: pleurocystidioid cheilocystidia 27.5–45 × 7.5–15 μm, numerous, intermixed with numerous spheropedunculate and clavate cells, 15–22.5 × 7.5–12.5 μm; all cells thin-walled and colourless. Hymenophoral trama very pale brown from membranal pigment, without yellow hyphal septa and encrustations. Pileipellis a 2–3 cells deep layer of in NH_4OH 10% very pale brown globose and subglobose cells (a few broadly ellipsoid cells), 25–40 μm diam.

Habitat & distribution.—Terrestrial in heath, solitary. September. Only known from type locality in southern England.

Collection examined.—GREAT BRITAIN, Hampshire, New Forest, Denny Bog, 21 Sept. 1971, *E. K. v. W.* (type, L).

Psathyrella dennyensis in several respects rather resembles *P. romseyii* in subsection *Lutenses*. The pleurocystidia and the pattern of cellular lining of the gill edge is for both species basically the same and the spores of both species have an indistinct germ-pore (callus). The difference between the two species hardly finds expression in the actual description of the spores but immediately leaps to the eye when spores of both species are compared in two mounts on one slide. In *P. romseyensis* the mean values for the spore size are 7.7 × 4.2 μm, the spores are orange-brown (Mu. 5 YR 4/6, 4/8) when mounted in water and often slightly phaseoliform, whereas in *P. dennyensis* they are slightly smaller, the mean values for their sizes being 7.3 × 4.5 μm (which places the species in section *Hydrophilae*), while when mounted in water they also are darker, reddish (Mu. 2.5 YR 4/8) and not phaseoliform. Also in *P. dennyensis* the pleurocystidia are more ventricose, measuring × (10–)12.5–17.5 μm.

Because of the scarcity of material for comparison and considering the great variability of macroscopical characters the following differences between *P. romseyensis* and *P. dennyensis* are less reliable but provisionally may be taken into account. Contrary to *P. romseyensis* the cap in *P. dennyensis* is conico-paraboloid and not convex, neither umbonate, the veil is rather strongly developed, and the gills are neither ventricose nor conspicuously broadly adnate. But here again more observations on more collections are needed.

Psathyrella obtusata (Pers.: Fr.) A. H. Smith

Synonymy.—See Kits van Waveren, 1985: 197.

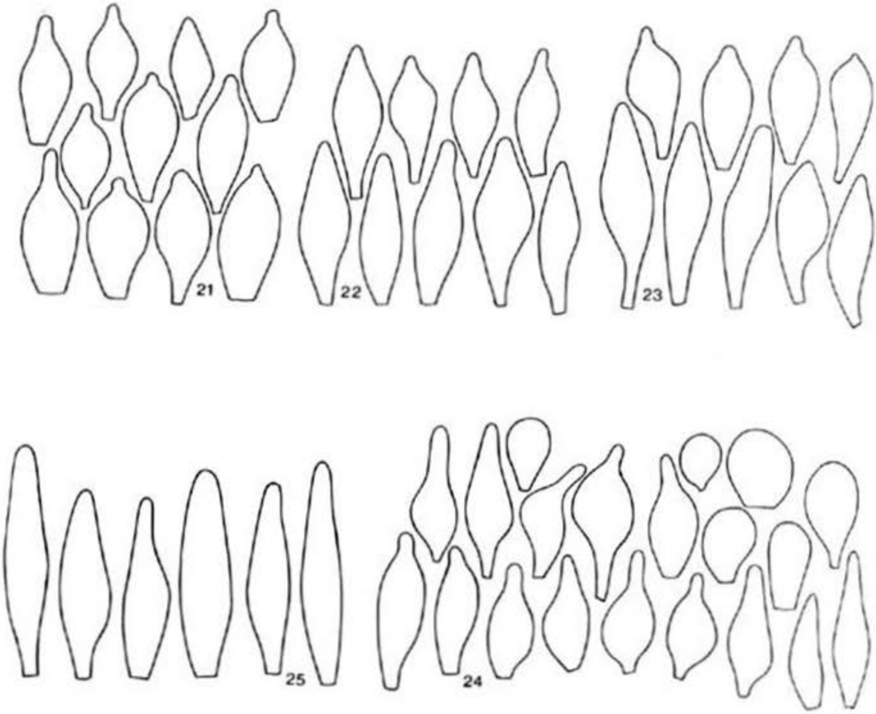
var. **obtusata**—Figs. 21–25

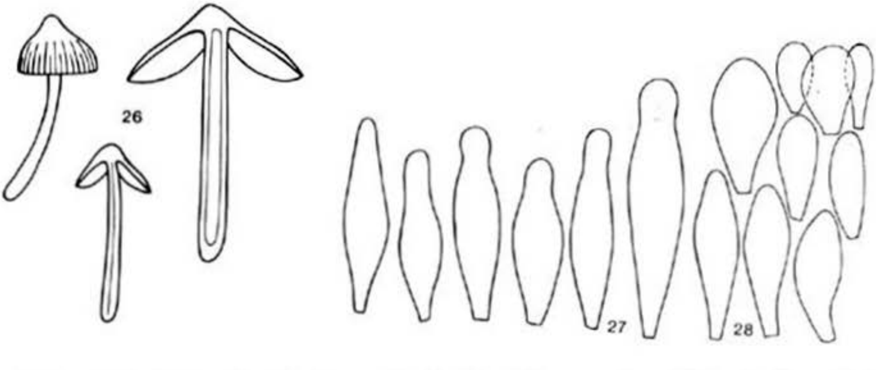
Descriptions & illustrations.—See enumeration by Kits van Waveren, 1985: 197.

Cap 20–25 mm, conical, conico-convex, but sometimes conspicuously paraboloid, without (rarely with) umbo, striate up to 2/3 from margin, at central half strikingly brown (between Mu. 7.5 YR 4/4 and 5/4), in peripheral half much paler (Mu. 10 YR 6/4) but with darker striation (Mu. 7.5 YR 5/4), hygrophanous, drying out to very pale brown (Mu. 10 YR 8/4), without pink, rugulose and distinctly micaceous. Veil white, distinct but variable, usually scanty; velar fibrils and minute fibrillose networks of fibrils on surface of cap in a 1–2 mm broad zone along margin, but sometimes more strongly developed, fibrils and networks reaching up to 2/3 from margin, rarely even up to apex; surface of lower 2/3 of stem covered with quite a few fibrils. Gills 3–4 mm broad, strikingly pinkish brown, colour of weak chocolate (Mu. 5 YR 5/3–6/3), moderately ventricose, rather broadly adnate, with white edge. Stem 60–75 × 2–3 mm, slightly thickening towards base, somewhat flexuous, not rooting, hollow, with white smooth surface and pruinose apex. Flesh of cap 2 mm thick in centre, concolorous (c. Mu. 10 YR 4/3) with a trace of reddish. Trama of 'washed' gill pale brown (Mu. 10 YR 7/3) in peripheral half, slightly browner (Mu. 10 YR 7/4) towards base, sometimes still browner in narrow strip at base, sometimes with brownish yellow (Mu. 10 YR 5/6) anastomosing tissue strands running from base towards edge through the in itself pale brown (Mu. 10 YR 6/4) gill tissue. Spore print brown with purplish hue.

Spores 7–8 × 4.5–5.5 µm (mean values: sometimes 7.4–7.5 × 4.5–4.8 µm, bringing the species in section *Hydrophilae*; more often 7.6–7.9 × 4.5–4.9 µm, bringing the species in section *Pennatae*), in face view ellipsoid or ellipsoid-ovoid, in profile adaxially flattened, often subphaseoliform, sometimes even distinctly phaseoliform, pale, in water pale yellowish brown (Mu. 7.5 YR 6/8, 5/8) with reddish hue, in NH_4OH 10% brown (Mu. 5 YR 4/6, 5/6; 7.5 YR 5/6) without reddish hue, in KOH 5% sordid brown (Mu. 10 YR 5/3, 5/4), not opaque, with small and sometimes rather indistinct germ pore and small hilar appendix. Basidia 17.5–22 × (9–)10 µm, spheropedunculate to clavate, 4-spored. Pleurocystidia 25–75 × 9–15 µm, abundant, ventricose-fusoid or sublageniform, with short rather broad pedicel and subacute to subobtuse, rarely obtuse apex, thin-walled, practically colourless or very pale brown in NH_4OH 10%. Marginal cells: three different kinds of cells, viz. (i) spheropedunculate and clavate cells, normally large, 35 × 10–20 µm, abundant, very densely packed (see our monograph: 198, fig. 283, bottom row of cells); (ii) the same cells but at apex equipped with a short, relatively thick protuberance (bulge), 2.5–5 × 3–5 µm, passing gradually into cell body, or with a somewhat longer subcylindrical or cylindrical short neck, 5–6 × 2.5–4 µm, either passing gradually into cell body or more or less sharply delimited from it (see our monograph: 198, fig. 283, top row of cells); (iii) pleurocystidioid cheilocystidia, 30–45 × 12.5–17 µm, very few to few in number (rarely locally or along entire edge slightly more). (The cells mentioned sub ii are distinctive for *P. obtusata* (Figs. 21–24), normally few in number, rarely numerous and then very striking. Needless to say that intermediate forms between sub i, ii and iii occur.) Hymenophoral trama in NH_4OH 10% sub micr. in basal half distinctly brown from membranal pigment with a fair number of yellowish hyphal septa and few to many minute encrustations, in peripheral half very pale brown. Pileipellis a 2–4 cells deep layer of globose and subglobose cells, 25–50 µm diam., in NH_4OH 10% very pale brown.

Habitat & distribution.—Terrestrial, solitary but sometimes gregarious, in deciduous woods. Sept.–Oct. Rather rare in the Netherlands. Reported from France and the British Isles; several collections seen from Norway.





Figs. 21–25. *Psathyrella obtusata*. — 21. Cheilocystidiogram, from 21 Oct. 1976. — 22. Id., from 17 Oct. 1968. — 23. Id., from 25 Sept. 1975. — 24. Id., from 30 June 1985 (Norway, *Weholt 8/85*). — 25. Pleurocystidiogram, 30 June 1985 (Norway, *Weholt 8/85*).

Figs. 26–28. *Psathyrella obtusata* var. *aberrans*. — 26. Carpophores (×1). — 27. Pleurocystidiogram. — 28. Cheilocystidiogram.

Collections examined.—THE NETHERLANDS: prov. Overijssel: Denekamp, estate 'Singraven', 17 & 20 Oct. 1962, 15 Oct. 1967 (L); Delden, bank of 'Oelerbeek', 17 Oct. 1968 (L); prov. Noord-Holland, estate 'Elswout', 25 Sept. 1975, 21 Oct. 1976 (L); prov. Limburg, Wittem, 2 Oct. 1964 (2 collections, L).—BRITISH ISLES: Oxford, estate 'Wychwood Forest', 13 Sept. 1969 (L); Scotland, Invernessshire, Tomich, 17 Sept. 1968 (L).—NORWAY: 2 Sept. 1982 (herbarium O. Weholt Nr. 188/82), 31 Oct. 1982 (Nr. 226/82), 21 May 1983 (Nr. 24/83) and 30 June 1985 (Nr. 8/85) (O) at (L).

This is our second redescription and reevaluation of an in our experience in the Netherlands rather rare species.

Our observations on this species in our monograph (1985: 199) and earlier (1977: 299) on the reasons why we adopted the interpretation by Lange (1939: 98, pl. 152 A), A.H. Smith (1972: 385) and Romagnesi (1975: 197) of Fries's *Agaricus obtusatus* for the species described above, are still valid. In our 1977 description of *P. obtusata* we had only one collection of this rare species at our disposal. Its characters, above all the microscopical ones, fully agreed with those reported by Lange: (i) Gill edge lined with abundant large spheropedunculate and clavate cells, intermixed with only few of these cells, equipped with a very short apical protuberance or neck. (In 1977 we called the latter cells wrongly merely 'cheilocystidia' and in 1982 did not sharply distinguish between these latter cells and the pleurocystidioid cheilocystidia.) (ii) Small spores (with Lange 7¼–7¾ × 4¾ µm), mean values for our then sole collection 7.4 × 4.6 µm. For our 1985 description we had seven collections at our disposal for which we (1985: 198) incorrectly (printer's error) gave 7–7.9 × 4.5–5 µm for the mean values of the spore sizes. (iii) The overall brown colour of cap and gills.

The fourteen collections now at our disposal can be split into two groups, one (a) comprising three collections in which the spores are small (7.4–7.5 µm long) and therefore fitting very well in section *Hydrophilae* and one (b) comprising eleven collections in which the spores are larger (7.6–7.9 µm long) and therefore fitting less well in this section and keying out in section *Pennatae*.

Going by the size of the spores *P. obtusata* is intermediate between the two sections mentioned. Because of its overall resemblance to the other typical members of section *Hydrophilae* (particularly the dominantly brown colours of the fruit-bodies) we maintain the species in that section, but also are dealing with it in the key to the section *Pennatae*.

In retrospect it turned out to be that all our cheilocystidiograms made in previous years of our collections of this species showed a few to several spheropedunculate and clavate cells equipped with an apical protuberance or short neck, although while making these cheilocystidiograms we had never been aware of the presence of these rather peculiar and striking cells. These cells are easily overlooked but not at all difficult to notice. They seem to be distinctive for *P. obtusata* and therefore of taxonomical value. They did not occur on the three cheilocystidiograms we made in 1979 of *P. vyrnwyii*, a species close to *P. obtusata* and were not seen in *P. obtusata* var. *aberrans*.

Psathyrella obtusata var. **aberrans** Kits van Wav., *var. nov.*—Figs. 26–28

Misapplied name.—*Psathyrella obtusata* var. *utriformis* sensu Kits van Wav. in Persoonia (Suppl.) 2: 200. 1985.

A forma typica differt pleurocystidia et cheilocystidia pleurocystidioidea utriformis. Cheilocystidia spheropedunculatae et clavatae sine protuberantiae. Typus: The Netherlands, prov. Overijssel, Denekamp, 'Singraven', 15 Oct. 1967 (L).

On Oct. 15th 1967 we found two lots, each comprising two specimens of seemingly the same species of *Psathyrella* on a mossy coniferous tree stump, growing close to each other. The specimens of one lot turned out to be typical specimens of *P. obtusata* var. *obtusata* with conical caps, mean values of spore sizes 7.6 × 4.6 μm, slender fusoid pleurocystidia and scanty pleurocystidioid cheilocystidia, large quantities of spheropedunculate and clavate cells (some equipped with an apical protuberance). The specimens of the other lot had (like sometimes also in *P. obtusata*) umbonate caps, mean values of spore sizes 7.9 × 4.6 μm, but the pleurocystidia and scanty pleurocystidioid cheilocystidia were distinctly utriform (Figs. 27, 28), many even with subcapital constriction; none of the numerous spheropedunculate and clavate, cheilocystidia were equipped with an apical protuberance. We described (1982: 499) this aberrant variety as *P. obtusata* var. *utriformis*.

A recent revision of our material of *P. obtusata*, however, revealed that we had erroneously designated (Kits van Waveren, 1982: 499) the wrong collection for the type of this variety, viz. one that turned out to represent *P. spadiceogrisea* f. *exalbicans* (spores with distinct germ pore and dark gills and spores). Nevertheless a variant of the true *P. obtusata*, characterised by the pleurocystidia and pleurocystidioid cheilocystidia being utriform as the sole difference with *P. obtusata* var. *obtusata* does exist. It is described here as *P. obtusata* var. *aberrans*. The pleurocystidia depicted in our monograph (1985: 200, fig. 284) are those of *P. obtusata* var. *aberrans* and nòt of *P. obtusata* var. *utriformis*. The latter name has now to be placed in the synonymy of *P. spadiceogrisea* f. *exalbicans*.

Collections of *P. obtusata* var. *aberrans* with a mean value of the length of the spores above 7.5 μm key out in subsection *Spadiceogriseae* side by side with *P. clivensis* (Kits van Waveren, 1985: 221).

It turned out to be quite difficult to distinguish between *P. obtusata* var. *aberrans* and *P. clivensis*. Size, shape, and colours of the carpophores of both species are about the same, both have utriform pleurocystidia and the same pattern of cellular-lining of the gill edge (large quantities of spheropedunculate and clavate cells, intermixed with only few utriform cheilocystidia). But *P. obtusata* var. *aberrans* has smaller (mean values 7.9 × 4.6 μm) and darker (although still fairly pale spores (in water Mu. 7.5 YR 6/8, 5/8), which have a very small, sometimes indistinct germ pore, whereas the spores of *P. clivensis* are distinctly larger (mean values 8.4–9.7 × 5.5–5.7 μm) and paler (in water Mu. 7.5 YR 6/6), and do not have a germ pore (at most a callus). Besides *P. obtusata* var. *aberrans* is a woodland and *P. clivensis* typically a grassland species.

SUBSECTION LUTENSES

REVISED KEY TO THE SPECIES OF SUBSECTION LUTENSES

1. Mucoid deposits staining bluish green in NH_4OH 10% on pleurocystidia and pleurocystidioid cheilocystidia (deposits very gradually disappearing in exsiccata) . . . . *P. lutenses*

1. Not as above:

  2. Annulus present on stem (very rarely exclusively as very distinct appendiculate denticles at margin of cap . . . . *P. sphagnicola*

  2. No annulus on stem:

    3. Veil strongly developed, covering entire cap:

      4. Carpophores densely caespitose; veil forming dense arachnoid fleece of silky adpressed radial fibrils on cap . . . . *P. pannucioides*

      4. Carpophores not caespitose; veil on cap floccose scaly:

        5. Cap small (8–12 mm), predominantly snow-white, only at centre very pale yellowish brown (see also *P. kitsiana* from Sweden, p. 364) . . . . *P. vestita*

        5. Cap medium-sized (25–35 mm), at first at central half pale ochre, pale brown, later predominantly pale mouse grey practically all over (see also *P. suavissima* from Switzerland, p. 362) . . . . *P. pervelata*

    3. Veil thin, rudimentary, fugacious:

      6. Germ pore present:

        7. Few, many or most pleurocystidioid cheilocystidia distinctly capitate, the non-capitate ones being utriform (Fig. 33) . . . . *P. capitatocystis*, p. 342

        7. Not as above:

          8. Rather large and tall species; stems 50–110 mm long; caps (15–)25–60 mm.

            9. Stem gradually and conspicuously thickening towards base; gills dark grey to black (rarely brownish if spores failed to ripen); spores large (mean values 9.6–10.9 × 5.3–6 µm), in water dark red (Mu. 2.5 YR 3/6, 3/4) *P. tephrophylla*

            9. Stem cylindrical (sometimes only very slightly thickening towards base); gills greyish brown-purple; spores smaller (mean values 7.5–8.4 × 4.5–4.7 µm) in water orange-brown (Mu. 5 YR 4/4, 4/6, 4/8) . . . . *P. fusca*

          8. Smaller species; stems not tall, 20–35(–55) mm long; caps 7–40 mm (but see also in subsection *Spadiceogriseae*: *P. almerensis* and *P. spadiceogrisea* f. *exalbicans* of which the gill edge sometimes, be it rarely, is lined with many instead of few utriform cells):

            10. Most, many, or only a few spores in face view distinctly subtriangular *P. panaeoloides* (see also p. 368)

            10. Not as above:

              11. Habitat: in marshy areas, muddy borders of ponds with thick bed of decaying leaves, boggy beds of ditches, often gregarious; cap rarely umbonate; stems relatively short (15–55 × 1.5–4 mm) as compared with diameter of cap (10–40 mm); many cystidia with subapical constriction . . . . *P. noli-tangere*

              11. Habitat not as above; terrestrial:

                12. Surface of fresh cap strongly wrinkled, cap 5–15 mm *P. reticulata*

                12. Not as above; cap 34 mm and distinctly umbonate *P. twickelensis*, p. 344

      6. Germ pore indistinct (callus) or absent:

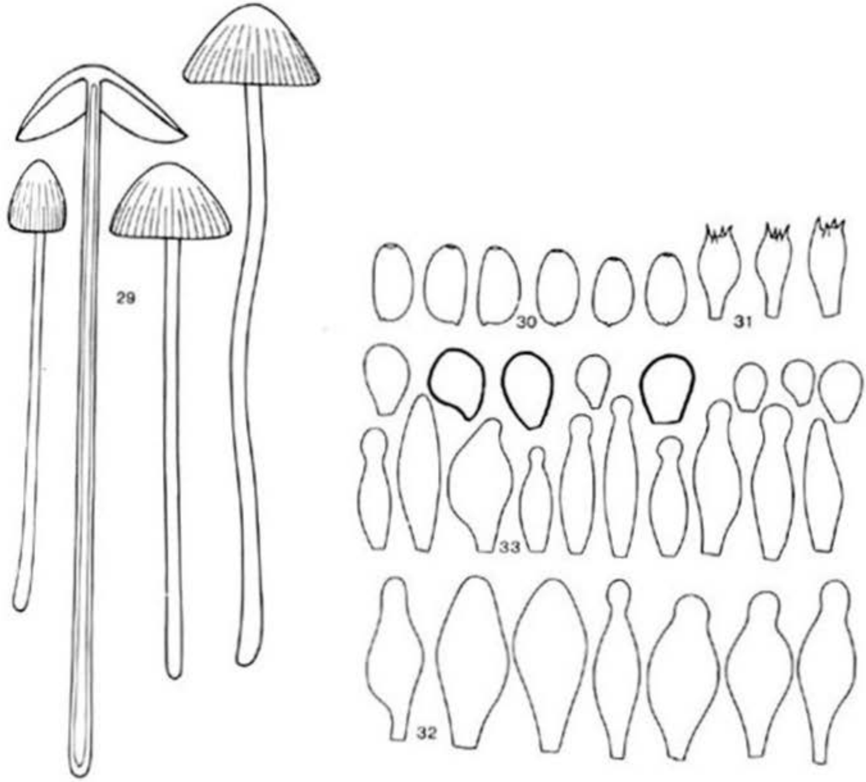
13. Pleurocystidia exceedingly abundant, versiform . . . . . *P. multicystidiata*, p. 346
13. Not as above:
    14. Pleurocystidia utriform, thick-set, very ventricose, 32.5–40(–42.5) × 10–17.5(–20) μm, many with subapical constriction, others fusoid with very obtuse apex; spores in water dark red (Mu. 2.5 YR 3/6, 4/6); small species; cap 14 mm, without umbo; stem 20 × 1 mm . . . . *P. badia*, p. 348
    14. Pleurocystidia utriform, rather slender, (30–)35–45(–50) × (7.5–)9–15 μm, most pleurocystidia fusoid with (very) obtuse to subobtuse apex, very few with subapical constriction; spores in water orange-brown (Mu. 5 YR 5/8, 4/8); robuster species; cap 17–32 mm, with umbo; stem 20–30 × 2–4 mm *P. romseyensis*, p. 349

Psathyrella capitatocystis Kits van Wav., *spec. nov.*—Figs. 29–33

Pileus 10–25 mm latus, exumbonatus, conicus, maturitate cinereus, brunnescens apicem versus, perstriatus, hygrophanus, in sicco margine admodum pallide cinereus, apicem versus pallide brunneus, apice dilute ochraceus. Velum album, primo e fibrillis fasciculisque fibrillosis numerosis zonam pilei marginalem 1–1.5 mm latam formans, nec appendiculatum, et fibrillae in stipite paucae. Lamellae 3–5 mm latae ad pilei marginem ventricosae, alibi rectae, adscendentes, late adnatae, acie albae. Stipes 50–90 × 2 mm, deorsum leviter incrassatus, eradicatus, cavus, apice eximie pruinosus. Caro pilei centro 1 mm crassa, brunnea, stipitis alba. Sporae in cumulo purpureo-atrae, 8–10 × 4.5–5 μm, ellipsoideae, nec phaseoliformes, obscurae, in aqua observatae obscure badiae, nec opacae, poro germinativo distincto munitae. Basidia 20–22.5 × 8–10 μm clavata, 4-sporigera. Pleurocystidia (35-) 40–50 × 12.5–17.5(–20) μm, sat numerosa, utriformia, plurimum subutriformia vel ventricoso-fusiformia, nonnulla capitata, collo lato brevique praedita, interdum collis tenuitunicatis. Cellulae marginales: cheilocystidia pleurocystidioidea 30–40 × 10–12.5(–15) μm, numerosa, vulgo capitata, cheilocystidiis spheropedunculatis et clavatis 10–20(–22.5) × 7.5–17.5 μm intermixta. Pileipellis e cellulis formata. Trama lamellarum colorata. Terrestris, solitaria, in graminis sub *Betula*. Autumno. Typus: The Netherlands, prov. Overijssel, Oldenzaal, 'Roderveld', 21 Oct. 1975, *E. Kits van Waveren* (L).

Cap 10–25 mm, conical, without umbo, at maturity conspicuously grey (Mu. 10 YR 6/2), in peripheral half, towards centre slightly browner (Mu. 10 YR 6/3) and at 4 mm broad apex brown (Mu. 10 YR 6/4, 5/4), strongly striate up to 3/4 from margin, hygrophanous, rapidly drying out to very pale grey at margin, pale brown (Mu. 10 YR 8/3, 8/4) elsewhere, slightly ochraceous at apex, without pink, distinctly micaceous and finely rugulose; cap of young specimens drying out to pale brown everywhere, but slightly ochraceous at apex. Veil white, in young specimens forming on a 1–1.5 mm broad marginal zone many isolated fibrils and rather dense fibrillose wicker-works, the latter in many places interwoven to small strands, lying horizontally along extreme margin of cap, not appendiculate; a few scattered fibrils on stem. Gills 3–5 mm broad, ventricose near margin of cap, then ascending, straight, broadly adnate with tooth, brownish grey (Mu. 5 YR 5/2) to greyish brown (Mu. 7.5 YR 5/2), with white, minutely fimbriate edge. Stem 50–90 × 2 mm (growing in tall grass, hence the long stem), gradually very slightly thickening (3 mm) towards non rooting base, hollow, white, densely pruinose at apex. Flesh of cap in centre 1.5 mm thick, brown (Mu. 10 YR 4/3, 3/3), of stem white, in bottom part pale brown and in base brown. Smell indistinctive. Trama of 'washed' gill pale brownish grey (Mu. 2.5 YR 6/2), from base to edge. Spore print purplish black.

Spores 8–10 × 4.5–5 μm (mean values 8.7 × 4.6 μm: 1 collection), ellipsoid, adaxially flattened, neither ovoid nor phaseoliform, dark, in water dark red (Mu. 2.5 YR 3/6), in NH_4OH 10% dark brown (Mu. 5 YR 4/4), in KOH 15% dark sordid brown (Mu. 7.5 YR 4/2), not opaque, with distinct germ pore (1.5–1.8 μm) and small apiculus. Basidia 20-



Figs. 29–33. *Psathyrella capitatocystis*. — 29. Carpophores (×1). — 30. Spores. — 31. Basidia. — 32. Pleurocystidiogram. — 33. Cheilocystidiogram.

22.5 × 8–10 μm, clavate, 4-spored, many with sterigmata up to 5 μm long. Pleurocystidia (35–)40–50(–55) × 12.5–17.5(–20) μm, fairly numerous, most cells subutriform or (very) ventricose-fusoid, some utriform, most cells with broad, usually very short neck, passing either gradually or abruptly into cell body, very few capitate, thin-walled, colourless, infrequently neck longer and very thin-walled and more or less sharply delimited from cell body; pedicel either short and broad or longer and narrower. Marginal cells: pleurocystidioid cheilocystidia 30–40 × 10–12.5(–15) μm, abundant, in most places densely packed, few or many or even most cells distinctly capitate, intermixed with many unobtrusive small spheropedunculate and clavate cells, 10–12.5 × 7.5–10 μm, and a small number of larger cells, 12.5–20(–22.5) × 10–17.5 μm, some of which with slightly thickened wall and very pale brown in NH_4OH 10%. Hymenophoral trama very pale brown from membranal pigment with very few yellow hyphal septa in basal part of gill, without encrustations. Pileipellis a 2–4 cells deep layer of colourless globose and subglobose cells, 25–40 μm diam.

Habitat & distribution.—Terrestrial, solitary, found in tall grass in deciduous wood under *Betula*. Known only from type locality.

Collection examined.—THE NETHERLANDS, prov. Overijssel, estate 'Rodenveld' (nature reserve), 21 Oct. 1975 (7 specimens), *E. K. v. W.* (type, L).

In this species capitate cystidia are always present but their number varies from one specimen and even one gill to another. Capitate pleurocystidia are few to even very few in number (easily overlooked, a thorough search needed), but capitate cheilocystidia occur more frequently and sometimes numerous to even abundant.

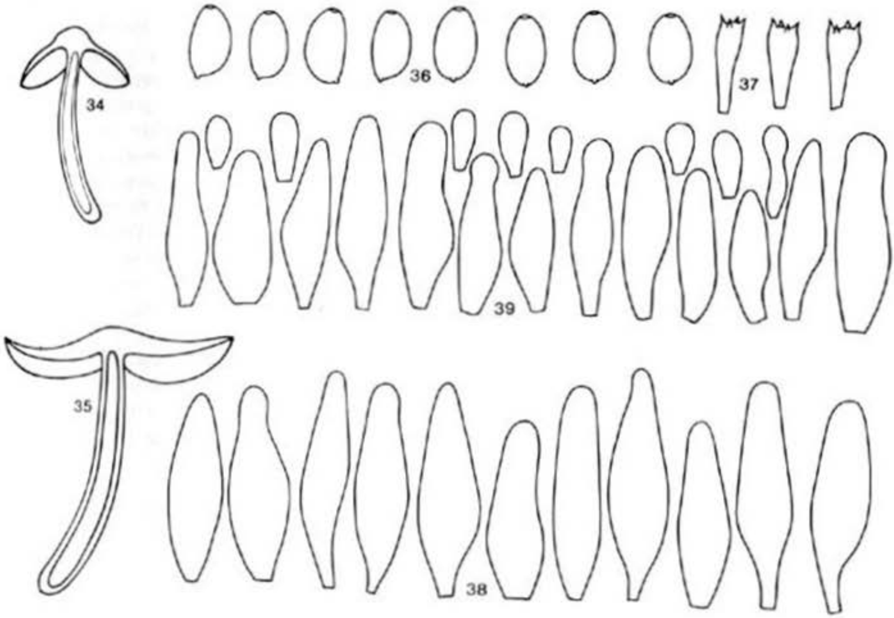
Psathyrella twickelensis Kits van Wav., *spec. nov.*—Figs. 34–39

Pileus primo 10 mm latus, parabolicus, dein convexus vel denique revolutus, robuste umbonatus, obscure badius dein brunneus, margine substriato, subsulcatus, hygrophanus, in sicco pallide brunneus, centro ochraceus, colore roseo destitutus, paulum rugulosus, nec atomatus. Velum album, e fibrillis et fasciculis parvis, zonam pilei marginalem 2 mm latam formans, etiam fibrillae in stipite. Lamellae 3–5 mm latae, subventricosae, adscendentes, late adnatae, purpureo-cinereobrunneae, brunneae ad basim, acie albae. Stipes 20–35 × 1.5–3 mm, cylindraceus, eradicatus, albus, minute fibrilloso-striatus. Caro pilei centro 3 mm crassa, obscure badia. Sporae in cumulo purpureo-atrae, (6.5–)7–8(–9) × 4–5 µm, ellipsoideae, nec phaseoliformes, in aqua observatae obscure rubellae, poro germinativo distincto (1.5–1.8 µm) munitae. Basidia 19–24 × 8–9 µm, clavata, 4-sporigera. Pleurocystidia 35–55(–60) × 10–15 µm, numerosa, utriformia, fusoideo-pedicellata, apice perobtusa, raro constrictione subapicale instructa, tenui-tunicata, colore carentia. Cellulae marginales: cheilocystidia pleurocystidioidea 30–50 × 9–12.5(–15) µm, numerosa, cellulis spheropedunculatis et clavatis (10–)12.5–17.5(–20) × 5–10 µm intermixta, tenui-tunicata et colore destituta. Trama lamellarum valde distincte colorata. Pileipellis e cellulis formata. Terrestris sub Fago vel Querquo. Aestate–Autumno. Typus: The Netherlands, prov. Overijssel, Delden, 20 Oct. 1973, *E. Kits van Waveren* (L).

Etymology: Named after the estate 'Twickel', where it was first found.

Cap at first c. 10 mm, paraboloid, later spreading to 35 mm and then convex with deflexed marginal zone and finally plane with even revolute marginal area, with large umbo, at first very dark red-brown (Mu. 2.5 YR 2.5/4, 3/4; 5 YR 3/2) later dark reddish brown (Mu. 2.5 YR 3/6, 4/6), red soon disappearing from margin towards centre and colour gradually becoming warm brown (Mu. 7.5 YR 4/4) then yellowish brown (Mu. 5 YR 5/8, 5/6; 7.5 YR 6/8, 7/8), faintly striate-sulcate only at margin, hygrophanous, rapidly drying out, finally all over pale brown (Mu. 10 YR 7/3) with centre more ochreous, without pink, slightly rugulose, not micaceous. Veil white, forming fine, radially arranged fibrils and small wicker-works of fibrils on a 2 mm broad zone along entire margin of cap; scattered fibrils on stem. Gills 3.5 mm broad, near margin slightly concave, half-way edge becoming slightly ventricose and ascending, broadly adnate, in basal 1/3 brown (Mu. 10 YR 5/4), elsewhere purplish brown (± Mu. 2.5 YR 4/4 with greyish hue), with minutely fimbriate white edge. Stem 20–35 × 1.5–3 mm, cylindrical, not rooting, very pale brown under a rather dense and homogeneous layer of white fibrils, rendering surface white and minutely longitudinally striate, with pruinose apex. Flesh of cap in centre 3 mm thick (umbo!), very dark red-brown (Mu. 5 YR 3/2), rapidly becoming browner (Mu. 5 YR 3/3, 4/3), of stem pale brown (Mu. 10 YR 6/3). Trama of 'washed' gill conspicuously pigmented, in basal 1/3 pale (reddish) brown (Mu. 5 YR 6/4; 7.5 YR 6/4), towards edge rather suddenly much paler, in peripheral 1/3 very pale brown (Mu. 10 YR 7/2), practically colourless. Spore print purplish black.

Spores (6.5–)7–8(–9) × 4–5 µm (mean values 7.7–8 × 4.5 µm: 2 collections), ellipsoid, adaxially flattened, neither ovoid nor phaseoliform, dark, in water dark red (Mu. 2.5 YR 3/6), in NH_4OH 10% dark brown (Mu. 5 YR 3/4, 4/4), in KOH 5% dark sordid brown (Mu. 10 YR 3/3), not opaque, with distinct germ pore (1.5–1.8 µm) and distinct



Figs. 34–39. *Psathyrella twickelensis*. — 34. Carpophores (× 1), Delden, 20 Oct. 1973. — 35. Beilen, 13 June 1974. — 36. Spores. — 37. Basidia. — 38. Pleurocystidiogram. — 39. Cheilocystidiogram.

hilar appendix. Basidia 19–24 × 8–9 µm, clavate, 4-spored. Pleurocystidia 35–55(–60) × 10–15 µm, numerous, utriform, fusoid-pedicellate with very obtuse to subobtuse apex, hardly ever with subapical constriction, thin-walled, colourless. Marginal cells: pleurocystidioid cheilocystidia 30–50 × 9–12.5 µm, numerous, intermixed with numerous small, (10–)12.5–17.5(–20) × 5–10 µm, spheropedunculate and clavate cells. All cells thin-walled, colourless. Hymenophoral trama strikingly brown from membranal pigment with a number of yellow hyphal septa and numerous minute encrustations.

Habitat & distribution.—Terrestrial under *Fagus* and *Quercus*.

Collections examined.—THE NETHERLANDS: prov. Overijssel, verge of main road Delden-Borne, near ice rink, 20 Oct. 1973, *E. K. v. W.* (type, L); prov. Drenthe, Beilen, garden of Schapendrift 29, 13 June 1974, *H. S. C. Huijsman* (L).

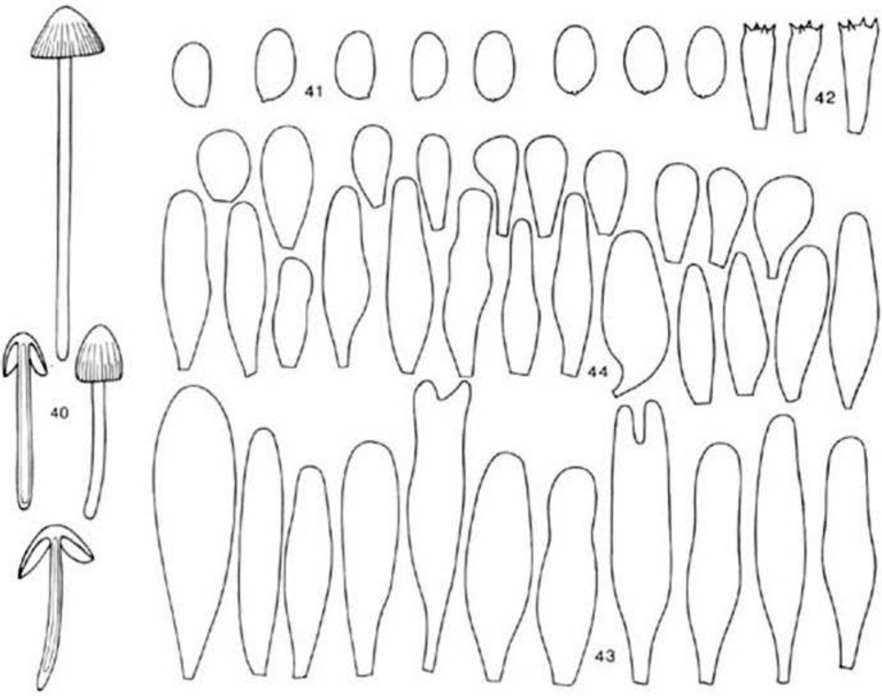
Although a majority of both pleurocystidia and pleurocystidioid cheilocystidia of the specimen of the June 1974 collection were fusoid with (very) obtuse apex, we identified this specimen, which was also growing solitarily, as *P. twickelensis* on account of the presence of a number of utriform cells while its macroscopical characters agreed with those of the type specimen.

Psathyrella multicystidiata Kits van Wav., *spec. nov.*—Figs. 40–44

Pileus 8–17 mm latus, parabolicus vel conico-parabolicus, primo margine incurvatus, obscure badius, dein (centro excepto) umbrinus vel ochraceus, striatus, hygrophanus, in sicco brunneus, colore rosea destitutus. Velum album primo e fibrillis et fasciculis fere ad apicem, nec appendiculatum, evanescens, fibrillae in stipite paucae. Lamellae 2 mm latae, parum ventricosae, anguste adnatae, primo brunneae, dein obscure sordideque marginem versus purpureo-cinereae, acie albae. Stipes 20–45 × 1–2 mm, cylindraceus, parte superiore albus, parte inferiore isabellinus, eradicatus, apice pruinosus. Caro pilei concolor, stipitis alba, deorsum dilute brunnea. Sporae in cumulo obscure umbrinae, 7.5–8.5 × 4.5 μm, ellipsoideae, nec phaseoliformes, in aqua observatae sat pallide flavobrunneae, sine poro germinativo vel callo. Basidia 22.5–27.5 × 7.5–9 μm, clavata, 4-sporigera. Pleurocystidia 50–70 × 10– 17.5(–20) μm, perabundantia, versiformia, utriformia, vulgo fusoidea vel subcylindracea, pedicellata, apicibus valde obtusa et interdum constrictione subapicali instructa, etiam interdum late clavata, raro sublageniformia vel apicibus furcatis, tenui-tunicata, colore destituta vel admodum dilute brunnea in NH_4OH 10%. Cellulae marginales eximie versiformes: cheilocystidia pleurocystidioidea 35–47.5(–50) × 10–12.5 μm, sat numerosa, cellulis anguste clavatis vel sublageniformibus intermixta, 35–40 × 7.5–10 μm, etiam cellulis spheropedunculatis clavatisque 12.5–30 × 7.5–15 μm. Trama lamellarum admodum pigmento praedita. Pileipellis e cellulis formata. Terrestris. Autumno. Typus: The Netherlands, prov. Overijssel, Denekamp, 'Singraven' (arboretum), 23 Oct. 1971, *E. Kits van Waveren* (L).

Cap 8–17 mm, paraboloid or conico-paraboloid, at first with incurved marginal area, dark reddish brown (Mu. 5 YR 3/3, 3/4), later only at centre dark reddish brown or brown (Mu. 7.5 YR 5/4), outside centre warm brown (Mu. 7.5 YR 4/4) to ochreous (Mu. 7.5 YR 6/6), striate up to half-way from margin, hygrophanous, drying out to pale brown, slightly darker than in most species of *Psathyrella* (acorn-colour, Mu. 10 YR 7/4), darker at centre, without pink, not rugulose or micaceous. Veil white, in the beginning many scattered fibrils and fascicles of fibrils almost reaching apex of cap, increasing in number towards margin, but not appendiculate, fugacious, later decreasing in number; scattered fibrils on stem. Gills 2 mm broad, slightly ventricose, strongly ascending, narrowly adnate, conspicuously yellowish brown (slightly paler than Mu. 10 YR 5/6) at base, gradually paler and slightly greyish towards edge (Mu. 10 YR 7/2, 8/2), later dark sordid brown (Mu. 10 YR 4/3) with trace of purple at base, towards edge via greyish brown (Mu. 10 YR 5/2) to purplish grey (Mu. 5 YR 6/1), with white edge. Stem 20–45 × 1.5–2 mm, cylindrical, white from a minutely fibrillose superficial layer, glossy, isabelline in lower 1/3, not rooting, hollow, with pruinose apex. Flesh of cap concolorous, of stem white but in lower half pale brown. Trama of 'washed' gill very distinctly pigmented, in a very narrow zone along base strong brown (Mu. 7.5 YR 5/6), basal 1/3 brownish yellow (Mu. 10 YR 6/6), peripheral 2/3 pale greyish brown (Mu. 10 YR 7/2). Spore print dark brown.

Spores 7.5–8.5 × 4.5 μm (mean values 8.1 × 4.5 μm: 1 collection), ellipsoid adaxially flattened, neither ovoid, nor phaseoliform, relatively pale, in water yellowish brown (Mu. 7.5 YR 5/6, 6/6) with reddish hue, in NH_4OH 10% brown (Mu. 5 YR 5/6), KOH 5% sordid brown (Mu. 10 YR 5/3), neither with pore nor even with callus, not opaque, with minute, scarcely visible hilar appendix. Basidia 22.5–27.5 × 7.5–9 μm, clavate, 4-spored. Pleurocystidia 50–70 × 10–17.5(–20)μm, exceedingly abundant, very versiform but in the main to be called utriform, far and away most cells fusoid to subcylindric, pedicellate and with very obtuse apex, rarely with subapical constriction or forked apex (2 or even 4 apical protrusions), some cells (broadly) clavate, rarely sublageniform, all cells thin-walled and very pale brown in NH_4OH 10% or practically colourless. Marginal cells: gill edge sterile from a motley of cells: utriform pleurocystidia 35–47.5(–50) × 10–12.5 μm, fairly numerous, in some parts predominating and intermixed with narrow



Figs. 40–44. *Psathyrella multicystidiata*. — 40. Carpophores (× 1). — 41. Spores. — 42. Basidia. — 43. Pleurocystidiogram. — 44. Cheilocystidiogram.

clavate and/or sublageniform cells, 35–40 × 7.5–10 µm, in other parts either narrow clavate or sublageniform cells predominating, intermixed with only few to fairly numerous utriform cells, often transitional forms, in some parts spheropedunculate and clavate cells, 12.5–30 × 7.5–15 µm, predominating. Hymenophoral trama in basal part of gills strongly pigmented from yellowish brown membranal pigment, numerous yellow hyphal septa, and numerous very small encrustations; pigmentation gradually decreasing towards edge. Pileipellis a 3–4 cells deep layer of globose, subglobose, obpyriform and a few very broadly ellipsoid colourless cells, 30–60 µm diam.

Habitat & distribution.—Terrestrial against small dead branch in humose ground of path in very mixed deciduous wood (arboretum). Known only from type locality.

Collection examined.—THE NETHERLANDS, prov. Overijssel, Denekamp, 'Singraven' (arboretum), 23 Oct. 1971, *E. K. v. W.* (type, L).

The exceedingly abundant, large and in the main utriform pleurocystidia with very obtuse apex are distinctive.

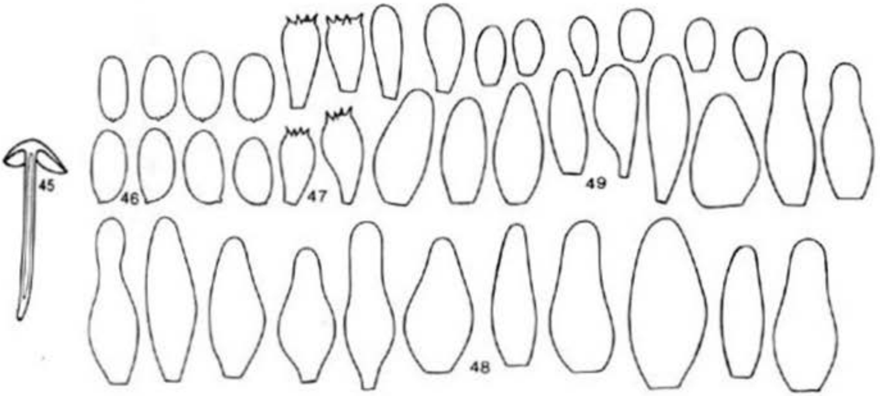
Psathyrella multicystidiata resembles both *P. frustulenta* and *P. obtusata* because of the brown colour of its cap and gills, its abundance of pleurocystidia (most of which pale brown in NH_4OH 10%), its strongly pigmented hymenophoral trama and its pale spores. It differs from *P. frustulenta* by its less strongly developed veil, its larger spores (mean values 8.1 × 4.5) which are not phaseoliform and its in the main utriform pleurocystidia. It differs from *P. obtusata* (in which not infrequently the spores are almost of the same size as in *P. multicystidiata*) by its non-phaseoliform spores, which do not have a germ pore (very small in *P. obtusata*), its much longer and differently shaped pleurocystidia and above all by its pattern of the cellular lining of the gill edge, which is not of the spadiceogrisea type as in *P. obtusata*.

Psathyrella badia Kits van Wav., *spec. nov.*—Figs. 45–49

Pileus 14 mm latus, conico-parabolicus, obscure badius, striatus, hygrophanus, in sicco sat pallide brunneus, parum subsulcatus, haud roseus. Velum album e fibrillis et fasciculis parvis, zonam pilei marginalem 1 mm latam formans, haud appendiculatum, et fibrillae in stipitis parte inferiori paucae. Lamellae 2.5 mm latae, ventricosae, late adnatae, cinereobrunneae, acie albae. Stipes 20 × 1 mm, cylindraceus, cavus, sordide albus, basi paulum radicatus, apice pruinosus. Caro pilei centro 5 mm crassa, badia, stipitis alba. Sporae in cumulo non observatae, 7–8 × (4–)4.5–5 µm, ellipsoideae, vel ellipsoideo-ovoideae, nec phaseoliformes, obscure rubellae, poro germinativo distincto munitae. Basidia 17.5–22.5 × 8–9.5 µm, clavata, 4-sporigera. Pleurocystidia 32.5–42.5 × 10–15(–17.5) µm, sat numerosa, utriformia, tunica tenui praedita, colore carentia. Cellulae marginales: cheilocystidia pleurocystioidea 27.5–37.5 × 10–17.5 µm, sat numerosa, cheilocystidia sphaeropedunculatis et clavatis 7.5–17.5(–22.5) × 6–10 µm intermixta. Trama lamellarum distincte colorata. Pileipellis e cellulis haud coloratis formata. Terrestris in locis muscosis. Autumno. Typus: The Netherlands, prov. Noord Holland, Castricum, 5 Oct. 1968, *E. Kits van Waveren* (L).

Cap 14 mm, conico-paraboloid, without umbo dark red-brown (Mu. 5 YR 3/4), striate up to 2/3 from margin, hygrophanous, drying out to fairly pale brown (Mu. 7.5 YR 6/4), without pink, not micaceous, slightly radially sulcate. Veil white, forming numerous fibrils and small fascicles on surface of cap in a 1 mm broad zone along entire margin of cap, not appendiculate; on lower half of stem scattered fibrils and a few fascicles. Gills 2.5 mm broad, ventricose near margin of cap, then ascending, straight, conspicuously broadly adnate, at edge pale grey (Mu. 10 YR 6/1), towards base soon greyish brown (Mu. 10 YR 5/2), at base browner (Mu. 10 YR 4/3), with minutely fimbriate white edge. Stem 20 × 1 mm, cylindrical, hollow, sordid white, minutely longitudinally fibrillose striate, with very slightly rooting base (pseudorrhiza 3 mm) and pruinose apex. Flesh of cap in centre 0.5 mm thick, reddish brown (c. Mu. 5 YR 4/3), of stem whitish, smell indistinctive. Trama of 'washed' gill distinctly pigmented, in basal 2/3 of gill pale brown (Mu. 10 YR 7/4), in periphery paler (Mu. 10 YR 7/3). Spore print not recorded.

Spores 7–8 × (4–)4.5–5 µm (mean values 7.8 × 4.5 µm: 1 collection), ellipsoid to ellipsoid-ovoid, not phaseoliform, dark, in water dark red (Mu. 2.5 YR 3/6, 4/6), in NH_4OH 10% dark brown (Mu. 5 YR 3/3) in KOH 5% dark sordid brown (Mu. 10 YR 3/3); germ pore indistinct (callus), at most minute; hilar appendix small. Basidia 17.5–22.5 × 8–9.5 µm, clavate, 4-spored. Pleurocystidia small, 32.5–40(–42.5) × 10–17.5(–20) µm, moderately numerous, utriform, mostly with subapical constriction, sometimes fusoid, very ventricose and with very obtuse apex, thin-walled, colourless. Marginal cells: pleurocystidioid (utriform) cheilocystidia 27.5–37.5 × 10–17.5 µm, rather numerous but—except in a few places—not densely packed, intermixed with many small and unobtrusive spheropedunculate and clavate cells, 7.5–17.5(–22.5) × 6–10 µm; all cells thin-walled and colourless. Hymenophoral trama very distinctly yellowish brown from



Figs. 45–49. *Psathyrella badia*. — 45. Carpophore (× 1). — 46. Spores. — 47. Basidia. — 48. Pleurocystidiogram. — 49. Cheilocystidiogram.

membranal pigment with a fair number of yellow hyphal septa and many minute encrustations. Pileipellis a 2–3 cells deep layer of globose to subglobose, rarely broadly ellipsoid colourless cells, 25–40 μm diam.

Habitat & distribution.—In moss of dip in coastal dunes. October. Known only from type locality.

Collection examined.—THE NETHERLANDS, prov. Noord-Holland, Castricum, coastal dunes of Amsterdam Water Supply, 5 Oct. 1968, *E. K. v. W.* (type, L).

Because of the utriform shape of the cystidia, which on the gill edge are numerous and intermixed with very small spheropedunculate and clavate cells, this species belongs to subsection *Lutenses*, in which the species is outstanding because of its small size and dark spores.

Psathyrella romseyensis Kits van Wav., *spec. nov.*—Figs. 50–55

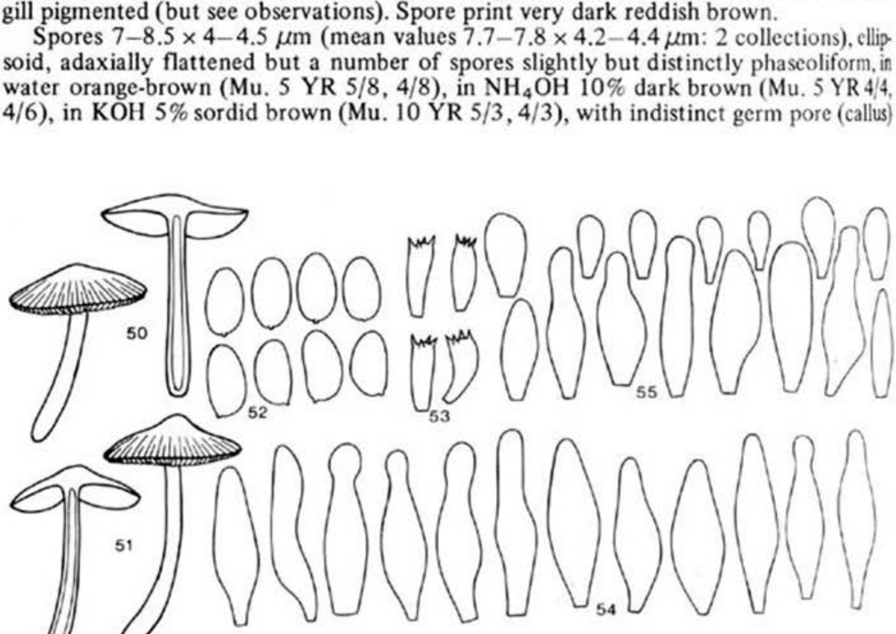
Pileus 17–32 mm latus, conico-convexus, convexus vel plano-convexus, umbonatus, obscure brunneus, rubello-tinctus (an primo centro badius) marginem versus pallescens, striatus, hygrophanus, in sicco pallide brunneus, colore roseo destitutus, nec rugulosus, nec atomatus. Velum album tenue, evanescens, margine pilei, e fibrillis et fasciculis parvis formatum, nec appendiculatum, fibrillae in stipite paucae. Lamellae 3–5 mm latae, ventricosae, late vel admodum late adnatae, obscure tabacinae vel cinereobrunneae, acie albae. Stipes 20–30 × 2–4 mm, cylindraceus, cavus, sordide albus, deorsum brunnescens, eradicatus, apice pruinosus. Caro pilei centro 1.5–2 mm crassa, obscure brunnea, stipitis sordide alba vel pallide brunnea et brunnescens deorsum. Sporae in cumulo admodum obscure badiae, 7–8.5 × 4–4.5 μm, ellipsoideae, nonnullae phaseoliformes, in aqua observatae aurantiobrunneae, poro germinativo indistincto munitae. Basidia 16–20 × 7–7.5 μm, clavata, 4-sporigera. Pleurocystidia (30–)35–45(–50) × (7.5–)9–13 μm, utriformia, raro apice constricta, vulgo fusoidea apice (admodum) obtusa vel subobtusa, parum numerosa, tenuitunicata, sine colore vel admodum dilute brunnea in NH_4OH 10%. Cellulae marginales: cheilocystidia pleurocystidioidea

25–45 × 7.5–12.5 μm, abundantia, cellulis spheropedunculatis et clavatis 12.5–22.5 × 7.5–12.5 μm intermixta, tenuitunicata et sine colore, numerosa. Trama lamellarum colorata. Pileipellis e cellulis formata. Terrestris, subcaespitosa vel solitaria. Typus: Brittannia, Hamsphire, New Forest, Romsey, 11 Sept. 1971, *E. Kits van Waveren* (L).

Etymology: Named after the village of Romsey.

Cap 17–32 mm, conico-convex to convex or plano-convex, with umbo, very dark brown (Mu. 7.5 YR 3/2; 10 YR 3/2) with reddish hue (in early stages probably dark reddish brown) or dark brown (Mu. 7.5 YR 4/4) at centre, elsewhere paler, greyish brown (Mu. 10 YR 5/2) or acorn-coloured, striate up to 2/3 from margin, hygrophanous, drying out to pale brown (Mu. 10 YR 7/4), slightly darker at centre, without pink, neither rugulose nor micaceous. Veil white, rudimentary, forming many or only a few fibrils and small wicker-works of fibrils in a 1 mm broad zone along margin of cap, not appendiculate, fugacious; few scattered fibrils on stem. Gills 3–5 mm broad, ventricose, broadly to very broadly adnate without tooth, more or less tobacco-coloured or greyish brown (Mu. 7.5 YR 4/4; 10 YR 5/2, 5/3, 5/4), with white edge. Stem 20–30 × 2–4 mm, cylindrical or slightly thicker towards base, hollow, whitish (but see observations), minutely longitudinally fibrillose striate from a thin whitish layer, pruinose at apex; base not rooting, covered by down. Flesh of cap in centre 1.5–2 mm thick, dark brown (Mu. 10 YR 3/3) of stem whitish (but see observations); smell indistinctive. Trama of 'washed' gill pigmented (but see observations). Spore print very dark reddish brown.

Spores 7–8.5 × 4–4.5 μm (mean values 7.7–7.8 × 4.2–4.4 μm: 2 collections), ellipsoid, adaxially flattened but a number of spores slightly but distinctly phaseoliform, in water orange-brown (Mu. 5 YR 5/8, 4/8), in NH_4OH 10% dark brown (Mu. 5 YR 4/4, 4/6), in KOH 5% sordid brown (Mu. 10 YR 5/3, 4/3), with indistinct germ pore (callus)



Figs. 50–55. *Psathyrella romseyensis*. — 50. Carpophores (× 1), Romsey, 11 Sept. 1971. — 51. Id., Delden, 23 Sept. 1969. — 52. Spores. — 53. Basidia. — 54. Pleurocystidiogram. — 55. Cheilocystidiogram.

and distinct hilar appendix, not opaque. Basidia 16–20 × 7–7.5 μm, clavate, 4-spored. Pleurocystidia (30–)35–45(–50) × (7.5–)9–13 μm, utriform but very few with subapical constriction, most cells being fusoid with (very) obtuse to subobtuse apex, with broad pedicel, little numerous, thin-walled, colourless or very pale brown in NH_4OH 10%. Marginal cells: pleurocystidioid cheilocystidia 25–45 × 7.5–12.5 μm, abundant or merely numerous and then in some areas crowded, intermixed with fairly numerous spheropedunculate and clavate cells, 12.5–22.5 × 7.5–12.5 μm; all cells thin-walled and colourless. Hymenophoral trama pigmented (but see observations). Pileipellis a 2–3 cells deep layer of globose and subglobose cells, 15–40 μm diam., very pale brown in NH_4OH 10%, practically colourless.

Habitat & distribution.—Terrestrial (found in dry soil of a heath, also in moss), solitary or subcaespitose. September.

Collections examined.—GREAT BRITAIN, Hampshire, New Forest, Ampfield Wood near Romsey, 11 Sept. 1971, *E. K. v. W.* (type, L). — THE NETHERLANDS, prov. Overijssel, Delden, Bornse straatweg near ice rink, 23 Sept. 1969, *E. K. v. W.* (L).

This species in some respects resembles *P. noli-tangere* but differs from that species by its habitat (not in marshy areas), its slightly robuster habit, the presence of an umbo, its very broadly adnate gills, its smaller, narrower and little numerous pleurocystidia, which moreover are very infrequently provided with a subapical constriction, and its spores not having a distinct germ pore.

At first we were reluctant in concluding the specimens of the British collection (4 subcaespitose specimens on a heath) and the Dutch collection (1 solitary specimen in wet moss) to represent one and the same species. In the end we decided that they may be regarded as such, chiefly because sizes, shape, colour, and germ pore (callus) of the spores and sizes and shapes of pleurocystidia and pleurocystidioid cheilocystidia in both collections were precisely the same, while most macroscopical characters (size, umbo, rudimentary veil, broadly adnate gills) also were fully identical. There were three differences between the two collections: (i) In the Dutch specimen the flesh of the stem was clearly pigmented, the result being that while the thin superficial layer of the stem rendered the upper half of the stem whitish, the lower half was increasingly brownish towards the base, the fibrils of the thin layer increasingly disjoining towards the base and therewith increasingly exposing the brown colour of the stem, which in its upper half was yellowish brown (Mu. 10 YR 5/4), lower down gradually darker towards the base (Mu. 10 YR 3/3). In the British collection the flesh of the stem was very pale brown. (ii) In the Dutch specimen the hymenophoral trama was little pigmented ('washed' gill pale brown, Mu. 10 YR 7/4, paler towards the edge, sub micr. very pale brown, without yellow hyphal septa and encrustations) whereas in the British material this trama was distinctly pigmented ('washed' gill with very vague yellowish brown anastomosing tissue strands running from base almost to edge through the in itself pale brownish grey, paler than Mu. 10 YR 6/2, gill tissue and sub micr. distinctly brown with few yellow hyphal septa and here and there minute encrustations). (iii) The Dutch specimen grew in wet moss, the British specimens in the dry soil of a sandy heath.

Considering the great variability of pigmentations in *Psathyrella* and the doubtful importance here to be attached to the difference in habitat as only two collections were available, we let the striking similarity of the macro- and microscopical features between the specimens of our two collections overrule these three differences. Obviously more collections are needed for further observation.

For a comparison of *P. romseyensis* with *P. dennyensis* (in sect. *Hydrophilae*) see the discussion under that species.

SECTION PENNATAE

REVISED KEY TO THE SPECIES OF SECTION PENNATAE

1. Veil very strongly to strongly developed; no red underlining of gill edge; cystidia without oily inclusions:
    2. In coastal dunes, behind fore dunes, amongst *Ammophila, Carex* and *Festuca*; spores 9–10 (–11) × 4.5–5 µm (but see first 9; also in dunes but gill edge red underlined and spores 7–9 × 4.5–5 µm) . . . . *P. flexispora*
    2. Not as above:
        3. Pleurocystidia ventricose-fusoid, tapering to a subacute, acute or very acute apex, slightly thick-walled, distinctly (pale) brown in NH$_4$OH 10%, with refractive wall:
            4. On burnt ground; pleurocystidia 22.5–40 × 7.5–12.5 µm, with very acute, sharply pointed apex; spores 6.5–8 × 4–4.5 µm, without germ pore . . . . *P. pennata*
            4. Not on burnt ground, terrestrial; pleurocystidia 40–80 × 8–17.5 µm, with subacute to acute apex; spores with germ pore:
                5. Spores 8–10 × 4.5–5 µm . . . . *P. artemisiae* var. *artemisiae*
                5. Spores 6.5–7(–8) × 4–4.5 µm . . . . *P. artemisiae* var. *microspora*
        3. Pleurocystidia ventricose-fusoid with subobtuse to subacute apex, with wall neither thickened, nor refractive, not distinctly (pale) brown in NH$_4$OH 10%:
            6. Distinctly pink in drying cap . . . . *P. impexa* (see also p. 368)
            6. No pink in drying cap (see also *P. rostellata*, p. 365) . . . . *P. friesii*
1. Veil rudimentary or thin, only rarely at most moderately developed, fugacious:
    7. Pleurocystidia and pleurocystidioid cheilocystidia with one large oily inclusion and/or a few smaller ones . . . . *P. gossypina*
    7. Cystidia without oily inclusions:
        8. Carpophores on culms of *Phragmitis, Scirpus* just above water level (see also *P. almerensis*) *P. basii*
        8. Not as above:
            9. Gill edge red underlined; spheropedunculate and clavate cheilocystidia large (12.5–35 × 7.5–25 µm) and abundant; spores 7–9 × 4.5–5.5 µm (If spores 9–11 × 5.5–6.5, see *P. murcida*.):
                10. Pink in drying cap; spores (mean values 8.1 × 4.6 µm), ellipsoid, dark, with small (c. 1 µm wide) germ pore; pleurocystidioid cheilocystidia moderately numerous *P. dunensis*
                10. No pink in drying cap; spores (mean values 8.7 × 5.4 µm) ellipsoid but many distinctly ovoid, with distinct (c. 1.8 µm wide) germ pore; pleurocystidioid cheilocystidia few in number . . . . *P. dunarum*
            9. Gill edge not red underlined (except rarely in *P. murcida*):
                11. Carpophores minute; cap 3–9(–11) mm; stem 15–25 mm long:
                    12. Basidia 2-spored; pleurocystidia not mucronate . . . . . . *P. perpusilla*, p. 354
                    12. Basidia 4-spored; pleurocystidia mucronate, subcapitate or forked *P. minutissima*, p. 356
                11. Carpophores larger:

13. Rather large central area of cap becoming conspicuously warm ochre-brown during process of drying:
    14. Spores 10–11.5 × 5.5–6.5 μm, very dark, opaque; basidia subspheropedunculate; pleurocystidia 47–72.5(–75) × 10–17.5 μm, lageniform with long, narrow neck . . . . *P. dicrani*
    14. Spores smaller, 7–10 × 4–4.5 μm, dark, subopaque or not opaque; basidia clavate:
        15. Pleurocystidia 55–75(–88) × (8–)10–12(–15) μm, narrowly fusoid or lageniform . . . . *P. fulvescens*
        15. Pleurocystidia 35–55(–60) × (8–)10–15(–17.5) μm, fusoid or sublageniform . . . . *P. fulvescens* var. *brevicystis*
13. Central area of cap not conspicuously browning during process of drying (but if spores very dark and opaque and basidia subspheropedunculate, see *P. dicrani*):
    16. Carpophores densely caespitose, with long stems and relatively small caps *P. multipedata*
    16. Not as above:
        17. Spores large (mean values 9.6–10.5 × 5.5–5.7 μm); large species from *Fagus* woods; cap 15–35 mm; stem 50–110 × 3.5–6 mm *P. murcida*
        17. Spores smaller (mean values 7–9.5 × 3.9–5.5 μm) and smaller species:
            18. Carpophores on dead wood from deciduous trees . . . *P. senex*
            18. Carpophores terrestrial, in grass, moss, or clayey soil, often attached to sprigs or wooden debris hidden in the ground (compare also *P. twickelensis* in subsect. *Lutenses* with pleurocystidia doubtfully utriform):
                19. Medium-sized species, robust; cap 30 mm; stem 64 × 4 mm *P. ploddensis*, p. 357
                19. Smaller, usually more slender species; cap 8–25 mm; stem 17–60(–75) × 1.5–3 mm:
                    20. Spores pale, in water pale yellowish brown to orange (Mu. 7.5 YR 6/8, 5/8, 5 YR 5/6, 6/6); spheropedunculate and clavate cheilocystidia large, 17.5–35 × 10–20 μm, abundant; pleurocystidioid cheilocystidia few; pleurocystidia ventricose-fusoid, 35–75 × 9–15 μm; spore print some shade of brown:
                        21. Spores small (mean values 7.4–7.9 × 4.5–4.9 μm); pleurocystidioid cheilocystidia scarce, rarely locally or along entire edge somewhat more; pleurocystidia ventricose-fusoid, sublageniform, 35–75 × 9–15 μm . . . . . . *P. obtusata*, p. 336
                        21. Spores larger (mean values 8.7 × 5.2 μm); pleurocystidioid cheilocystidia as under first 21 but in very small stretch adjoining stem suddenly numerous; while spheropedunculate and clavate cells less numerous and smaller; pleurocystidia narrowly fusoid to subcylindrical, 50–65 × 10–12 μm *P. vyrnwyensis*, p. 359
                    20. Spores dark, in water dark red (Mu. 2.5 YR 3/6), spore print purplish black.

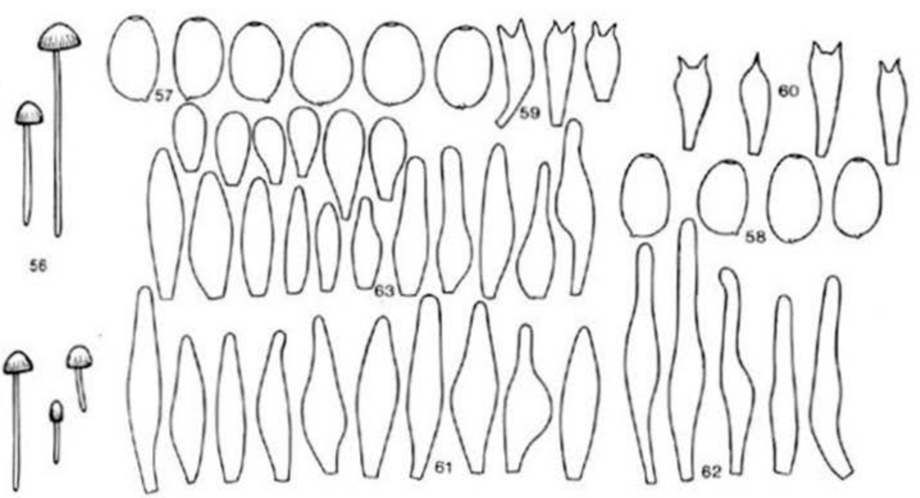
22. Spheropedunculate and clavate cheilocystidia large, 12.5–27.5 × 7.5–17.5 µm, numerous, pleurocystidioid cheilocystidia scanty, spores not elongate (mean values 7.8–8.2 × 4.7–4.9 µm) *P. seymourensis*
22. Spheropedunculate and clavate cheilocystidia small, 10–20 × 5–10 µm, unobtrusive, pleurocystidioid cheilocystidia numerous, spores elongate (mean values 7.7–9.5 × 3.9–4.7 µm) *P. ocellata*

Psathyrella perpusilla Kits van Wav., *spec. nov.*—Figs. 56–63

Pileus 3–5(–8) mm, parabolicus, striatus, obscure badio-cinereo-brunneus, hygrophanus, in sicco centro pallide ochraceus, marginem versus pallescens, colore roseo destitutus, eximie micaceus, leviter rugulosus. Velum album, primo dense membranaceum, pileum et stipite conjugens, fibrillas numerosus pilei marginem formans. Lamellae 1.5 mm latae, ventricosae, late adnatae, obscure badiae, acie albae. Stipes 20–25 × 0.75–1 mm, cylindraceus, albus, eradicatus, apice pruinosus. Caro pilei eximie tenuis, concolor, stipitis alba. Sporae in cumulo obscure purpureo, 8.0–9(–10) × (5–)5.5–6.5 µm, late ellipsoideae, haud phaseoliformes, in aqua observatae obscure badiae, poro germinativo 1.5 µm munitae. Basidia 15–25 × 6.5–9 µm, clavata, 2-sporigera. Pleurocystidia 32.5–42.5(–50) × 7.5–12.5 µm, moderatim numerosa, lageniformia vel sublageniformia, collo subcylindraceo praedita, tenui-tunicata. Cellulae marginales: cheilocystidia pleurocystidioidea 20–35(–37.5–40) × 7.5–10 (–12.5) µm numerosa, cellulis sphaeropedunculatis et clavatis, 15–20(–22.5) × 7.5–12.5 µm intermixta. Trama lamellarum colorata. Pileipellis e cellulis formata, nec colorata. Terrestris, in terram argillosam inter graminis in silva frondosa (*Alnus, Populus*), solitaria. Typus: The Netherlands, prov. Noord-Holland, Amsterdam Wood, 24 July 1962, *E. Kits van Waveren* (L).

Cap 3–5(–8–11) mm, paraboloid or conico-paraboloid, when moist striate up to 1/2–2/3 from margin, dark reddish-greyish brown (Mu. 5 YR 4/2; 7.5 YR 4/2) with purplish hue, soon browner (Mu. 7.5 YR 4/4), hygrophanous, rapidly drying out to pale greyish ochre (Mu. 10 YR 7/4) at centre, paler (Mu. 10 YR 8/4) towards margin or alutaceous (Mu. 10 YR 6/2, 7/3), without pink, strongly micaceous, not or only slightly rugulose. Veil distinct, in very young specimens forming a dense fleece, connecting stem with margin of cap, at maturity leaving many white minute fibrils and wicker-works of fibrils in a 1 mm broad zone along margin of cap and scattered isolated fibrils further up, even at apex, also at base of stem. Gills 1.5 mm broad, ventricose, broadly adnate, first pale, later dark chocolate (Mu. 2.5 YR 5/2; 5 YR 4/2), with white, minutely fimbriate edge. Stem 20–25 × 0.75–1 mm, cylindrical with distinct very small bulb at base, sometimes springing from a minute, disc-like structure, white, in lower part isabelline, hollow, not rooting; apex distinctly pruinose. Flesh of cap in centre very thin, concolorous, of stem white. Trama of 'washed' gill in basal 2/3 of gill pale yellowish brown (Mu. 7.5 YR 7/6) in periphery paler (Mu. 10 YR 7/3), without red underlining of gill edge. Spore print not recorded.

Spores 8.0–9(–10) × (5–)5.5–6.5 µm (mean values 8.5–9.2 × 5.2–5.9 µm: 4 collections), broad-ellipsoid to ovoid, adaxially flattened, in water dark orange-red (Mu. 2.5 YR 4/6, 3/6), in NH_4OH 10% dark brown (Mu. 5 YR 4/3, 4/4, 3/4), in KOH 5% dark sordid brown (Mu. 7.5 YR 4/2), not opaque to subopaque, with distinct germ pore (c. 1.5 µm) and distinct hilar appendix. Basidia 15–25 × 6.5–9 µm, clavate, 2-spored (very few 1-spored basidia seen, accounting for the presence of very few, very large spores, e.g. 11 × 7.0 µm). Pleurocystidia 32.5–50(–60) × 7.5–12.5 µm, fairly numer-



Figs. 56–63. *Psathyrella perpusilla*. — 56. Carpophores (× 1), Amsterdam Wood, 13 June 1961 and 24 July 1962. — 57. Spores, Amsterdam Wood, 24 July 1962. — 58. Id., Oost Flevoland, 12 March 1977. — 59. Basidia, Amsterdam Wood, 24 July 1962. — 60. Id., Oost Flevoland, 12 March 1977. — 61. Pleurocystidiogram, 24 July 1962. — 62. Id., 12 March 1977. — 63. Cheilocystidiogram, 24 July 1962.

ous lageniform to sublageniform or fusoid, with cylindrical to subcylindrical and sometimes long neck (4–5 μm thick) and subacute to acute apex, passing gradually into ventricose cell-body, with relatively broad and distinct pedicel, thin-walled, colourless. Marginal cells: pleurocystidioid cheilocystidia, 20–35(–45) × 7.5–10(–12.5) μm, numerous, often even densely packed, intermixed with moderately numerous spheropedunculate and clavate cells, 15–20(–22.5) × 7.5–12.5 μm; all cells thin-walled and colourless. Hymenophoral trama in NH_4OH 10% sub micr. pale but distinctly (particularly at base) yellowish brown from membranal pigment, with near base a few and at base a fair number of yellow hyphal septa, without encrustations. Pileipellis a 2–3 cells deep layer of globose, colourless cells, 25–40(–50) μm diam.

Habitat & distribution.—Terrestrial in clayey soil, against small dead sprigs in deciduous woods (*Alnus, Populus*) between thin grass. Very rare.

Collections examined.—THE NETHERLANDS: prov. Noord-Holland, Amsterdam, Amsterdam Wood, 13 June 1961, 30 Sept. 1961 & 24 July 1962 (type), *E. K. v. W.* (L); prov. Flevoland, Oost-Flevoland, Wisentbos (lot K 85), 12 March 1977, *D. Tjallingii-Beukers*; Lelystad, Zuigerplas (lot A 62), 15 June 1983, *P. B. Jansen*. Not recorded from France and British Isles.

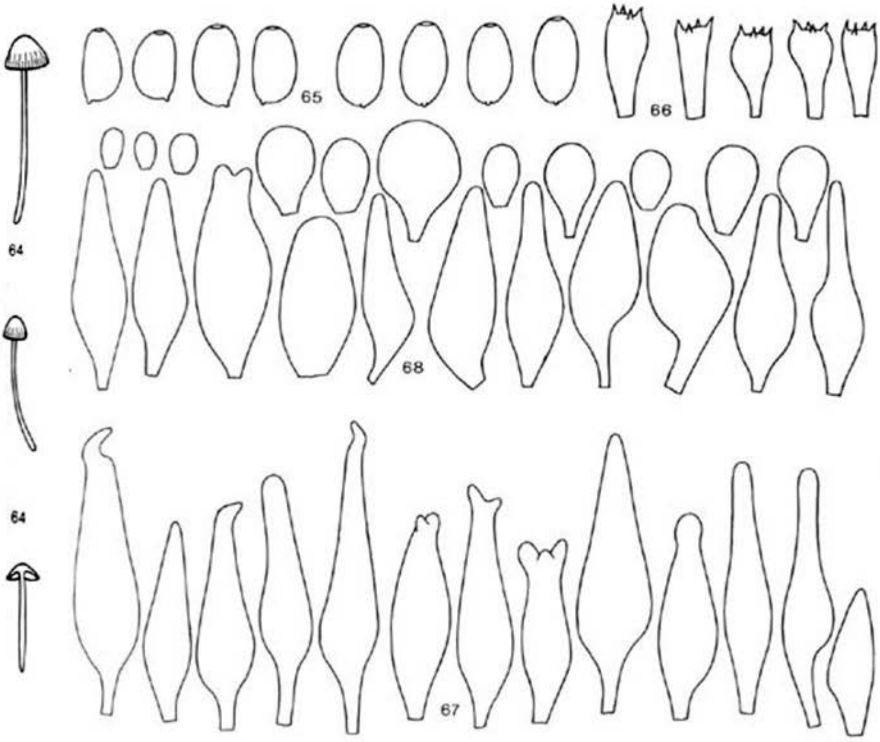
This species is characterised macroscopically by its exceedingly small size of the carpophores and its bulbillate stem, microscopically by its 2-spored basidia, and broad spores.

Psathyrella minutissima Kits van Wav., *spec. nov.*—Figs. 64–68

Pileus 4–9 mm latus, conicus vel parabolicus, pallide flavo-brunneus sed marginem versus cinereo-brunneus, perstriato-sulcatus, hygrophanus, in sicco pallide brunneus, colore roseo destitutus, nec atomatus, parum rugulosus. Velum album, initio pileum obvolvens, fugacissimum demum a pileo abscedens, stipitis ad basim parum. Lamellae 1 mm latae, subventricosae, late adnatae, cinereo-purpureae, acie albae. Stipes 15–25 × 0.75–1 mm, cylindraceus, basi parum incrassatus, eradicatus, pallide brunneus, apice pruinosus. Caro centro pilei 1 mm crassa, brunnea, stipitis alba. Sporae in cumulo obscure brunneae, 8–10 × 4.5–5.5 μm, ellipsoideae vel ellipsoideo-ovoideae, nec phaseoliformes, nec opacus, nec obscurae, in aqua observata rubbelo-aurantiacae, poro germinativo distincto (1.5–1.8 μm) munitae. Basidia 22.5–27.5 × 8–10 μm, clavata, 4-sporigera. Pleurocystidia 45–70 × 12.5–17.5 (–20) μm, sat numerosa, sublageniformia vel fusiformia, apice subacuta vel obtusa, saepe mucronata vel subcapitata furcata, tenui-tunicata, colore destituta. Cellulae marginales: e basidiis numerosis constantes et cellulis spheropedunculatis parvis (7.5–)10–15 × 5–10 μm etiam cellulis sphaeropedunculatis majoribus, 20–25(–30) × 12.5–15(–20) μm, cheilocystidiis sparsis versiformibus plerumque tenui-tunicatis, decoloratisque intermixtis. Trama lamellarum colorata. Pileipellis e cellulis formata. Terrestris solitaria, inter ramentis silvarum (*Quercus, Fagus*). Autumno. Typus: The Netherlands, prov. Noord-Holland, Overveen, 'Elswout', 25 Oct. 1980, *E. Kits van Waveren* (L).

Cap 4–9 mm, conical or paraboloid, central half or two third pale yellowish brown (Mu. 10 YR 6/4–5/4), peripheral half or one third greyish brown (Mu. 10 YR 5/2), striate-sulcate up to half-way from margin, hygrophanous, drying out to very pale brown (Mu. 10 YR 8/3), at centre ochreous yellow, without pink, not micaceous, slightly rugulose. Veil white in primordium (total length of stem + height of cap 2 mm) covering entire cap with a whitish, silvery coating, inserting on stem, very fugacious, at maturity absent from cap but on basal half of stem as scattered minute fibrils. Gills 1 mm broad, slightly ventricose, rather broadly adnate distant, greyish purple (Mu. 5 YR 5/2), with white edge. Stem 15–25 × 0.75–1 mm, cylindrical, slightly thicker at base, not rooting, very pale brown, minutely longitudinally fibrillose striate, at apex rather coarsely pruinose. Flesh of cap in centre 1 mm thick, brown (Mu. 10 YR 5/4), in stem white, lower down very pale brown. Trama of 'washed' gill pale yellowish brown (Mu. 10 YR 7/4), gradually paler towards edge. Spore print very dark brown.

Spores 8–10 × 4.5–5.5 μm (mean values 8.6 × 5.1 μm: 1 collection), ellipsoid or ellipsoid-ovoid, not phaseoliform, not dark, in water reddish yellow, orange (Mu. 5 YR 5/6) in NH_4OH 10% brown (Mu. 7.5 YR 5/4) with reddish hue, in KOH 5% sordid brown (Mu. 10 YR 5/3), not opaque, with distinct germ pore (1.5–1.8 μm) and small hilar appendix. Basidia 22.5–27.5 × 8–10 μm, clavate, 4-spored. Pleurocystidia 45–70 × 12.5–17.5(–20) μm, rather numerous, sublageniform to fusoid with fairly short and broad or longer and narrower (10–15 × 2.5–4 μm) pedicel and subacute, subobtuse or obtuse and often mucronate or subcapitate or lobed (forked) apex, thin-walled, colourless. Edge of gill heteromorphic: numerous immature and rather few mature basidia intermixed with (i) many small spheropedunculate cells, (7.5–)10–15 × 5–10 μm and only few and scattered larger spheropedunculate cells, 20–25(–30) × 12.5–15(–20) μm, some of the latter cells slightly thick-walled and very pale brown in NH_4OH 10%, (ii) relatively few and scattered (in a few places somewhat more) versiform sublageniform or fusoid cheilocystidia, 35–50(–55) × 10–15 μm with subobtuse or obtuse, rarely forked apex and short, broad pedicel, and (iii) some broadly ellipsoid to utriform cheilocystidia, 35–50 × 20 μm; far and away most cells thin-walled and colourless in NH_4OH 10%. Hymenophoral trama pale brown from membranal pigment, paler towards edge, no yellow hyphal septa or encrustations. Pileipellis a two cells deep layer of colourless globose and subglobose cells, 15–25 μm diam.



Figs. 64–68. *Psathyrella minutissima.* — 64. Carpophores (× 1). — 65. Spores. — 66. Basidia. — 67. Pleurocystidiogram. — 68. Cheilocystidiogram.

Habitat & distribution.—Solitary, against dead branch on the ground in deciduous woods (*Quercus* and *Fagus*). Known only from type locality.

Collection examined.—THE NETHERLANDS, prov. Noord-Holland, Overveen, estate 'Elswout', 25 Oct. 1980 (5 specimens), *E. K. v. W.* (type, L).

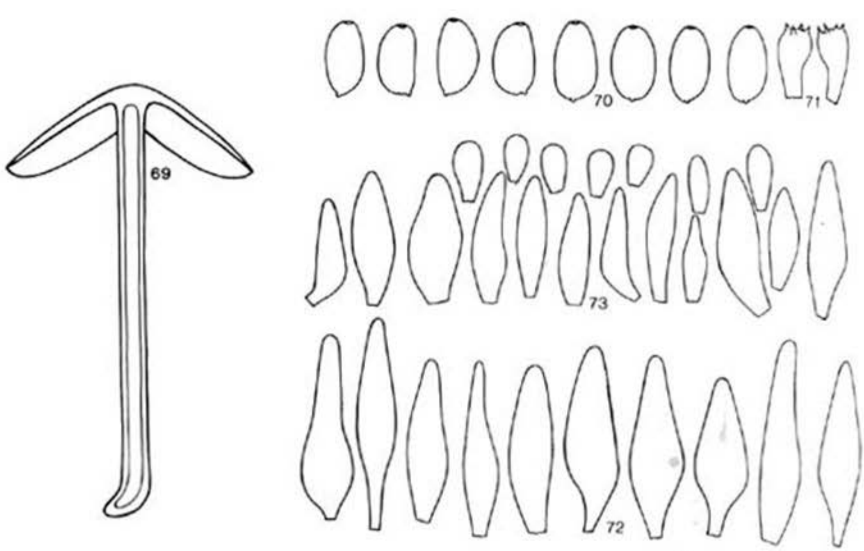
Psathyrella ploddensis Kits van Wav., *spec. nov.*—Figs. 69–73

Pileus 30 mm latus, conico-convexus, recens obscure badius, perstriatus, hygrophanus, in sicco pallide brunneus, haud roseus. Velum album, e fibrillis vel fasciculis numerosis in zonam pilei marginalem 8 mm latam formans, haud appendiculatum, et fibrillae in stipite paucae. Lamellae 4 mm latae, ad pilei marginem ventricosae, alibi rectae adscendentes, late adnatae, basi brunneae, aciem versus cinerascentes, acie albae. Stipes 65 × 4 mm, cylindraceus, eradicatus apice pruinosus, cavus, albus. Caro pilei centro 2 mm crassa, obscure brunneus, stipitis apice brunneus, alibi pallide brunnea. Sporae in cumulo purpureo-atrae, 7–8 × 4.5–5 µm, ellipsoideae, haud phaseoliformes, in aqua observata obscure badiae, poro germinativo parvo instructae. Basidia 17.5–20 × 7.5–9 µm, clavata, 4-sporigera.

Pleurocystidia (35–)40–50 × 10–15(–17.5) µm, sat numerosa, ventricoso-fusoidea, apice subacuta vel subobtusa, tenui-tunicata. Cellulae marginales: cheilocystidia pleurocystidioidia et sublageniformia 25–35 × 7.5–12.5(–15) µm, abundantia, interdum confertissima, cellulis spheropedunculatis et clavatis 12.5–15 × 5–7.5 µm immixta. Trama lamellarum distincte colorata. Pileipellis e cellulis formata. In muscos udos sub *Betula*. Typus: Scotia, Invernessshire, Tomich, Plodda Falls, 10 Sept. 1968, *E. Kits van Waveren* (L).

Etymology: Named after the type locality.

Cap 30 mm, conico-convex, when fresh dark reddish brown (Mu. 5 YR 3/4), red very soon disappearing, then becoming dark warm brown (Mu. 7.5 YR 4/4), with extreme margin slightly extending beyond gills and whitish, strongly striate up to 2/3 from margin, hygrophanous, drying out to pale brown without pink, neither micaceous nor rugulose. Veil white, leaving numerous fibrils, isolated and fasciculated in a 8 mm broad marginal zone of cap, not appendiculate, and loose scattered fibrils on stem. Gills 4 mm broad, ventricose near margin of cap, then straight and ascending, broadly adnate, brownish (Mu. 10 YR 5/4) at base, becoming greyer towards edge, in periphery pale brownish grey, with white edge. Stem 65 × 4 (apex) × 5 (base) mm, cylindrical, not rooting, hollow, white, glossy, flamed, with minute longitudinal fibrillose striation, pruinose at apex. Flesh of cap in centre 2 mm thick, dark brown (Mu. 10 YR 4/4), of stem alongside gills brownish (Mu. 10 YR 4/4), lower down very pale brown (Mu. 10 YR 7/3) but near and in base darker, entire stem covered by a thin white superficial layer. Trama of 'washed' gills brownish yellow in a very narrow strip at base, in basal 1/3 pale brown (Mu. 10 YR 7/4), elsewhere very pale brown (Mu. 10 YR 7/3). Spore print purplish black.



Figs. 69–73. *Psathyrella ploddensis*. — 69. Carpophore (× 1). — 70. Spores. — 71. Basidia. — 72. Pleurocystidiogram. — 73. Cheilocystidiogram.

Spores 7–8 × 4.5–5 µm (mean values 7.8 × 4.6 µm: 1 collection), ellipsoid, adaxially flattened, dark, in water dark red (Mu. 2.5 YR 3/6) in NH_4OH 10% dark brown (Mu. 5 YR 4/4, 3/4), in KOH 5% dark sordid brown (Mu. 10 YR 4/3, 3/3), with distinct but small germ pore (c. 1 µm) and small but distinct hilar appendix. Basidia 17.5–20 × 7.5–9 µm, clavate, 4-spored. Pleurocystidia (35–)40–50 × 10–15(–17.5) µm, fairly numerous, ventricose fusoid to sublageniform, with short and fairly broad pedicel and subacute to subobtuse apex, thin-walled, colourless. Marginal cells: pleurocystidioid cheilocystidia 25–35 × 7.5–12.5(–15) µm, densely packed, intermixed with many unobtrusive small spheropedunculate and clavate cells, 12.5–15 × 5–7.5 µm; all cells thin-walled and colourless. Hymenophoral trama distinctly brown from membranal pigment, particularly in basal 1/3 and there with many yellow hyphal septa and minute encrustations. Pileipellis a 2–3 cells deep layer of globose and subglobose in NH_4OH 10% colourless or very pale brown cells, 15–50 µm diam.

Habitat & distribution.—In very wet moss under *Betula*. September. Known only from type locality.

Collection examined.—SCOTLAND, Invernessshire, Tomich, Plodda Falls, 10 Sept. 1968, *E. K. v. W.* (type, L).

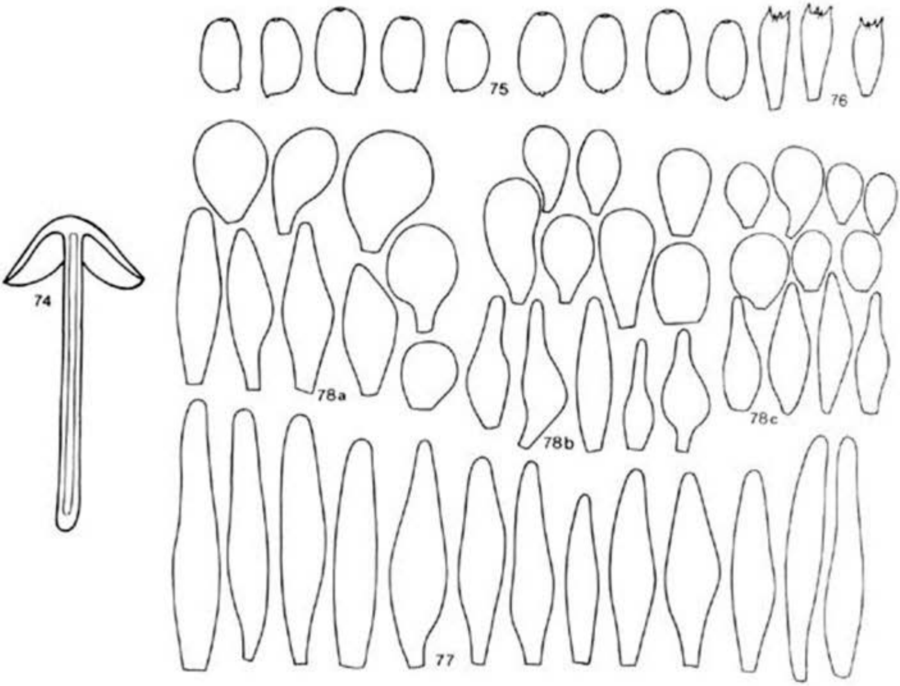
Psathyrella ploddensis is a rather robust but otherwise uncharacteristic species, which because of the size of its dark spores and fusoid to sublageniform pleurocystidia belongs to section *Pennatae*.

Psathyrella vyrnwyensis Kits van Wav., *spec. nov.*— Figs. 74–78

Pileus 17 mm latus, 10 mm altus, obtuse conicus ex umbonate, centro brunneus marginem versus sordide brunneus, striatus, hygrophanus, in sicco admodum pallide brunneus, apice flavidus, colore roseo destitutus, subatomatus et subrugosus. Velum album, e fibrillis et fasciculis fibrillosis minutis disseminatis marginem pilei formatum. Lamellae 4 mm latae, ad pilei marginem ventricosae, alibi rectae, adscendentes, late adnatae, acie albae. Stipes 40 × 2–3 mm, apice albus, deorsum pallide brunneus, cavus, apice pruinosus. Caro pilei centro 2 mm crassa, concolor, caro stipitis apice alba, deorsum pallide brunnea. Sporae in cumulo obscure brunneae, 8–9 × 4.5–5.5 µm, ellipsoideae nonnullae vix phaseoliformes, nec obscurae, in aqua observata aurantiacae, haud opacae, poro germinativo admodum parvo. Basidia 17.5–22.5 × 7–10 µm, clavata, 4-sporigera. Pleurocystidia (45–)50–65 × 10–12.5 µm, abundantia, anguste fusiformia, apice obtusa, subobtusa vel subacuta, brevi pedicellata, tenui-tunicata, colore destituta cellulae. Cellulae marginales: cellulae spheropedunculatae et clavatae perabundantes, 17.5–30 × 12.5–27.5 µm, creberrimae, cheilocystidiis lageniformibus, sublageniformibus vel fusiformibus 30–40(–45) × 7.5–12.5 µm parvulus sed juxta stipes confertis intermixtae. Trama lamellarum colorata. Pileipellis e cellulis formata. Terrestris, sub *Fagus*. Typus: Brittanica, Wales, prov. Powys, Lake Vyrnwy, 29 Aug. 1979, *E. Kits van Waveren* (L).

Etymology: Named after the type locality.

Cap 17 mm broad, 10 mm high, obtuse conical without umbo, central half warm brown (Mu. 7.5 YR 5/4) with reddish, peripheral half sordid brown (Mu. 10 YR 5/4), striate up to 2/3 from margin, hygrophanous, drying out to yellowish (Mu. 10 YR 8/6) at apex, very pale brown (Mu. 10 YR 8/4) towards margin, palest (Mu. 10 YR 8/4) at margin, without pink, slightly micaceous, not rugulose but distinctly, be it slightly, sulcate. Veil white, forming here and there minute fibrils and small wicker works of fibrils close to margin of cap, not appendiculate, not seen on stem. Gills 4 mm broad, ventricose near margin of cap, then straight, ascending, broadly adnate, with white, fimbriate edge. Stem 40 × 2 (apex) × 3 (base) mm, gradually thickening towards base, white at apex over a distance of 8 mm, lower down pale brown, hollow, at apex pruinose, at base



Figs. 74–78. *Psathyrella vyrnwyensis*. — 74. Carpohore (× 1). — 75. Spores. — 76. Basidia. — 77. Pleurocystidiogram. — 78. Cheilocystidiogram, a. near margin of cap, b. half way stem, c. adjoining stem.

strigose from white hairs. Flesh of cap in centre 2 mm thick, brown (Mu. 7.5 YR 5/4) with reddish hue, of stem in apex white to very pale brown, browner towards base, yellowish brown in the middle, pale bronze brown in base. Trama of 'washed' gill very pale yellowish brown (Mu. 10 YR 7/3) from base to edge. Spore print dark brown.

Spores 8–9 × 4.5–5.5 µm (mean values 8.7 × 5.2 µm: 1 specimen), ellipsoid, adaxially flattened, few slightly phaseoliform, not dark, in water orange (Mu. 5 YR 5/6, 6/6), in NH_4OH 10% yellowish brown (Mu. 7.5 YR 5/8), in KOH 5% sordid olivaceous brown (Mu. 10 YR 6/4) with reddish hue, not opaque, with very small germ pore and small hilar appendix. Basidia 17.5–22.5 × 7–10 µm, clavate, 4-spored. Pleurocystidia (45–) 50–65 × 10–12.5 µm, abundant, narrowly fusiform with obtuse, subobtuse or acute apex and short pedicel, thin-walled, colourless. Marginal cells: gill edge sterile from very large quantities of spheropedunculate cells, 17.5–30 × 12.5–27.5 µm, near margin of cap densely packed and intermixed with only very few lageniform, sublageniform or fusoid cheilocystidia, 30–40(–45) × 7.5–12.5 µm, half-way towards stem slightly increasing in number, but suddenly in very small stretch adjoining stem, numerous, simultaneously the spheropedunculate cells, although remaining distinctly in evidence, becoming less numerous, smaller and more clavate; most spheropedunculate cells, particularly those in the area of the margin of the cap slightly thick-walled and pale brown in NH_4OH 10%. Hymenophoral trama very pale brown from membranal pigment, hardly any yellow hyphal septa, few minute encrustations. Pileipellis a 2–3 cells deep layer of colourless globose and subglobose cells, 30–50 μm diam. and a few broadly ellipsoid cells 50 × 25 μm.

Habitat & distribution.—On humus in rich soil under *Fagus*. Known only from type locality in Wales.

Collection examined.—BRITISH ISLES, Wales, county Powys, Lake Vyrnwy, 29 Aug. 1979, *E. K. v. W.* (type, L).

In an attempt to identify this species with Smith's (1972) keys, we arrived at *P. agrariella*, of which Smith states, unfortunately without giving pictures of carpophores and cells, that the pleurocystidia are abundant, fusoid ventricose, 48–60 × 10–14 μm, that the spores have a small germ pore. Allowing for the great variability of macroscopical characters within all species of *Psathyrella*—Smith's description of these characters in *P. agrariella* seems sufficiently to fit in with *P. vyrnwyensis*. But of the cellular lining of the gill edge of *P. agrariella* Smith states 'cheilocystidia abundant, broadly ventricose, mucronate or saccate, 22–30 × 10–16 μm, slightly yellowish revived in KOH in some.' This description unfortunately does not elucidate to which kind of cells it pertains as no distinction is made between on the one hand the lageniform, sublageniform and fusoid cheilocystidia and on the other hand the spheropedunculate and clavate cells while the ratio between these two types of cells (very important in *P. vyrnwyensis*) is not mentioned. Moreover none of the marginal cells of *P. vyrnwyensis* were mucronate and in *P. agrariella* the pleurocystidia were more ventricose (up to 14 μm) than in *P. vyrnwyensis* (12.5 μm; among the abundance of pleurocystidia we found only one cell of which the breadth was 14 μm and one in which it was 15 μm). As both size and shape of the pleurocystidia in *P. vyrnwyensis* and the dark brown colour of the spore print (not mentioned by Smith for *P. agrariella*) are striking, it was decided to regard *P. vyrnwyensis* as a species in its own right.

RECENTLY DESCRIBED NEW SPECIES FROM OUTSIDE THE AREA COVERED BY OUR MONOGRAPH

(The data on macroscopical characters mentioned are taken from the original descriptions. The microscopical data mentioned are from our own examination of the type material, except in the case of *P. berolinense*.)

Psathyrella berolinense Gerhardt, Höh. Pilze Langen Luch: 137, fig. 120, pl. 15. 1978.

Descriptions & illustrations.—Engel in Pilzfl. N.W.oberfranken 6: 95, pl. on cover. 1982; Gerhardt, Pilze 1: 205. 1984, Kriegelsteiner in Z. Mykol. 49: 89. 1983; Kubicka in Z. Mykol. 48: 41. 1982.

This small (cap 3–20 mm, stem 20–40 × 1–2 mm) coprophilous (boar-droppings) *Psathyrella* was discovered in Germany (Berlin-Grunewald, August 1977, Gerhardt). Because of its small spores (5.8–7.4 × 3–3.7 μm) it would belong in section *Hydrophilae*, but because of the presence of pileocystidia and other striking characters (coprophilous growth, small size, entirely pruinose stem, dark spores) it should perhaps be placed in a new section or be removed from *Psathyrella*, e.g. to *Coprinus* subsect. *Setulosi*. It is furthermore characterised by the presence of lageniform pleurocystidia (20–30 × 4–9.5 μm), cheilocystidia (size not given, no distinction given between pleurocystidioid cheilocystidia and spheropedunculate and clavate cells) and even pileocystidia (50 × 11 μm), their numbers not given. We have not examined type material.

Psathyrella subumbrina Kits van Wav. & Örstadius in Persoonia 31: 129. 1986.

This species, found in Sweden by Örstadius (Kjugekull, 22 Oct. 1983), differs from *P. umbrina* by its thick-set habit (stem 15–30 × 2–3 mm, cap 9–13 mm), its stem having a bulbous base, its strongly developed and in early stages conspicuously appendiculate veil and its slightly smaller spores (6.5–7 × 4.5–5 μm, mean values 6.7 × 4.5 μm) which are provided with a rather striking oily drop in the centre. Because of the small size of the spores and the overall brown colours this species belongs to section *Hydrophilae*.

Psathyrella suavissima Ayer in Mycol. helv. 1: 145–153. 1984. — *Psathyrella sacchariolens* Enderle in Beitr. Kenntn. Pilze Mitteleur. 1: 35–60. 1984.

This remarkable species was first found by Ayer in 1971, later again by him and others in several Swiss localities. Like *P. pervelata*, to which it is very close, it has a very strongly developed veil but it differs from that species by its cap being in all stages strikingly paraboloid (in the end with flattened centre) and never, like in *P. pervelata*, conical or conico-paraboloid, while its colour is strong ochreous orange to brown-orange (Mu. 5 YR 6/8, 5/8; 7.5 YR 6/8, 5/8); in *P. pervelata* the cap colour is predominantly mouse grey, only in the beginning at centre pale ochre to pale brown. Furthermore *P. suavissima* is characterised by a very strong smell (of *Hebeloma sacchariolens*), while its utriform pleurocystidia are smaller (37.5–45 × 12.5–16 μm) and do not have a subapical constriction. We examined the type (Switzerland, Fribourg, Chatonnye, 20 May 1980 (LAU)), in fact produced the line-drawings of the cystidia, depicted by the author.

Much later (between May and October 1983) Enderle found in Germany (Grimmelfingen, forest 'Hörnle') the very same species and published it—provisionally as a new species producing two kinds of spores (obviously mature and larger, paler, immature ones) under the name *Psathyrella sacchariolens* Enderle, nom. prov. (1984, loc. cit.).

The pleurocystidia being utriform and the utriform pleurocystidioid cheilocystidia being numerous this species belongs to subsection *Lutenses*.

Psathyrella stigmatospora Clémençon in Mycol. helv. 1: 402. 1985.

A combination of three striking microscopical features characterises this species of which we examined type material: (i) Spores small, 7–8 × 4–4.5 μm (mean values 7.3 × 4.6 μm) rather pale, in water reddish brown (Mu. 5 YR 4/8), in NH_4OH 10% warm brown (Mu. 5 YR 4/6), in KOH 5% sordid brown (Mu. 10 YR 4/4) with distinct germ pore and hilar appendix. (ii) Surface of most spores minutely but distinctly rough to punctate (oil immersion). (iii) Gill edge lined with abundant and densely packed sphero-pedunculate (majority) and clavate (minority) rather small cells, (12.5–)15–20(–25) × 10–12.5(–15) μm, intermixed with very few, easily overlooked, pleurocystidioid cheilocystidia, 22.5–27.5 × 10–12.5 μm, some of which scarcely distinguishable from clavate marginal cells. Pleurocystidia (20–)25–40(–42.5) × 9–15 μm, numerous, in the main ventricose-fusoid with short pedicel and obtuse to very obtuse apex, some utriform but without subapical constriction. Cap 11–26 mm, paraboloid, brown, hygrophanous, drying out to very pale brown without pink; veil very distinct, white; flocculi at maturity reaching up to half-way centre and appendiculate; gills 3 mm broad, not crowded, brownish, broadly adnate, with white edge; stem 30–35 × 3–4 mm, cylindrical, not rooting, white; flesh of cap fairly thick, in centre 2–3 mm thick, sordid brown, of stem white but wall of cavity pale yellowish. Trama of 'washed' gill in NH_4OH 10% almost colourless, in peripheral 1/3 very pale brown (Mu. 10 YR 7/3) towards base slightly darker (Mu. 10 YR 7/4) and at base Mu. 10 YR 6/4. Spore print (Clémençon) dark brown.

The average length of the spores (7.3 μm)—7.1 μm in the Swedish collection, see below—brings this species in section *Hydrophilae*. Many spores in the Swiss collection were abnormally shaped, elongate or constricted, or/and provided with a protruding, drawn out apex. Clémençon—aware of this great variability of the spores, obviously due to abnormal development—very wisely deleted these spores in measuring their proper sizes, which he nevertheless still recorded as rather diverging (5.9–9 × 3.6–4.8 μm); he did not give mean values. We did and were careful in selecting only the darkest (= mature) spores of which the shape moreover could be regarded to be normal. In this way we arrived at the figure 7.3 μm for the average length of the spores. The spores sub micr. being fairly pale, the spore print accordingly dark brown and the prevailing colour of cap and gills also having been described as brown, the species seemed to fit in well with those of section *Hydrophilae*.

The minutely but distinctly rough surface of most spores is a phenomenon hitherto not yet described for European species of *Psathyrella*. A.H. Smith (1972: 35–42) described four species (*P. echiniceps, P. rugocephala, P. rigidipes, P. subcinomomea*) all of them having a distinctly, be it faintly, rough surface, only just perceptible with the light microscope and comparable with the ornamentation in *P. stigmatospora*. In *Lacrymaria velutina* and allied species this ornamentation is very much coarser.

The characteristic pattern of the cellular lining of the gill edge would bring *P. stigmatospora* in our subsection *Spadiceogriseae*, in which this species would be very close to (and in our key to that subsection would adjoin) *P. casca*. Having examined *P. stigmatospora* we immediately reexamined the two collections of *P. casca* mentioned in our monograph (1985: 228). Our Dutch collection (1 Aug. 1974, the only one used for calculating the mean values for the spore sizes as given in our monograph; the Swedish collection having been added much later, while the manuscript was already with the printer) had larger and perfectly smooth spores (mean values 7.7 × 4.5 μm), larger pleurocystidia, 35–45(–55) × 10–12 μm, which, moreover, in the main were distinctly utriform with subapical constriction, while the marginal spheropedunculate and clavate cells also were distinctly larger, 15–40 × 15–17.5(–20) μm and intermixed with very few ventricose-fusoid and also larger (25–40 × 10–15 μm) pleurocystidioid cheilocystidia.

To our very great surprise we next discovered on reexamination of the microscopical characters of the Swedish collection, mentioned in our monograph (1985: 230), that they were fully identical with those of *P. stigmatospora* and that, while examing that collection earlier, we had overlooked the ornamentation of the spores (of which the mean values for the sizes had been found to be 7.1 × 3.9 μm). Pleurocystidia and the pattern of the cellular lining of the gill edge were exactly the same as those of Clémençon's *P. stigmatospora*. This Swedish collection therefore was wrongly mentioned as a collection of *P. casca* and is to be deleted from the paragraph 'collections examined' under that species. The last sentence of our exposition on *P. casca* is also to be deleted as it pertains to the Swedish collection of *P. stigmatospora*.

The sizes given by Örstadius for the carpophores of his collection of *P. stigmatospora* are: cap 30–70 mm; stem up to 80 × 7 mm, sometimes thickening towards its base (10 mm); veil well developed, appendiculate, sometimes even forming a fugacious annular zone; gills light brown, 6–7 mm broad; spore print dark brown.

Collections examined.—Switzerland, Epalinges near Lausanne, 'Les Liaises', 3 June 1979 (type LAU, isotype L). — Sweden, Skåne, Kjugekull, c. 15 km East of Kristianstad, 1 June 1983 (herb. L. Örstadius 53-83, L).

Psathyrella kitsiana Örstadius in Windahlia 16: 154. 1986.

The author found four specimens of this small species in Sweden, Skåne, Näsum, Västana, on 4 Oct. 1985, growing near an old trunk of *Quercus* (*Örstadius 217-85*). Cap 10–18 mm, conical to convex, strong brown, striate. Veil very strongly developed, both on cap and stem. Stem 20–30 mm, pale brown. Gills subdistant, slightly ventricose, very pale brown when young, then brownish. Spore print dark brown. The species is characterised by the curious and conspicuous shape of the spores, immediately leaping to the eye sub micr. They measure 7–8(–9) × 3.5–4.5 μm (mean values 7.9 × 4.3 μm) are in face view ellipsoid to sometimes subobovoid, conspicuously narrowing near base, in profile adaxially flattened but in lower half usually strikingly depressed and terminating in a conspicuously protruding hyaline hilar appendix, without germ pore (at most a callus). Basidia 15–22 × 7.5–9 μm, 4-spored. Pleurocystidia 35–50 × 12.5–17.5 μm, numerous, utriform without subapical constriction, subutriform or fusoid with very obtuse to subobtuse apex. Pleurocystidia cheilocystidia 30–40 × 7.5–15 µm, numerous, spheropedunculate and clavate cheilocystidia 20–35 × 10–20 µm numerous. Hymenophoral trama practically colourless.

Because of the size of its spores, its in the main utriform pleurocystidia and its pleurocystidioid cheilocystidia being numerous this species belongs to subsection *Lutenses*.

Psathyrella rostellata Örstadius in Windahlia 16: 156. 1986.

Of this species the author found four collections in Sweden of which he sent us two: *Örstadius 240-85*, Skåne, Opmanna, Bökenäs, (*Fagus* forest) 12 Oct. 1985 and *Örstadius 246-85*, Skåne, Benestad (on decayed mossy wood, probably *Ulmus*) 17 Oct. 1985. Cap 23–30 mm, conico-convex, dark brown, striate. Veil moderately to strongly developed on both cap (up to 2/3 from margin) and stem. Gills crowded, ventricose, adnate, light brown, with white fimbriate edge. Stem 35–60 × 3–5 mm, whitish, sometimes thickening towards base. Spore print very dark brown, almost black. Spores 7–8 × (4–)4.5–5 µm (mean values 7.9–8.1 × 4.5–4.6 µm), ellipsoid, adaxially flattened, not dark (in water yellowish brown), with distinct but small germ pore. Basidia 20–25 × 7.5–9(–10) µm, 4-spored. Pleurocystidia 50–65 × 10–17.5 µm, abundant, fusoid-pedicellate with subobtuse to subacute and often either mucronate or forked apex, practically colourless, thin-walled. Pleurocystidioid cheilocystidia 40–50 × 12.5–17.5 µm, fairly abundant; numerous spheropedunculate and few clavate cheilocystidia 12.5–27.5 × 10–17.5 µm. Hymenophoral trama pigmented.

Because of the size of its spores and the shape of its pleurocystidia this species belongs to section *Pennatae*. Because of its strongly developed veil it finds its place in the first half of our key to that section close to *P. friesii*. It differs from *P. friesii* by the presence of both mucronate and forked pleurocystidia and its distinctly paler spores.

Psathyrella ivoeensis Örstadius in Windahlia 16: 155. 1986.

Of this species the author found three specimens in Sweden: *Örstadius 234-85*, Skåne, Ivö, growing at the base of an old *Fagus* tree on 7 Oct. 1985. Cap 12–30 mm, convex while young, only slightly spreading at maturity, brown, striate. Veil absent on cap, sparse fibrils on stem. Gills crowded, rather broadly adnate, 3 mm broad, blackish brown, with edge coarsely fimbriate. Spore print dark brown, blackish brown. Spores 7–7.5 (–8) × 3.5–4.5 µm (mean values 7.3 × 4 µm), ellipsoid, adaxially flattened, some slightly phaseoliform, dark, in water orange, germ pore absent but callus. Basidia 20–27.5 × 6–7.5 µm, 4-spored. Pleurocystidia 35–45 × 8–12 µm, moderately numerous, narrowly fusoid, sublageniform or subcylindric with obtuse to subobtuse apex and with short and fairly broad pedicel, sometimes with minute droplets or granules at the apex, staining pale blue in NH_4OH 10%. Gill edge lined with a motley of very versiform abundant and densely packed clavate, utriform, subutriform, subcylindrical, sublageniform cheilocystidia, 30–45 × 10–15 µm (in the absence of spheropedunculate and small clavate cheilocystidia) many of which (particularly those near the margin of the cap) at their apex covered by a crown of refractive crystalloid mucoid material staining pale blue in NH_4OH 10% but for the greater part dissolving in KOH 5%. Hymenophoral trama: mediostratum very pale brown in NH_4OH 10% from membranal pigment but subhymenium (particularly at gill edge) very strongly pigmented from yellowish brown membranal pigment with numerous yellow hyphal septa. Because of the small spores (mean length 7.3 µm) this species is to be ranked with those of section *Hydrophilae* (the overall brown colours, the strongly pigmented hymenophoral trama and the absence of a germ pore also fitting well in this section) in which it is outstanding because of the nature of the cellular lining of the gill edge and the mucoid material on the apices of many cheilocystidia, staining blue in NH_4OH 10%.

Having asked us to examine and identify his three new species discussed in the present paper, Mr. Örstadius accepted our offer to use our complete microscopical descriptions and line drawings for publication, but gave his own figures for the sizes of cystidia, basidia, and spores. In *P. ivoeensis* this resulted in a fundamental difference between his and our findings with regard to the size of the spores, which we found to be 7–7.5(–8) × 3.5–4.5 µm (mean values 7.3 × 4 µm) on account of which the species belongs to section *Hydrophilae* (upper limit of length of spores 7.5 µm) whereas Örstadius found 7.2–8 × 3.8–4.2 µm (mean values 7.6 × 4 µm). Our figure of 7.3 µm is fully in keeping with the macroscopical characters of *P. ivoeensis*: brown cap and gills, spore-print blackish-brown, spores brown sub micr., strongly pigmented hymenophoral trama even with browner anastomosing strands running from base to edge when studied under the binocular lens on a 'washed' gill. In spite of having found the mean length of the spores 76 µm, i.e. just above the upper limit of 7.5 µm for the species of section *Hydrophilae*. Örstadius correctly ranked this species with that section.

SUPPLEMENTARY NOTES ON THE SPECIES DEALT WITH IN OUR MONOGRAPH AND CORRECTIONS

(The page numbers between brackets refer to those of our monograph.)

(p. 98) *P. stercoraria.*—In the synonymy: Arnolds in Bibl. myc. 90: 439. 1983 should read 1982.

(p. 123) *P. populina.*—Collections examined: We received exsiccata of this extremely rare species from Mr. O. Weholt (Norway), who had found it in a valley on the North coast of the Isle of Samos (Greece) on 5 June 1985, and from Mr. P. Blank (Switzerland), who had found it in a wood along the river 'Whitach', municipality Schleitheim (Switzerland), date not mentioned.

(p. 159) *P. cernua.*—Addition to the observations on *P. cernua*: *Agaricus areolatus* Klotzsch apud Berk. in J. E. Smith, Engl. Fl. 5(2): 112. 1836 or in Hooker Brit. Fl. 2(2): 112. 1836, of which many authors later gave descriptions, has been associated with *P. cernua*, e.g. Bres., Iconogr. mycol. 18: pl. 861, 1931, as *Psilocybe cernua* Vahl var. *areolata*

(Klotzsch) Bres. Dennis, Orton & Hora (1960: 172) already indicated that *Agaricus areolata* was a doubtful species. Reid & Austwick (1963: 296) examined the type (K) and discovered that this species in fact is *Lacrymaria velutina* (Pers. ex Fr.) Konr. & Maubl. We were enabled to examine a fragment of the type and confirmed their conclusion.

(p. 163) *P. spadicea*.—Reevaluation of the colour of the spores of *P. spadicea*: in water as well as in NH_4OH 10% and in KOH 5% very pale greyish-pinkish to yellowish pink (Mu. 5 YR 7/4; 7.5 YR 7/4, 7/6, 8/6) with scarcely different hues in these three media.

(p. 165) *P. sarcocephala*.—Reevaluation of the colour of the spores of *P. sarcocephala*: in water as well as in NH_4OH 10% and in KOH 5% pale reddish brown (Mu. 7.5 YR 6/4) with slightly different hues in the three media.

(p. 180) *P. piluliformis*.—In footnote: 1971 should read 1791.

(p. 186) *P. mucrocystis*.—The pleurocystidia of specimens (exsiccata sent to us) found, growing in a group, by U. Söderholm on 29 August 1985 in Finland, Tampere, were identical with those described and depicted by us, but the abundant spheropedunculate and clavate cheilocystidia were intermixed with scattered but rather numerous pleurocystidioid cheilocystidia provided not with a small and short but with a strikingly large apical elongation (see Fig. 80).

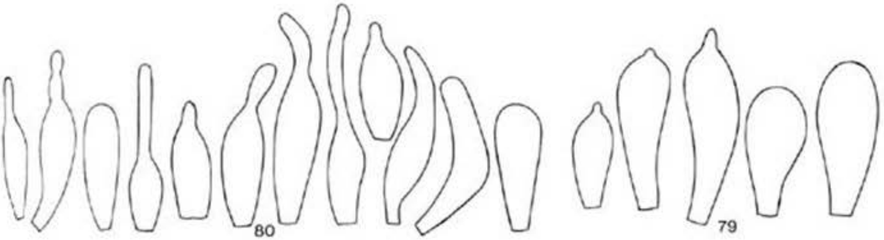
(p. 189) *P. frustulenta*.—In first line of the description: for 'up to 30 mm' read 'up to 40 mm'.

(p. 190) 'Stem 25–50 × 2–3.5(–5)' should read 'Stem 25–60 × 2–4(–5) mm'.

(p. 190) Pleurocystidia . . . . 'colourless' should read 'colourless or very pale brown in NH_4OH 10%'.

(p. 192) *P. chondroderma*.—Top line of 2nd paragraph '(mean values 7.2–7.4 3.9–4.4 μm: 3 collections)' should read '(mean values 7.2–7.4 × 3.9–4.4 μm: 3 collections).'

(p. 196) *P. rannochii*.—Addition to description of pigmentation of 'washed' gill: or distinctly yellowish brown, particularly in basal half, from brownish yellow (Mu. 10 YR 6/4–6/6) anastomosing tissue-strands running through the in itself pale greyish brown (Mu. 10 YR 6/2) tissue from base (where they merge) almost to edge.



Figs. 79–80. *Psathyrella mucrocystis* (Finland, Tampere, 29 Aug. 1985 (herb. Örstadius, L)). — 79. Pleurocystidiogram. — 80. Cheilocystidiogram.

(p. 196) Addition to description of colour of spores in KOH 5%: 5/4, 4/4.

(p. 196) Collections examined: we received exsiccata with full descriptions of two collections (both from coniferous sawdust) from Mr. O. Weholt (Norway): Norway, Lindedalen, 12 Sept. 1983 (herb. Weholt Nr. 129/83) and Frederikstad, Østfold, 30 May 1984 (herb. Weholt Nr. 5/84).

(p. 197) *P. obtusata*.—See redescription of this species and its var. *aberrans* on p. 336 of the present publication.

(p. 213) *P. panaeoloides*.—Description of size and shape of the spores to be deleted and substituted by: Spores 7–10(–11) × 4.5–7 × 4.5–6.5 μm (mean values 7.5–9.7 × 4.9–6.7 × 4.5–6.1 μm: 10 collections), usually all, sometimes only many, rarely only a few spores in face view very broadly ovate or subtriangular (some even subglobose), in profile lenticular (spores not having this shape are ellipsoid, adaxially flattened).

(p. 214) Additional information: In specimens in which only a limited number of spores is lenticular (the others ellipsoid, adaxially flattened) it is impossible to decide whether a given spore, seen in profile would turn out to be subtriangular if seen en face. In such cases it may be impossible to give the spore size in three dimensions.

(p. 229) *P. casca*.—Swedish collection cited belongs to *P. stigmatospora*.

(p. 230) Delete last paragraph above '*Psathyrella niveobadia*'.

(p. 239) *P. spadiceogrisea* f. *exalbicans*.—To be added to the synonymy: *Psathyrella obtusata* var. *utriformis* Kits van Wav. in Persoonia 11: 499. 1982.

(p. 249) *P. impexa*.—Pleurocystidia 'tapering towards obtuse to subacute apex' to be substituted by 'tapering towards subobtuse to subacute apex'.

(p. 272) *A. areolatus* Klotzsch = *Lacrymaria velutina*. See note above under '(p. 159) *P. cernua*'.

(p. 284) 'Arnolds, E. (198)' should read 'Arnolds, E. (1982)'.

(p. 285) Omitted from the list of references: Hirsch, G. (1984) 'Pilzflora der D.D.R.' — Zur Nomenklatur einiger Taxa. In Wiss. Z. Friedrich-Schiller-Univ., Jena, Naturwiss. R., 33: 813–820.

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ULTRASTUCTURE OF THE ASCUS AND THE ASCOSPORES IN PSEUDASCOZONUS (PEZIZALES, ASCOMYCOTINA)

J. VAN BRUMMELEN

Rijksherbarium, Leiden

The ultrastructure of the ascus and the ascospores in *Pseudascozonus* is described. The top of the ascus opens by a small rather roughly delimited operculum. A circular furrow in the inner ascal wall causes a weakened zone. The development of the ascospore wall shows a simple homogeneous epispore and disappearance of all secondary wall material. In the epiplasm of the ascus a unique type of envelope, surrounding all eight ascospores, is described. Relationship with *Ascozonus* and Theleboli with 8-spored asci is suggested.

Since the first description of *Pseudascozonus* Brumm., based on a single species, *Pseudascozonus racemosporus* Brumm. (van Brummelen, 1985), fresh material of this fungus came to hand for a more detailed study.

The earlier study of *P. racemosporus* with the help of light microscopy already indicated the presence of an interesting structure of the opening mechanism of the ascus top and the peculiar way in which the ascospores are loosely united into fascicles or bunches.

The aim of this study is to reveal the fine structure of the ascus and the ascospores with the help of electron microscopy.

MATERIALS AND METHODS

The material of *Pseudascozonus racemosporus* was isolated from deer dung collected at the type locality of the species, at the 'Tourbière de Frasne', Frasne, dép. Doubs, France, 20 III 1985 (*van Brummelen 7398*).

In the laboratory fruit-bodies were taken from the substratum kept under humid conditions in petri-dishes for several weeks at 12°C in a conditioned growth chamber.

Fruit-bodies were fixed for 3 hours in 1% glutaraldehyde buffered at pH 7.2 with 0.2 M cacodylate at 4°C. To compensate for differences in osmotic value 1.5% sucrose was added. The material was post-fixed for 1 hour in 1% buffered OsO_4 at 4°C. Fixed material was spread in very thin layers of solidifying water agar, dehydrated in an ethanol series, and embedded in Epon.

Longitudinal median sections were cut with a diamond-knife on an LKB Ultratome III, contrasted with Reynolds' lead citrate and uranyl acetate, and examined with a Philips EM 300 electron microscope.

OBSERVATIONS

The ascus

Because of the rather small number of fruit-bodies available for this study, the methods were restricted to glutaraldehyde-OsO_4-fixation followed by Epon embedding.

In *P. racemosporus* the fruit-body consists for the main part of a fully exposed, relatively small bundle of asci.

The shape of the asci is broadly clavate to oblong obovoid, often slightly curved towards one side. They reach a length of 28–33 µm and a width of 11–15 µm (Figs. 1A, B, D).

The base is rather broad with a plugged narrow central pore in the basal septum. The top is regularly rounded. The walls of the young ascus, up to the moment of meiosis, are of rather uniform thickness (approximately 250–300 nm) and undifferentiated.

After meiosis the ascal wall thickens and becomes stratified. An inner, rather thick, more flexible, electron-dense layer is differentiated from an outer, rather rigid, relatively electron-transparent layer.

In the lateral region of the ascal wall the inner layer reaches a thickness of 250–340 nm and the outer layer 70–110 nm.

On further ripening neither a subapical ring, as observed in asci of *Ascozonus* (Renny) E.C. Hansen (van Brummelen, 1974, 1978; Samuelson, 1978), nor a subapical ring-shaped protrusion of the inner ascal wall layer, as reported for several members of the Pyronemataceae (Hung, 1977; Samuelson, l.c.), is found.

Structural differentiation in the top of the ascus is observed only shortly before the moment of spore discharge. Especially the inner ascal layer thickens. Slightly behind the tip it then measures 380–550 nm. At the extreme tip an irregular hemispherical or truncate-conical body is demarcated at the inner side of the wall (Figs. 2B, C). The diameter of this body is about 1780–2100 nm, in the centre it reaches a thickness of 800–900 nm. At the inner side of the ascal wall it is surrounded by a gradually deepening circular furrow. At this stage no stratification of the inner or the outer layer can be observed.

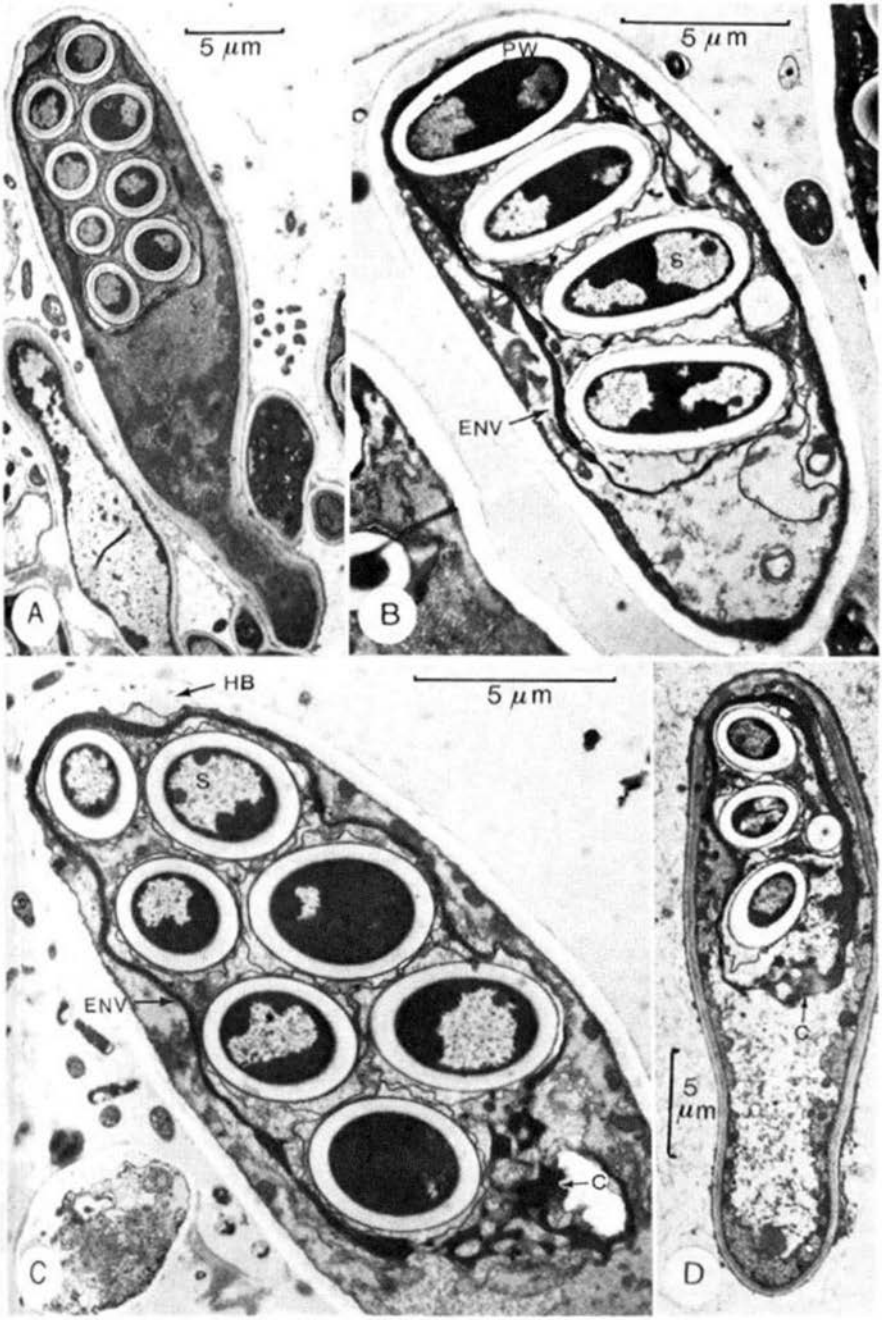
Abbreviations used in figures.—AS, ascostome; AW, ascus wall; C, complexes of electron-dense material of the envelope surrounding all ascospores; E, epiplasm; EN, endospore; ENV, envelope; EP, epispore; ER, endoplasmatic reticulum; F, furrow; HB, hemispherical body; IL, inner layer; IM, investing membrane; O, operculum; OL, outer layer; PW, primary spore wall; S, ascospore; SW, secondary spore wall; WZ, weakened zone.

The scale markers in all figures equal approximately 0.5 µm.

Fig. 1. *Pseudascozonus racemosporus*, electron micrographs of asci. — A, B, D. Longitudinal sections of almost mature asci. — C. Distal portion of an ascus.

Fig. 2. *Pseudascozonus racemosporus*, electron micrographs of ripening and emptied asci. — A. Detail of a ripening ascus. — B. Detail of the apex of an almost mature ascus just before dehiscence. — C. Median section of the apex of a ripening ascus. — D. Median section of an emptied ascus showing the operculum.

Fig. 3. *Pseudascozonus racemosporus*, electron micrographs of advanced ascospore development. — A. Ascospores showing investing membranes and a portion of the envelope. — B. Detail showing investing membranes. — C, D. Details showing investing membranes and portions of the envelope.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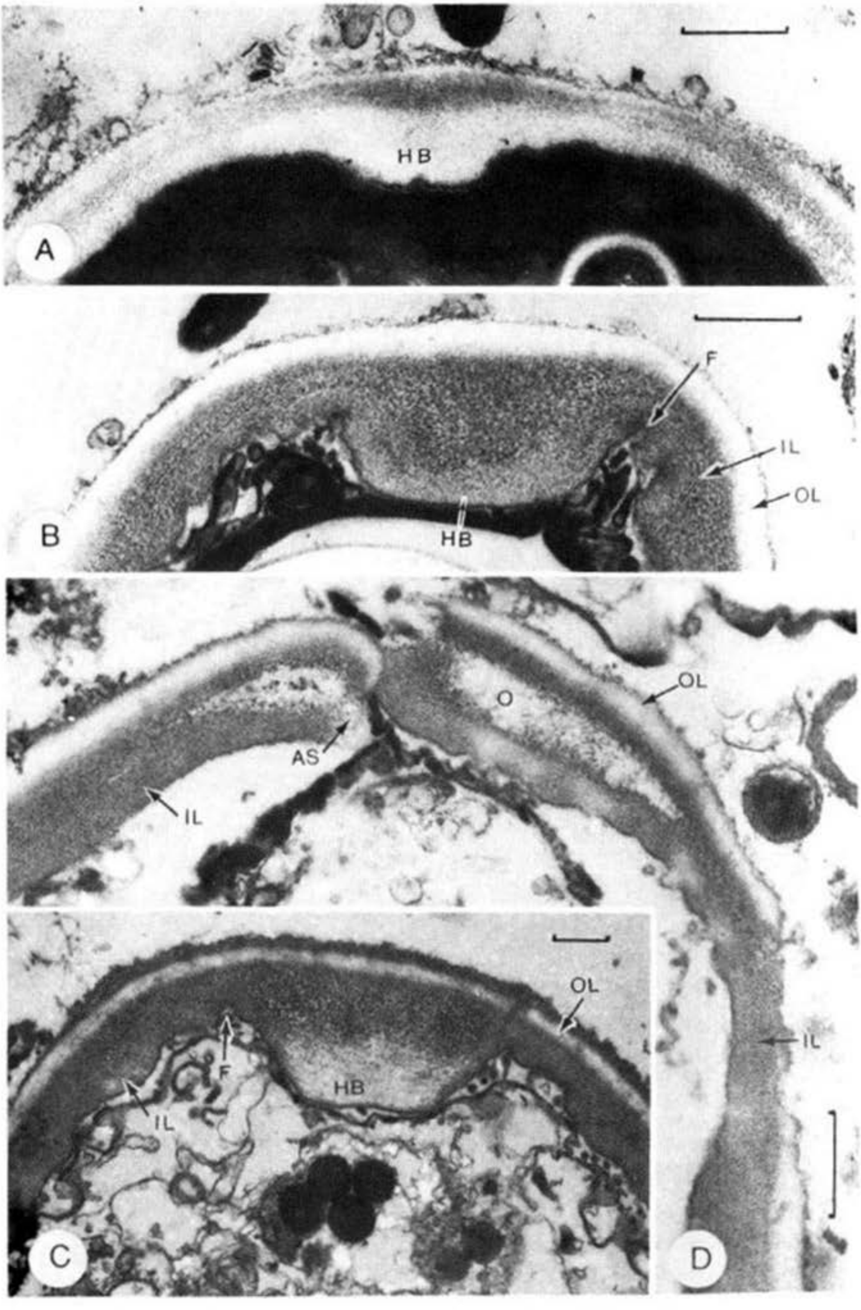
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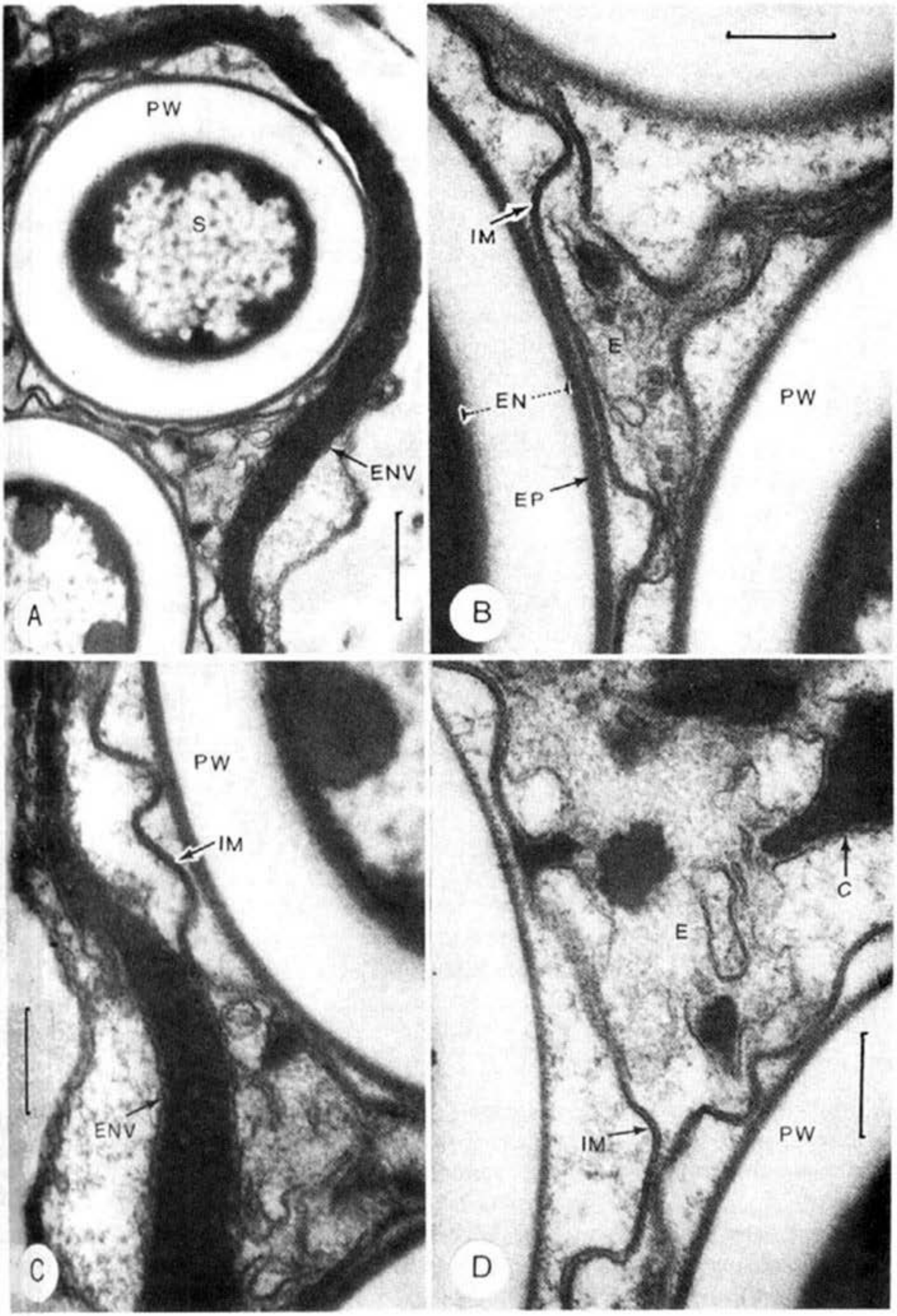
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The circular furrow in the inner layer forms a weakened zone in the top of the ascus. From observations of sections of dehisced asci it is clear that the initial fracturing starts very close to this circular furrow. A small operculum of about 2 μm diameter and 1 μm thick opens forcibly by a fracture in this zone of the inner layer and a very irregular rupture in the outer layer (Fig. 2D). As a result the margins of the operculum and the ascostome are very irregular and rough (Fig. 2D). Because of strong tearing towards the base, often a more or less tongue-shaped operculum is formed. Also rather deep cleavage of the ascal wall from the top downwards can be found in emptied asci. After dehiscence of the ascus, swollen remnants of the inner layer can be found at the inner face of the operculum (Fig. 2D).

Neither a funnel nor a tract is present in the apical part of the epiplasm at any stage of development.

The ascospores

The initial development of ascospores in *Pseudascozonus* closely confirms the general process described for Ascomycetes (e.g. Reeves, 1967; Wells, 1972; Merkus, 1973, 1974, 1975, 1976).

In the young ascus eight ascospores are formed. The primary wall develops between the two delimiting unit membranes and consists of homogeneous electron-transparent material. At a later stage two layers can be distinguished in the primary wall, an inner endospore and an outer epispore. The endospore varies in the thickness from 230–340 nm and is always fairly electron-transparent, with only some vague sublayering at full maturity. The epispore is 33–38 nm thick and seems to consist only of a single fairly electron-dense layer without finer striation (Figs. 3A–D).

While the inner spore delimiting membrane becomes the sporoplasmalemma, the outer spore delimiting membrane changes into the investing membrane (or perisporal sack).

Between the investing membrane and the primary wall new material is deposited on the outside of the epispore. This secondary wall material is floccose and fairly electron-transparent. Its thickness varies with the strong undulations of the investing membrane (Figs. 3A–D).

The investing membrane remains till the last stages, has a constant thickness of 14–18 nm, and consists of two very thin electron-dense layers separated by a transparent one.

The secondary wall material shows no condensation on the primary wall and becomes fully electron-transparent in the end (Fig. 3A). The mature ascospores are perfectly smooth.

During development all eight ascospores become surrounded by a more or less complete envelope (Figs. 1A–D). This envelope includes all ascospores with their investing membranes and some epiplasm. It is formed by very thin cohering membranes of what seems to be endoplasmatic reticulum. Between these membranes an almost homogeneous, very electron-dense material is deposited as an irregular often very incomplete layer. Its thickness varies usually from 100 to 370 nm, but reaches even 1000–2000 nm in greater complexes (Figs. 3C, D).

With light microscopy only the thick parts and the larger complexes can be observed as a yellowish or pale brownish amorphous substance (van Brummelen, 1985).

To a certain degree the arrangement of the ascospores in the fully mature ascus is influenced by the presence of this envelope. In spore shots, the ascospores are often found to be more or less cohering in clusters (van Brummelen, 1985: fig. 2). On ripening, the amorphous substance tends to concentrate at one side of the spore-cluster.

DISCUSSION

The structure of the ascus top in *Pseudascozonus* is summarized in a diagrammatic scheme (Figs. 4B–C).

This type of ascus is characterized by a relatively thin, electron-transparent, rather rigid outer layer and a thicker, more electron-dense, rather flexuous inner layer. At the inner face of the latter an apical hemispherical or truncate-conical part is segregated, surrounded by a narrow circular furrow. Here disintegration of the inner wall takes place and causes a circular weakened zone at the top. Dehiscence of the ascus starts in this weakened zone of the inner layer, inciting rather irregular tearing at the corresponding places of the outer layer.

This causes a small roughly delimited operculum and ascostome. Further tearing of the ascal wall from this initial opening downwards is caused by the forcible release of the more or less cohering ascospore cluster.

Although such a type of ascus top is not known from the genera of Pezizales studied thus far, there is a certain resemblance with the tops of asci described for species of *Ascozonus* and *Thelebolus* (van Brummelen, 1974, 1978).

In *Ascozonus* a minor operculum or an apical disk (van Brummelen, 1974) is also found at the extreme top of the ascus, and the layers in the top are similar. The prominent ring in the ascal wall of *Ascozonus* is absent in *Pseudascozonus*. A somewhat similar type of ascus top is found in *Thelebolus* Tode, where a roughly delimited operculum occurs in some of the species with 8-spored asci.

In the development of the ascospore wall in *Pseudascozonus* it should be noted that the epispore consists of only one homogeneous electron-dense layer, that all secondary wall material disappears, and that the investing membrane remains persistent till the latest stages of development. This is very similar to the structure and development of the ascospore wall as described by Merkus (1976) for *Ascozonus woolhopensis* (Berk. & Br. apud Renny) E.C. Hansen. Rather resembling are also the ascospore walls in *Thelebolus crustaceus* (Fuckel) Kimbr. apud Y. Kobay. & al., *T. stercorarius* Tode, and *'Ascophanus' coemansii* Boud. (a representative of *Thelebolus* with 8-spored asci), but here it is reported (Merkus, l.c.) that the secondary wall condenses on the epispore to form a smooth, persistent, extra layer.

The envelope surrounding all ascospores is very reminiscent of the common investing membrane of the ascospores in *Saccobolus glaber* (Pers.: Fr.) Lamb., as described by Carroll (1967, 1969, as *S. kerverni*). But, while the common investing membrane in *Saccobolus glaber* is continuous and replaces the individual investing membranes of the asco-

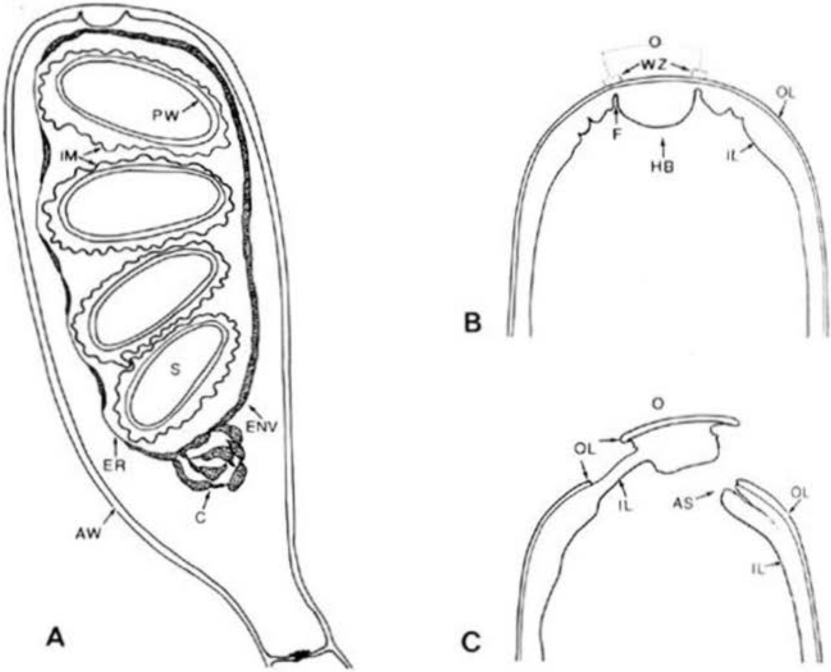

Fig. 4. Diagrammatic longitudinal, median sections of the ascus and the ascus top as seen with electron microscopy. — A. Mature ascus. — B. Top of mature ascus. — C. Top of ascus after spore discharge.

spores, the envelope in *Pseudascozonus* is not formed by fusion of these membranes, since here they are very persistent.

In the epiplasm of *Pseudascozonus*, cohering elements of the endoplasmatic reticulum form the inner and outer clothing of a common envelope consisting for the main part of rather homogeneous electron-dense material. Such an envelope has not previously been observed in other representatives of the Pezizales (Fig. 4A).

Peculiar epiplasmatic structures have especially been recorded in some species of the Thelebolaceae. A pale brownish net-shaped structure, holding all eight ascospores is known from '*Ascophanus*' *coemansii* (Boudier, 1869: pl. XXX, figs. 7, 8; Merkus, 1976: pl. 5F, G). Large globules with a net-work of plaited units occur in the epiplasm of *Thelebolus stercoreus* (Merkus, l.c.: pl. 4F, 5A, B).

The ultrastructure of the ascus top and of the ascospore wall strongly support the view that *Pseudascozonus* is related to *Ascozonus*, while it also shows affinity to representatives of *Thelebolus* with 8-spored asci. There are, however, sufficient differences to maintain it as a separate genus within the Thelebolaceae.

ACKNOWLEDGEMENTS

The author wishes to thank Mr. W. Star for his most skilful technical assistance throughout this study. Gratitude is also due to the director of the Botanical Laboratory (Leiden) for the use of the transmission electron microscope.

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NOTES AND BRIEF ARTICLES

NOTULAE AD FLORAM AGARICINAM NEERLANDICAM XIV
A NOMENCLATURAL NOTE ON RHODOCYBE TRUNCATA

MACHIEL E. NOORDELOOS* and THOMAS W. KUYPER**

Agaricus truncatus Schaeff. (Fungi Bavariae, pl. 251. 1763) is variously interpreted as a species of *Hebeloma* and *Rhodocybe*. Although the type-plate is not so easy to interpret, the adnate, sinuate lamellae, sordid spore print, and red-brown, truncate pileus give way to the idea that Fries (1838) was right in placing *Agaricus truncatus* in tribus *Hebeloma*. This opinion was followed by e.g. J. Lange (1938) and Moser (1978, 1984). Quélet (1880) had another opinion on *Agaricus truncatus* and placed it in the genus *Tricholoma*. This concept is known by modern mycologists as *Rhodocybe truncata* (Schaeff.) Singer. Still *Tricholoma truncatum* (Schaeff.) Quél., *Rhodopaxillus truncatus* (Schaeff.) Maire, and *Rhodocybe truncata* (Schaeff.) Singer all have the same type, viz. Schaeffer's plate, and must be considered as synonyms of *Hebeloma truncatus* (Schaeff.) Kumm.

It is clear that the binomial *Rhodocybe truncata* cannot be used for Quélet's fungus. Therefore Bon (1985) was wrong in creating the so-called new combination *Rhodocybe truncata* (Quél.) Bon. The epithet truncata cannot be ascribed to Quélet, as is pointed out above. Even if Bon had been right, the name *Rhodocybe truncata* (Quél.) Bon would have been a heterotypical homonym of *Rhodocybe truncata* (Schaeff.) Singer and could not have been used for that reason.

Fries (1836) described *Agaricus geminus* as a new species referring to Paulet (1800) who described the same fungus under the name *Fungus cinnamomeus*. This species clearly represents *Rhodocybe truncata* sensu Quélet, and has been depicted by J. Lange (1938) as *Tricholoma geminum*. For this reason the epithet gemina is accepted here for *Rhodocybe truncata* sensu Quélet, and the new combination is proposed.

Rhodocybe gemina (Fr.) Kuyp. & Noordel., *comb. nov.*

Agaricus geminus Fr., Epicr. 38. 1838 (basionym). — *Tricholoma geminum* (Fr.) S. Petersen, Danske Agar. 61.1907.

Misapplied name.—*Tricholoma truncatum* sensu Quélet in Bull. Soc. Amis Sci. nat. Rouen, Sér. II, 15: 153. 1890 (Champ. Jura Vosges, Suppl. 9); *Rhodophyllus truncatus* sensu Maire in Annls mycol. 11: 338. 1913; *Rhodocybe truncata* sensu Singer in Mycologia 38: 687. 1946; sensu Baroni in Beih. Nova Hedwigia 67: 79. 1981; *Clitopilus truncatus* sensu Kühner & Romagnesi, Fl. anal. Champ. sup. 172. 1953.

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*Rijksherbarium, Leiden.

**Biological Station, Kampsweg 27, 9418 PD Wijster, Netherlands.

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ON THE IDENTITY OF CURVULARIA SUBULATA

C.S. TAN and G.S. de HOOG

Centraalbureau voor Schimmelcultures, Baarn

Occasionally fungal strains have been received by the 'Centraalbureau voor Schimmelcultures' under the name *Curvularia subulata* (Nees) Boedijn. This name also turns up in the literature (Corbetta, 1965; Jalal & al., 1984). A culture, carrying this name and deposited recently at the CBS, was indistinguishable from *Curvularia lunata*. Since the epithet 'subulata' is older than 'lunata', a study was made to establish the identity of *Curvularia subulata*.

The binomial *Curvularia subulata* was mentioned by Gilman (1945), with the cited author's names '(Nees) Boedijn' and making reference to Boedijn's (1983) paper on *Curvularia*. However, neither in this article, nor in any other article Boedijn's personal notes, maintained at the Rijksherbarium at Leiden, no reference to *Curvularia subulata*, nor its basionym, *Helminthosporium subulatum* Nees, could be found. The name was also not included in most of the recent treatments of *Curvularia* (see for example Ellis, 1966); neither was *Helminthosporium subulatum* mentioned in Hughes' (1985) list of excluded *Helminthosporium* species. We consequently assume that Gilman (1945) first made the combination *Curvularia subulata*. The same conclusion was drawn in the 'Index of Fungi' (1950: 278). Gilman's material had originally been isolated by Takahashi (1919) from soil and is now probably lost.

Nees & Nees (1818) described *Helminthosporium subulatum* Nees & T. Nees as having straight, mostly unbranched conidiophores bearing oblong-clavate conidia with rounded apices. On their accompanying tab. V, fig. 13 the conidia were depicted as being 3–4-septate. This concept of *H. subulatum* was adopted by Fries (1832), Saccardo (1886), and Lindau (1910). The last mentioned author gave the conidial measurements as 22–26 × 9–11 μm. His description was copied by Gilman (1945). Apparently Lindau's (1910) and Gilman's (1945) descriptions do not refer to the type specimen, as in a collection preserved at the Brussels herbarium (No. 17749, without data; scr. Nees ?), which is probably authentic for *H. subulatum*, and a collection preserved at the Leningrad herbarium (no. 72, ex 'Sredinsky Crypt. Mosquensis'), the conidia are found to be obclavate, measuring 53–76 × 12–18 μm. Both specimens are indistinguishable from *Helminthosporium velutinum* Link: Fr. A similarity of *H. subulatum* to *H. velutinum* was already suggested by Ellis (1961) when he reidentified a secondary specimen of *H. subulatum* at the Kew herbarium.

Judging from Nees & Nees' (1818) description and illustration, they and many later authors interpreted the conidial attachment incorrectly, and depicted the conidia upside-down. This explains its erroneous interpretation by later authors as a possible *Curvularia* species.

Consequently *Helminthosporium subulatum* Nees & T. Nees: Fr. should be regarded as a synonym of *H. velutinum*, and the combination *Curvularia subulata* does not jeopardize *Curvularia lunata*. Strains that are maintained (CBS 231.39) in, or received by the CBS collection as *C. subulata*, have all been reidentified as *C. lunata* (Wakker) Boedijn.

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TAXONOMIC AND NOMENCLATURAL NOTES ON LACCARIA B. & BR.—II LACCARIA BICOLOR, L. FRATERNA, AND L. LACCATA VAR. PALLIDIFOLIA

ELSE C. VELLINGA

Rijksherbarium, Leiden

GREGORY M. MUELLER

Field Museum of Natural History, Chicago, IL, U.S.A.

Since our previous publication (Mueller & Vellinga, 1986), additional information concerning the nomenclature and synonymy of some names in the genus *Laccaria* has been obtained.

Study of the holotypes of *Laccaria laccata* var. *pseudobicolor* M. Bon and *L. affinis* var. *sardoa* M. Bon revealed microscopic characters that support the view that these names should be placed in the synonymy of *L. bicolor* and *L. laccata* var. *pallidifolia* respectively.

Laccaria bicolor (Maire) P. D. Orton—Fig. 1

Laccaria laccata var. *bicolor* Maire in Publcions Inst. bot., Barcelona 3: 84. 1937. — *Laccaria proxima* var. *bicolor* (Maire) Kühn. & Romagn., Fl. anal. Champ. sup.: 131. 1953 (nom. inval., ICBN Art. 33.2). — *Laccaria bicolor* (Maire) P. D. Orton in Trans. Br. mycol. Soc. 43: 177. 1960. —Type specimen (holotype): *R. Maire*, 7 Oct. 1933, Spain, Catalonia, Collado de Tosses (MPU).

Laccaria laccata var. *pseudobicolor* M. Bon in M. Bon & Haluwijn in Docum. mycol. 12(46): 42. 1982. — Type specimen (holotype): *M. Bon 70428* (Herb. M. Bon).

Misapplied name. — *Laccaria farinacea* sensu Sing. non Huds. in Sydowia Beih. 7: 8. 1973.

Basidiospores (excl. ornamentation) (6.5–)7.0–8.5 × 5.5–7.0 µm, Q = 1.15–1.35, $\bar{Q}$ = 1.23, usually broadly ellipsoid, occasionally ellipsoid, echinulate; spines up to 1.2 µm long, numerous; hilar appendage truncate; wall up to 1 µm thick. Basidia 4-spored. Cystidia not observed. Pileipellis an undifferentiated cutis with ascending fascicles of hyphae; terminal hyphae with rounded apices and brown pigment. Stipitispellis a cutis of cylindrical hyphae; apex of stipe lacking cystidia.

The description above is based on study of the holotype of *L. laccata* var. *pseudobicolor* M. Bon.

The colour of the lamellae, vivid lilac (Bon & van Haluwijn, 1982: 42), and the size and shape of the basidiospores observed in the holotype fit within the circumscription of *L. bicolor* (Maire) P. D. Orton. Additionally, specimens of *L. bicolor* are occasionally encountered that lack lilac tinges at the base of the stipe. Thus, *L. laccata* var. *pseudobicolor* is considered a synonym of *L. bicolor*, and not of *L. laccata* (Scop.: Fr.) B. & Br., as we stated previously (Mueller & Vellinga, 1986: 35).

Laccaria fraterna (Cooke & Mass. → Sacc.) Pegl.[1]

Agaricus fraternus Cooke & Mass. in Grevillea 16: 31. 1887, non *Agaricus fraternus* Lasch in Linnaea 3: 402. 1828 (= *Cortinarius* spec.). — *Naucoria fraterna* (Cooke & Mass. →) Sacc. in Syll. Fung. 9: 110. 1891. — *Laccaria fraterna* (Cooke & Mass. → Sacc.) Pegl. in Aust. J. Bot. 13: 332. 1956.

Naucoria goossensiae Beeli in Bull. Soc. r. Bot. Belg. 61: 88. 1928. — *Laccaria laccata* f. *bispora* Heinemann in Bull. Jard. bot. État 34: 310. 1964 (change of name).

Laccaria lateritia Malenç. in Bull. trimest. Soc. mycol. Fr. 82: 189. 1966.

Dr. R. Courtecuisse (Aubers, France) kindly drew our attention to the existence of *Agaricus fraternus* Lasch, 1828. This name is now treated in *Cortinarius*. The correct citation and synonymy of *Laccaria fraterna* is as presented above.

Laccaria laccata var. **pallidifolia** (Peck) Peck—Fig. 2

For synonymy see Mueller & Vellinga, 1986: 37.

Basidiospores (excl. ornamentation) 8.5–10.5 × 7.5–9.0(–9.5) μm, Q = 1.0–1.2, $\bar{Q}$ = 1.1, globose to subglobose, occasionally broadly ellipsoid, finely echinulate; spines up to 1 μm high; hilar appendage truncate; wall up to 1 μm thick. Basidia 4-spored. Pleurocystidia lacking. Cheilocystidia up to 50 × 12 μm, cylindrical with rounded apices, hyaline. Pileipellis an undifferentiated cutis with some ascending fascicles of hyphae; terminal hyphae with rounded apices and brown pigment. Stipitispellis a cutis of cylindrical hyphae; apex of stipe with patent cylindrical, hyaline, cystidia-like elements; elements up to 80 × 14 μm, with rounded apices.

The description above is based on study of the holotype of *Laccaria affinis* var. *sardoa* M. Bon & Contu (coll. *M. Bon 84395*, Herb. M. Bon).

Bon & Contu (1985: 53) state that *Laccaria affinis* var. *sardoa* is unique because of the pink colours of its basidiocarps. Colour variation within the *L. laccata* complex is so great, however, that we do not feel that this is taxonomically significant. While the conspicuous cystidia-like elements at the stipe apex observed in the holotype are significant and deserving of mention, we do not feel that this alone is sufficient to merit maintaining this taxon as a separate variety. Following our circumscription of *L. laccata* var. *pallidifolia* (Mueller & Vellinga, 1986: 38–39) we place *L. affinis* var. *sardoa* in the synonymy of *L. laccata* var. *pallidifolia*.

ACKNOWLEDGEMENTS

Dr. R. Courtecuisse is thanked for his letter concerning *Agaricus fraternus* and we are indebted to Mr. M. Bon for the loan of type specimens.

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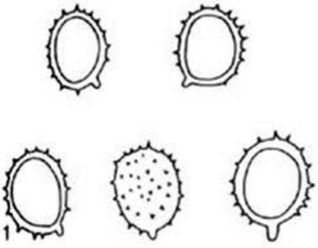
[1] For the use of the arrow see Mueller & Vellinga, 1986: 27.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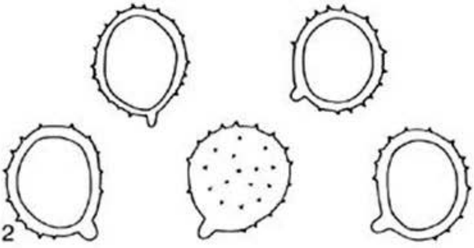
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Fig. 1. *Laccaria bicolor*. — Spores (× 1500) (from *M. Bon 70428*, holotype of *L. laccata* var. *pseudobicolor*).

Fig. 2. *Laccaria laccata* var. *pallidifolia*. — Spores (× 1500) (from *M. Bon 84395*, holotype of *L. affinis* var. *sardoa*).

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NOTES ON HYGROPHORACEAE–X
THREE NEW COMBINATIONS IN HYGROPHORACEAE

EEF ARNOLDS

*Biological Station, Wijster**

In the scope of the preparation of the volume on Hygrophoraceae of Flora agaricina neerlandica (Bas, 1983) three additional new combinations have to be made:

Camarophyllopsis micacea (B. & Br.) Arnolds, *comb. nov.* — Basionym: *Hygrophorus micaceus* B. & Br., in Ann. Mag. nat. Hist., Ser. V, 3: 207. 1879 (Notic. Brit. Fung. 31).

It was intended to include this taxon in the Flora as *Camarophyllopsis phaeoxantha* (Romagn.) Arnolds (1986: 643). However, I agree with Printz & Laessøe (1986: 90) that *Hygrophorus phaeoxanthus* Romagn. (1971: 874) is a synonym of the older name *H. micaceus* B. & Br. Printz & Laessøe did not propose the necessary combination in *Camarophyllopsis*.

Hygrocybe cinerella (Kühner) Arnolds, *comb. nov.* — Basionym: *Camarophyllus cinerellus* Kühner in Bull. trimest. Soc. mycol. Fr. 93: 144. 1977.

Hygrocybe hygrocyboides (Kühner) Arnolds, *comb. nov.* — Basionym: *Camarophyllus hygrocyboides* Kühner in Bull. trimest. Soc. mycol. Fr. 93: 144. 1977.

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* Comm. no. 335 of the Biological Station Dr. W. Beijerinck, Wijster, Netherlands.

BRUNNEOSPORA RETICULATA, GEN. ET SPEC. NOV. A KERATINOPHILIC ASCOMYCETE FROM SPAIN

J. GUARRO, L. PUNSOLA and M.J. FIGUERAS*

Two strains of a gymnoascaceous keratinophilic fungus growing on hair have been encountered during the routine screening of soil fungi in Catalonia (Spain), using the hair bait method. Examination of these strains indicated that they differ from previously described genera of the Eurotiales or Onygenales and apparently represent a new genus. It is described below.

BRUNNEOSPORA Guarro & Punsola, *gen. nov.*

Ascomata rubro-brunnea, globosa, ad peripherum appendicibus spiralibus praedita, discreta vel confluentia, elementa ascomata componentia eis hypharum vegetarum similis, laxe intertexta et ascos circundata; asci globosi vel ellipsoidei, evanescentes, octospori; ascosporae irregulariter ellipticae, rubro-brunneae, reticulatae, crassitunicatae. Status asexualis in forma aleuriosporarum. Species typica: *Brunneospora reticulata.*

Ascomata reddish brown, more or less globose, with coiled appendages at the periphery, solitary or confluent. Peridial elements similar to those of the vegetative hyphae, loosely interlaced to enclose the asci. Asci globose or ellipsoidal, evanescent, 8-spored. Ascospores irregularly elliptical, thick-walled, reticulate, reddish brown.

Type species.—*Brunneospora reticulata.*

Brunneospora reticulata Guarro & Punsola, *spec. nov.*

Ascomata rubro-brunnea, 400–600 μm; asci 8–12 μm diam.; ascosporae, irregulariter ellipticae, crassitunicatae, reticulatae, 6.3–7.2 × 4.6–6.1 μm, rubro-brunneae. Conidia terminalia et alteralia, sessilia vel in protrusionibus brevibus vel ramulis lateralibus oriunda, hyalina, tenui-tunicata, obovoidea vel clavata, 4–8(–10) × 2.5–4 μm, conidia intercalaria solitaria. Ceratinophilica. Typus ex solo in herb. FMR* e cultura FMR 784.

Ascomata reddish-brown, more or less globose, 400–600 μm diam., often confluent; peridial hyphae scanty to absent, smooth, septate, 2–4 μm wide, hyaline, anastomosed or intertwined, loosely reticulate, peripheral appendages coiled, septate, subhyaline to pale brown, 3.5–4.5 μm diam. Asci globose or ellipsoidal, 8–12 μm diam., evanescent, 8-spored, ascospores irregularly elliptical, with rounded ends, roundish in polar view, reddish brown, thick-walled, aseptate, reticulate, 6.3–7.2 × 4.6–6.1 μm, often covered with mucilaginous material which masks the reticle.

Keratinophilic.

Anamorph represented by terminal, intercalarly and lateral conidia, sessile or on short protrusions or branches, usually solitary, hyaline, smooth, obovoid to clavate with a broad and truncate base with long frills after secession, 4–8(–10) × 2.5–4 μm, thin-walled, aseptate or occasionally 1-septate, intercalarly conidia hyaline, inequilaterally swollen or cylindrical.

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* Address: Department of Microbiology, Faculty of Medicine, Reus, Tarragona, Spain (= FMR).

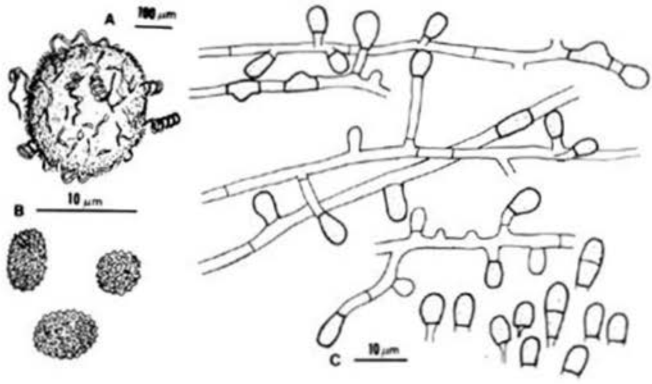

Fig. 1. *Brunneospora reticulata*. — A. Ascomata. — B. Ascospores. — C. *Chrysosporium* anamorph.

Material examined.—FMR 784 (type strain) isolated from arable soil by L. Punsola, Segrià, Catalonia, Spain, Sept. 1980. FMR 811, from the same kind of soil, Baix Ebre, Catalonia, Spain, Aug. 1980. Dried material of the type has been deposited at the IMI herbarium.

In artificial culture it is very difficult to obtain the teleomorph, and we only had some success using oatmeal agar mixed with human hair and small pieces of cow hoof, in that case a lot of ascomata immersed in an abundant aerial, white mycelium are obtained, although these ascomata lack coiled appendages.

The *Chrysosporium* anamorph grows well on Phytone-yeast extract agar (PYE) with colonies attaining 30–35 mm diam. in 14 days, mostly white or pale yellow, rather dense, slightly raised at the centre, margin defined, reverse pale creamy yellow. On potato-dextrose agar (PDA) the colonies are similar reaching 30–33 mm diam. in 14 days, white, powdery; margin defined, regular, slightly fimbriate, reverse pale brown.

Distinguishing characters of *Brunneospora* are the ellipsoidal, pigmented ascospores with a thick, reticulate-alveolate wall. Such ascospores occur also in *Aphanoascus* Zukal which includes species with spherical ascomata with a distinct, dark peridium composed of flattened cells. Spirally coiled appendages are absent. The ascospores are usually ovate or oblate, bilaterally flattened. Those of *Brunneospora reticulata* are round in polar view. Currah (1985) classified *Aphanoascus* in the Onygenaceae. The species of *Onygena* Pers. also have ellipsoidal, but pale and nearly smooth ascospores. Currah classified in the Onygenaceae also genera with dorsiventrally flattened (lenticular or discoid) or with spherical ascospores, which formerly had been classified in the Gymnoascaceae. Von Arx (1986) on the other hand restricted the Onygenaceae to taxa with elongate, ellipsoidal, fusiform, or cylindrical ascospores. Currah included the genera *Myxotrichum* Kunze, *Pseudogymnoascus* Raillo, and *Byssoascus* v. Arx, characterized by ellipsoidal or fusiform ascospores in a new family Myxotrichaceae. All species of these genera have

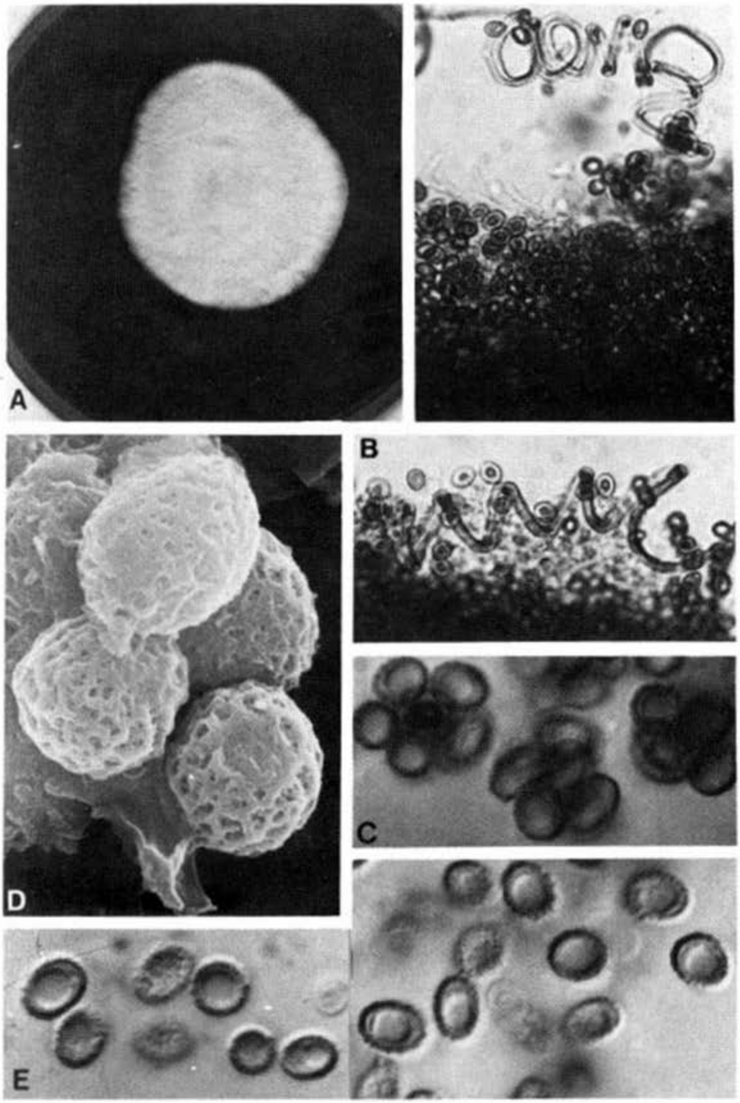

Fig. 2. *Brunneospora reticulata*. — A. Colonial morphology of the anamorph after 14 days on PYE, × 0.9. — B. Coiled appendages of the ascomata, × 512. — C. Asci, × 1600. — D. Ascospores (scanning electron micrograph), × 6000. — E. Ascospores (interference contrast optics), × 1600.

hyaline or pale, smooth, striate or longitudinally furrowed ascospores. Another genus with elongate, often slightly inequilateral, hyaline ascospores is *Renispora* Sigler & Carmichael. Currah classified this genus in the Onygenaceae, because the ascospores of its type are finely pitted when studied with SEM and because it is keratinophilic.

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The authors thank Dr. C. Ramirez for reading the manuscript and correcting the Latin descriptions and Dr. J. A. von Arx for his many helpful suggestions during the visit of one of us (J. G.) to the CBS and his critical reviewing of the manuscript.

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PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 3, pp. 391–395 (1987)

BOOKS RECEIVED BY THE RIJKSHERBARIUM LIBRARY

R. Agerer (Editor). *Colour Atlas of ectomycorrhizae with glossary*. (Einhorn-Verlag, Schwäbisch Gmünd, B. R. D. 1987.) Pp. 18, including 10 Col. Pls., 20 pages of black-and-white photographs. Price: DM 29.80 (atlas with 10 Pls.), DM 5.- (binder for 50 Pls.).

This is the first delivery of what is meant to become a long series of coloured and black-and-white photographs of ectomycorrhizae, arranged according to fungal species. Of each species a plate with four high-quality colour photographs of the mycorrhizae at different magnifications are provided together with an additional series of half-tone photographs showing important characters, such as details of structures, mantle, and rhizomorphs, both in surface views and in sections.

The colour of the mycorrhizae is considered to be of prime importance for the identification of a species. A key and synoptic tables are included for determination of the mycorrhizae shown. Each year 10–15 plates will be delivered as part of a loose-leaf system. Finally this will contain 200–300 species.

J. A. von Arx. *Plant pathogenic fungi*. (Beihefte Nova Hedwigia 87, Cramer, Berlin & Stuttgart. 1987.) Pp. 288, 105 Text-figs. Price: DM 120.-.

This book is based on an unpublished English translation of 'Pilzkunde' (von Arx, 1967) and some data from 'Mykologie' (Müller & Loeffler, 1982). It includes a taxonomic treatise on the fungi with special emphasis on those groups which cause diseases of cultivated plants and of forest trees. Also fungi causing decay of wood, fruits, or food are included. Revised keys for the identification of genera are provided. In a few cases, keys to the species are also included. The contents of the book has been fully rearranged and brought up-to-date with new insights in the taxonomy of the fungi.

G. Chevassut. *Catalogue écologique des champignons supérieurs méditerranéens. Fasc. I: Amanitacées*. (École Nationale Supérieure Agronomique, Montpellier. 1985.) Pp. 44, 2 Text-figs. Price: Fr. 10.-.

The first part of a series of six publications on the ecology of agarics in the French Mediterranean region. Mycologists of Roussillon, Languedoc, Provence, and Côte d'Azur have cooperated to bring together ecological information on 38 species of *Amanita* and *Limacella*, many of which are very rare. In the introduction the special characters of the French Mediterranean climate, phanerogamic vegetation, and soils with respect to the mushroom habitat are given.

E.J.H. Corner. *Ad Polyporaceae IV. The genera Daedalea, Flabellophora, Flavodon, Gloeophyllum, Heteroporus, Irpex, Lenzites, Microphorellus, Nigrofomes, Nigroporus, Oxyporus, Paratrichaptum, Rigidoporus, Scemidium, Trichaptum, and Steccherinum*. (Beihefte Nova Hedwigia 86, Cramer, Berlin & Stuttgart. 1987.) Pp. 265, 35 Text-figs., 8 Col. Pls., 3 black-and-white Pls. Price: DM 190.-.

This is the fourth in a series of taxonomic notes on generic and family classification of polypores. The choice of the sixteen genera assembled in this delivery is made rather arbitrarily. There are discussions on structure, taxonomy, and nomenclature. Most species treated are tropical and based for the major part on the collections made by the author in southeast Asia, the Solomon Islands, and Brazil. Full descriptions of genera and species are given. The descriptions and the illustrations are based on notes on the living fungi as well as on dried specimens and alcohol-formalin material. Indented keys for determination of genera and species are provided. Altogether 56 new species and one new genus are described.

H. Dörfelt & C. Müller-Uri. *Geastrales – Bibliographie. 3 Hefte. Terrestrische Ökologie Sonderheft 6*. (Universitäts- und Landesbibliothek Sachsen-Anhalt, Halle, D.D.R. 1986.) Pp. 254. Price not known.

The aim of the bibliography is a quick reference to information published on systematics, ecology, anatomy, morphology, and geography of the group of fungi concerned. It should help beginning students in the Geastrales. About 1000 publications are included.

A. Einhellinger. *Die Gattung Russula in Bayern*. (Bibliotheca mycologica 98, J. Cramer in der Gebrüder Borntraeger Verlagsbuchhandlung, Berlin-Stuttgart. 1987.) Pp. 311, including 32 pp. of Col. Pls. Price: DM 44.-.

This is a re-edition of this important book on *Russula* first published in Hoppea 43, 1985 (see Persoonia 13: 134). Text and plates seem to be unaltered except that the brilliant water colours of H. Marxmuller illustrating 42 species and varieties are printed now on both sides of the leaves, which does them no harm, but resulted in changed page numbers of the appendices and the key to *Russula* by Bresinsky following the plates. One page of errata and complimentary observations has been added.

H. Kreisel (Editor). *Pilzflora der Deutschen Demokratischen Republik. Basidiomycetes (Gallert-, Hut- und Bauchpilze)*. (VEB Gustav Fischer Verlag, Jena. 1987). Pp. 281. Price: DM 62.-.

The main part of this mycoflora consists of a list of 2577 species in 390 genera of Basidiomycetes s.str. recorded from the Democratic Republic of Germany. Fourteen authors cooperated in this volume. Each one is responsible for a number of genera. Records from literature were checked and many collections in state and private herbaria were revised. The information for each species consists of the correct scientific name according to the Sydney-Code, the German name, important synonyms, illustrations in literature, and notes on habitat, frequency, and distribution within the D. R. G.

P. Konrad & A. Maublanc. *Icones selectae Fungorum. Vol. IV and V*. (Reprint edition. Libreria editrice Giovanna Biella, Saronno (It.). 1986-1987.) Together 201 Col. Pls. and accompanying text-pages. Price: Lire 110.000 each volume.

With the appearance of the fourth and fifth volume of this important mycological iconography all 500 coloured plates have been reproduced. As stated before (Persoonia 13: 134, 231), the plates of this new edition are of a high standard, with only occasionally slight differences in tinges. Even colours that, according to remarks by Konrad & Maublanc, were not correct in the original edition, are corrected accordingly in the reprint edition.

H. E. Laux. *Unsere besten Speisepilze. Erkennen, Sammeln, Zubereiten*. (Wissenschaftliche Verlagsgesellschaft, Stuttgart. 1987.) Pp. 103, 66 Col. Pls. Price: DM 28.-.

This is an introductory guide for mushroom hunters. Thirty-five of the most common edible species are described and illustrated with colour photographs. For each species hints are given on collecting and preparation for the kitchen. Cases where poisonous mushrooms could eventually be mistaken for edible ones are mentioned and illustrated. There is an appendix with new recipes by Mrs. H. Laux.

M. McKenny & D. E. Stuntz. *The new savory wild mushroom*. (University of Washington Press, Seattle. 1987.) Pp. xiii + 249, 200 Col. Pls. Price: $ 12.50 (paperback), $ 25.- (clothbound).

This is the third edition of 'The savory wild mushroom' by McKenny & Stuntz. It has been completely revised by J. F. Ammirati under a slightly changed title. Fine colour photographs are included for all of the 200 edible or poisonous species of mushroom described. Although this guide contains many species with a wide distribution, it primarily covers the region of the Pacific Northwest of the United States. There are two additional chapters, on mushroom poisons (by V. E. Tyler) and on preparing mushrooms for the kitchen (by A. M. Pellegrini).

E. Michael, B. Hennig & H. Kreisel. *Handbuch für Pilzfreunde. Band 3. Blätterpilze-Hellblätter und Leistlinge. 4. Aufl.* (Gustav Fischer Verlag, Stuttgart & New York. 1987.) Pp. 484, 23 Text-figs, 147 Col. Pls. Price: DM 58.-.

The fourth edition of volume 3 of this handbook contains the families of agarics with pale gills and the Cantharellaceae. The information on taxonomy, ecology, and toxicology have been brought up-to-date. The nomenclature is now in accordance with the 'Rules' of the Sydney-Code. Most chapters of the general part have been thoroughly revised. In the systematic part many keys have been improved as a result of recent taxonomic revisions. More references to modern literature are given. In the special part all plates are now printed by colour offset. Several plates have been replaced and 49 new plates by E. W. Ricek and B. Decker are added.

M. Moser & W. Jülich. *Farbatlas der Basidiomyceten. Colour Atlas of Basidiomycetes.* (Gustav Fischer Verlag, Stuttgart & New York.) Lief. 3 (1986): Pp. vi + 24, 76 Pls. with 159 coloured figs. Price: DM 98.-. — Lief. 4 (1987): Pp. vi + 22, 74 Pls. with 163 coloured figs., including a loose-leaf binder. Price: DM 110.-.

The third and fourth issue of a loose-leaf colour atlas of which the initial double issue appeared in 1985 (see Persoonia 13: 135). Most plates are of reasonable to good quality, revealing relevant taxonomic characters. The plates of the agarics show two coloured figures of different, but related species, while the plates of the aphyllophorales usually show different aspects of the same species.

The value of the work as a reference and complement to the two volumes of the 'Kleine Kryptogamenflora' II b/1, and II b/2 will certainly increase on further completion.

S. T. Moss (Editor). *The biology of marine fungi*. (Cambridge University Press, Cambridge. 1986.) Pp. xii + 382, 30 Text-figs. Price: £ 27.50.

A collection of 30 papers presented at the Fourth International Symposium on Marine Mycology, held at Portsmouth, U. K., in August 1985. The four main themes of the contributions are ecology, taxonomy, physiology, and biotechnology of marine fungi. Each author gives a survey of his specialized field of research with emphasis on recent developments and provides a comprehensive and up-to-date list of references.

P. D. Orton. *Pluteaceae: Pluteus & Volvariella*. (British Fungus Flora part 4, Royal Botanic Garden, Edinburgh. 1986.) Pp. 99, including 8 pp. of line-drawings. Price: £ 8.-.

In this fourth part of the British Fungus Flora Orton supplies keys to and full descriptions of the 43 species of *Pluteus* and 21 species of *Volvariella* of which the occurrence on the British Isles has been established by him. In addition five extralimital species of *Pluteus* are treated in the key. The general features of the three sections recognized in *Pluteus* and of *Volvariella* are illustrated and in addition (mainly microscopical) characters of 21 species of *Pluteus* and two species of *Volvariella*. Near the end of the book are added an ecological list of the species and indices to synonyms and misidentifications, to rejected names, and to epithets mentioned in the observations. In an appendix Watling gives a list of references to literature on cultivation, genetics, chemistry, development, and general aspects of the family.

C. H. Peck. *Annual reports of the state botanist 1868–1912. Vol. 3 (1891–1899).* (Reprint edition. Boerhaave Press, P.O. Box 1051, 2302 BB Leiden. 1987.) Pp. 720, including 68 black-and-white plates. Price: Dfl. 220.-.

The third volume of the reprint edition of Peck's 45 annual reports of the State Botanist of New York. The whole series contains the descriptions, and often also the illustrations, of about 2500 new species of North American fungi. The work is now scheduled to be published in six volumes. The first five with approximately 3400 pages of text and 206 plates in black-and-white, the sixth with a full index of Latin names.

D. N. Pegler. *Agaric flora of Sri Lanka*. (Kew Bulletin Additional Series XII, HMSO, London. 1986). Pp. 519, 1 Map, 104 Text-figs. Price: £ 27.-.

Through the studies by Rev. M. J. Berkeley and subsequently by T. Petch and a few others the mycoflora of the island of Sri Lanka is probably one of the best explored in southeast Asia. Many of the names for agaricoid fungi have hitherto been used with little criticism. This new agaric flora of Sri Lanka is based on the study of types, other authentic material, original water-colour drawings, and additionally collected specimens. All material is deposited in the Kew Herbarium.

This mycoflora comprises 335 species of agarics within 94 genera and 21 families. There are indented keys for the determination of all orders, families, genera, and species treated. Each species is fully described and illustrated in black-and-white line drawings showing both the macroscopic and the microscopic characters. Although the author described only a single species as new, four new names and 70 new combinations are proposed. There are valuable appendices with lists of agaric collections (mostly types) made by G. Gardner and G. H. K. Twaites from Sri Lanka with their recent redetermination.

A work indispensable for the study of tropical agarics.

T. Wieland. *Peptides of poisonous Amanita mushrooms*. (Springer Verlag, Berlin. 1986.) Pp. xiv + 256, 78 Text-figs., 1 Col. Pl. Price: DM 198.-.

This is a monograph on molecular biology, especially elucidating the analytical, structural, and synthetic chemistry of the toxic componentes (like amatoxins, phallotoxins, and virotoxins) of *Amanita* mushrooms and many of their structurally related non-toxic analogues (e.g. antamanide and other cycloamanides). All current knowledge on these components and their use in natural science is brought together in a concise form. An up-to-date list of references on the subject covers 35 pages.

The book is recommended for reading by biochemists, pharmacologists, medical scientists, and mycologists interested in toxicology.