PERSOONIA

A MYCOLOGICAL JOURNAL

VOLUME 13

1986–1988

Published by the
RIJKSHERBARIUM
LEIDEN, THE NETHERLANDS

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

NOTES AND BRIEF ARTICLES

Dates of publication:

Part 1, pp. 1–136, 30 June 1986
Part 2, pp. 137–232, 16 Dec. 1986
Part 3, pp. 233–396, 27 Oct. 1987
Part 4, pp. 397–520, 21 July 1988

PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 1, pp. 1–26 (1986)

THE GENUS FLAMMULASTER (AGARICALES) IN THE NETHERLANDS AND ADJACENT REGIONS

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A key to the species and varieties of *Flammulaster* growing in the Netherlands and adjacent regions is given; each taxon is provided with a description and line drawings. *Flammulaster limulatus* var. *litus* is described as new. The following new combinations are made: *F. carpophilus* var. *rhombosporus, F. carpophilus* var. *subincarnatus, F. limulatus* var. *novasilvensis* and *Galerina harrisonii*. Problems concerning delimitation of the genus and its systematic position are briefly discussed.

The genus *Flammulaster* was first described by Earle (1909: 435) as a segregate of the genus *Naucoria* (Fr.) Kumm. to accommodate species with the following characters: basidiocarp putrescent; pileus convex, squamose or silky; lamellae adnexed to decurrent; stipe central, slender with cartilaginous cortex; veil subevanescent, not forming a distinct annulus; spores ferrugineous or cinnamon.

Unaware of Earle's genus, Kühner & Romagnesi (1953: 239) recognized the infrageneric taxon *Naucoria* subgen. *Floccularia* for more or less the same taxonomic group, but excluding the taxa belonging to their *Naucoria* subgen. *Tubaria*. Orton (1960: 168) accepted the autonomy of this group, but preferred to recognize it as a separate genus, which he called *Flocculina*, because of the already existing genus *Floccularia* Pouz.

The synonymy of *Flammulaster* and *Flocculina* was soon recognized and Watling (1967) transferred the majority of the European species, which had been keyed out by Orton (1960), to *Flammulaster*.

In its modern circumscription *Flammulaster* is characterized as follows:

- basidiocarps small, white to dark brown, with granular to flocculose, or squamulose pileus, and mostly with flocculose-fibrillose stipe.
- spore print pale ochraceous, rusty to dark brown.
- spores very pale brown or brown, smooth, thin-walled to thick-walled, without or with germ pore, very rarely with dextrinoid inner wall.
- cheilocystidia present.
- pleuro- and chrysocystidia absent.
- pileipellis dry, a cutis made up of globose to inflated elements in ascending chains, or a cutis made up of cylindrical hyphae with cystidioid terminal elements, with heavily incrusting, brown pigment.
- velum universale in adult stage innate to surface of pileus, made up of globse to inflated elements (Reijnders, 1963).

- velum partiale present, mostly very fugacious, rarely more or less persistent.
- clamp-connections present in all tissues.
- KOH-reaction on pileus dark brown.
- growing saprophytically on wood or on leaves, or terrestrially.

Flammulaster in this circumscription is fairly heterogeneous. The European representatives can be divided into two groups, viz. (i) a group characterized by pale ochraceous to brown, moderately to very thin-walled, fusoid to amygdaliform spores, often with a suprahilar depression, and a pileipellis made up of ellipsoid-oblong to globose elements in chains, and (ii) a group characterized by brown, thick-walled, ellipsoid to oblong, phaseoliform or rarely amygdaliform spores with or without germ pore, and by a pileipellis varying from a cutis made up of inflated elements to a cutis with chains of globose elements. The latter group is fairly heterogeneous in itself again on account of the variation both in the structure of the pileipellis and in the spores, especially the presence or absence of a germ pore.

Both the delimitation of the genus *Flammulaster* and the question to which family it belongs, are rather controversial. Having studied only the European representatives of this genus, I can provide only a limited contribution towards the solution of these problems, as in other parts of the world, e.g. in Australasia (Horak, 1980c) a great morphological diversity, differing from the diversity in the European taxa, can be found.

A close relationship between *Flammulaster* and *Phaeomarasmius* is generally admitted. The latter genus differs according to Singer (1975: 564) in possessing revivescent basidiocarps with the pileipellis being a cutis of elongated elements with heavily incrusting pigment, and somewhat longer spores, viz. 8–16 μm long (in *Flammulaster* 5–11 μm long). Singer considers these differences too insignificant to warrant generic status and therefore reduced *Flammulaster* to subgeneric status under *Phaeomarasmius*.

Horak (1980c: 174) in his work on *Flammulaster* and *Phaeomarasmius* in New Zealand mentioned spore shape as the main differentiating character, viz. limoniform or sublimoniform in *Flammulaster*, and subglobose, phaseoliform or amygdaliform in *Phaeomarasmius*. However, these differences are only valid in a restricted area, as a species from Papua New Guinea combined limoniform spores (a character of *Flammulaster*) with a pileipellis made up of elongated elements (a character of *Phaeomarasmius*) (Horak, 1980b: 176). Application of Horak's criterion to the European species would make *Flammulaster* homogeneous, viz. comprising only the first of the two groups as mentioned above, but would simultaneously make *Phaeomarasmius* extremely heterogeneous.

A critical revaluation of the generic limit between *Flammulaster* and *Phaeomarasmius* is urgently needed, but this should be preceded by a world-wide monograph of both genera. For the time being I consider it prudent to refrain from a new generic arrangement and therefore Singer (1975) is followed as to the circumscription of *Flammulaster* and *Phaeomarasmius*, but these taxa are recognized here on generic instead of subgeneric level.

The group of *F. limulatus* shows resemblances to the group of *Pholiota lucifera* as well as to the group of *Inocybe dulcamara*. It is not impossible that *F. limulatus* and *F. muricatus* contain styrylpyrones, as both species are vividly yellow-brown coloured, as do several wood-inhabiting species of the genera *Pholiota* and *Gymnopilus*. In *Pholiota lucifera* the pileipellis is, in contrast with the pileipellis of *Flammulaster*-species, a slightly gelatinized cutis of cylindrical hyphae with incrusting pigment.

Romagnesi (in Kühner & Romagnesi, 1953: 244) suggested a relationship of *F. limulatus* and *F. muricatus* with the group of *Pholiota tuberculosa-curvipes*, but Kühner (in Kühner & Romagnesi, 1953: 244) suggested affinities with the group of *Inocybe dulcamara*, a possibility also considered by Kuyper (1986). The latter group differs in the presence of a well-developed cortina, the colour of the spore print, viz. clay brown to snuff brown, spores without a germ pore and the mycorrhizal mode of life. It is difficult, however, to interpret such resemblances as support for (phylogenetic) relationships, as the similarities relate predominantly to presumably primitive characters.

The group of species with a pileipellis with cystidioid terminal elements shows a strong resemblance to some species of *Simocybe* (Horak 1980a, c, d). Species of the latter genus, however, usually possess non-limoniform spores and are characterized by olivaceous pigments in pileus and/or lamellae. These characters suffice for generic separation in Europe, but it has to be admitted that some Australasian species cannot be classified unequivocally.

Another genus that shows resemblances to certain species of *Flammulaster* is the genus *Tubaria*. The pileipellis of *Tubaria* is a cutis made up of repent cylindrical hyphae, but in *T. confragosa* the hyphae of the pileipellis are inflated and minutely incrusted. This species has also been placed in *Phaeomarasmius*, but in spore characters and in shape and implantation of the cheilocystidia it strongly resembles *T. furfuracea*, the type species of the genus (Kühner, 1969; Harmaja, 1978).

It is remarkable that variation in thickness of the spore-wall and hence in spore-colour in *Flammulaster* is parallelled by that in *Tubaria*.

Representatives of European taxa of the above mentioned groups and genera with resemblances to *Flammulaster* show all the same dark brown KOH-reaction on the pileus.

The question to which family *Flammulaster* belongs is likewise rather diversely answered. Evaluation of the different answers to this question is seriously hampered because present-day mycologists do not agree on the circumscription of the families. Bas (in Bas & al., 1986) evaluates the family concepts by Singer (1975) and Kühner (1980) and suggests that the differences in family concept are primarily caused by different evolutionary assumptions. He, therefore, advocates a strictly phenetic approach for the time being. Both this basic taxonomic philosophy and his resultant conclusion that *Flammulaster* is best regarded a member of the Cortinariaceae are accepted here.

As, for the time being, the delimitation of the genus *Flammulaster* is not quite clear, and in view of the well-defined European taxa, this seems to support Voous' statement (1970: 3) that genera can be described and given a name, but genera cannot be discovered as they do not exist, in contrast to species which do exist in nature as real entities.

In this paper a key to the species of *Flammulaster* in north-western Europe is given, and the species are described and illustrated. Much attention is given to the species concept in two groups of taxa, viz. the group around *F. carpophilus* and the group of *F. limulatus*. As the species belonging to this genus are generally easily overlooked because of the small size of the basidiocarps, it is not surprising that owing to the unknown variability of the taxa concerned too many have been distinguished.

All collections studied are conserved; if no herbarium is mentioned the concerning collection is deposited in the personal herbarium of the collector.

The magnification of the microscopical figures is as follows: spores × 1500, basidia and cystidia × 1000, elements of the pileipellis × 500.

Flammulaster Earle

Flammulaster Earle in Bull. N.Y. Bot. Gdn 5: 435. 1909. — Holotype: *Agaricus carpophilus* Fr.

Flocculina P. D. Orton in Trans. Br. mycol. Soc. 43: 168. 1960. — Holotype: *Naucoria granulosa* J. Lange.

Naucoria subgen. *Floccularia* Kühn. & Romagn., Fl. anal. Champ. sup.: 239. 1953 (not valid, no Latin diagn.).

KEY TO THE SPECIES

1. Spores very pale coloured and thin-walled; pileus pale ochraceous, pale pinkish or pale pinkish brown, rarely orange-brown.
   2. Spores (5.0–)5.5–6.5(–7.0) × 3.0–3.5(–4.0) μm; cheilocystidia 17–30 μm long, cylindrical; terrestrial . . . . 4. *F. speireoides*
   2. Spores (6.0–)6.5–10.5(–11.5) × (3.5–)4.0–5.5(–6.0) μm; cheilocystidia longer than 25 μm, cylindrical or narrowly lageniform; on plant debris, very rarely terrestrial . 3. *F. carpophilus*
1. Spores distinctly brown, moderately to strongly thick-walled; pileus orange-brown, rusty brown, golden-brown, etc.
   3. Cheilocystidia from non-pedunculate and utriform to pedunculate and narrowly utriform, never (sub)capitate; inner spore wall dextrinoid . . . . 7. *F. wieslandri*
   3. Cheilocystidia cylindrical or pedunculate and narrowly lageniform, sometimes subcapitate; spore wall not dextrinoid.
      4. Spores fusiform-ellipsoid, without germ pore, moderately thick-walled.
         5. Elements of pileipellis mostly globose to subglobose; spores (7.5–)8.0–9.5(–10.5) × 4.0–5.5 μm; cheilocystidia narrowly lageniform to cylindrical, not subcapitate 1. *F. granulosus*
         5. Elements of pileipellis ellipsoid to oblong; spores 6.5–8.5(–9.0) × 4–5.0(–5.5) μm; cheilocystidia narrowly lageniform and subcapitate . . . . 2. *F. ferrugineus*
      4. Spores phaseoliform, ellipsoid or amygdaliform, distinctly thick-walled, often, but not in all species, with distinct germ pore.
         6. Spores 8.5–10.5(–11.0) × 5.0–6.0 μm; cheilocystidia lageniform and subcapitate 8. *F.* species
         6. Spores up to 9 μm long; cheilocystidia cylindrical, broadly cylindrical, or narrowly lageniform, sometimes subcapitate.
            7. Spores ellipsoid and without germ pore; cheilocystidia lageniform . . . 9. *F. gracilis*
            7. Spores phaseoliform, amygdaliform with or without acute apex, or ellipsoid, mostly with distinct germ pore; cheilocystidia cylindrical and then often subcapitate to subclavate.
               8. Pileipellis with squamules made up of globose to ellipsoid elements 6. *F. muricatus*
               8. Pileipellis with squamules made up of cylindrical hyphae with some globose elements . . . . 5. *F. limulatus*

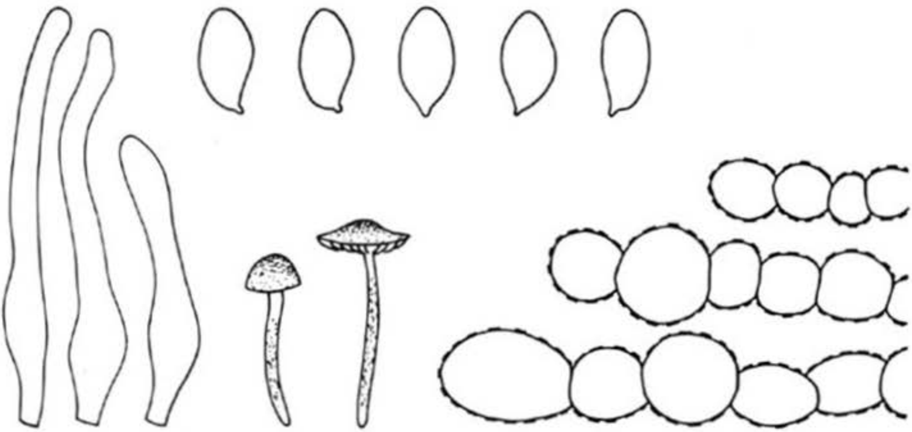


Fig. 1. *Flammulaster granulosus*. — Habit (× 1), spores, cheilocystidia and elements of pileipellis (from *Vellinga 697*).

1. **Flammulaster granulosus** (J. Lange) Watl. — Fig. 1

Naucoria granulosa J. Lange, Fl. agar. dan. 4: 20. 1939 (no Latin diagn.); ex J. Lange, Fl. agar. dan. 5: VI. 1940. — *Phaeomarasmius granulosus* (J. Lange) Sing. in Lilloa 22: 577 ('1949') 1951. — *Flocculina granulosa* (J. Lange) P. D. Orton in Trans. Br. mycol. Soc. 43: 175. 1960. — *Flammulaster granulosus* (J. Lange) Watl. in Notes R. bot. Gdn Edinb. 28: 66. 1967 (as *F. granulosa*).

Selected descriptions & illustrations. — Enderle in Z. Mykol. 51: 16–17. 1985; Gröger in Mykol. Mitt. Blatt 25: 18. 1981; Kühner in Kühn. & Romagn. in Bull. Soc. Nat. Oyonnax 10–11: 27–28. 1957; J. Lange, Fl. agar. dan. 4: pl. 124C. 1939.

Pileus (3–)5–25 mm, when young hemispherical, expanding to undulately plano-convex with broad umbo, or applanate, when young dark brown (Munsell 7.5 YR 3/4), later in centre dark brown, dark reddish brown and slightly paler at margin (Munsell 7.5 YR 4/6–6/6), when dry pale brown (K. & W. 5C4), when young completely dark granulose, later distinctly granulose in centre only, more granulose-fibrillose towards margin, when young with velar remnants at margin. Lamellae (L = 15–28, l = 1–5), moderately distant, emarginate, with or without decurrent tooth, ventricose or not, up to 2.5 mm broad, when young pale brown (Munsell 10 YR 7/6), later brown to orange tinged brown (Munsell 7.5 YR 5/6), with irregular white flocculose edge (lens). Stipe 13–40 × 0.2–3.5 mm, cylindrical or slightly broadened at apex, fistulose, pale brown at apex (Munsell 10 YR 7/6), brown or dark brown in lower part (Munsell 7.5 YR 4/6), at apex finely pubescent (lens), in lower 2/3 or 3/4 loosely fibrillose-floccose. Context concolorous with surface in all parts. Smell indistinct, fungoid, slightly resembling the smell of *Pelargonium*. Taste indistinct, mild.

Spores in side view (7.5–)8.0–9.5(– 10.5) × 4.0–5.5 µm, Q = (1.45–)1.6–1.9(–2.2), $\bar{Q}$ = 1.65–2.0, fusiform-amygdaliform with suprahilar depression and confluent hilar appendage, in frontal view (4.0–)4.5–5.5 µm broad, Q = (1.4–)1.5–1.85(–2.0), $\bar{Q}$ = 1.6–1.9, slightly fusiform to oblong, without germ pore, brown, moderately thick-walled. Basidia 22– 40 × 6–8 µm, 4-spored, also some 2-spored. Cheilocystidia

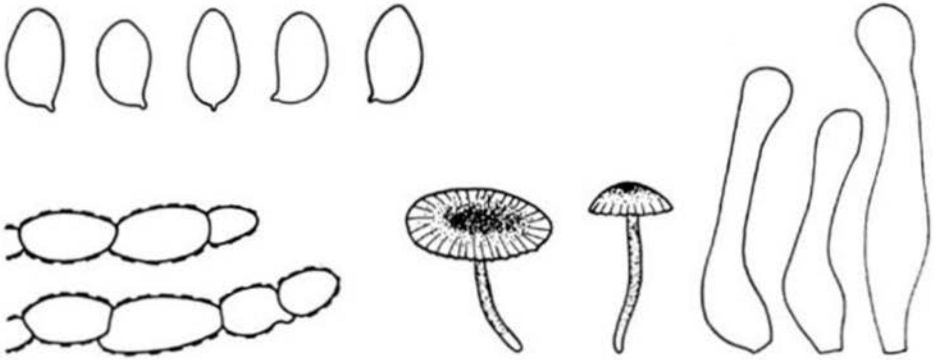


Fig. 2. *Flammulaster ferrugineus*. — Habit (= 1), spores, cheilocystidia and elements of pileipellis (from *Schreurs 763*).

25–75 × 3–9 µm, narrowly lageniform to narrowly cylindrical, irregularly flexuose in apical part, colourless, thin-walled. Pileipellis made up of chains of mostly globose to oblong, 10–30 µm wide elements with thickened wall and heavily incrusting brown pigment. Stipitipellis a cutis, at apex with caulocystidia similar to cheilocystidia, in lower part with loosely arranged cylindrical hyphae with rather short elements, thick-walled, with incrusting brown pigment.

Habitat & distribution. — Gregarious, terrestrial on rather rich loamy to clayey soils in deciduous forests, not common, widespread in Europe. Sept.–Dec.

Collections examined. — NETHERLANDS: prov. Noord-Holland: Amsterdam, Amsterdamse Bos, 26 Dec. 1959, *E. Kits van Waveren* (L); ibidem, 8 Nov. 1983, *C. B. Uljé* (coll. E. C. Vellinga 579) (L); prov. Zuid-Holland, Ridderkerk, 'Huys ten Donk', 13 Oct. 1978, *F. Tjallingii & G. J. M. G. Tjallingii-Beukers*; prov. Zeeland, Zeeuws Vlaanderen, Groede, 't Vlaamsche Duyn, 19 Nov. 1982, *A. de Meijer 679* (L); prov. Limburg, Wijlre, along Geul, 28 Oct. 1979, *E. J. M. Arnolds* (WBS). — DENMARK, Sjaelland, Praestø, Leestrup Skov, 17 Sept. 1985, *E. C. Vellinga 802 & 819* (L). — BELGIUM, prov. Limburg, Kanne, near Castle Caster, 17 Oct. 1984, *E. C. Vellinga 697* (L). — GERMAN FEDERAL REPUBLIC, Bayern, Bayreuth, Oct. 1978, *W. Bayer 720* (L).

2. **Flammulaster ferrugineus** (Maire) Watl. — Fig. 2

Naucoria ferruginea Maire in Kühn. & Romagn. in Bull. Soc. Nat. Oyonnax 10–11: 5. 1957. — *Flocculina ferruginea* (Maire) P. D. Orton in Trans. Br. mycol. Soc. 43: 175. 1960. — *Flammulaster ferrugineus* (Maire) Watl. in Notes R. bot. Gdn Edinb. 28: 66. 1967 (as *F. ferruginea*).

Misapplied name. — *Naucoria siparia* sensu J. Lange, Fl. agar. dan. 4: 19. 1939; sensu Romagn. in Kühn. & Romagn., Fl. anal. Champ. sup.: 241. 1953.

Selected descriptions & illustrations. — Kühner in Kühn. & Romagn. in Bull. Soc. Nat. Oyonnax 10–11: 12–14. 1957; J Lange, Fl. agar. dan. 4: pl. 124E. 1939 (as *N. siparia*).

Pileus 6–22 mm, at first hemispherical, convex or conico-convex, expanding to plano-convex or applanate with low broad umbo, hygrophanous, in moist condition dark rusty brown, paler towards margin (Munsell 5 YR 4/4 – 4/6), indistinctly translucently striate up to 1/2 of radius, on drying pallescent to yellowish orange-brown, with darker granulose squamules at centre, towards margin granulose-fibrillose or subglabrous. Lamellae (L = 15–25, l = 1–3) moderately distant, broadly adnate, slightly emarginate to subdecurrent with tooth, not or slightly ventricose, rusty red-brown (Munsell 5 YR 4/6), with concolorous or whitish, even or flocculose edge (lens). Stipe 10–20 × 0.7–2 mm, cylindrical or slightly broadened at base, fistulose, more or less concolorous with pileus, but paler at apex, whitish finely pubescent at apex, brown ochraceous fibrillose-lanate in lower 3/4 part. Context concolorous with surface, in pileus pallescent to cream on drying. Smell indistinct, slightly unpleasant when bruised. Taste indistinct, acidulous-astringent.

Spores in side view 6.5–8.5(–9.0) × 4.0–5.0(–5.5) µm, Q = (1.45–)1.5–1.95(–2.15), $\bar{Q}$ = 1.6–1.85, subfusiform to oblong, some with suprahilar depression, with confluent hilar appendage, in frontal view 4.0–5.5(–6.5) µm broad, Q = (1.35–)1.5–1.85 (–2.1), $\bar{Q}$ = 1.6–1.85, oblong-fusiform, without germ pore, brown to pale brown, slightly thick-walled. Basidia 20–30 × 6–8 µm, 4-spored. Cheilocystidia crowded, 28–60 × 3–9 µm, narrowly lageniform, some cylindrical, subcapitate, at apex 4–10 µm wide, colourless and thin-walled. Pileipellis made up of chains of inflated elements 6–45 × 8–25 µm, thick-walled with brown incrusting pigment, with ellipsoid terminal elements. Stipitipellis a cutis with at apex caulocystidia, similar to cheilocystidia, lower down with loosely arranged hyphae made up of inflated elements with intracellular and incrusting brown pigment.

Habitat & distribution. — Gregarious, terrestrial on loamy, clayey, rather rich soils in deciduous forests; not common, widespread in Europe. June–Dec.

Collections examined. — NETHERLANDS: prov. Overijssel: Denekamp, Singraven, 14 Oct. 1961, *C. Bas 2484* (L) and *J. J. Barkman 7118* (WBS); Denekamp, Borg Bosch, 16 Oct. 1962, *E. Kits van Waveren* (L); prov. Noord-Brabant: Ginneken, Ulvenhoutse Bos, 8 June 1958, *P. B. Jansen* (L); Breda, Liesbos, Dec. 1953, *P. B. Jansen* (L); prov. Limburg: Swalmen, Hillenraadt, 7 Oct. 1962, *C. Bas 2849* (L) and *F. Benjaminsen 49*; Sint Geertruid, Riesenberg, 30 Oct. 1982, *J. Schreurs 763* (L). — DENMARK, Sjaelland, Praestø, Leestrup Skov, 17 Sept. 1985, *E. C. Vellinga 803* (L). — GREAT BRITAIN, Wales, Montgomery, Lake Vyrnwy, 11 Sept. 1962, *E. Kits van Waveren* (L). — BELGIUM, prov. Namur, Rochefort, 30 Sept. 1967, *P. B. Jansen.* — GERMAN FEDERAL REPUBLIC: Rheinland-Pfalz, Pelmer Wald, 15 Sept. 1970, *P. B. Jansen* (L); Nordrhein-Westfalen, München Gladbach, 27 Oct. 1985, 30 Oct. 1985, *M. & S. Meusers.*

3. **Flammulaster carpophilus** (Fr.) Earle — Fig. 3

Agaricus carpophilus Fr., Observ. mycol. 1: 45. 1815. — *Naucoria carpophila* (Fr.) Quél., in Mém. Soc. Emul. Montbéliard, sér. II, 5: 134. 1872. — *Galera carpophila* (Fr.) Quél., Fl. mycol. France: 81. 1888. — *Flammulaster carpophilus* (Fr.) Earle in Bull. N.Y. bot. Gdn 5: 435. 1909. — *Tubaria carpophila* (Fr.) Kühner, Genre Galera: 32. 1935. — *Phaeomarasmius carpophilus* (Fr.) Sing. in Sydowia 2: 37. 1948. — *Flocculina carpophila* (Fr.) P. D. Orton in Trans. Br. mycol. Soc. 43: 175. 1960.

Lepiota rhombospora Atk. in Proc. Am. phil. Soc. 57: 356. 1918. — *Armillaria rhombospora* (Atk.) C. H. Kauffm. in Pap. Mich. Acad. Sci. 4: 317. 1925. — *Cystoderma rhombosporum* (Atk.) A. H. Smith & Sing. in Pap. Mich. Acad. Sci. 30: 99 ('1944') 1945. — *Naucoria rhombospora* (Atk.) J. Favre in Mat. Fl. crypt. Suisse, X, 3: 144. 1948. — *Phaeomarasmius rhombospora* (Atk.) Mos. in Gams, Kl. Kryptog.-Fl. 2b/2, 2. Aufl.: 168. 1955 (not valid, basionym not mentioned). — *Flocculina rhombospora* (Atk.) P. D. Orton in Trans. Br. mycol. Soc. 43: 175. 1960. — *Flammulaster* *rhombosporus* (Atk.) Watl. in Notes R. bot. Gdn Edinb. 28: 67. 1967 (as *F. rhombospora*). — *Phaeomarasmius rhombosporus* (Atk.) Malloch & Redh. in Fungi canad. 142. 1979.

Naucoria carpophiloides Kühner in Kühn. & Romagn., Fl. anal. Champ. sup.: 241. 1953 (not valid, no Latin). — *Phaeomarasmius carpophiloides* (Kühner) Mos. in Gams, Kl. Kryptog.-Fl. 2b/2. 2. Aufl.: 169. 1955 (not valid). — *Naucoria carpophiloides* Kühner in Kühn. & Romagn. in Bull. Soc. Nat. Oyonnax 10–11: 5. 1957. — *Flocculina carpophiloides* (Kühner) P. D. Orton in Trans. Br. mycol. Soc. 43: 175. 1960. — *Flammulaster carpophiloides* (Kühner) Watl. in Notes R. bot. Gdn Edinb. 28: 65. 1967.

Naucoria subincarnata Joss. & Kühn. in Kühn. & Romagn., Fl. anal. Champ. sup.: 241. 1953 (nom. nud.). — *Naucoria subincarnata* Joss. & Kühn. in Kühn. & Romagn. in Bull. Soc. Nat. Oyonnax 10–11: 6. 1957. — *Flocculina subincarnata* (Joss. & Kühn.) P. D. Orton in Trans. Br. mycol. Soc. 43: 176. 1960. — *Flammulaster subincarnatus* (Joss. & Kühn.) Watl. in Notes R. bot. Gdn Edinb. 28: 67. 1967 (as *F. subincarnata*).

The group of small, pale-spored *Flammulaster* taxa that grow on leaves and other plant debris, has thusfar been divided in a rather large number of species. Besides morphological differences, such as colour of basidiocarps, spore shape, and shape of cheilocystidia, much attention has been given to ecological differences.

Revaluation of the morphological differences indicates that these differences are small, and that the various taxa differ from each other in only one character. These differences do not warrant the recognition of these taxa on specific level, but as these morphological differences concur with ecological specialization, it seems likely that incipient speciation occurs. For the time being, it seems better to give these taxa the rank of variety under *F. carpophilus*, except *F. carpophiloides*, which is considered to represent not more than a colour variant of var. *carpophilus* with a slightly different habitat. The various varieties can be considered as ecotypes of *F. carpophilus*.

However, occasionally specimens can be encountered that do not easily fit in the infraspecific classification proposed, e.g. a collection from the German Federal Republic (Sandebeck, 5 Oct. 1976, *C. Bas 7062* (L)) (variant 1) with flexuose cylindrical cheilocystidia and long spores: (8.0–)8.5–10.5(–11.5) × (4.0–)4.5–5.0(–5.5) µm, $\bar{Q}$ = 2.05; basidiocarps growing on bare soil.

Another collection (Belgium, Vencimont, 25 Sept. 1984, *P. B. Jansen 84–375*) (variant 2) shows a remarkable combination of characters: pileus pale ochre; spores 7.0–9.0(–9.5) × 5.0–6.0(–6.5) µm in side view, 5.0–5.5(–6.0) µm broad in frontal view, mostly with apical papilla; cheilocystidia 40–60 × 4–6 µm, cylindrical, slightly flexuose, not capitate and not or slightly inflated in lower part; growing on a path in deciduous forest. This collection represents an up to now undescribed taxon in this group.

The occurrence of this kind of variants makes it likely that speciation in this group is in full progress. Therefore the acceptance of one species with a number of varieties and variants seems the best way of presenting this complex in this stage of evolutionary development.

Three other taxa, viz. *F. saliciphilus* (J. Favre) Watl., *F. fusisporus* (P. D. Orton) Watl., and *F. microspilus* (Romagn.) Watl., seem also to belong to this species complex. Probably, these taxa deserve also the rank of variety, but they are rare and have not yet been recorded from the Netherlands. Since I have not seen any material of these taxa, I refrain from formally proposing the probably necessary new combinations.

KEY TO THE INFRASPECIFIC TAXA OF F. CARPOPHILUS

1. Spores with distinct papilla.
    2. Cheilocystidia distinctly lageniform . . . . var. *rhombosporus*
    2. Cheilocystidia cylindrical, slightly flexuose, some slightly inflated in lower part variant 2 (description see above)
1. Spores without papilla.
    3. Cheilocystidia lageniform . . . . var. *carpophilus*
    3. Cheilocystidia cylindrical.
        4. Cheilocystidia subcapitate; spores (6.5–)7.0–9.5(–10.0) µm long, $\bar{Q}$ = 1.45–1.7 var. *subincarnatus*
        4. Cheilocystidia not (sub)capitate; spores (8.0–)8.5–10.5(–11.5) µm, long, $\bar{Q}$ = 2.05 variant 1 (description see above)

Flammulaster carpophilus var. **carpophilus** — Fig. 3a, b

Excluded. — *Naucoria carpophila* sensu Romagn. in Rev. Mycol. 8(3,4): 31. 1943 (= *F. microspilus*).

Selected descriptions & illustrations. — Kühner in Kühn. & Romagn. in Bull. Soc. Nat. Oyonnax 10–11: 18–21 (as *N. carpophila*) and 23–24 (as *N. carpophiloides*). 1957; J. Lange, Fl. agar. dan. 4: pl. 124F, 124F$_1$. 1939; Mal. & Bert., Fl. Champ. sup. Maroc 1: 423–433. 1970; Moreno & Checa in An. Jard. bot. Madr. 40: 18–19. 1983 (as *F. carpophiloides*); Rick., Blätterpilze: 223. 1912; Romagn. in Kühn. & Romagn. in Bull. Soc. Nat. Oyonnax 10–11: 70–72. 1957 (as *N. carpophiloides*); Ryman & Holmåsen, Svampar: 463. 1984.

Pileus 2.5–15 mm, when young hemispherical, expanding to convex or plano-convex, slightly hygrophanous, (pinkish) ochraceous to pale pinkish brown (Munsell 7.5 YR 6/6, 7/6), cream coloured at margin, very rarely brown (7.5 YR 5/4–5/6), whitish granulose all over, rarely glabrous (after heavy rain fall). Lamellae (L = 10–20, l = 0–5), moderately distant to rather crowded, narrowly adnate, adnate, emarginate or slightly decurrent, up to 1.5 mm broad, pale pinkish brown to pale brown (10 YR 8/4–7.5 YR 5/6) with whitish, flocculose or concolorous, even edge. Stipe 8–40 × 1–2.5 mm, cylindrical or slightly broadening towards apex, solid, concolorous with pileus but white at apex, striate, white pruinose-flocculose at apex and glabrous to flocculose at lower half. Context concolorous with surface or slightly darker, especially in base of stipe. Smell indistinct, fungoid or like leaves of *Pelargonium*. Taste not recorded.

Spores in side view (6.0–)6.5–10.0(–10.5) × 4.0–5.5(–6.0) µm, Q = (1.3–)1.45–1.9(–2.1), $\bar{Q}$ = 1.4–1.8, amygdaliform with obtuse, rarely acute apex, to ellipsoid or oblong, in frontal view 4.5–6.5(–7.0) µm broad, Q = (1.45–)1.5–1.95(–2.0), $\bar{Q}$ = 1.55–1.8, more or less fusiform to ellipsoid or oblong, a very few with apical papilla, sometimes a few with apical germ tube, very pale coloured and thin-walled. Basidia 19–31 × 5–10 µm, 4- and 2-spored. Cheilocystidia 24–70 × 4–10 µm, narrowly lageniform with 1.5–4 µm wide, long, often flexuose and sometimes branched neck to cylindrical, thin-walled and colourless. Pileipellis made up of chains and clusters of spherical to ellipsoid or oblong elements, 15–60 × 12–40 µm, with pale brown incrusting pigment in patches. Caulocystidia in tufts at apex of stipe, similar to cheilocystidia.

Habitat & distribution. — Gregarious on debris of various trees, *Fagus*, *Quercus*, *Tilia*, *Salix repens*, etc. in deciduous woods in the inland or *Salix repens*-vegetation in coastal dunes. Not uncommon. May–Nov. (–Jan.).

Collections examined. — NETHERLANDS: prov. Groningen, Isle Rottumeroog, 26 Oct. 1977, *E. Arnolds 3933* (WBS); prov. Friesland: Isle Schiermonnikoog, Reddingweg, 21 Nov. 1976, *Th. W. Kuyper 502* (L); ditto, Kooiduinen, 17 Nov. 1984, *J. H. Ietswaart & E. C. Vellinga 727*; ditto, Groene Glop, 18 Nov. 1984, *J. H. Ietswaart & E. C. Vellinga 733* (L); Isle Terschelling, 16 July 1955, *P. B. Jansen* (L); ditto, Oosterend, 24 Oct. 1974, *M. E. Noordeloos* (L) and *F. Tjallingii & G. J. M.J. Tjallingii-Beukers*; prov. Drente, Roden, Mantinger Bos, 2 Nov. 1973, *P. IJpelaar 201* (WBS); prov. Gelderland, Eibergen, loampits near Zwilbroek, 21 Oct. 1985, *E. Arnolds* (WBS); prov. Noord-Holland: Castricum, Provinciale Waterleidingduinen, Watervlak, 2 Nov. 1984, *E. C. Vellinga 714* (L); Vogelenzang, Amsterdamse Waterleidingduinen, 20 Oct. 1973, *C. Bas 6223* (L); Zandvoort, Amsterdamse Waterleidingduinen, 1 Jan. 1985, *J. H. Ietswaart & E. C. Vellinga 744* (L); prov. Zuid-Holland; Oostvoorne, south of Jachtveld, 4 May 1969, *C. Bas 5120* (L); IJsselmeerpolders, Noordoostpolder, Urkerbos, 10 June 1982, *F. Tjallingii & G. J. M. G. Tjallingii-Beukers*. — GREAT BRITAIN, SCOTLAND, Perthshire, MacGregor's Leap, 27 Sept. 1983, *P. B. Jansen 83–212*. — DENMARK, Sjaelland, near Hareskov station, 28 June 1971, *H. Dissing* (C). — GERMAN FEDERAL REPUBLIC: Nordrhein Westfalen: Mönchen Gladbach, 10 May 1984, *M. & S. Meusers E 754*; Bayern: Burggailenreuth, 1 June 1984, *W. Bayer 554* (L); Weissenburg, Laubental, Rodenfels, 14 Sept. 1985, *G. Wölfel* (L).

As pointed out above, *F. carpophiloides* is considered only as a colour variant of *F. carpophilus*. In the Netherlands this variant is mostly confined to low *Salix repens*-vegetations in the coastal dunes. Since it is originally described from leaves etc. of various deciduous trees in France, and the only morphological difference with var. *carpophilus* s.s. is a slightly different colour, it is not given a special rank.

Typical var. *carpophilus* has not yet been recorded from the Netherlands. This variant differs ecologically from *F. carpophilus* var. *subincarnatus* in being confined to cupules and other debris of *Fagus* on calcareous soils (pers. comm. Wölfel, 1985), whereas var. *subincarnatus* prefers the same substratum on non-calcareous soils. Besides, var. *carpophilus* s.s. is recorded from Marocco, growing on leaves of *Quercus*.

The shape of the cheilocystidia, especially the length of the neck varies widely in var. *carpophilus*. Specimens from collections made late in the season possess very long and flexuose, often irregularly widened necks. It is likely that this phenomenon is caused by low temperatures as collections made earlier in the season possess more regular cystidia with shorter necks.

Flammulaster carpophilus var. **rhombosporus** (Atk.) Vellinga, *stat. & comb. nov.* — Fig. 3d

Lepiota rhombospora Atk. in Proc. Am. phil. Soc. 57: 356. 1918 (basionym).

Selected descriptions & illustrations. — J. Favre in Mat. Fl. crypt. Suisse X,3: 144–145, pl. 4 fig. 8. 1948; Malloch & Redh. in Fungi canad. 142. 1979; Watl. in Notes R. bot. Gdn Edinb. 28: 68–69. 1967.

Pileus 4.5–12 mm, conico-convex, pale ochraceous cream to pale orange-yellow, in centre brown punctate, granulose-pulverulent. Lamellae (L = 16, l = 1–3), moderately crowded, slightly adnate to slightly emarginate, subventricose, pale ochraceous fulvous with paler, even edge. Stipe 12–37 × 0.3–1.0 mm, slightly broadened towards base, solid, pale brownish ochre, silvery striate, at apex flocculose, towards base with adnate, brown fibrils or granulose. Context concolorous with surface. Smell and taste indistinct.

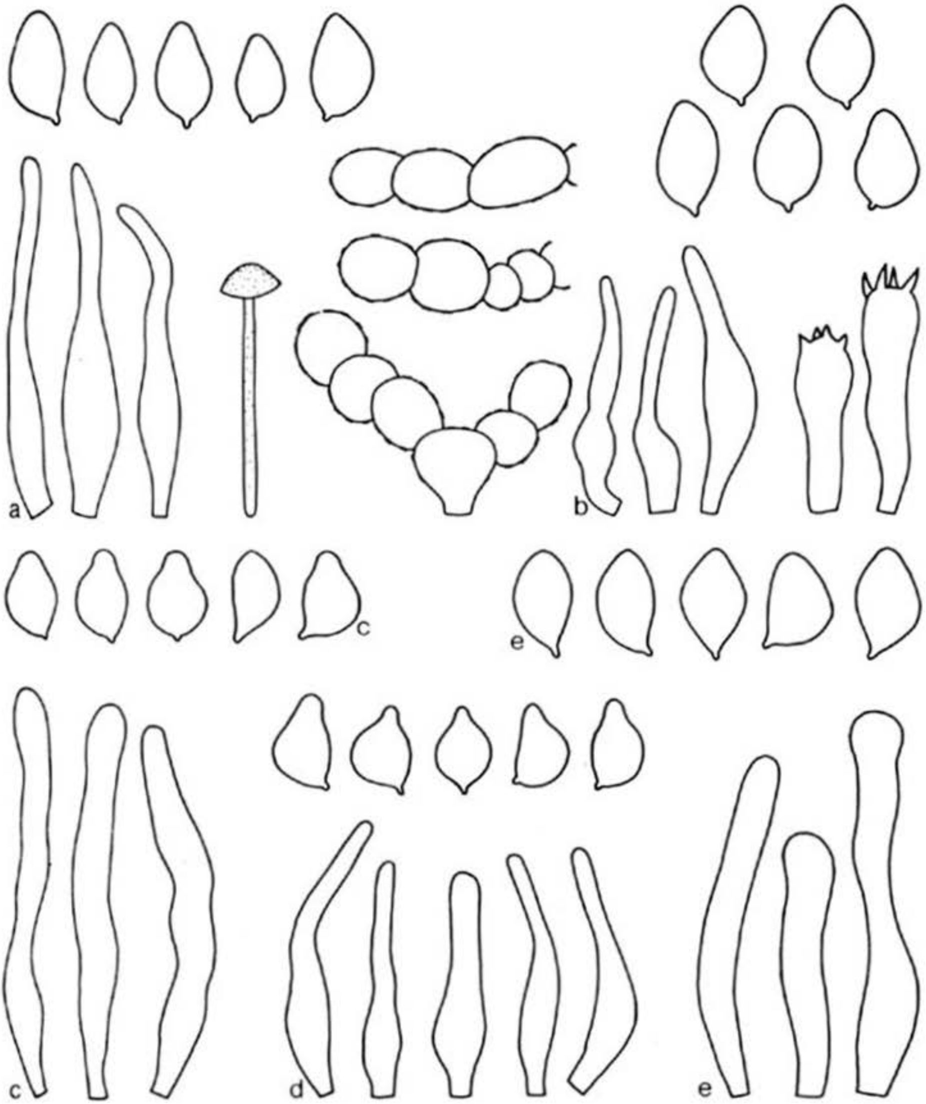


Fig. 3. *Flammulaster carpophilus*. — a, b. var. *carpophilus*, habit (× 1), spores, cheilocystidia, basidia, and elements of pileipellis. (a. from *Vellinga 733*, b. from *Bayer 558*.) — c. variant 2, spores, and cheilocystidia (from *Jansen 84–375*). — d. var. *rhombosporus*, spores and cheilocystidia (from *Kits van Waveren, 25 May 1958*). — e. var. *subincarnatus*, spores and cheilocystidia (from *Vellinga 709*).

Spores in side view (6.0–)6.5–7.5(–8.5) × (3.5–)4.0–4.5 µm, Q = (1.45–)1.5–1.9(– 2.15), $\bar{Q}$ = 1.65–1.7, amygdaliform, in frontal view 4.0–5.0(–5.5) µm broad, Q = (1.3–)1.35–1.75(–2.0), $\bar{Q}$ = 1.55–1.6, ellipsoid to oblong, with broad apical papilla, very pale and thin-walled. Basidia 14–22 × 5–7 µm, 4-spored. Cheilocystidia 27–41 × 4–7 µm, narrowly lageniform with 2–4 µm wide neck, some cylindrical, thin-walled and colourless. Pileipellis made up of chains and clusters of spherical to ellipsoid elements, 11– 30 × 9–17 µm, with pale brown incrusting pigment. Caulocystidia in clusters at apex of stipe, similar to cheilocystidia.

Habitat & distribution. — Solitary to gregarious on leaves of *Populus, Salix, Carex* etc., in rather damp places. Rare in the temperate parts of the Northern Hemisphere; in the Netherlands known from one locality. May–Sept.(–Jan.).

Collections examined. — NETHERLANDS, prov. Gelderland, Vorden, 25 May 1958, *E. Kits van Waveren* (L). —DENMARK, Sjaelland, near Gentofte Sø, 26 Aug. 1984, *E. Rald*.

The macroscopical data in the description are taken from the notes on the first collection mentioned and from the literature. The size of the spores of the Netherlands' collection agrees with that recorded by Malloch & Redhead (1978), whereas Favre (1948: 144) gives 7–9 × (3.5–)4–5(–5.5) µm.

Flammulaster carpophilus var. **subincarnatus** (Joss. & Kühn.) Vellinga, *stat. & comb. nov.* — Fig. 3e

Naucoria subincarnata Joss. & Kühn. in Kühn. & Romagn. in Bull. Soc. Nat. Oyonnax 10–11: 6. 1957 (basionym).

Misapplied name. — *Naucoria pygmaea* sensu Heim & Romagn. in Bull. trimest. Soc. mycol. Fr. 50: 173. 1934; sensu J. Favre in Mat. Fl. crypt. Suisse X, 3: 143. 1948.

Selected descriptions. — J. Favre in Mat. Fl. crypt. Suisse X, 3: 143–144. 1948 (as *N. pygmaea*); Heim & Romagn. in Bull. trimest. Soc. mycol. Fr. 50: 173. 1934 (as *N. pygmaea*); Kühner in Kühn. & Romagn. in Bull. Soc. Nat. Oyonnax 10–11: 21–23. 1957.

Pileus 3–7 mm, hemispherical, expanding to convex or plano-convex, with or without shallow depression, pale pinkish ochraceous to pale cream at margin (Munsell 7.5 YR 7/6–8/4), translucently striate, covered with minute granules. Lamellae (L = 8–13, l = 0–1), rather distant to distant, adnate, or slightly decurrent, up to 1 mm broad, concolorous with pileus, with concolorous even edge. Stipe 8–20 × 0.5–1 mm, cylindrical to slightly broadened towards base, solid, concolorous with or paler than pileus, striate, at apex white pubescent, irregularly white flocculose in lower part. Context concolorous with surface, in pileus hygrophanous and pallescent to white on drying. Smell indistinct, fungoid. Taste not known.

Spores in side view (6.5–)7.0–9.5(–10.0) × 4.5–5.5(–6.5) µm, Q = (1.3–)1.4–1.8(–1.85), $\bar{Q}$ = 1.45–1.7, amygdaliform to fusiform, in frontal view 5.0–6.0(–6.5) µm broad, Q = (1.3–)1.35–1.85, $\bar{Q}$ = 1.5–1.65, fusiform to oblong, pale and thin-walled. Basidia 16–28 × 5–8 µm, 4- and 2-spored. Cheilocystidia 26–55 × 4–8 µm, mostly cylindrical, some narrowly utriform, subcapitate, 5–9.5 µm wide at apex, thin-walled and colourless. Pileipellis made up of spherical to ellipsoid elements in chains, 15–50 × 12– 25 µm, with pale brown incrusting pigment in patches. Caulocystidia in tufts at apex of stipe, similar to cheilocystidia.

Habitat & distribution. — Solitary to gregarious on leaves, cupules and debris of *Fagus* in woods on poor sandy or humose sandy soils, rarely on more calcareous and loamy soils; rather common in north-west Europe. June–Oct.

Collections examined. — NETHERLANDS: prov. Friesland: Kollumer en Nieuw Kruisland, Veenklooster, 'Fogelsanghstate', 24 Oct. 1984, *E. C. Vellinga 709* (L); Opsterland, Duurswoude Bos, 22 Oct. 1984, *A. Becker* (coll. *E. C. Vellinga 705*) (L); prov. Overijssel: Delden, est. 'Twickel', 29 June 1958, *E. Kits van Waveren* (L); ditto, 20 Aug. 1977, *E. Arnolds 3853* (WBS); prov. Gelderland: Apeldoorn, 'Het Loo', 8 Oct. 1960, *J. J. Barkman 6859* (WBS) and *C. Bas 2263* (L); Staverden, 14 Aug. 1971, *C. Bas 5597* (L); Putten, 'Schovenhorst', 29 Aug. 1956, *W. J. Reynders* (L); Neerijnen, est. 'Neerijnen', 13 Aug. 1977, *C. M. den Held-Jager*; prov. Noord-Holland, Bloemendaal, 'Elswout', 5 Nov. 1976, *E. Kits van Waveren* (L). — GERMAN FEDERAL REPUBLIC, Schleswig-Holstein: Reinfeld, Fohlenkoppel, 23 Oct. 1983, *H. G. Unger*; Hamburg, 20 July 1984, *P. Steindl* (L). — SWITZERLAND, Kt. Luzern, Hutwill, 19 Sept. 1984, *P. B. Jansen 84–326*.

4. **Flammulaster speireoides** (Romagn.) Watl. — Fig. 4

Naucoria speireoides Romagn. in Kühn. & Romagn. in Bull. Soc. Nat. Oyonnax 10–11: 6. 1957. — *Flammulaster speireoides* (Romagn.) Watl. in Notes R. bot. Gdn Edinb. 28: 68. 1967.

Flocculina pusillima P. D. Orton in Trans. Br. mycol. Soc. 43: 236. 1960. — *Flammulaster pusillimus* (P. D. Orton) Watl. in Notes R. bot. Gdn Edinb. 28: 67. 1967 (as *Flammulaster pusillima*).

Selected descriptions. — Kühner in Kühn. & Romagn. in Bull. Soc. Nat. Oyonnax 10–11: 17–18. 1957; Romagn. in Kühn. & Romagn. in Bull. Soc. Nat. Oyonnax 10–11: 68–70. 1957.

Pileus 1.5–5.5 mm, hemispherical, when young with inflexed margin, dark orange-brown in centre, towards margin pale orange-brown (Munsell 7.5 YR 4/6–7/6), subgranulose to hairy (lens). Lamellae (L = 9–11, l = 1.5), rather distant, broadly adnate to slightly decurrent or slightly emarginate, cream to pale orange-brown (7.5 YR 7/6), with finely eroded, slightly paler edge. Stipe 8–13 × 0.2–0.5 mm, cylindrical or broadened at apex (up to 0.7 mm), solid, concolorous with pileus, or orange-brown in lower half to cream at apex, with short repent hairs all over, white tomentose at base. Context concolorous with surface. Smell fungoid when cut. Taste not known.

Spores in side view (5.0–)5.5–6.5(–7.0) × 3.0–3.5(–4.0) µm, Q = (1.55–)1.6–1.8(–2.1), $\bar{Q}$ = 1.75, subphaseoliform, slightly amygdaliform to oblong, in frontal view 3.0–3.5(–4.0) µm broad, Q = (1.55–)1.7–1.85(–1.9), $\bar{Q}$ = 1.8, oblong to fusiform, very pale, thin-walled. Basidia 16–20 × 4–5.5 µm, 4-, some 2-spored. Cheilocystidia 17–31 × 5–8 µm, cylindrical to subclavate, some subcapitate, slightly thick-walled and colourless. Pileipellis made up of repent and ascending chains of inflated, ellipsoid to sometimes spherical elements, 14–28 × 4–15 µm, with coarsely incrusting pale brown pigment (in patches).

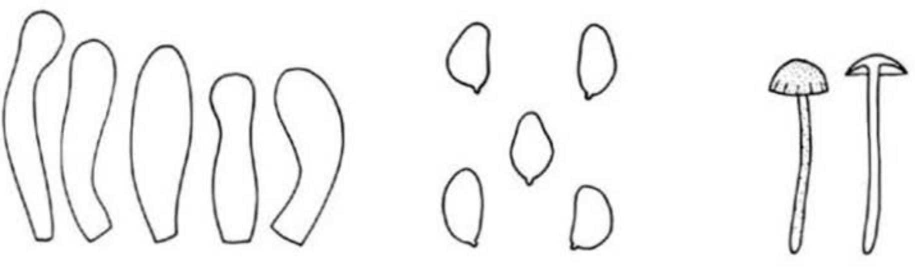


Fig. 4. *Flammulaster speireoides*. — Habit (× 2), spores and cheilocystidia (from *Vellinga 601*).

Habitat & distribution. — Subgregarious, terrestrial on clods of clay in deciduous forests, very rare in north-west Europe; in the Netherlands known from one locality. July–Sept.

Collections examined. — NETHERLANDS, prov. Zuid-Holland, Ridderkerk, 'Huys ten Donk', 28 July 1984, *C. Bas 8257* (L).

The description of the macroscopical features is based on the collection mentioned and data from literature.

Flammulaster speireoides differs from *F. carpophilus* in the darker colours of the basidiocarp, the size of cheilocystidia and spores, and the different habitat.

5. **Flammulaster limulatus** (Fr.) Watl. — Fig. 5

Agaricus limulatus Fr., Observ. mycol. 2: 28. 1818. — *Flammula limulata* (Fr.) P. Karst., Ryssl. Finl. Skand. Halföns Hattsvamp.: 410. 1879. — *Dryophila limulata* (Fr.) Quél., Enchir. Fung.: 72. 1886. — *Fulvidula limulata* (Fr.) Romagn. in Rev. Mycol. 2: 191. 1937 (not valid, generic name not valid). — *Flavidula limulata* (Fr.) Romagn. in Bull. trimest. Soc. mycol. Fr. 58: 89. 1942 (not valid, generic name not valid). — *Naucoria limulata* (Fr.) Kühn. & Romagn., Fl. anal. Champ. sup.: 242. 1953 (not valid, basionym not mentioned). — *Phaeomarasmius limulatus* (Fr.) Sing. in Schweiz. Z. Pilzk. 34: 62. 1956 (not valid, basionym not mentioned). — *Flocculina limulata* (Fr.) P. D. Orton in Trans. Br. mycol. Soc. 43: 175 1960. — *Flammulaster limulatus* (Fr.) Watl. in Notes R. bot. Gdn Edinb. 28: 66. 1967 (as *F. limulata*).

Flammulaster limulatoides P. D. Orton in Notes R. bot. Gdn Edinb. 41: 580. 1984.

Flammulaster novasilvensis P. D. Orton in Notes R. bot. Gdn Edinb. 41: 582. 1984.

Excluded. — *Flammulaster limulatus* sensu Cetto, Funghi Vero 4: pl. 1436. 1983 (= *F. muricatus*).

Recently Orton (1984) distinguished three species instead of one in the *F. limulatus* complex, viz. *F. limulatus, F. limulatoides* and *F. novasilvensis*. Unfortunately, he altered the concept of *F. limulatus*, changing the name of what was known in literature as *F. limulatus* into *F. limulatoides*. Consequently two questions have to be answered: (i) do these three taxa exist and which level do they deserve; (ii) is Orton's concept of *F. limulatus* correct?

The differential characters of the three taxa are the following:

Flammulaster limulatus – Stipe soon dark brown, at least in lower part; spores in side view amygdaliform, slightly phaseoliform or ellipsoid, without or with indistinct germ pore; cheilocystidia cylindrical and subcapitate.

Flammulaster limulatoides – Stipe yellow-brown, darker brown in lower part; spores phaseoliform in side view, with germ pore; cheilocystidia cylindrical or narrowly clavate.

Flammulaster novasilvensis – Stipe soon dark brown in lower part; spores amygdaliform or ellipsoid with acute apex in side view, with germ pore; cheilocystidia clavate.

Orton mentions also differences in habitat, viz. *F. limulatus* only on chips or sawdust of coniferous wood; *F. limulatoides* on coniferous or deciduous wood, and *F. novasilvensis* only on deciduous wood. But this distinction does not hold: collections with the characters of *F. limulatus* have been found growing on deciduous wood in Sweden and in Poland (resp. on *Fagus* and on *Alnus*) and collections with the characters of *F. limulatoides* have been found growing on sawdust in Denmark.

In my opinion the main differential character of these taxa is the shape of the spores, whereas colour differences are not very important. Considering the fact that Orton refrains from using the rank of variety (Orton, 1960: 161) and the fact that in our opinion species should differ from each other in at least two distinct independent characters (species concept for the Flora agaricina neerlandica), I prefer to reduce Orton's species to varieties.

Orton (1984: 578) based his interpretation of *F. limulatus* on three descriptions in literature, viz. the original description by Fries (1818: 28), the description by Weinmann (1836: 201) and the description and plate by Fries (1878: 18, pl. 119 fig. 3). Under the Sydney-rules of nomenclature (Voss & al., 1983) the only relevant description is that of Fries of 1818. Fries (1818: 28) mentioned as colour of the stipe, according to Orton the most important character, 'fuscescens', meaning 'becoming dusky' (Wharton, 1884: 28), and as habitat sawdust. The stipes of all three taxa are darker coloured at the base than at the apex, and two of the three taxa are recorded from sawdust. Orton knew best of all the dark stiped taxon, growing on the famous sawdust-locality of the Black Wood of Rannoch, close to the place where he lived for many years, and called this taxon *F. limulatus*. Other characters, as the colour of the pileus, viz. 'fulvus', 'ochraceus vel ferrugineo-fulvus' in Fries' description fit *F. limulatoides* sensu Orton best. Both taxa occur in Sweden, the country where Fries lived. Considering that Fries' description of *F. limulatus* is not in contradiction with the description of *F. limulatoides* sensu Orton (*F. limulatus* sensu modern authors, e.g. Kühner & Romagnesi, 1953: 242), *F. limulatus* (var. *limulatus*) is interpreted in this paper in the same way as Kühner & Romagnesi (1953: 242) did.

KEY TO THE VARIETIES OF F. LIMULATUS

1\. Spores in side view in majority distinctly phaseoliform, with germ pore . . . . var. *limulatus*

1\. Spores in side view in majority ellipsoid to oblong, or amygdaliform with acute apex, with or without distinct germ pore.

   2\. Spores in side view amygdaliform or ellipsoid, with acute apex, with distinct germ pore var. *novasilvensis*

   2\. Spores in side view amygdaliform, slightly phaseoliform or ellipsoid with rounded apex, without or with indistinct germ pore . . . . var. *litus*

Flammulaster limulatus var. **limulatus** — Fig. 5a, b

Flammulaster limulatoides P. D. Orton in Notes R. bot. Gdn Edinb. 41: 580. 1984.

Selected descriptions & illustrations. — P. D. Orton in Notes R. bot. Gdn Edinb. 41: 580–581. 1984 (as *F. limulatoides*); Romagn. in Bull. trimest. Soc. mycol. Fr. 58: 140–141. 1942; Ryman & Holmåsen, Svampar: 463. 1984.

Pileus 10–55 mm, convex, sometimes plano-convex, with inflexed margin, sometimes with depressed centre, slightly hygrophanous, when moist deep orange-brown in centre (K. & W. 5D8, 6D8), slightly paler and more yellow at margin (Munsell 10 YR 7/8), completely covered with small granular squamules causing a velutinous look. Lamellae (L = c. 45, l = 3–5), moderately crowded, emarginate-adnate, not or slightly ventricose, up to 5 mm broad, when young ochraceous yellow or brownish yellow (10 YR 8/8), with

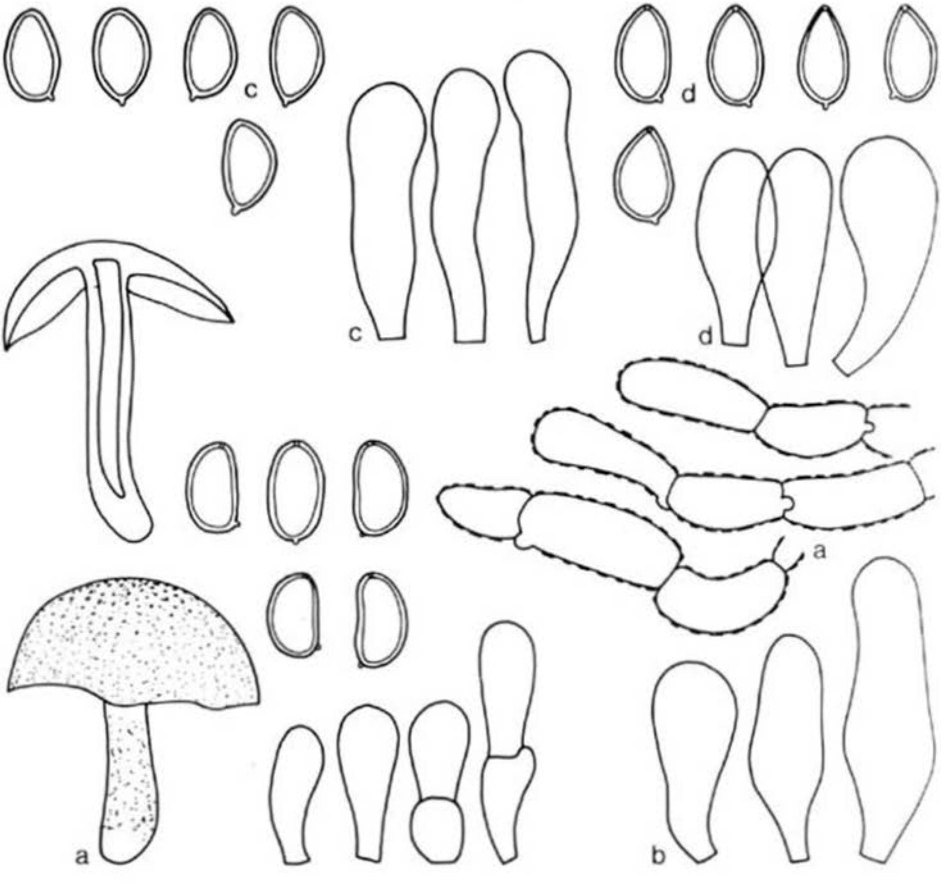


Fig. 5. *Flammulaster limulatus*. — a, b. var. *limulatus*, habit (× 1), spores, cheilocystidia and elements of pileipellis. (a. From *Vellinga 648*, b. from *Hechler 83/121*.) — c. var. *litus*, spores and cheilocystidia (from holotype). — d. var. *novasilvensis*, spores and cheilocystidia (from holotype).

age more brown, with very finely flocculose, pale or brown edge. **Stipe** 10–55 × 1–6 mm, cylindrical, often compressed, hollow, at apex golden yellow-brown (10 YR 8/8), below vague annular zone rusty brown (K. & W. 5D8) or completely rusty brown, in upper part loosely flocculose-fibrillose, in lower part coarsely fibrillose lengthwise. **Context** in pileus rather thick, concolorous with surface, in stipe in all parts darker than surface. **Smell** indistinct or farinaceous fungoid. **Taste** indistinct.

Spores in side view 7.0–8.0(–8.5) × 3.5–5.0 µm, Q = 1.55–2.05(–2.2), $\bar{Q}$ = 1.7–1.9, phaseoliform with rounded apex, a few ellipsoid or oblong, in frontal view (3.5–)4.0–5.0(–5.5) µm, Q = 1.45–2.0(–2.1), $\bar{Q}$ = 1.65–1.85, ellipsoid to oblong, with distinct germ pore, brown and thickwalled. **Basidia** 20–27 × 5–8 µm, 4-spored, some, especially close to lamella edge, brown. **Cheilocystidia** crowded, often in small clusters, 11–42 × 6–12 µm, cylindrical with rounded apex, narrowly clavate or subutriform, colourless to brown, sometimes slightly thick-walled. Pileipellis a cutis with ascending and reflexed bundles of hyphae, made up of slightly inflated elements, with terminal members 20–50 × 8–25(–45) µm, with coarsely brown incrusting pigment. Stipitipellis a cutis with loosely lying brown incrusted hyphae, with at apex some velar remnants, made up of colourless, often branched c. 4 µm wide, cylindrical hyphae.

Habitat & distribution. — Gregarious to (sub)caespitose, on sawdust or on wood of deciduous or coniferous trees in forests. Widespread in the temperate parts of the Northern Hemisphere; not known from the Netherlands. Sept.–Oct.

Collections examined. — DENMARK, Sjaelland, Køge, near Tryggevaelde Å, 19 Sept. 1984, *E. C. Vellinga 648* (L). — GREAT BRITAIN: SCOTLAND: Inverness-shire: Guisachan, Plodda, 2 Sept. 1957, *P. D. Orton 1177* (holotype of *F. limulatoides*, E); Tomich, 6 Sept. 1968, *E. Kits van Waveren* (L); Angus, Glenisla, Brewlands, 28 Aug. 1966, *E. Kits van Waveren* (L). — GERMAN FEDERAL REPUBLIC, Niedersachsen, Lüchow-Dannenberg, 1 Oct. 1983, *J. Hechler 83.121* (part in L).

Flammulaster limulatus var. **litus** Vellinga, *var. nov.* — Fig. 5c

Differt a typo in sporis non phaseoliformibus, sed amygdaliformibus cum apicem rotundatum, vel ellipsoideis. — Holotypus: *P. D. Orton 3264*, 21-IX-1968, 'Great Britain, Scotland, Rannoch, Black Wood (E)'.

Etymology: litus means 'covered, stained'.

Misapplied names. — *Flammulaster limulatus* sensu P. D. Orton in Notes R. bot. Gdn Edinb. 41: 579. 1984; *Flammula muricata* sensu Nath.-W. in Lund. & Nannf. in Fungi exs. suec.: 2036. 1953.

Selected description. — P. D. Orton in Notes R. bot. Gdn Edinb. 41: 579–580. 1984 (as *F. limulatus*).

Pileus 8–44 mm, convex expanding to applanate with lobed margin when old, rusty-tawny or rusty-sienna, paler at margin, entirely minutely saffron or ochraceous scurfy-fibrillose squamulose, with appendiculate margin when young. Lamellae (L = (14–)18–30, l = (1–)3–7), fairly crowded, adnate, often emarginate or decurrent with tooth, straw then saffron or fulvous-saffron, finally deep fulvous, with paler flocculose denticulate edge. Stipe 10–35 × 1–3 mm, cylindrical or slightly thickened at base or at apex, sometimes compressed, hollow, fulvous or cinnamon with paler apex, but soon dark brown from base up, yellowish floccose-pruinose at apex. Context in pileus concolorous with surface, on drying pallescent to pale ochraceous, in stipe concolorous, but on drying yellow in central parts. Smell and taste none.

Spores in side view (6.0–)6.5–8.5(–10.0) × 3.5–4.5(–5.0) µm, Q = (1.5–)1.6–2.05(–2.2), $\bar{Q}$ = 1.7–19, amygdaliform with rounded apex, some more ellipsoid, a few slightly phaseoliform, in frontal view 4.0–5.0(–5.5) µm broad, Q = (1.45–)1.5–2.0(–2.2), $\bar{Q}$ = 1.7–1.85, ellipsoid, oblong, without or with vaguely visible germ pore, brown and thick-walled. Basidia 20–38 × 4.5–8 µm, 4-spored, a few 2-spored. Cheilocystidia crowded, 20–56 × 5–13 µm, narrowly clavate, cylindrical and subcapitate, some narrowly sublageniform, mostly thin-walled, some slightly thick-walled, mostly colourless, some pale brown to brown. Pileipellis a cutis with ascending hyphae, unified to squamules, made up of inflated, 10–16 µm wide hyphae, very heavily incrusted with brown pigment. Stipitipellis a cutis, at apex with some caulocystidia similar to cheilocystidia, in lower part with loosely lying, brown hyphae.

Habitat & distribution. — Gregarious and sometimes subcaespitose, on sawdust of conifers or on wood of deciduous trees (*Fagus, Alnus*). Widespread in Europe but not common; not known from the Netherlands. May–Oct.

Collections examined. — SWEDEN, Västergötland, Göteborg, St. Ånggården, 'Naturparken', 13 July 1940, 17 July 1942, *T. Nathorst-Windahl 1973* (Fungi exs. suec. 2036, as *Flammula muricata*, C). — POLAND, Białowieza, 10 Oct. 1984, *E. Rald.* — GREAT BRITAIN: SCOTLAND: Perthshire: Rannoch, Black Wood, 6 June 1968, *P. D. Orton 3262*; ditto, 8 June 1968, *P. D. Orton 3263*; ditto, 21 Sept. 1968, *P. D. Orton 3264* (holotype); ditto, 25 May 1971, *P. D. Orton 4140*; ditto, 30 Sept. 1976, *P. D. Orton 4842* (all E).

The macroscopical description is copied from Orton (1984: 579).

Flammulaster limulatus var. **novasilvensis** (P. D. Orton) Vellinga, *stat. & comb. nov.* — Fig. 5d

Flammulaster novasilvensis P. D. Orton in Notes R. bot. Gdn Edinb. 41: 582. 1984 (basionym).
Selected description. — P. D. Orton in Notes R. bot. Gdn Edinb. 41: 582–583. 1984.

Pileus 10–35 mm, convex to plano-convex, sometimes with lobed margin, fulvous, sienna or orange-sienna, on drying golden yellowish, sometimes with orange or rusty centre, with appendiculate margin. Lamellae (L = 16–28, l = 3–7), fairly crowded, adnate with small decurrent tooth, straw to fulvous buff, finally deep fulvous-cinnamon, with concolorous or slightly paler flocculose denticulate edge. Stipe 20–55 × 1.5–4 mm, cylindrical or slightly broadened at base or at apex, more or less hollow, saffron or pale ochre with straw apex, soon becoming darker from base up, when old entirely umber or date-brown, with straw apex, on upper part squarrose, with paler base. Context in pileus concolorous with surface, on drying pallescent to straw or golden yellowish, in stipe fulvous or rusty, often dark brown in lower part. Smell none. Taste not recorded.

Spores in side view 7.5–8.5(–10.0) × 4.0–5.0 µm, Q = (1.6–)1.7–1.85, $\bar{Q}$ = 1.8, amygdaliform, a few slightly phaseoliform, with acute apex, in frontal view (4.0–)4.5–5.0 µm broad, Q = (1.6–)1.65–1.8(–2.05), $\bar{Q}$ = 1.75, oblong with acute apex, with germ pore, brown and thick-walled. Basidia 26–32 × 5–6 µm, 4-spored, some 2-spored, near lamella edge some brown coloured. Cheilocystidia crowded, 25–35 × 8–14 µm, clavate, pedunculate ellipsoid, some subutriform, slightly thick-walled, pale brown. Pileipellis a cutis of inflated hyphae with squamules of reflexed hyphae, with ellipsoid to inflated elements, 20–75 × 18–37 µm, with brown, strongly incrusting pigment. Stipitipellis a cutis with some loose, repent, colourless hyphae.

Habitat & distribution. — On deciduous wood in deciduous forest; very rare, only known from the New Forest in southern England. Aug.–Oct.

Collection examined. — GREAT BRITAIN: ENGLAND: Hampshire: New Forest, Park Dale, 31 Aug. 1970, *P. D. Orton 3967* (holotype of *F. novasilvensis*, E).

The macroscopical description is copied from Orton (1984: 582).

6. **Flammulaster muricatus** (Fr.: Fr.) Watl. — Fig. 6

Agaricus muricatus Fr.: Fr., Syst. mycol. 1: 244. 1821. — *Pholiota muricata* (Fr.: Fr.) Kumm., Führ. Pilzk.: 83. 1871. — *Dryophila muricata* (Fr.: Fr.) Quél., Enchir. Fung.: 69. 1886. — *Naucoria*

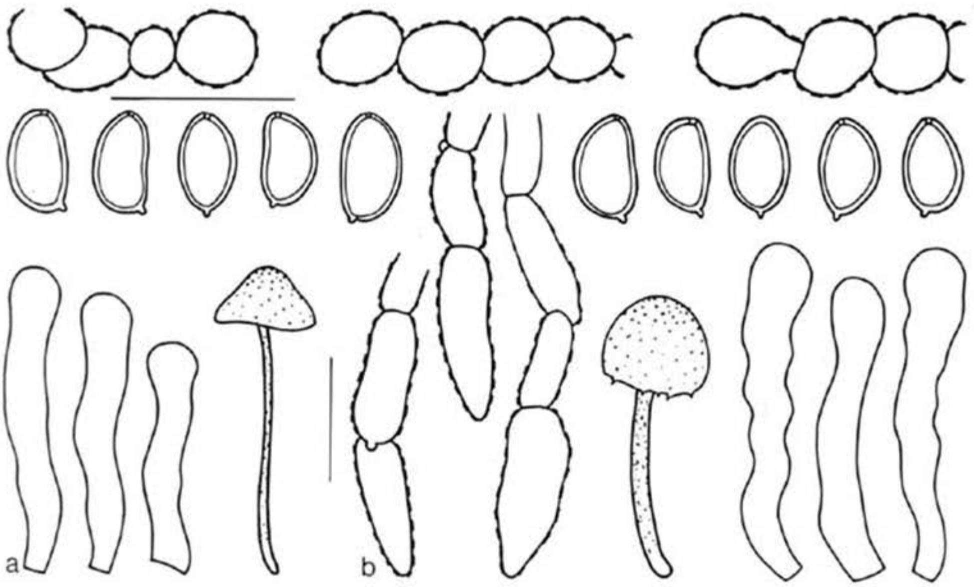


Fig. 6. *Flammulaster muricatus*. — Habit (× 1), spores, cheilocystidia, elements of pileipellis, and hairs of stipe. (a. From *Bas 5467*, b. from *Bayer & Wölfel, 7 July 1984.*)

muricata (Fr.: Fr.) Romagn. in Bull. trimest. Soc. mycol. Fr. 58: 133. 1942. — *Phaeomarasmius muricatus* (Fr.: Fr.) Sing. in Sing. & Digilio in Lilloa 25: 387. 1951. — *Flammula muricata* (Fr.: Fr.) Nath.-W. in Lund. & Nannf. in Fungi exs. suec.: 2036. 1953. — *Flocculina muricata* (Fr.: Fr.) P. D. Orton in Trans. Br. mycol. Soc. 43: 175. 1960. — *Flammulaster muricatus* (Fr.: Fr.) Watl. in Notes R. bot. Gdn Edinb. 28: 66. 1967 (as *F. muricata*).

Flammulaster denticulatus P. D. Orton in Notes R. bot. Gdn Edinb. 41: 577. 1984 (as *F. denticulata*).

Misapplied names. — *Flocculina erinaceella* sensu P. D. Orton in Trans. Br. mycol. Soc. 43: 234. 1960. — *Flammulaster erinaceellus* sensu Watl. in Notes R. bot. Gdn 28: 65. 1967. — *Naucoria wieslandri* sensu Kühner in Kühn. & Romagn., Fl. anal. Champ. sup.: 242. 1953; sensu Kühner in Kühn. & Romagn. in Bull. Soc. Nat. Oyonnax 10–11: 29–30. 1957. — *Flammulaster limulatus* sensu Cetto, Funghi Vero 4: pl. 1436. 1983.

Excluded. — *Flammula muricata* sensu Nath.-W. in Lund. & Nannf. in Fungi exs. suec.: 2036. 1953.

Selected descriptions & illustrations. — Cetto, Funghi Vero 4: pl. 1436. 1983 (as *F. limulatus*); Grauwinkel in Krieglsteiner & al. in Z. Mykol. 49: 93. 1983 (as *F. erinaceella*); Kühner in Kühn. & Romagn. in Bull. Soc. Nat. Oyonnax 10–11: 29–30. 1957 (as *N. wieslandri*); P. D. Orton in Notes R. bot. Gdn Edinb. 41: 577–578. 1984 (as *F. denticulata*).

Pileus 4–20 mm, hemispherical, broadly rounded conical to applanate, reddish-ochraceous brown (Munsell 7.5 YR 5/6) at centre to more yellowish golden-brown at margin (10 YR 7/8), covered with small ochraceous brown or reddish brown squamules, when young with fimbriate-dentate margin. Lamellae (L = 20–30, l = 1–3), moderately crowded to moderately distant, adnate, slightly emarginate, when young pale ochraceous brown, later more rusty brown (10 YR 6/6–7.5 YR 5/6), with paler or white, flocculose edge. Stipe 13–35 × 0.8–2.5 mm, cylindrical, sometimes slightly bulbous at base, fistulose, more or less concolorous with pileus, slightly darker at base, covered with reddish brown or ochraceous brown granular floccules. Context in pileus brown to orange-brown, in stipe concolorous with surface. Smell absent or indistinct, rarely terroid-astringent. Taste not known.

Spores in side view 6.5–8.0(–9.0) × 3.5–5.0 µm, Q = (1.3–)1.35–1.85, $\bar{Q}$ = 1.5–1.75, mostly phaseoliform, some amygdaliform with rounded or acute apex, in frontal view 4.0–5.5(–6.0) µm broad, Q = (1.2–)1.35–1.85, $\bar{Q}$ = 1.5–1.65, ellipsoid, oblong, with rounded or slightly acute apex, mostly with visible germ pore, brown and thick-walled. Basidia 17–32 × 7–10 µm, 4- and also some 2-spored, near edge of lamella often brown. Cheilocystidia 30–70 × 4–9 µm, cylindrical, straight to flexuose, subcapitate or not, up to 13 µm wide at apex, colourless or some with yellow or brown content, thin-walled or moderately thick-walled at apex. Pileipellis a cutis with a covering of epithelioid granules made up of globose to obpyriform, thick-walled elements measuring up to 50 × 35 µm and with brown incrusting pigment. Stipitipellis a cutis with patent chains of inflated globose elements; terminal elements fusiform to ellipsoid, up to 65 × 16 µm, thick-walled, with patches of brown incrusting pigment.

Habitat & distribution. — Solitary to gregarious on old putrified wood of deciduous trees, mainly *Fagus*; rare and widespread in temperate parts of Europe; in the Netherlands known from one locality in southern Limburg. June–Oct.

Collections examined. — NETHERLANDS, prov. Limburg, Cadier en Keer, Schiefferberg, 11 Oct. 1970, *C. Bas 5467* (L). — DENMARK, Sjaelland, Jagersborg, Dyrehaven, 13 Sept. 1984, *P. Rabenborg* (C). — GREAT BRITAIN, WALES, Montgomeryshire, Lake Vyrnwy, 21 Sept. 1967, *E. Kits van Waveren* (L). — GERMAN FEDERAL REPUBLIC, Bayern: Burggailenreuth, Wiesenttal, 23 Sept. 1981, *W. Bayer 402* (L); Burggailenreuth, Wiesenttal, Sachsenmühle, 7 July 1984, *G. Wölfel & W. Bayer* (L); Pegnitz, Kosbrunn, 7 June 1985, *G. Wölfel* (L).

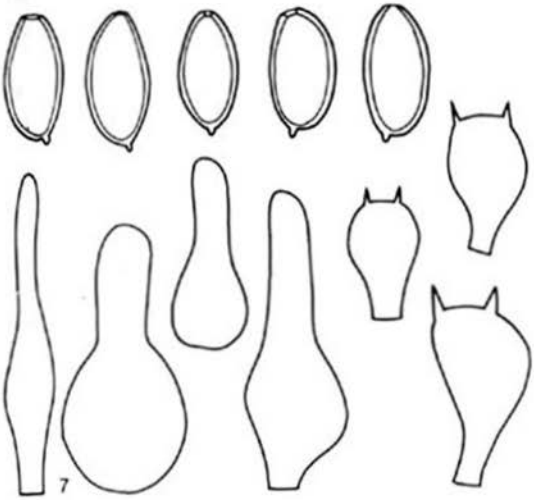
Orton (1960: 234 and 1984: 577) described a species very close to *F. muricatus*, viz. *F. denticulatus*, said to differ in the slender habitus and in the shape of the terminal elements of the hairs of the stipe, viz. fusiform and not globose as those in *F. muricatus*. As was found that the stipital hairs of the sturdy basidiocarps called *F. muricatus* by Orton have variously shaped terminal elements, from subglobose, ellipsoid to fusiform, Orton's taxon could be distinguished on habitus only, and therefore is here considered a slender variant of *F. muricatus*.

The differences between *F. limulatus* and *F. muricatus* can be found in the pileipellis: the squamules on the pileus of *F. muricatus* are made up of globose elements, and easily rubbed off; the squamules of the pileus of *F. limulatus* are made up of oblong to inflated hyphae, ascending from the surface, and not rubbed off. Young specimens of *F. muricatus* show a beautiful fringed dentate margin as illustrated by Cetto (1983: pl. 1436).

7. **Flammulaster wieslandri** (Fr.) Mos. — Fig. 7

Agaricus wieslandri Fr. in Öfvers. kongl. vetensk. Akad. Förh. 8: 48. 1852. — *Naucoria wieslandri* (Fr.) Sacc., Syll. Fung. 5: 856. 1887. — *Flammulaster wieslandri* (Fr.) Mos. in Gams, Kl. Krypt.-Fl. 2b/2, 4. Aufl.: 302. 1978.

Excluded. — *Naucoria wieslandri* sensu Kühn. & Romagn., Fl. anal. Champ. sup.: 242. 1953 (= *F. muricatus*).



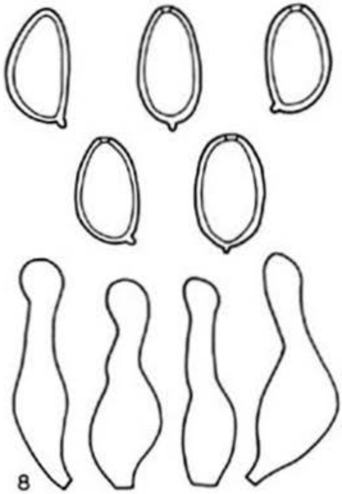


Fig. 7. *Flammulaster wieslandri*. — Spores, basidia and cheilocystidia. (All figs. from *Tjallingii & Tjallingii-Beukers, 15 Dec. 1984*.)

Fig. 8. *Flammulaster spec.* — Spores and cheilocystidia (from *Kits van Waveren, 28 Oct. 1962*).

Selected illustration & description. — Fr., Ic. sel. Hymenomyc. 2: pl. 126 fig. 3. 1878; Sing. in Rev. Mycol. 2: 241–242. 1937.

Pileus 6–10 mm, convex to plano-convex, pale ochraceous brown, ochraceous brown at centre, flocculose-granulose. Lamellae (L = 20, l = 0–1), moderately distant, narrowly adnate, dark purplish brown, with white, flocculose edge. Stipe 9–14 × 0.8–1 mm, cylindrical, pale cream-coloured ochraceous fibrillose-flocculose on pale reddish brown background. Context, smell and taste not known.

Spores in side view (8.0–)8.5–10.5 × 5.0–5.5(–6.0) µm, Q = (1.6–)1.65–2.05, $\overline{Q}$ = 1.75–1.9, oblong, in frontal view (4.5–)5.0–5.5(–6.0) µm broad, Q = (1.55–)1.65–2.05(–2.25), $\overline{Q}$ = 1.8–1.95, mostly oblong, some cylindrical, with broad, central germ pore, yellow-brown to dark brown, thick-walled; inner wall red-brown in Melzer's reagent. Basidia 16–24 × 9–12 µm, 4-spored, distinctly clavate. Cheilocystidia crowded, 26–46 × 8–16 µm, at apex 4–8 µm wide, non-pedunculate and broadly utriform, but some pedunculate and narrowly lageniform, thin-walled and colourless. Pileipellis a cutis made up of chains of ellipsoid to inflated elements, 25–65 × 15–35 µm, with pale brown, incrusting pigment.

Habitat & distribution. — Solitary to subgregarious on wood, mostly of deciduous trees. Rare and widespread in Europe. In the Netherlands very rare, only known from the IJsselmeerpolders. Nov.–Dec.

Collections examined. — NETHERLANDS, IJsselmeerpolders: O. Flevoland, Houtribbos, 11 Nov. 1978, *F. Tjallingii & G. J. M. G. Tjallingii-Beukers*; Harderbos, 15 Dec. 1984, *F. Tjallingii & G. J. M. G. Tjallingii-Beukers.*

Flammulaster wieslandri has some characters, viz. the shape of the cheilocystidia and basidia and the dextrinoid inner spore wall, that make its place within the genus *Flammulaster* debatable.

However, it does not seem correct to place the species in *Galerina*, as the spores are completely smooth and oblong. For the time being it is considered as to belong to *Flammulaster*.

8. **Flammulaster spec.** — Fig. 8

Pileus 7.5–12 mm, plano-convex with low umbo or slightly depressed centre, pale ochraceous buff, slightly ochraceous brown at centre, minutely appressedly fibrillose. Lamellae broadly adnate with decurrent tooth, concolorous with pileus, with subcrenulate whitish edge. Stipe 18 × 0.8 mm, cylindrical and subbulbous at base, very pale buff at apex, bright ferrugineous brown in lower 2/3, slightly white pruinose-flocculose at apex, with scattered whitish fibrils in lower part. Context in pileus concolorous with surface, in stipe at apex pale yellowish, gradually darker ferrugineous brown at base. Smell not distinct. Taste not known.

Spores in side view (8.0–)8.5–10.5(–11.0) × 5.0–5.5(–6.0) µm, Q = (1.6–)1.65–1.85(–1.95), $\bar{Q}$ = 1.8, oblong, in frontal view 5.0–6.0 µm broad, Q = (1.45–)1.55–1.85(–1.95), $\bar{Q}$ = 1.75, oblong and some ellipsoid, with germ pore, brown and thick-walled. Basidia 17–25 × 6–9 µm, 4-spored. Cheilocystidia in crowded clusters, 21–34 × 5–10 µm, subutriform or sublageniform, mostly subcapitate, colourless, some thick-walled at apex. Pileipellis a cutis of radially arranged 4–10 µm wide hyphae with chains of ellipsoid to oblong elements, up to 50 × 20 µm, with brown, incrusting pigment. Stipitipellis a cutis of cylindrical hyphae, at apex with caulocystidia similar to cheilocystidia.

Collection examined. — NETHERLANDS, prov. Overijssel, Denekamp, Singraven, Arboretum, 28 Oct. 1962, *E. Kits van Waveren* (L).

The collection described here comes very close to *F. gracilis*, differing from this species in the larger spores provided with a germ pore and in the shape of the cheilocystidia.

As till now this collection is the only one known with this set of characters, it is only provisionally, described as a new taxon.

9. **Flammulaster gracilis** (Quél.) Watl. — Fig. 9

Pholiota muricata var. *gracilis* Quél. in Bull. Soc. Ann. Sc. nat., Rouen 9: pl. 1 fig. 3 ('1879') 1880. — *Naucoria muricata* var. *gracilis* (Quél.) Romagn. in Bull. trimest. Soc. mycol. Fr. 58: 133. 1942 — *Phaeomarasmius gracilis* (Quél.) Sing. in Schweiz. Z. Pilzk. 34: 56. 1956 (not valid, basionym not mentioned). — *Flammulaster gracilis* (Quél.) Watl. in Notes R. bot. Gdn Edinb. 28: 68. 1967.

Flammulaster albopunctatus Callebaut & Imler in Sterbeeckia 13: 25. 1983 (as *F. albopunctata*).

Selected description. — Romagn. in Bull. trimest. Soc. mycol. Fr. 58: 133–134. 1942 (as *N. muricata* var. *gracilis*).

Pileus 6–9 mm, plano-convex to applanate, with or without central depression, with or without low umbo, rather dark reddish brown, with pale isabella ochraceous, very finely squamulose covering; when dry pinkish isabella (Munsell 10 YR 7/4). Lamellae (L = 13–16, l = 1–3), rather distant, adnate or adnate and decurrent with tooth, dark

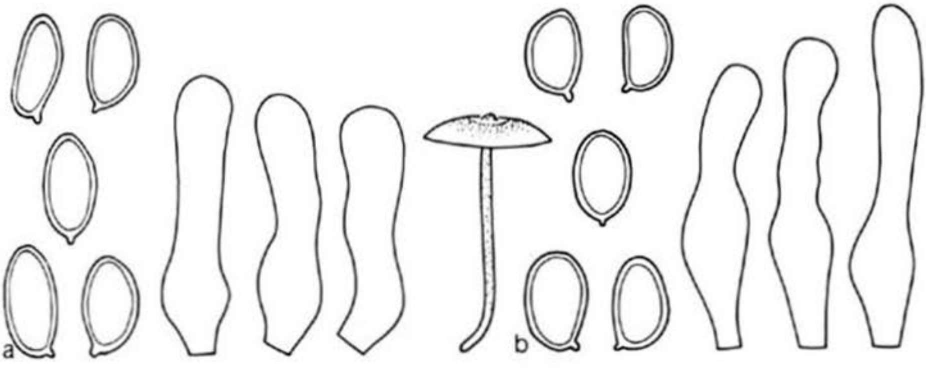


Fig. 9. *Flammulaster gracilis*. — Habit (× 2), spores and cheilocystidia. (a. From *Bas 7468*, b. from *De Meijer 389.*)

rusty brown, dark brown ochre with vague olivaceous tinge (10 YR 6/6, 5/6), with concolorous even or white floccose edge. Stipe 11–20 × 0.5–1.2 mm, cylindrical or slightly tapering downwards, dark red-brown, dark purplish red-brown (5 YR 4/3–4/6), innately fibrillose, slightly pruinose at apex. Context smell and taste not known.

Spores in side view (6.5–)7.0–9.0(–10.0) × (4.0–)4.5–5.0(–5.5) µm, Q = (1.55–) 1.6–1.85(–1.9), $\bar{Q}$ = 1.7, ellipsoid to oblong, a few slightly phaseoliform, in frontal view 4.5–5.0(–5.5) µm broad, Q = 1.55–1.8(–1.85), $\bar{Q}$ = 1.65–1.7, oblong, without germ pore, brown and thick-walled. Basidia 21–38 × 7–10 µm, 4- and also 2-spored, some with brown content. Cheilocystidia not crowded, 29–45 × 5–12 µm, very variable in shape, cylindrical, subutriform, narrowly clavate, without or with subcapitate apex, colourless and thin-walled. Pileipellis a cutis made up of cylindrical and inflated hyphae, with an upper layer of globose to oblong elements, 10–50 × 8–45 µm, with brown incrusting pigment. Stipitipellis a cutis, at apex with caulocystidia similar to cheilocystidia.

Habitat & distribution. — Solitary to gregarious, terrestrial in deciduous woods, parks or gardens. Rare throughout Europe, rare in the Netherlands. Aug.–Sept.

Collections examined. — NETHERLANDS: prov. Zuid-Holland: Leiden, 1 Sept. 1979, *C. Bas 7468* (L); ditto, 21 Aug. 1980, *C. Bas* (L); prov. Zeeland, Zeeuws Vlaanderen, Axel, Axelse Bos, 18 Sept. 1981, *A. de Meijer 389* (L).

On account of the similarities in size and shape of spores, cheilocystidia, and elements in the pileipellis, *Flammulaster albopunctatus* is, judging from description and drawings, considered conspecific with *F. gracilis*, although *F. albopunctatus* shows unusual abundant velar remnants on pileus and stipe, and a white flocculose lamella edge.

EXCLUDED TAXON

harrisonii — *Phaeomarasmius harrisonii* Dennis in Kew Bull. 19: 113. 1964. — *Flammulaster harrisonii* (Dennis) Watl. in Notes R. bot. Gdn Edinb. 28: 68. 1967.

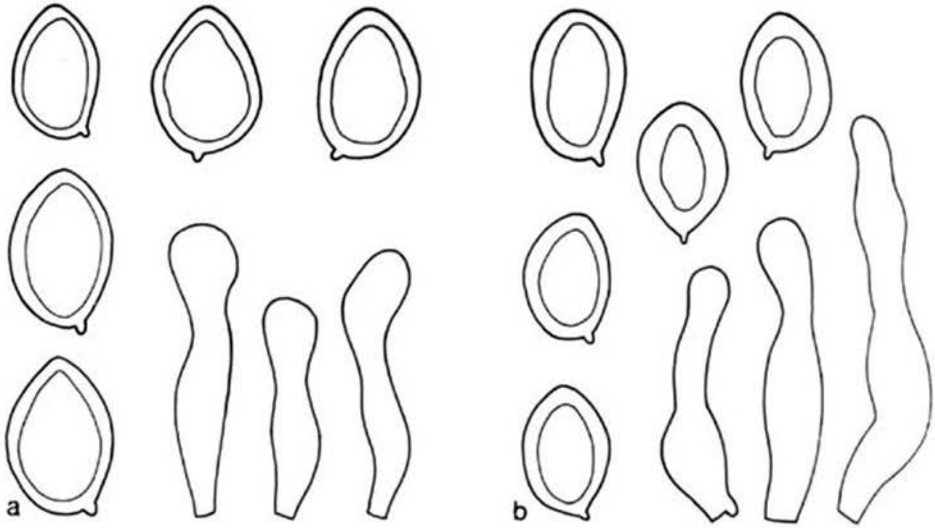


Fig. 10. *Galerina harrisonii*. — Spores and cheilocystidia. (a. From holotype, b. from holotype of *Galerina antheliae*.)

The holotype of this species (Great Britain, Scotland, Argyllshire, Isle of Rhum, 3 Sept. 1962, *R. W. G. Dennis* (K)) showed the following data (Fig. 10a):

Spores in side view 10.5–13.5(–15.5) × 7.5–8.5(–9.5) µm, Q = (1.35–)1.4–1.5(–1.6), $\bar{Q}$ = 1.45, broadly amygdaliform with subacute or rounded apex, in frontal view 8.0–9.0 µm broad, Q = (1.3–)1.35–1.6(–1.9), $\bar{Q}$ = 1.45, ovoid, ellipsoid, a few oblong, with subacute apex, with very thick brown wall, sometimes with indistinct germ pore; inner wall in Melzer's reagent slowly turning reddish-brownish and wall inconspicuously minutely rough, with plage. Basidia 22–32 × 9–12 µm, 4-spored. Cheilocystidia 25–39 × 3–7 µm, at apex 6–10 µm wide, cylindrical or subutriform, subcapitate at apex, colourless. Pleurocystidia absent. Pileipellis a cutis made up of inflated repent hyphae, with terminal elements up to 50 × 12 µm, with heavily brown incrusting pigment.

On account of the minutely rough spores with a plage this taxon is placed in the genus *Galerina* and the following new combination is proposed: **Galerina harrisonii** (Dennis) Bas & Vellinga, *comb. nov.* — basionym: *Phaeomarasmius harrisonii* Dennis in Kew Bull. 19: 112. 1964.

Examination of the holotype of *Galerina antheliae* Gulden showed complete similarity with the microscopical characters of *G. harrisonii* (Fig. 10 b). Consequently *G. antheliae* is considered as a synonym of *G. harrisonii*.

ACKNOWLEDGEMENTS

Without the help of many mycologists in and outside the Netherlands, who provided me with material and information, it would not have been possible to write this paper.

especially to Mr E. Jahn, Mr G. Wölfel and Mrs G. J. M. G. Tjallingii-Beukers I am very grateful.

The curators of the Herbaria at E, K, O, and WBS are thanked for the loan of type specimens and the curator of C for the hospitality during my stay to study collections.

Frequent discussions with Thomas Kuyper about the species concept in agaricology are highly appreciated, and he is thanked for critically reading the text.

The investigations were supported by the Foundation for Fundamental Biological Research (BION), which is subsidized by the Netherlands Organization for the Advancements of Pure Research (ZWO).

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PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 1, pp. 27–43 (1986)

TAXONOMIC AND NOMENCLATURAL NOTES ON LACCARIA B. & BR.
Laccaria amethystea, L. fraterna, L. laccata, L. pumila, and their synonyms

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Laccaria amethystea, not *L. amethystina* nor *L. calospora*, is shown to be the correct name for the amethyst colored *Laccaria*. A neotype for *L. amethystea* is proposed and a complete list of its synonyms is given. Data which support placing *L. ohiensis* and *L. tetraspora* in synonymy with *L. laccata* are discussed and three varieties within *L. laccata* are recognized. These varieties are *L. laccata* var. *laccata*, *L. laccata* var. *moelleri*, and *L. laccata* var. *pallidifolia*. Based on these data, a synonymy list and description of each variety is presented. *Laccaria laccata* var. *pallidifolia* is shown to be the most common and abundant variety. The correct name for *L. striatula* sensu Sing. non Peck is *L. pumila* and for *L. ohiensis* sensu Sing. non Montagne is *L. fraterna*.

While *Laccaria* B. & Br. (Agaricales) is well circumscribed, several taxonomic and nomenclatural problems have persisted within the genus. This paper addresses four of these problems: (i) the correct name for the violet colored *Laccaria* species found commonly in Europe and eastern North America, (ii) the circumscription and nomenclature of *L. laccata* (Scop.: Fr.) B. & Br., (iii) the correct name for the bisporic *Laccaria* with moderate sized basidiospores and tropical to temperate distribution, and (iv) the correct name for the bisporic *Laccaria* with moderately large to large basidiospores and boreal to arctic distribution.

Laccaria amethystea (Bull.) Murrill

Agaricus amethysteus Bull., Herb. France: Pl. 198. 1784. — *Agaricus laccatus* var. *amethysteus* (Bull.) B. & Br. in J. linn. Soc. Bot. 11: 518. 1871. — *Russuliopsis laccata* var. *amethystea* (Bull.) J. Schroet. in Cohn, Krypt.-Fl. Schlesien 3(1): 623. 1889 (erroneously written '*amethystina*') — *Laccaria amethystea* (Bull.) Murrill in N. Amer. Fl. 10: 1. 1914.

Agaricus amethystinus Huds., Fl. angl. 2: 612. 1778; non *Agaricus amethystinus* Scop., Fl. carn. 2: 437. 1772 (= *Cortinarius* spec.); nec *Agaricus amethystinus* Schaeff., Fung. Bavariae 4: 24. 1774 (= *Cortinarius traganus*). — *Laccaria amethystina* (Huds. →[1]) Cooke in Grevillea 12: 70. 1884. —

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[1] The arrow (→) in an author citation indicates that the specific epithet when published by the author before the arrow was illegitimate, because of being a later homonym, and has been legalized by the author after the arrow when the latter combined it with another generic name (see Kuyper, Persoonia 12: 448. 1985).

Collybia amethystina (Huds. → Cooke) Quél., Fl. mycol. France: 237. 1888. — *Clitocybe amethystina* (Huds. → Cooke) Peck in Ann. Rep. N.Y. St. Bot. 50: 128. 1897.

Laccaria calospora Sing. in Sydowia Beih. 7: 7. 1973.

Type specimen (neotype, design. nobis): MICH — *R. L. Shaffer 4570*, 15 Aug. 1965, France, Bois de Bonnet, west of Coye-la-forêt (Oise).

Two names have been commonly used for the amethyst colored *Laccaria* in recent mycological literature. Most authors have used the epithet *amethystina* (e.g., Kühner & Romagnesi, 1953: 131; Singer, 1975: 231; Kühner, 1980: 519; Mueller & Sundberg, 1981: 584; Bon, 1983: 48; Moser, 1983: 98; Clémençon, 1984: 5; Fries & Mueller, 1984: 633), while others have used the epithet *amethystea* (e.g., Dennis & al., 1960: 90; Phillips, 1981: 52). *Agaricus amethystinus* Huds., however, is a later homonym of *A. amethystinus* Scop. (= *Cortinarius* spec.) and of *A. amethystinus* Schaeff. (= *Cortinarius traganus* (Fr.: Fr.) Fr.) and thus is not usable. Since *A. amethysteus* Bull. was the first legitimate name published for the amethyst colored *Laccaria*, *L. amethystea* is the correct name for this taxon.

The holotype of *L. calospora* Sing. is characterized by having dingy purple-violet basidiocarps which fade buff, purple lamellae, violet spore print color, scattered cheilocystidia, and moderate sized (7.5–8.5 × 7.0–8.5 μm, excluding ornamentation), globose to subglobose (Q = 1.0–1.1), echinulate basidiospores. Since these character states are included within the circumscription of *L. amethystea*, the two are considered conspecific.

The collection designated as neotype of *L. amethystea* was selected from material requested from several herbaria including BPI, FH, LG, K, MICH, and PC. Of the collections which both fit Bulliard's (1784: Pl. 198) drawing and description and had been collected near Paris (the presumed type locality), the chosen collection was the largest and best preserved. The neotype has the following micromorphological characteristics:

Basidiospores (excluding ornamentation) 8.0–9.5(–10.0) × (7.5–)8.0–9.0 μm, Q = 1.0–1.05(–1.1), $\bar{Q}$ = 1.0, globose to occasionally subglobose, echinulate; spines up to 1.5–2.5 μm high, crowded; hilar appendage 1.5–2.5 μm long, prominent, truncate; contents occasionally uniguttulate; wall inamyloid and acyanophilous. Basidia 38–52 × 8–12 μm, clavate, elongate, hyaline, tetrasporic. Pleurocystidia absent. Cheilocystidia 40–86 × 7–12 μm, undifferentiated to subclavate or subcapitate or ventricose-rostrate, very abundant, thin-walled, hyaline. Pileipellis a cutis of radially arranged cylindrical hyphae, 8–12 μm wide with numerous more or less perpendicular individual large hyphae; terminal elements 30–85 × 11–14 μm, undifferentiated to clavate, hyaline to light vinaceous; walls up to 0.5 μm thick.

Laccaria laccata (Scop.: Fr.) B. & Br.

Agaricus laccatus Scop., Fl. carn. 2: 444. 1772. — *Agaricus laccatus* Scop.: Fr., Syst. mycol. 1: 106. 1821. — *Clitocybe laccata* (Scop.: Fr.) Kumm., Führ. Pilzk.: 122. 1871. — *Camarophyl-*

lus laccatus (Scop.: Fr.) P. Karst., Ryssl., Finl. Skand. Halföns Hattsvamp.: 231. 1879. — *Laccaria laccata* (Scop.: Fr.) B. & Br. in Ann. Mag. nat. Hist., ser. V, 12: 370. 1883. — *Omphalia laccata* (Scop.: Fr.) Quél., Enchir. Fung.: 26. 1886. — *Collybia laccata* (Scop.: Fr.) Quél., Fl. mycol. France: 237. 1888. — *Russuliopsis laccata* (Scop.: Fr.) J. Schroet. in Cohn, Krypt.-Fl. Schlesien 3(1): 622. 1889.

Agaricus carneus Schaeff., Fung. Bavariae 4: 71. 1774.

Agaricus farinaceus Huds., Fl. angl. 2: 616. 1778. — *Omphalia farinacea* (Huds.) S. F. Gray, Nat. Arr. Brit. Pl. 1: 612. 1821. — *Laccaria farinacea* (Huds.) Sing. in Sing. & Mos. in Mycopath. Mycol. appl. 26: 149. 1965 (not val. publ.; basionym lacking). — *Laccaria farinacea* (Huds.) Sing. in Sydowia Beih. 7: 8. 1973.

Agaricus rosellus Batsch, Elench. Fung. Contin. 1: 121. 1786; non *Agaricus rosellus* Fr.: Fr., Syst. mycol. 1: 151. 1821 (= *Mycena rosella*). — *Omphalia rosella* (Batsch →) S. F. Gray, Nat. Arr. Brit. Pl. 1: 613. 1821. — *Russuliopsis laccata* var. *rosella* (Batsch → S. F. Gray) J. Schroet. in Cohn, Krypt.-Fl. Schlesien 3(1): 623. 1889. — *Laccaria laccata* var. *rosella* (Batsch → S. F. Gray) Sing. in Annls mycol. 41: 17. 1943.

Agaricus subcarneus Batsch, Elench. Fung. Contin. 1: 123. 1786.

Agaricus ohiensis Mont., Syll. Gen. Sp. Crypt.: 100. 1856. — *Clitocybe ohiensis* (Mont.) Sacc., Syll. Fung. 5: 181. 1897. — *Laccaria ohiensis* (Mont.) Sing. in Mycologia 38: 688. 1946.

Laccaria tetraspora Sing. in Mycologia 38: 689. 1946.

Excluded. — *Laccaria farinacea* sensu Sing. in Sydowia Beih. 7: 8. 1973 (= *L. bicolor* (Maire) P.D. Orton).

While Singer's (Singer, 1967: 107) typification of *L. laccata* satisfied the rules for designating neotypes established by the ICBN (Voss & al., 1983), the collection that he chose does not serve as a representative specimen for the species because the micromorphological characters of the collection are near the extreme range for the taxon. This fact, coupled with conflicting published concepts of *L. laccata* and of several segregate taxa, has perpetuated confusion in the delimitation of *L. laccata* and the taxonomy of the genus as a whole.

The following information is based on fresh material collected by us in North America north of Mexico, Sweden, the Netherlands and adjacent regions. Additionally, numerous herbarium specimens were examined including all extant *Laccaria* types. To augment these studies, somatic culture mat analysis and mating studies were undertaken (Fries & Mueller, 1984; Mueller & al., 1985).

Singer (1946, 1967, 1977) separated *L. tetraspora* from *L. laccata* primarily on basidiospore characteristics. *Laccaria tetraspora* reportedly had globose or rarely subglobose basidiospores which were normally over 10 μm in diameter (including ornamentation) with ornamentation > 1.2 μm high, whereas *L. laccata* had subglobose to broadly ellipsoid, rarely globose or ellipsoid basidiospores which were normally < 10.3 μm long (including ornamentation) with ornamentation rarely > 1.3 μm high. Additionally, *L. tetraspora* basidiocarps were small- to moderate-sized while *L. laccata* basidiocarps were usually moderate-sized.

With these distinctions in mind, Singer (1967, 1977) designated 7 varieties of *L. tetraspora* (reduced to 6 in 1977) and 12 varieties of *L. laccata* based on a small number of specimens collected world-wide. These varieties were proposed to delimit phenotypically distinct and stable entities and to serve as a starting point for mating studies which are much needed in this group (Singer, 1977: 347). An examination of the type speci-

Table I. Basidiospore characteristics for type specimens of taxa discussed under *Laccaria laccata*. Basidiospore dimensions exclude ornamentation. All measurements based on n = 30 and in µm. Herbarium abbreviations from Index Herbariorum.

Name	Herb.	Dimensions (L × W)	mean L × W	L/W ratio	mean L/W	Ornamentation length
Agaricus ohiensis	PC	7.5–9.0(–10.0) × 7.5–9.0(–10.0)	8.4 × 8.4	0.95–1.05	1.01	1.5–2.5
Clitocybe tortilis var. *gracilis*	NYS	(8.0–)8.5–10.5 × 8.0–10.0(–10.5)	9.3 × 9.1	1.0–1.05(–1.1)	1.02	1.5–2.5(–3.0)
Clitocybe laccata var. *pallidifolia*	NYS	8.0–11.0(–11.5) × 7.5–9.0(–10.5)	9.2 × 8.5	1.0–1.1(–1.2)	1.08	< 0.5–1.5(–2.0)
var. *striatula*	NYS	(7.0–)8.0–9.5(–12.0) × (7.0–)8.0–9.5(–12.0)	8.8 × 8.7	1.0(–1.05)	1.01	1.4–2.5(–3.0)
Laccaria laccata var. *laccata*	BAFC	8.5–9.0(–11.0) × 6.5–8.0(–8.5)	9.2 × 7.1	(1.1–)1.2–1.35(–1.45)	1.3	1.0–2.0(–2.5)
var. *decurrens*	NYS	7.5–9.0(–11.5) × 7.0–9.0(–10.0)	8.6 × 8.0	1.0–1.15(–1.25)	1.08	(< 0.5–)1.0(–1.5)
var. *chilensis*	BAFC	6.5–8.0 × 6.0–7.5(–8.0)	7.3 × 6.7	1.0–1.15	1.08	(< 0.5–)1.5–2.0
var. *carbonicola*[1]	FH	7.7–8.2 × 6.5–7.2	—	—	—	0.7
var. *anglica*	BAFC	(7.5–)8.0–9.0(–9.5) × (7.5–)8.0–9.0(–9.5)	8.4 × 8.3	1.0–1.05	1.01	(1.0–)1.5–2.0
var. *affinis*	BAFC	(7.0–)8.0–10.0 × (7.0–)8.0–10.0	8.6 × 8.6	1.0(–1.05)	1.0	1.0–1.5
var. *gibba*	SGO	7.0–8.5 × (5.0–)6.0–7.5	7.8 × 6.3	1.1–1.4	1.25	1.0–2.0(–2.5)
var. *moelleri*	F	9.0–11.0 × (6.5–)7.0–8.5	10.0 × 7.3	1.25–1.45(–1.6)	1.3	< 0.5–1.5(–2.0)

var. *vulcanica*	F	(7.5–)8.5–9.5(–11.0) × (6.0–)6.5–8.0(–8.5)	9.0 × 7.1	1.15–1.35(–1.45)	1.27	(0.5–)1.0–1.5(–2.0)
var. *subalpina*	F	(6.5–)7.0–8.0(–8.5) × (6.0–)6.5–7.5	7.5 × 6.8	1.0–1.15(–1.2)	1.1	(1.0–)1.5–2.0
var. *tatrensis*	F	7.5–9.0 × 7.5–9.0	8.4 × 8.2	1.0–1.1	1.03	1.0–2.0
var. *intermedia*	F	(6.5–)7.5–10.0(–13.0) × (6.5–)7.0–10.0(–12.5)	8.9 × 8.6	0.95–1.2(–1.3)	1.04	1.5–2.0(–2.5)
var. *pseudobicolor*[2]		8.0–9.0(–9.5) × 6.0–7.5(–8.0)	—	—	—	< 1.0
f. *minuta*	SAP	7.0–8.5(–9.0) × 7.0–8.5	8.0 × 7.9	1.0–1.05	1.01	1.0–2.0
Laccaria tetraspora						
var. *tetraspora*	FH	(8.0–)8.5–11.0 × 8.5–10.0(–10.5)	9.3 × 9.1	0.95–1.2	1.02	(1.0–)1.5–2.5(–3.0)
var. *peullensis*	BAFC	7.5–8.5(–9.5) × 7.5–8.5(–9.0)	8.1 × 8.0	1.0(–1.1)	1.01	1.0–2.0
var. *valdiviensis*	BAFC	(7.0–)8.0–9.0(–10.0) × (7.0–)8.0–9.0(–10.0)	8.4 × 8.3	1.0–1.05	1.01	1.5–2.0(–2.5)
var. *scotica*	BAFC	7.0–9.0 × 7.0–9.0	8.0 × 7.9	1.0–1.05(–1.15)	1.01	1.0–2.0(–2.5)
var. *xena*[3]	BAFC	(7.0–)8.0–9.5 × (7.0–)8.0–9.5	8.6 × 8.6	1.0(–1.05)	1.0	(1.0–)1.5–2.5
var. *aberrans*	BAFC	7.0–8.5(–9.5) × 7.0–8.5(–9.0)	7.9 × 7.8	1.0–1.05(–1.1)	1.01	(1.0–)1.5–2.0
var. *peladae*	BAFC	(6.5–)7.0–9.0 × (6.5–)7.0–9.0	7.9 × 7.8	1.0–1.05	1.01	1.0–1.5(–2.0)

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[1] Type not found at FH. Data from Singer (1967).

[2] Type not studied. Data from Bon in Bon & Haluwijn (1982).

[3] No type designated. Data based on a representative specimen (*Singer M4063*).

mens of these varieties, however, has shown that the distinctions between the two species become blurred and, in some cases, the varieties of one species intergrade with the varieties of the other species (Table I).

Based on the following data, we consider *L. tetraspora* to be a synonym of *L. laccata*. (i) Not only does the macro- and micromorphology of several of the proposed varieties intergrade between the two putative species (Table I), but these data, along with those from numerous other specimens, do not support the presence of any distinct hiatus in either basidiospore size, shape, or ornamentation height, except for a few extreme cases. Basidiocarp size also appears to form a continuum from very small to moderate. (ii) Culture mat morphology data do not support the separation of these taxa. All examined isolates of these two putative species have similarities in growth form and color (Fries & Mueller, 1984; Mueller, 1985). (iii) Finally, mating studies using several *Laccaria* species showed that, at least in the laboratory, isolates from collections with basidiospore characteristics corresponding to either *L. laccata* or *L. tetraspora* were compatible and formed clamp connections (Fries & Mueller, 1984). Collections referable to both putative species comprised two mating groups (III and IV) in the study by Fries & Mueller (1984). These two groups, however, could not be distinguished on basidiocarp morphology, basidiospore size or shape, or basidiospore ornamentation height and were, therefore, treated as sibling species (Table II). Thus, the character states which were to separate *L. laccata* and *L. tetraspora* were found in both mating groups and were not usable in delimiting the two groups.

The holotype of *L. ohiensis* consists of basidiocarps which have moderate-sized, globose, echinulate basidiospores born on 4-sterigmate basidia and lack cheilocystidia (Table I). This agrees with Singer's (1942: 102) description of the type and Malençon's (1966: 187) and Malençon & Bertault's (1975: 194) concept of the taxon. In subsequent papers (e.g., Singer & Digilio, 1952: 24; Singer, 1977: 348), however, Singer treats *L. ohiensis* as being bisporic. Since the type collection is tetrasporic and has its macro- and micromorphological characters in common with *L. laccata*, the two are treated as synonyms. The correct name for the bisporic taxon discussed by Singer (Singer, 1967: 119; 1977: 350) which has moderate sized subglobose basidiospores and normally occurs in warm and dry regions, often under *Eucalyptus*, is *L. fraterna* (Cooke & Mass.) Pegl. (see below).

The species that we recognize from North America north of Mexico and western Europe which could be confused with *L. laccata* are *L. bicolor* (Maire) P. D. Orton, *L. striatula* (Peck) Peck, *L. montana* Sing., *L. nobilis* Mueller, *L. oblongospora* Mueller, *L. proxima* (Boud.) Pat., and *L. trichodermophora* Mueller. All but *L. montana* and *L. striatula* have recently been discussed by Mueller (1984, 1985). *Laccaria montana* is distinguished primarily from *L. laccata* by its relatively large (usually 10–14 µm long excluding ornamentation), subglobose to broadly ellipsoid, short spined basidiospores, and its habitat (arctic, subarctic, boreal, and alpine).

Laccaria striatula has only been reported in the study area from very moist and well shaded habitats, often in moss, in eastern North America (Mueller, 1985: 127 as *L. gla-*

Table II. Basidiospore characteristics of the *Laccaria laccata* collections used in mating studies by Fries & Mueller (1984) arranged by mating group. Within a mating group monokaryotic isolates formed clamp connections when paired.

Stock no.	Mating group	Mean spore size in µm (n = 30–40)	Mean spore length/width ratio (n = 30–40)	Maximum length of echinulae per spore in µm
369	III	8.3 × 8.1	1.03 (= globose)	1.5–2.5
1505	III	8.5 × 8.1	1.02 (= globose)	2.0–2.5
1604	III	8.3 × 8.2	1.01 (= globose)	1.0–2.0(–2.5)
363	IV	7.8 × 7.2	1.09 (= subglobose)	0.5–1.5
367	IV	8.7 × 8.0	1.08 (= subglobose)	0.5–2.0
368	IV	8.5 × 7.9	1.08 (= subglobose)	0.5–1.5
1495	IV	8.6 × 7.6	1.13 (= subglobose)	0.5–1.5
1512	IV	8.4 × 8.2	1.02 (= globose)	1.5–2.0
1515	IV	8.1 × 7.6	1.06 (= subglobose)	0.5–1.5
1519	IV	8.5 × 8.2	1.04 (= globose)	0.5–1.5(–2.0)
1523	IV	7.9 × 7.7	1.02 (= globose)	0.5–1.5(–2.0)
1560	IV	8.2 × 7.9	1.05 (= subglobose)	0.5–1.5
1588	IV	8.4 × 8.1	1.03 (= globose)	0.5–1.5
1599	IV	9.0 × 8.3	1.09 (= subglobose)	0.5–1.5

bripes). It is characterized by having strongly translucent striate pilei and thin, cartilaginous, glabrous stipes that are darker than or concolorous with the pilei. Its micromorphological features are similar to those found in *L. laccata*. Mating studies on this taxon have not yet been done, and consequently, the rank at which to recognize this taxon is still unclear. Although *L. striatula* has occasionally been treated as a bisporic taxon (e.g., Singer, 1943: 151; Orton, 1960: 281), an examination of its type revealed moderate sized basidiocarps, 4-sterigmated basidia, no cheilocystidia, and moderate to relatively large, globose, strongly ornamented basidiospores (Table I). The bisporic taxon with moderately large to large, broadly ellipsoid basidiospores normally restricted to arctic, boreal, and alpine habitats in the Northern Hemisphere is referable to *L. pumila* Fay. (see below).

Following the definitions for subspecific taxa outlined by Singer (1975: 151), we use the term variety to indicate morphologically distinct infraspecific taxa for which important data, including the degree of interfertility, are unknown. While we agree with Singer (1977: 347) on the need for undertaking infraspecific mating studies within *L. laccata* and of the need to describe and delimit morphologically distinct forms within this species, we recognize far fewer subspecific taxa within *L. laccata* than have been proposed. An examination of the extant types of the published infraspecific taxa revealed that the vast majority of them could not be differentiated on morphological characters.

For the most part, the variation in macro- and micromorphological characters formed a continuum (Table I) and only three discrete, morphologically distinct units were discernable. Most of the published varieties and formae were based on very small morphological differences (e.g., attachment of lamellae or shape of the pileus, very small differences in basidiospore size and/or ornamentation height) coupled with differences in ecology (e.g., growing on humus versus growing among moss). Because of the large amount of observed variation in these features, even within a single collection, these morphological differences were determined to be taxonomically insignificant based on our examination of large numbers of specimens. Thus, most of the published subspecific taxa do not fit into Singer's definition of a variety and are not recognized.

The following infraspecific taxonomy within *L. laccata* is presented not to be a final statement on the subject, but to clarify the synonymy and taxonomy of the group based on available names and concepts of taxa. Some additional subspecific taxa may need to be recognized once the variation in this species has been more fully investigated and additional mating studies undertaken.

Only those putative taxa which have been reported from the U.S.A., Canada, and Europe are treated in this paper since fresh material of the extralimital taxa has not been seen by us. The extralimital names which have been proposed are: *L. tetraspora* var. *aberrans* Sing., *L. laccata* var. *chilensis* Sing., *L. laccata* var. *gibba* Sing., *L. laccata* var. *minuta* (Imai) Hongo, *L. tetraspora* var. *peladae* Sing., *L. tetraspora* var. *peullensis* Sing., *L. tetraspora* var. *valdiviensis* Sing., and *L. tetraspora* var. *xena* Sing. A decision on which of these putative taxa to recognize should be postponed until additional material has been examined and pairing studies undertaken.

The differences between the three varieties that we recognize from North America north of Mexico and Europe are summarized in the following key and further characterized in the discussion after the synonymy lists and descriptions.

KEY TO THE NORTH AMERICAN (NORTH OF MEXICO) AND EUROPEAN VARIETIES OF LACCARIA LACCATA

1. Stipe very long (most 70–120 mm long); pileus convex becoming depressed, often with papilla in depression; basidiospores subglobose to broadly ellipsoid, rarely ellipsoid. (Q = (1.0–)1.05–1.25(–1.6)); in moss including *Sphagnum* . . . . var. *moelleri* Sing.
1. Stipe short to moderately long (most 17–65 mm long); pileus convex to plane, sometimes depressed or umbonate, lacking papilla; basidiospores globose to occasionally broadly ellipsoid or broadly ellipsoid to ellipsoid; in moss or not in moss.
    2. Basidiospores globose to subglobose, occasionally broadly ellipsoid (Q = 1.0–1.1(–1.15)) var. *pallidifolia* (Peck) Peck
    2. Basidiospores broadly ellipsoid to ellipsoid ($Q > 1.2$) . . . . var. *laccata*

Laccaria laccata var. **laccata** — Fig. 1

Clitocybe laccata var. *rufo-carnea* Barla, Fl. mycol. ill.: 79. 1892.
Laccaria laccata var. *carbonicola* Sing. in Bull. trimest. Soc. mycol. Fr. 83: 110. 1967.

Laccaria laccata var. ***vulcanica*** Sing. ex Veselsky & Sing. in Sing. in Plant Syst. Evol. 126: 362. 1977.

Laccaria laccata var. ***pseudobicolor*** M. Bon in M. Bon & Haluwijn in Doc. mycol. 12(46): 42. 1982.

Russuliopsis laccata var. ***rosella*** f. ***pusilla*** J. Schroet. in Cohn, Krypt.-Fl. Schlesien 3(1): 623. 1889.

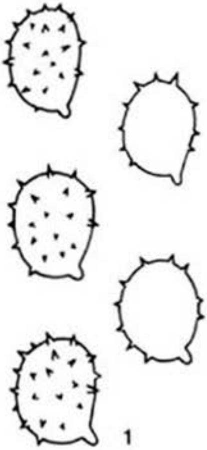
Type specimen (neotype): BAFC — *Singer C4083*, 17 Aug. 1964, Sweden, Femsjö.

Pileus 5–45(–60) mm, when young hemispherical with or without involute margin, later expanding to applanate or plano-convex, often with a shallow depression, hygrophanous, when moist orange-brown, pink-brown, rarely very pale buff or cream colored, or flesh colored vinaceous, with darker center and striae (Munsell 2.5 YR 4/4–6/8, 5 YR 4/4–7/6), fading to pale yellow, pale yellowish pink, very pale pinkish brown (Munsell 5 YR 5/4–10 YR 8/4), not striate or translucent-striate up to 1/3 of radius, rarely striate up to center; margin entire to undulate, occasionally becoming eroded with age; surface glabrous when moist, becoming radially adnately fibrillose, rarely squamulose at disc. Lamellae (L = (12–)15–26/1 = 1–4(–5)), close to distant, when young arcuate, becoming adnate or slightly emarginate or decurrent with tooth, relatively thin to thick, rarely very thick, pinkish flesh color (Munsell 7.5 YR 8/4), often becoming slightly vinaceous or dark pink-brown (10 R 5/3), white pruinose with age; edge entire, concolorous. Stipe (12–)17–65(–105) × 1.5–5(–12) mm, cylindrical to subclavate or tapering towards base, occasionally with subbulbous base, sometimes compressed, sometimes slightly eccentric, solid, later fistulose, concolorous with pileus, fibrillose, not striate to finely longitudinally striate, very rarely with pronounced striations. Basal mycelium sparse to copious, white. Context of pileus thin, hygrophanous and concolorous with, to slightly paler than surface. Context of stipe similar to pileus context. Smell fungoid, sometimes herbaceous fungoid or subraphanoid; taste mild fungoid. Spore print white.

Basidiospores (excluding ornamentation) 7.0–9.0(–11.0) × (5.0–)6.0–8.0(–8.5) µm, Q = (1.1–)1.15–1.35(–1.45), $\bar{Q}$ = 1.2–1.3, broadly ellipsoid to ellipsoid, echinulate; spines 0.5–2.0(–2.5) µm high, crowded; hilar appendage 1.5–2.0 µm long, prominent, truncate; contents occasionally uni- or biguttulate; basidiospore wall up to 1 µm thick. Basidia 27.5–55 × 7.5–13.5(–16.5) µm, clavate, elongate, hyaline, tetrasporic, very rarely bi- or trisporic. Pleurocystidia absent. Cheilocystidia (15–)25–55(–70) × 2–5(–7.5) µm, filiform to narrowly clavate, occasionally strangulate, sometimes branched, absent or scattered to abundant, thin-walled, hyaline. Pileipellis a cutis of radially arranged cylindrical hyphae 10–15 µm wide, often with scattered fascicles of more or less perpendicular hyphae; terminal elements of fascicular hyphae up to 37.5 µm in diam., undifferentiated to broadly clavate; contents hyaline to yellowish brown due to intracellular and slightly encrusting moderately yellowish brown pigment. Stipitipellis a cutis of 8–10 µm wide hyphae with yellowish brown intracellular and slightly encrusting pigment.

Habitat & distribution. — Solitary to gregarious, terrestrial, on humus or vulcanic or burnt soils; cosmopolitan, not abundant.

Laccaria laccata var. *laccata* is apparently uncommon. Neither of us have collected it and only few collections referable to it were found among the herbarium material that we have examined. Those names for which no type specimen and good micromorphological description exists are placed under this variety along with three of the varieties proposed by Singer (1967: 110; 1977: 362) and one by Bon (1982: 42). The holotypes



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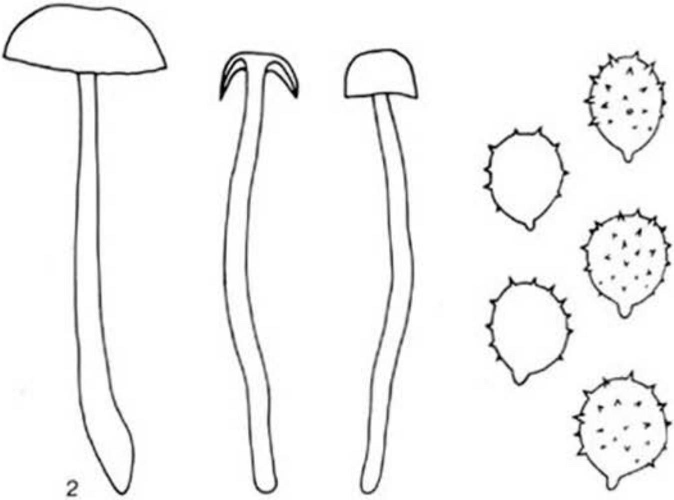

2

Fig. 1. *Laccaria laccata* var. *laccata*. — Spores (× 1500, from neotype).

Fig. 2. *Laccaria laccata* var. *moelleri*. — Habit (× 0.5), spores (× 1500). (Both from *Mueller 1926*, 18 Sept. 1984, Canada, Ontario, Algonquin Prov. Park, Spruce Bog Trail, WTU).

of these synonyms differed from the type variety in several minor ways, but *L. laccata* var. *laccata*, *L. laccata* var. *pseudobicolor*, *L. laccata* var. *carbonicola*, and *L. laccata* var. *vulcanica* are all macromorphologically similar and all share the important character state of relatively elongate basidiospores and are thus treated as contaxic.

This variety is differentiated from the other varieties of *L. laccata* by its broadly ellipsoid to ellipsoid, moderately ornamented basidiospores. All of the varieties, however, are tied together by their macromorphology. Although members of *L. laccata* var. *laccata* have not been included in mating studies, members of the other two varieties have been shown to be at least partly compatible with each other and genetically isolated from all other species tested (Fries & Mueller, 1984; Mueller & al., 1985).

Laccaria laccata var. *laccata* can only be differentiated from *L. proxima* with some difficulty. *Laccaria proxima* differs by being more robust and having somewhat darker colored and more scaly basidiocarps and more finely ornamented basidiospores.

Laccaria laccata var. **moelleri** Sing. — Fig. 2

Laccaria laccata var. *moelleri* Sing. in Sydowia Beih. 7: 9. 1973.

Type specimen (holotype): F — *Singer C5227*, 30 Sept. 1970, CSSR, Treboň.

Macromorphology as in type variety except where noted. Pileus (11–)18–42(–78) mm, often depressed, usually with papilla. Stipe (38–)70–120(–165) × 3–6(–11) mm.

Basidiospores (excluding ornamentation) (7.0–)8.0–10.0(–11.0) × 7.0–8.5 μm, Q = (1.0–)1.05–1.25(–1.6), $\bar{Q}$ = 1.1–1.3, subglobose to broadly ellipsoid, occasionally globose or ellipsoid, echinulate; spines 0.5–1.5(–2.0) μm high, crowded. All else as in type variety.

All other micromorphology as in type variety.

Habitat & distribution. — Gregarious, among moss, often *Sphagnum*; Europe and North America, not abundant.

This variety is characterized by its very long stipe, papilla in the pileal depression, subglobose to broadly ellipsoid basidiospores, and restricted habitat (among moss, especially *Sphagnum*). Singer reports this variety from Eastern Europe and one of us (G.M.M.) has collected it in Sweden and Canada.

In the laboratory, members of this variety will successfully mate with at least some members of *L. laccata* var. *pallidifolia* (Peck) Peck. Since several widely separated populations of *L. laccata* var. *moelleri* have been found, the two varieties may be partially genetically isolated and thus both taxa need to be recognized.

Laccaria laccata var. **pallidifolia** (Peck) Peck — Fig. 3

Clitocybe laccata var. *pallidifolia* Peck in Ann. Rep. N.Y. St. Bot. 43: 38. 1890. — *Laccaria laccata* var. *pallidifolia* (Peck) Peck in Ann. Rep. N.Y. St. Bot. 157: 92. 1912.

Clitocybe tortilis var. *gracilis* Peck in Ann. Rep. N.Y. St. Bot. 67: 36. 1903.

Laccaria laccata var. *decurrens* Peck in Ann. Rep. N.Y. St. Bot. 157: 92. 1912.

Laccaria laccata var. *anglica* Sing. in Bull. trimest. Soc. mycol. Fr. 83: 110. 1967. — *Laccaria anglica* (Sing.) M. Bon in Doc. mycol. 11(44): 22. 1981. (not val. publ.; basionym lacking). — *Laccaria affinis* var. *anglica* (Sing.) M. Bon in Doc. mycol. 13(51): 50. 1983.

Laccaria laccata var. *affinis* Sing. in Bull. trimest. Soc. mycol. Fr. 83: 111. 1967. — *Laccaria affinis* (Sing.) M. Bon in Doc. mycol. 13(51): 49. 1983.

Laccaria tetraspora Sing. in Mycologia 38: 689. 1946. — *Laccaria tetraspora* var. *tetraspora* automatically established by var. *peullensis* Sing. in Bull. trimest. Soc. mycol. Fr. 83: 113. 1967.

Laccaria tetraspora var. *scotica* Sing. in Bull. trimest. Soc. mycol. Fr. 83: 114. 1967. — *Laccaria scotica* (Sing.) M. Bon in Doc. mycol. 11(44): 23. 1981. (not val. publ.; basionym lacking).

Agaricus ohiensis Mont., Syll. Gen. Sp. Crypt.: 100. 1856. — *Clitocybe ohiensis* (Mont.) Sacc., Syll. Fung. 5: 181. 1887. — *Laccaria ohiensis* (Mont.) Sing. in Mycologia 38: 688. 1946. — *Laccaria ohiensis* var. *ohiensis* automatically established by var. *paraphysata* McNabb in N. Z. J. Bot. 10: 474. 1972.

Laccaria laccata var. *subalpina* Sing. in Plant Syst. Evol. 126: 365. 1977.

Laccaria laccata var. *tatrensis* Sing. in Plant Syst. Evol. 126: 367. 1977.

Laccaria laccata var. *intermedia* Sing. in Plant Syst. Evol. 126: 368. 1977.

Laccaria tetraspora var. *tetraspora* f. *major* Sing. in Bull. trimest. Soc. mycol. Fr. 83: 113. 1967. (not val. publ.: type specimen not designated). — *Laccaria tetraspora* var. *major* (Sing.) M. Bon & Haluwijn in Doc. mycol. 14(53): 6. 1984.

Excluded. — *Laccaria ohiensis* sensu Sing. in Lilloa 22: 177. ('1949') 1951; sensu Sing. & Digilio in Lilloa 25: 23. 1952; sensu auct. plur. (in all cases *L. fraterna*).

Type specimen (holotype): NYS — Peck, October, USA, Selkirk.

Macromorphology as in type variety.

Basidiospores (excluding ornamentation) (6.5–)7.5–10.0(–13.0) × (6.0–)7.0–10.0(–12.5) μm, Q = (0.95–)1.0–1.15(–1.3), $\bar{Q}$ = 1.0–1.1(–1.15), globose to subglo-

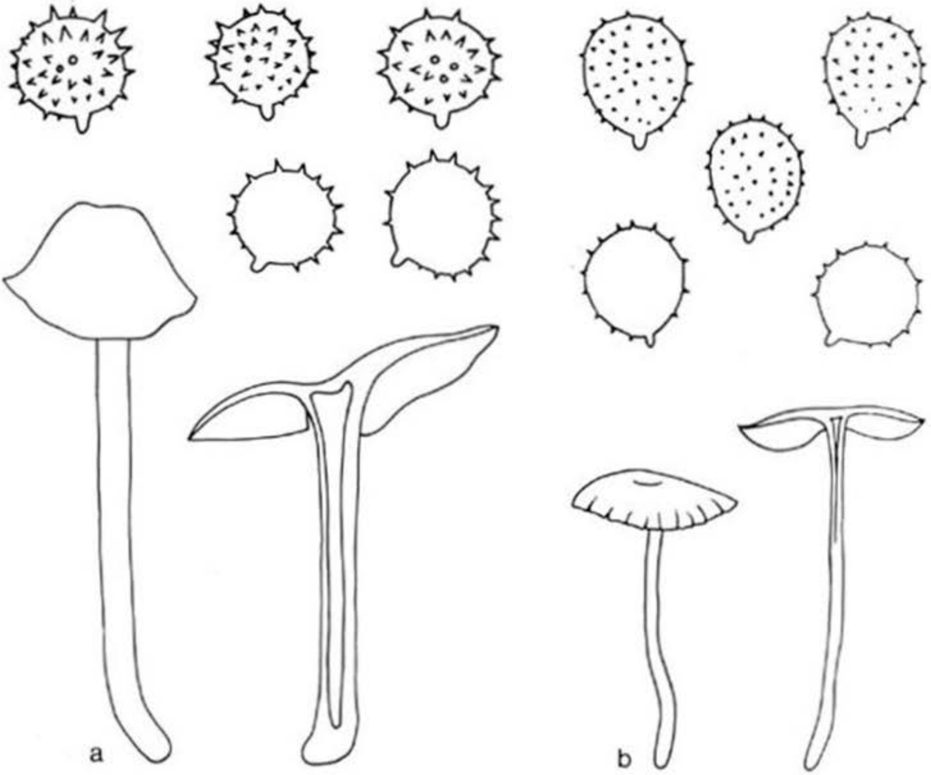

Fig. 3. *Laccaria laccata* var. *pallidifolia*. — Habit (× 1), spores (× 1500). (a. From *Vellinga 384*, 1 Aug. 1981, Netherlands, IJsselmeerpolders, Bremerbergbos, L; b. from *Vellinga 573*, 4 Nov. 1983, Netherlands, Noord-Holland, Zwanewater, L).

bose, rarely broadly ellipsoid, echinulate, spines 0.5–2.5 μm high, up to 1.5 μm wide at base. All else as in type variety.

All other micromorphology as in type variety.

Habitat & distribution. — Gregarious, more rarely solitary or caespitose, terrestrial on sand, soil or among moss including *Sphagnum*; cosmopolitan; abundant.

Laccaria laccata var. *pallidifolia* is by far the most common variety in the species and can be found in a wide variety of habitats. It differs from the type variety by having globose to subglobose or occasionally broadly ellipsoid, moderately to strongly ornamented basidiospores.

As can be seen from the lengthy list of synonyms, numerous names have been proposed for this taxon. All of these names were based on type specimens characterized by having small to moderate sized, orange brown, glabrous to finely scaly basidiocarps, white mycelium at the base of the stipe, 4-sterigmate basidia, and globose to subglobose, moderately to strongly ornamented basidiospores (Table I).

Laccaria fraterna (Cooke & Mass.) Pegl.

Agaricus fraternus Cooke & Mass. in Grevillea 16: 31. 1887. — *Naucoria fraterna* (Cooke & Mass.) Sacc., Syll. Fung. 9: 110. 1891. — *Laccaria fraterna* (Cooke & Mass.) Pegl. in Aust. J. Bot. 13: 332. 1965.

Naucoria goossensiae Beeli in Bull. Soc. Roy. Bot. Belgique 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.

Misapplied names. — *Laccaria ohiensis* sensu Sing. in Lilloa 22: 177 ('1949') 1951; sensu auct. plur.

Type specimen (holotype): K — *French No. 1*, Australia, vic. Port Phillip.

As mentioned above, neither *L. ohiensis* or *L. striatula* can be used for the bisporic *Laccaria* with moderate sized basidiospores (mostly 9–11 × 8–11 µm excluding ornamentation) because both are tetrasporic. Cooke & Massee (1887: 31) described *Agaricus fraternus* from Port Phillip, Australia as a dark rusty red mushroom growing on wood with ellipsoid, moderate sized basidiospores. Its type specimen has 2-spored basidia which bear moderate sized, globose to subglobose, echinulate basidiospores (Table III). As mentioned by Pegler (1965: 332), the report of ellipsoid spores in the original diagnosis of *A. fraternus* probably refers to another collection on the type sheet from New Zealand which Singer has annotated as a 'strophariaceous species.'

Two later names whose type specimens also have bisporic basidia which bear moderate sized basidiospores are *Naucoria goossensiae* Beeli and *L. lateritia* Malenç. (Table III). The major differences between the three type specimens is that *A. fraternus* was reportedly collected 'on logs', while the other two were growing under *Eucalyptus*. Since it is not uncommon to find other terrestrial *Laccaria* species growing on decomposed wood, the difference in their habitat does not appear significant and the three are considered contaxic.

Based primarily on ecological differences, Malençon (1966) and Pegler & Rayner (1969) recognized two bisporic species with moderate sized basidiospores: (i) *Laccaria fraterna* (as *L. lateritia*) growing in warm, dry regions (e.g., Australia, Mediterranean regions, and parts of South America) under *Acacia, Eucalyptus*, and *Coffea* and (ii) *L. striatula* sensu Singer growing in cool moist areas (e.g., Great Britain and the French Alps) in moss including *Sphagnum*. We consider these two forms as separate taxa, *L. fraterna* and *L. pumila* Fay., respectively.

Laccaria pumila Fay.

Laccaria pumila Fay. in Annali Accad. Agric. Torino 35: 91. 1893. — *Clitocybe pumila* (Fay.) Sacc., Syll. Fung. 17: 13. 1905. — *Laccaria laccata* var. *pumila* (Fay.) J. Favre in Ergebn. wiss. Unters. schweiz. NatnParks V, 33: 51. 1955 (not val. publ.; basionym not mentioned).

Table III. Characteristics of the three names discussed under *Laccaria fraterna*. Herbarium abbreviations from Index Herbariorum. Macromorphology based on original diagnosis. Micromorphology based on examination of cited specimens.

	Agaricus fraternus Holotype at K *French No. 1*	*Naucoria goossensiae* Holotype at BR *Goossens No. 588*	*Laccaria lateritia* Representative specimen at MPU *Felippone No. 2800*
Pileus:	convex, glabrous, dark rusty-red	convex, glabrous, brownish rust color	convex to depressed, striate to glabrous, red brown to dark brick-red
Lamellae:	adnate, rusty-red	adnate, brownish red color	adnate to arcuate, pallid rose to purple ochraceous
Stipe:	elongate, thin, glabrous, concolorous	elongate, relatively thin, glabrous, concolorous	short, thin, striate & twisted, reddish brown
Basidia:	2-sterigmate, clavate	2(–4)-sterigmate, clavate	2-sterigmate, clavate
Spores: (n = 30)	(8.5–)9.0–11.0(–11.5) × 8.5–10.5(–11.5) µm mean L × W = 9.9 × 9.9 µm mean L/W = 1.01	(8.0–)8.5–11.0(–11.5) × (7.5–)8.0–10.0 µm mean L × W = 9.9 × 8.9 µm mean L/W = 1.11	8.5–11.0(–13.5) × 8.5–10.5(–13.5) µm mean L × W = 9.7 × 9.5 µm mean L/W = 1.02
Echinulae:	(1.0–)1.5–2.0 µm long	<0.5–1.5 µm long	1.0–1.5 µm long
Habitat:	on logs	under *Eucalyptus*	under *Eucalyptus*

Laccaria altaica Sing. in Bull. trimest. Soc. mycol. Fr. 83: 122. 1967.

Misapplied names. — *Laccaria striatula* sensu Sing. in Mycologia 35: 151. 1943; sensu auct. plur.

Laccaria tortilis sensu M. Lange in Meddr Grønland 147: 29. 1955; sensu O. K. Miller & al. in Mycologia 74: 583. 1982.

Type specimen (neotype, design. nobis): L — *J. Trimbach 1463*, 18 July 1976, France, dept. Alpes maritimes, Col de la Cayolle, alt. 2500 m.

Fayod (1893: 91) described a small bisporic *Laccaria* from the Italian side of the French Alps (Torre Pellice) under the name *L. pumila*. While he stated that it differed from *L. tortilis* (Bolt.) Cooke, he did not designate a type specimen. The original description and Fayod's watercolor and line drawings of its micromorphology support treating *L. pumila* as a separate taxon.

A specimen collected by J. Trimbach (*J. Trimbach 1463*) in the French Maritime Alps approximately 80 km south southwest of the type locality of *L. pumila* fits the original description and drawing of *L. pumila*, represents our concept of this taxon, and is designated as the neotype. This collection has the following characteristics:

Macromorphology: See Trimbach (1978: 44–45).

Basidiospores (excluding ornamentation) (10.5–)11.0–12.0(–15.0) × (9.0–)9.5–10.5(–15.0) µm, Q = (1.0–)1.05–1.3(–1.35), $\bar{Q}$ = 1.18, subglobose to broadly ellipsoid or ellipsoid, a few globose, echinulate; spines 0.5–0.8(–1.0) µm high, very crowded; hilar appendage up to 2 µm long, prominent, truncate; basidiospore wall up to 1 µm thick. Basidia 47–55 × 10–15 µm, narrowly clavate, elongate, hyaline, bisporic.

As was already suggested by Trimbach (1978: 45), *L. pumila* and *L. altaica* Sing. are conspecific. Both have the same morphology (small, strongly striate pileus and bisporic basidia which bear large, elongate, finely ornamented basidiospores) and were first described from alpine habitats.

Laccaria pumila differs from *L. fraterna* by having larger basidiospores (most 11–16 × 10–15 µm versus most 9–11 × 8–11 µm in *L. fraterna*), orange-brown basidiocarp color versus rusty red-brown basidiocarp color in *L. fraterna*, and a preference for cooler, more humid, alpine, boreal, to arctic habitats.

Laccaria pumila differs from *L. tortilis* by having subglobose to ellipsoid finely ornamented basidiospores instead of the globose, strongly echinulate basidiospores of *L. tortilis*. Additionally, *L. tortilis* often displays highly contorted basidiocarps with very few and widely spaced lamellae.

ACKNOWLEDGEMENTS

The curators of the following herbaria are kindly thanked for the sending of type specimens and other collections on loan: BAFC, BPI, BR, F, FH, G, K, LE, LPS, MICH, MPU, NYS, PC, SAP, and SGO. Mr. Trimbach is thanked for the collections of *Laccaria pumila*.

The first author acknowledges the support of the National Science Foundation (Grant no. BSR 83-15238) and of the U.S.-Sweden Cooperative Science Program of the

U.S. National Science Foundation (Grant no. Int 82-11779) and the Swedish National Science Research Council.

The investigations of the second author were for a part supported by the Foundation for Fundamental Biological Research (BION), which is subsidized by the Netherlands' Organization for the Advancement of Pure Research (ZWO).

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PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 1, pp. 45–56 (1986)

NOTULAE AD FLORAM AGARICINAM NEERLANDICAM-XII

Some notes on the genera Oudemansiella and Xerula

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The generic separation of *Oudemansiella* and *Xerula* is discussed and accepted as proposed by Dörfelt. *Xerula caussei* and *X. kuehneri* are redescribed and illustrated. *Xerula nigra* and *X. renatii* are considered conspecific with *X. caussei*. *Dactylosporina* is reduced to the synonymy of *Xerula*. The new combinations *X. steffenii* and *X. macracantha* are introduced.

The genus *Oudemansiella* Speg. dates back to 1881. It was originally described as follows: 'Velum haud manifestum; stipes centralis; pileus emisphaericus, carnosi, non liquescentes; lamellae membranaceae, integrae, acie longitudinaliter fissa, labiis oppositis primo cum illis lamellarum lateralium connatis, dein liberis' (Spegazzini, 1881: 23). *Oudemansiella platensis* Speg. (= *O. canarii* (Jungh.) Höhn.) was the only species.

In 1887 Patouillard (1887: 95) created the genus *Mucidula* which according to his description has a distinct veil ('Stipe annulé') contrary to Spegazzini's diagnosis of the genus *Oudemansiella*. *Mucidula mucida* was the only species. Von Höhnel (1913: 2) and Boursier (1924: 332) already noted the similarity of *Mucidula mucida* to the genus *Oudemansiella*.

Boursier (l.c.) divided the genus *Mucidula* in two groups, viz. (i) *Viscosae* with among other species *M. mucida* and *M. radicata* and (ii) *Pilosae* with *M. longipes*. According to most modern authors (e.g. Horak, 1968: 425; Singer, 1975: 344) *Mucidula* and *Oudemansiella* are to be considered congeneric.

The genus *Xerula* was founded by Maire (1933: 66), who defined it as follows: 'Habitus *Mucidulae* cum qua lamellarum trama plus minusve intertexta nec non cute pilei hymeniformi congruit, differt pileo haud viscoso, cum stipite valde piloso, carne lenta haud putrescentes'. *Xerula longipes* was the only included species. According to Singer (1975: 344) *Xerula* Maire is a subdivision of *Oudemansiella* Speg. for which he created the name *Oudemansiella* subgenus *Xerula* (Maire) Sing.

Recently Dörfelt (1979: 365) restricted *Oudemansiella* to the annulate, non-rooting species and raised *Xerula* again to generic level. He emended the concept of the latter genus, so that it includes also viscid, non-pilose species such as *Xerula* (= *Oudemansiella*) *radicata*.

Dörfelt summarized the differences between *Oudemansiella* sensu stricto and *Xerula* sensu lato as follows (1981: 658–660):

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Oudemansiella	*Xerula*
1. Basidiocarps develop on normal mycelium.	1. Formation of yellowish, gnarled mycelium before basidiocarp development.
2. Pseudorrhiza absent; basidiocarps directly on wood.	2. Pseudorrhiza present; basidiocarps not directly on wood.
3. Basidiocarps hemiangiocarpous; velar remnants present.	3. Basidiocarps gymnocarpous (to paravelangiocarpous).
4. Pileipellis young a trichoderm later becoming a cutis; stipitepellis young a tricho-palisadoderm.	4. Pileipellis a hymeniderm; stipitipellis (young) a hymeniderm.
5. Spores verrucose (SEM).	5. Spores nearly smooth.
6. Spores > 15 µm.	6. Spores > 10 µm.

Although not all differentiating characters as given by Dörfelt seem to be as reliable as that author thinks (e.g. Pegler & Young, 1971: 57, pl. 9, demonstrated under SEM a remarkable ornamentation on the spores of *Xerula radicata*, although perhaps of a different nature from that in *O. canarii* and *O. mucida*), we believe that there are sufficient arguments to separate *Oudemansiella* and *Xerula* in the way Dörfelt does.

STRUCTURE OF STIPITITRAMA AND PILEIPELLIS IN OUDEMANSIELLA AND XERULA

The structure of the stipititrama and pileipellis of some species of *Oudemansiella* and *Xerula* has been studied by us in the framework of generic delimitation.

Corner (1966: 175) distinguished three main types of hyphal constructions in fleshy agarics; viz., monomitic, sarcodimitic and sarcotrimitic. According to his definitions, a sarcodimitic tissue is built up of narrow, branched, generative hyphae and hyphae consisting of long, inflating, frequently thick-walled elements ('skeletal hyphae'). In some cases, in addition many generative hyphae are thick-walled, thus forming the so-called sarcotrimitic structure.

Oudemansiella

Oudemansiella mucida has a monomitic stipititrama, which is built up of long, slender, thin-walled, rarely somewhat branched elements measuring (25–)60–750 × 3–30 µm. The hymenophoral trama is regular and made up of 10–30 µm wide attenuating elements. Very slender, 2–5 µm wide hyphae are also present. The pileipellis is somewhat intermediate between an ixohymeniderm and an ixotrichoderm and is made up of a c. 50 µm thick palisade of irregularly branched clusters of clavate elements in a gelatinous matrix. Below this layer slender repent hyphae occur, which have pale yellowish membranous pigment or weak incrustations. The pileipellis of *Oudemansiella canarii* proved to be an ixocutis.

Table 1. Sizes of hyphal elements of in the stipititrama in *Xerula* (taken from the middle of the stipe, unless otherwise indicated; after Scholtes, unpublished report Rijksherbarium, 1976).

species	elements of connective generative hyphae	elements of 'sarcoskeletals'[1]
X. radicata	$100-300 \times 2-5$ µm	$250-700 \times 5-45$ µm
atypical form with dry pileipellis (× *X. pseudoradicata*)	$60-125 \times 2-8$ µm	$250-750 \times 10-45$ µm
X. caussei		
upper part of stipe	$80-250 \times 3-8$ µm	$100-800 \times 6-30$ µm
basal part of stipe	$100-450 \times 3-12$ µm	$200-750 \times 6-25$ µm
X. longipes		
basal part of stipe	$30-175 \times 2-10$ µm	$125-1200 \times 5-20$ µm

Xerula

The stipititrama of most *Xerula* species investigated by us consists of two types of hyphae (= *sarcodimitic*), viz. hyphae consisting of very long, broad, (cylindrical or) fusiform elements (skeletal hyphae according to Corner[1], l.c.) and strongly branched narrow hyphae (generative hyphae according to Corner, l.c.). Only the tiny *X. kuehneri* was found to be monomitic. The sizes of hyphal elements in the species studied are presented in Table 1.

Xerula radicata has a subregular hymenophoral trama made up of c. 10–25 µm wide hyphae, which agrees with Knecht's observations (1967: 179). The subhymenium is c. 15–20 µm thick and pseudoparenchymatous. The pileipellis is a c. 60–90 µm thick ixohymeniderm, made up of clavate cells, c. 30–80 × 5–15 µm, with an intracellular brownish pigment.

Most of the specimens studied fully agree with *X. radicata*. Some of them differ, however, slightly by a dry pileipellis giving the pileipellis macroscopically a subvelutinous impression. This variant has been described as *Oudemansiella pseudoradicata* Moser (1955: 5).

The collection Bas 4545 (L) contains both specimens with the normal type of pileipellis and specimens with this dry type. These latter specimens with a dull, pruinose pileus

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[1] For convenience the term 'sarcoskeletals' is used here for this type of hyphae that is the essence of the sarcodimitic type of trama.

show anatomically a transition from a slightly gelatinized hymeniderm at the centre of the pileus to a dry hymeniderm at the margin of the pileus. Dörfelt (1981: 648) already noted this variability and therefore considered the name *X. pseudoradicata* a synonym of *X. radicata*, a conclusion supported by our observations. This is one of the reasons why the infrageneric classification of the genus *Oudemansiella* (including *Xerula*) made by Clémençon (1980: 74) is not acceptable, as *X. radicata* and *X. pseudoradicata* are placed there in two different subgenera.

Xerula caussei also has a subregular hymenophoral trama made up of 5–25 µm wide hyphae. The pileipellis is a c. 50–100 µm thick euhymeniderm made up of thin-walled clavate cells, c. 40–60 × 10–25 µm in size, with a pale grey-brown intracellular pigment. Among these cells occur ampulliform, slightly thick-walled pileocystidia up to 200 µm long and 10–30 µm wide at the base.

Xerula longipes has an irregular hymenophoral trama, which is made up of 10–25 µm wide, somewhat thick-walled hyphae. The pileipellis is a 50–100 µm thick ixohymeniderm made up of rather thick-walled, clavate cells, c. 50–70 × 7–13 µm in size, with a grey-brown intracellular pigment.

Xerula kuehneri has a monomitic stipitetrama made up of 3–16 µm wide, thin- to slightly thick-walled hyphae. The hymenophoral trama is irregular, made up of up to 25 µm wide thin-walled hyphae. The pileipellis is intermediate between a euhymeniderm and a trichohymeniderm, made up of clavate, fusiform or ventricose-fusiform, thin- to slightly thick-walled cells with brown contents, 45–95 × 8–26 µm in size. Among these cells occur lageniform to fusiform, thick-walled pileocystidia, 95–320 × 10–22 µm.

The separation of *Oudemansiella* and *Xerula* is thus supported by the structure of the pileipellis and, to a lesser extent, is also confirmed by the structure of the stipititrama. Although the stipititrama of *Xerula* (= *Mycenella*) *kuehneri* is monomitic we prefer its classification in the genus *Xerula* because of similarities of the pileipellis, the hymenium etc. (see also the paragraph on *Xerula kuehneri*).

Oudemansiella is therefore restricted to the species with a distinct veil, a bivelangiocarpous or monovelangiocarpous development (Reijnders, 1963: 154, 155), growing directly on wood, with a monomitic stipititrama and a pileipellis made up of a cutis (Horak, 1968: 426) or a palisade-like layer with clusters of clavate cells, e.g. *Oudemansiella mucida*.

Xerula contains the species without veil, with gymnocarpous development (Dörfelt & Schröder, 1984: 207), not growing directly on wood, with a sarcodimitic stipititrama (the tiny *X. kuehneri* is the only exception known) and a pileipellis varying from an (ixo)-hymeniderm to a trichoderm, e.g. *X. caussei*.

THE SPECIES COMPLEX OF XERULA CAUSSEI MAIRE

Xerula caussei Maire was originally described as follows: 'Ab affini *X. longipede* recedit pileo et stipite griseis a pigmento vacuolari (nec fulvis e pigmento membranari); pilis pilei et stipitis prostratis, flexuosis, hyalinis (nec erectis, rigidis, rufobrunneis); sporis

Table. 2. Spore dimensions in the *X. caussei* complex.

		reference:
X. caussei	8.5–9.5 × 6.0–7.5 µm	Maire (l.c.)
X. nigra	9–14.5 × 6.5–9.0 µm 8.5–10.5 × 6.0–8.0 µm	Dörfelt (l.c.) (our observations on type)
X. renati	8.9–10.1 × 6.6–7.2 µm (7.5–)8.5–11.5(–14.5) × (6.0–)6.5–8.0(–8.5) µm 9.0–12 × 7–8.7 µm	Clémençon (l.c.) Dörfelt, 1980 (our observations on type)
specimens from Belgium	9–12 × 5.5–8.0 µm	(our observations)

minoribus (8.5–9.5 × 6–7.5 µm, nec 11–13 × 9–12 µm); cystidis tenuiter tunicatis, graciliorlbus, apice capitatis' (Maire, 1937: 265).

The closely related *Xerula nigra* Dörfelt differs, judging from its description, mainly by its very dark blackish brown to greyish brown pileus, somewhat larger spores (viz. 9–14.5 × 6.5–9 µm) and cylindrical to lageniform cystidia (Dörfelt, 1973: 27).

Xerula (= *Oudemansiella*) *renati* Clémençon is said to differ from *X. caussei* by the absence of pleurocystidia, the absence of capitate cheilocystidia and shorter basidia (Clémençon, 1977: 14).

Because we found it very difficult to identify specimens of this complex, we studied the types of *X. nigra* and *X. renati*. The type of *X. caussei* could not be traced. In addition we studied material from France and particularly rich collections from eastern Belgium. We made the following observations: The colour of the pileus from specimens gathered during several years from one locality (Belgium, Bois de Resteigne) varies from pale grey-brown to dark blackish grey, thus nullifying the alleged value of the differences in colour given in the descriptions of *X. caussei*, *X. nigra* and *X. renati*. Also it turned out to be hardly possible to define species in this cluster on the base of spore size (Table 2).

According to the original descriptions, the only then remaining differences are to be found in the cheilocystidia. Both *Xerula caussei* and *X. nigra* have pleuro- and cheilocystidia. Those of the latter species are described as '60–90 × 10–13 µm, fast walzig bis flaschenförmig'. However, our study of the holotype revealed fusiform, thin-walled cystidia with a subcapitate apex agreeing very well with those described for *X. caussei*.

Clémençon (l.c.) reported only cheilocystidia for *X. renati*. However, the holotype has some pleurocystidia which are identical to the cheilocystidia. We found the cystidia of *X. nigra*, *X. renati* and those of the Belgian specimens similar. They also agree fairly well with those described for *X. caussei*, because they frequently have a subcapitate apex. Therefore within this complex we accept only one species.

Xerula caussei Maire—Fig. 1

Xerula caussei Maire in Bull. trimest. Soc. mycol. Fr. 53: 265. 1937. — *Mycenella caussei* (Maire) Romagn. in Bull. trimest. Soc. mycol. Fr. 56: 63. ('1940') 1941. — *Oudemansiella caussei* (Maire) Mos. ex Clémençon in Nova Hedwigia 28: 19. 1977.

Oudemansiella nigra Dörfelt in Ceská Mykol. 27: 28. 1973. — *Xerula nigra* (Dörfelt) Dörfelt in Landschaftspfl. Naturschutz Thüringen 14(3): 60. 1977.

Oudemansiella renati Clémençon in Nova Hedwigia 28: 14. 1977. — *Xerula nigra* var. *renati* (Clémençon) Dörfelt in Reprium nov. Spec. Regni veg. 91: 429. 1980.

Misapplied name. — *Collybia longipes* sensu Lange, Fl. agar. dan. 2: 9. 1936.

Selected illustrations. — Lange, Fl. agar. dan. 2, pl. 41A. 1936.

Selected descriptions. — Dörfelt in Reprium nov. Spec. Regni veg. 90: 375. 1979.

Basidiocarps small to medium. Solitary. Pileus 30–60 mm in diam., convex, plano-convex to applanate, with low, broad umbo, when young with margin inflexed, finally undulating, rather fleshy, pale to dark brown-grey, occasionally even blackish grey

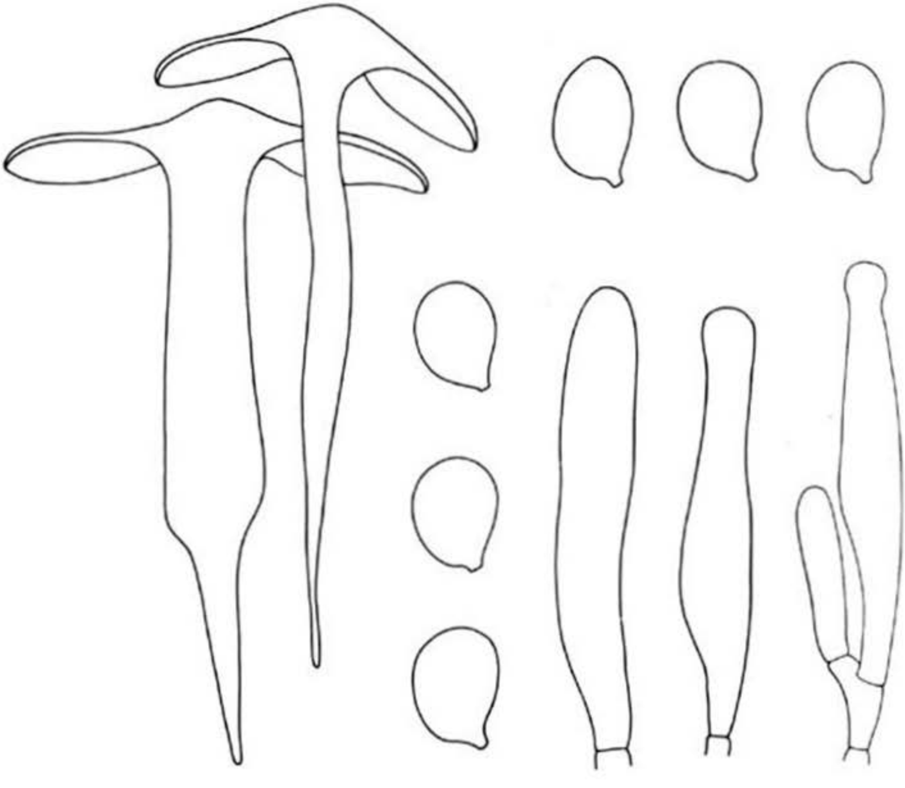

Fig. 1. *Xerula caussei*. Basidiocarps (× 1), spores (× 1500), and cheilocystidia (× 1000).

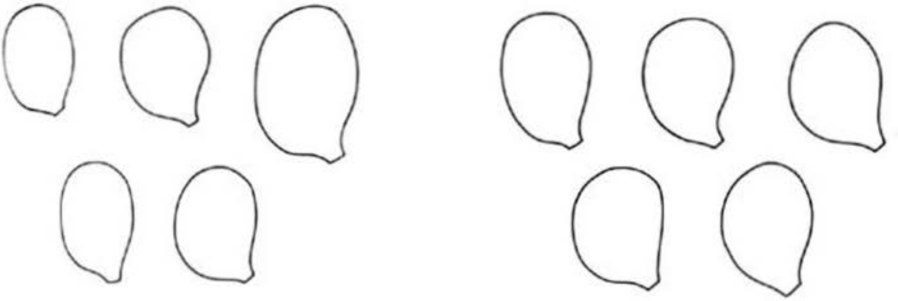

Fig. 2. Spores (× 1500) of type of *Oudemansiella renati* (left) and of type of *O. nigra* (right).

(Munsell 10 YR 4–5/3, 4/2, 5Y 4/2) or very pale (2.5Y 6–7/2), dry, frequently radially rugulose near margin, entirely pubescent with whitish hairs. Lamellae rather distant (L = 30, l = (1–)3–7), narrowly adnate, sinuate or adnexed, ventricose, frequently venose, rather thick, up to c. 7 mm wide, white to pale cream (10 YR 8/1–2, 5Y 9/2–4), with entire, concolorous edge. Stipe 40–80 × 3–10 mm, cylindrical with clavate base, occasionally attenuated towards base, mostly rooting, solid, whitish, towards base becoming grey-beige or grey-brown (10 YR 4/2, 5/3, 6/4), entirely whitish pubescent. Context white, but greyish in cortex of stipe. Smell weak, somewhat acid. Taste weak, mild or somewhat adstringent-fungoid. Spore print white.

Spores (8.0–)9.0–12.0 × 5.5–8.0 μm, Q = 1.3–1.8, ovoid or ellipsoid, thin-walled. Basidia 35–50 × 9–11 μm, clavate, (2–)4-spored. Cheilocystidia 55–100 × 7–15 μm, cylindrical to fusiform, mostly truncate, sometimes subcapitate at apex. Pleurocystidia sparse, similar to cheilocystidia. Hymenophoral trama subregular, made up of 5–25 μm wide hyphae, some with refractive contents. Pileipellis a hymeniderm, up to c. 70 μm thick, made up of clavate cells, 40–60 × 10–25 μm, with intracellular pale grey-brown pigment, with scattered, slightly thick-walled, colourless ampulliform setae, up to 200 μm long and 10–30 μm wide at base. Setae at stipe up to c. 400 × 10–20 μm, slightly thick-walled, colourless, attenuated towards apex. Clamps present.

Habitat & distribution. — Terrestrial in *Fagus* forest on rich, loamy, probably always calcareous soil. Known from Belgium, France, Germany (East and West), Great Britain, and Switzerland.

Collections examined. — BELGIUM, prov. Namur, Resteigne, Bois de Resteigne, 24 Sept. 1974, *C. Bas 6386* (L); ditto, 8 Sept. 1975, *A. E. Jansen 103* (L); ditto, 11 Sept. 1975, *C. Bas 6638* (L, LAU); ditto, 6 Oct. 1978, *J. Schreurs, Th. Kuijper & F. Tjallingii* (L); ditto, 3 Oct. 1982, *T. Boekhout 1003* (L). — EAST GERMANY, Thüringen, Jena, Leutratal, 22 Sept. 1970, *H. Dörfelt* (PR; holotype of *Xerula nigra*). — FRANCE, dpt. Var, Massif de la St. Baumme, Forêt de la St. Baumme, 25 Oct. 1974, *A. F. M. Reijnders* (L). — SWITZERLAND, kant. Vaud, Cuarnens, Sept. 1973, *R. Morrier-Genoud* (Clémençon 73/50, LAU; holotype of *Xerula renatii*).

3. **Xerula kuehneri** (Romagn.) Bas & Boekhout—Figs. 3, 4

Mycenella kuehneri Romagn. in Bull. trimest. Soc. mycol. Fr. 56: 63. ('1940') 1941. — *Oudemansiella kuehneri* (Romagn.) Sing. in Sydowia 15: 59. ('1961') 1962. — *Xerula kuehneri* (Romagn.) Bas & Boekhout in Persoonia 12: 439. 1985.

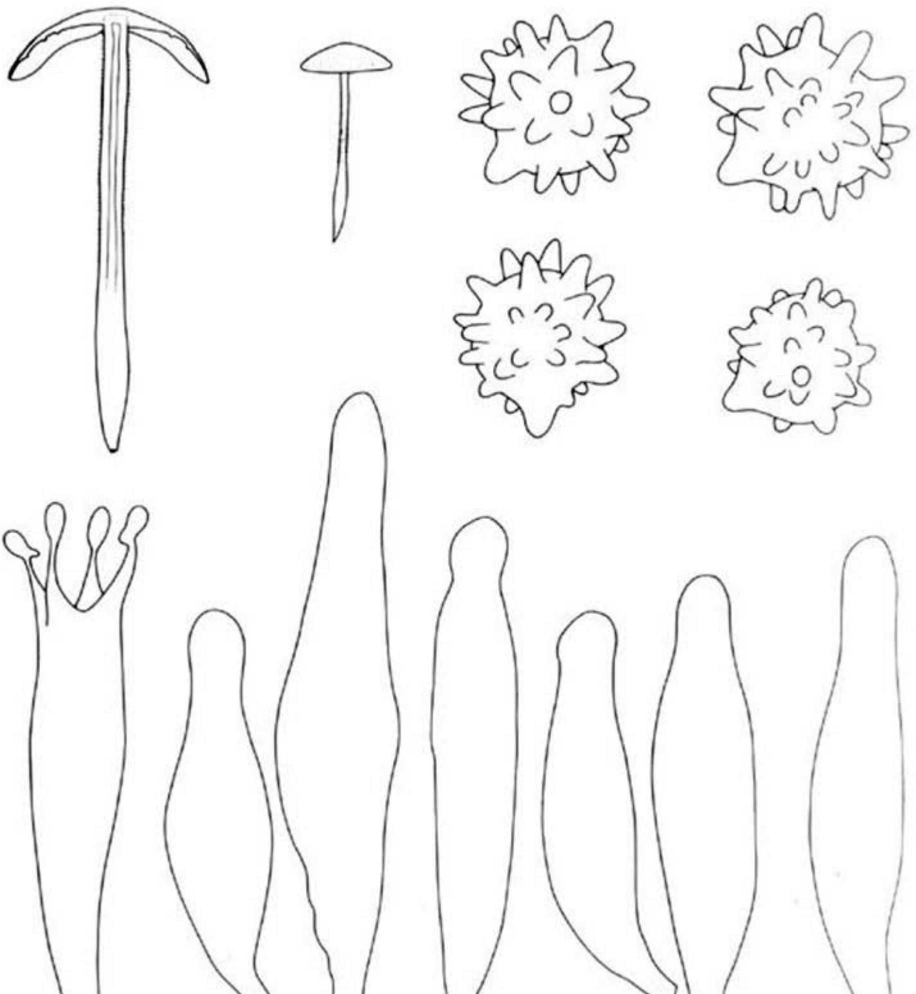

Fig. 3. *Xerula kuehneri*. Basidiocarp (× 1), spores (× 1500), basidium (× 1000), and hymenial cystidia (× 1000). (All figs. from *Bas 8244*.)

Basidiocarps small, solitary. Pileus 12–14 mm in diam., 3–5 mm high, from widely conico-convex with broadly rounded apex to plano-convex, with narrow slightly deflexed margin, very dark brown (between Munsell 5 YR 3/3 and 3/2) but locally paler because of minutely cracking pileipellis and pale context showing, under strong hand lens minutely dark brown subvelutinous-subgranular with minute white hairs locally varying in density but particularly dense near margin, dry, not hygrophanous. Lamellae rather distant

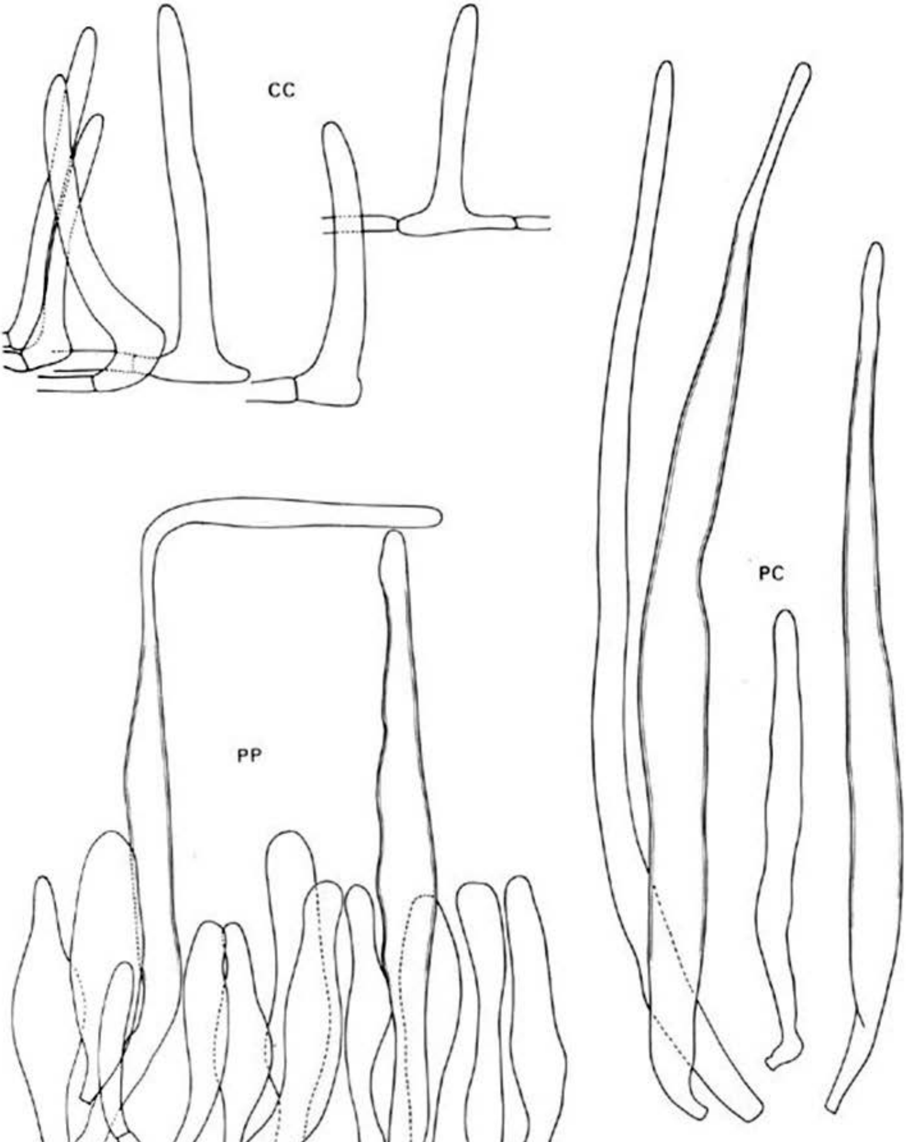

Fig. 4. *Xerula kuehneri*. Caulocystidia (CC), pileipellis (PP), and pileocystidia (PC). (All figs ×500 from *Bas 8244*.)

(L = 20–22, l = 0–3), attenuate towards stipe and narrowly adnate to free, rather narrow (1–2 mm wide), first concave, later straight to slightly ventricose, whitish with very pale yellowish-greyish tinge (paler than 2.5 Y 8/2), thickish, rather strongly transversely venose, with lamellae frequently anastomosing (here and there near margin of pileus almost net-like connected), under hand lens with powdery appearance, with concolorous, even edge. Stipe c. 20 × 1–1.2 mm, not including rooting part, which is 12 × 2.5 mm in the one (but lower part broken off and missing) and completely missing in the second basidiocarp, more or less equally thick but pseudorhiza very slightly fusiform, fistulose, brownish grey (10 YR 5/2 but somewhat tending towards 5/3), pubescent with whitish up to 0.8 mm long, erect but slightly irregular hairs; pseudorhiza smooth. Context white in pileus, glassy dark brownish grey in stipe but in centre whitish. Smell indistinct. Taste not recorded.

Spores [40/2] (13.5–)14.5–17 × 13.5–16.5 μm including spines, (10–)10.5–12.5(–13) × 10–12(–12.5) without spines, Q = 1.0–1.1(–1.15), $\bar{Q}$ = 1.03, globose to subglobose, with up to c. 36 conspicuous, 1.5–3 μm high and up to 2 μm wide, hollow, conical to subcylindrical processes with obtuse apex, colourless, with slightly thickened wall, inamyloid, cyanophilous, weakly metachromatic in Cresyl blue. Basidia 43–52 × 15–16 μm, with 5.5–9 μm long sterigmata, 4-spored, clamped. Cheilo- and pleurocystidia similar, 54–86 × 11–16 μm, slenderly fusiform tending to broad-necked lageniform, with obtuse, rather often subcapitate apex, thin- to slightly thick-walled. Hymenophoral trama irregular, composed of up to 25 μm wide thin-walled hyphae; subhymenium narrow, c. 10 μm wide, composed of densely ramose c. 2–4 μm wide hyphae. Pileipellis a transition between a euhymeniderm and a trichohymeniderm, with long pileocystidia; elements of pileipellis 45–95 × 8–26 μm, subcylindrical, clavate, fusiform, ventricose-fusiform and short-necked sublageniform, thin- to slightly thick-walled, with brown contents; pileocystidia 95–320 × 10–22 μm, slenderly lageniform to slenderly fusiform with cylindrical to tapering neck, colourless, with thickened wall (up to 1 μm) in middle part, at apex often with somewhat refractive granular contents. Stipitipellis a cutis; caulocystidia abundant, 40–165 × 9–18 μm at apex of stipe, several hundreds of microns long near base, subcylindrical, often tapering towards apex, with suddenly enlarged base (which is an intercalary or apical cell of a hypha of the stipitipellis), colourless, with slightly thickened wall and sometimes slightly granular contents. Stipititrama in upper part made up of 3–16 μm wide, thin- to slightly thick-walled, strictly longitudinal hyphae with clamps, in rooting part of somewhat irregular but still predominantly longitudinal similar hyphae, 3–28 μm wide, not sarcodimitic. Clamps present but not very conspicuous.

Habitat & distribution. — In the Netherlands known only from a park on humus-rich sandy soil just at the inside of the coastal dunes, under deciduous trees, ornamental shrubs and *Heracleum mantegazzianum*. Further recorded from France (Romagnesi's type collections, 20 July 1938, dpt. Seine-et-Oise, Bois de Cercay) in deciduous forest on humid clayey soil and from West Germany (Bresinsky & Haas, 1976: 111; Winterhoff & Krieglsteiner, 1984: 68, Baden-Württemberg, Karlsruhe-Durlach[2]).

Collections examined. — NETHERLANDS, prov. Zuid-Holland, The Hague, estate 'Clingendael', 21 Aug. 1984, *C.M. Swart-Velthuyzen* (Bas 8244) & 7 Aug. 1985, *C.M. Swart-Velthuyzen & F. van Luyn* (both coll. in L).

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[2] Prof. Dr. Winterhoff (in litteris) kindly informed us that these two records refer to the same observation by Mr. H. Schwöbel, who studied 2 basidiocarps found in a garden under *Hamamelis*, but did not preserve them.

Xerula kuehneri seems to be a very rare species. Since the publication of the original description from French material by Romagnesi in 1941 it has been recorded in the literature only once as far as we know (see above under 'Habitat & distribution'), viz. from West Germany. Unfortunately its tiny basidiocarps seem to occur often solitary; Romagnesi's description is based on one basidiocarp and ours on two basidiocarps collected in successive years at the same locality in the Netherlands.

Although the basidiocarps are difficult to spot because of their small size and dark colours, they are highly characteristic once they are seen under a hand lens on account of the minute white hairs on the subvelutinous dark brown pileus and on the grey-brown stipe and the strongly contrasting thickish, whitish, distant but intervenose lamellae. In fact *X. kuehneri* looks exactly like a diminutive *X. caussei*.

Notwithstanding its coarsely spinose spores, in our opinion *X. kuehneri* belongs to *Xerula* (in Dörfelt's and our wide sense) and not in *Mycenella* as stated by Romagnesi (1940: 63) and Dörfelt (1985: 236). The stipitetrama of both *Xerula* (see first paragraph) and *Mycenella* is sarcodimitic (Corner, 1966: 145) and thus the monomitic structure of the stipititrama of *X. kuehneri* disagrees with the structure of the stipititrama of both genera. However, the structure of the pileipellis of *X. kuehneri*, viz. a transition between a hymeniderm and a trichohymeniderm with pileocystidia partly shaped like hairs, in combination with the large size of spores and hymenial elements and the total absence of diverticulate elements agree much better with *Xerula*. We agree with Singer (1975: 347) that the gap between *Mycenella* and *Xerula* is still sufficiently wide to maintain these taxa as separate genera.

The spores of *X. kuehneri*, placed by Clémençon (1980: 76) in his new taxon *Oudemansiella* subg. *Pseudomycenella*, are very similar in size, shape, and ornamentation to those of **Xerula macracantha** (Sing.) Boekhout & Bas, *comb. nov.*[3] and **X. steffenii** (Rick) Boekhout & Bas, *comb. nov.*[4], from South America, two species placed by Clémençon in his new taxon *Oudemansiella* subg. *Dactylosporina*, which has been raised to generic level by Dörfelt (1985: 236).

It is just the existence of *X. kuehneri* that demonstrates the futility of separating *Dactylosporina* at generic level from *Xerula*. The only discriminating character is the ornamentation of large spines on the spores of *Dactylosporina*. Therefore the latter genus has to include also *X. kuehneri* and then becomes a 'one-character genus' with a variation in pileipellis structures parallel to that in remaining *Xerula*, viz. from a (sub)viscid hymeniderm without pileocystidia to a dry trichohymeniderm with hair-like pileocystidia.

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[3] Basionym: *Oudemansiella macracantha* Sing. in Sydowia 15: 59 ('1961') 1962. Description by Singer in Darwiniana 13: 157. 1964.

[4] Basionym: *Tricholoma steffenii* Rick in Broteria 24: 99. 1930 = *Oudemansiella steffenii* (Rick) Sing. in Lilloa 26: 66. 1953. Description by Singer in Darwiniana 13: 154. 1964. Material seen: *A. A. R. de Meyer 195b*, 13 XI 1979, Brazil, Paraná, Curitiba (L).

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PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 1, pp. 57–68 (1986)

NOTES ON HYGROPHORACEAE – VI

Observations on some new taxa in Hygrocybe

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In a preceding paper (Notes on Hygrophoraceae IV, Arnolds, 1985) Latin diagnoses have been provided of six new taxa of *Hygrocybe* from the Netherlands and Belgium, viz. *H. calciphila, H. luteolaeta, H subglobispora* forma ***aurantiorubra***, *H. viola, H. constrictospora* and *H. griseopallida*. In this paper full descriptions are given of the first four of these taxa. In addition the nomenclature and taxonomic position of *H. constrictospora* are discussed. *H. griseopallida* is reduced to the synonymy of *Hemimycena mairei* (E. J. Gilb.) Sing.

Hygrocybe calciphila Arnolds—Figs. 1–9

Hygrocybe calciphila Arnolds in Persoonia 12: 475. 1985.

Hygrocybe calcarum Gröger (ined.) in Mykol. Mitteilungsblatt 26–37. 1983. – [illegible]

Misapplied name.—? *Hygrophorus miniatus* sensu P. D. Orton in Trans. Br. mycol. Soc. 43: 249. 1960.

Pileus 10–32 mm, hemispherical or convex with flattened to depressed centre, then plano-convex to almost applanate, hygrophanous, when moist scarlet red or usually orange-red when young (Kornerup & Wanscher 7 A8, 8 A8, 9 A8), gradually fading to orange or orange-yellow, finally to ochraceous, translucently striate up to half-way radius, dry, minutely golden yellow, orange or pale brownish scurfy to adpressed squamulose at centre, sometimes also towards margin, more distinctly scaly when dried-out; when dry dull ochre-orange to ochre-yellow. Lamellae (L = 14–23, l = 1–3) broadly adnate to rather decurrent, subdistant to very distant, often slightly ventricose, rather thick, rather pale yellow, pale orange or orange (K. & W. 4 A5, 6; 5 A5, 6; 6 A6, 7), exceptionally with pink or reddish tinge. Stipe 20–50 × 1.5–5 mm, cylindrical or slightly tapering downwards, occasionally compressed, stuffed or fistulose, orange to orange-yellow, occasionally orange-red at apex, then yellow, smooth, dry. Context in pileus up to 2 mm thick, rather firm, concolorous with surface; in stipe yellowish. Smell somewhat fruity or not distinctive; taste not distinctive. Spore print white.

Spores 6–9(–10.5) × (4–)4.5–7(–7.5) µm, av. 6.6–8.6 × 5.0–6.1 µm, Q = (1.05–) 1.1–1.5(–1.7), $\bar{Q}$ = 1.25–1.45, broadly ellipsoid or ellipsoid to ovoid, not broader towards the base in face-view, not constricted in any view. Basidia 30–52 × 7.5–9.5(–11) µm, Q = 3.7–6.0(–6.6), rather broadly to slenderly clavate, 4-spored. Hymenial cystidia absent. Hymenophoral trama subregular; made up of short to medium sized, cylindrical or slightly inflated elements, 30–150(–200) × 4–19 µm. Pileipellis at centre a trichodermium, towards margin a cutis with trichodermial tufts of ascending hyphae constricted at septa; terminal elements subcylindrical to clavate, rounded, 20–90 ×

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7–14 μm. Stipitepellis an up to 30 μm broad cutis made up of repent hyphae, 2.5–6 μm wide, in places with erect hyphal tips, projecting up to 50 μm. Clamps present.

Habitat & distribution.—In the Netherlands rare in the limestone area of S. Limburg and along the big rivers, in unfertilized grasslands on mesic or dry, calcareous loam or clay, especially in limestone-grasslands (Mesobromion). (August–)October–November.

Collections examined.—NETHERLANDS: prov. Utrecht, Vleuten, de Bijleveld, in poor meadow on mesic, calcareous clay, 14 Oct. 1976, *C. Bas 7101* (L, holotype); prov. Zuid-Holland, Oudewater, estate 'Linschoten', among tall grass in orchard on heavy clay soil, 31 Aug. 1951, *R. A. Maas Geesteranus 7764* (L); prov. Limburg: Voerendaal, 'Kunderberg', in poor hayfield on dry calcareous loam over cretaceous limestone, 29 Oct. 1978, *Arnolds 4120* (WBS); 30 Oct. 1980, *Arnolds 4428* (WBS); Bemelen, E. slope of 'Bemelerberg', in poor sheep meadow on dry calcareous loam over cretaceous limestone, 31 Oct. 1980, *Arnolds 4481* (WBS); 20 Oct. 1984, *Arnolds 5309* (WBS); Bemelen, W. slope of 'Bemelerberg', same habitat, 20 Oct. 1984, *Arnolds 5330* (WBS); Valkenburg, 'Grachterberg', in poor unfertilized hayfield on dry calcareous loam over cretaceous limestone, 22 Oct. 1984, *Arnolds 5350* (WBS).—EAST GERMANY, Erfurt, 'Grenzberg' S. of Warza, in grassland on dry limestone, 9 and 12 Oct. 1984, *F. Gröger 197/84* (JE).

Hygrocybe calciphila is closely related to *H. miniata* and cannot be distinguished with certainty on macroscopic characters only, although the pileus tends to be orange or orange-red instead of scarlet when young and less brilliantly coloured by the presence of slightly brownish scales. In addition the lamellae in young basidiocarps of *H. miniata* are usually reddish, whereas this is rarely the case in *H. calciphila*. These differences, however, are by no means constant.

The main diagnostic character of *H. calciphila* is the shape of the spores: they are broadly ellipsoid to ellipsoid or ovoid in side-view ($\bar{Q} = 1.25–1.45$), not broader towards the base in face-view and not constricted in any view. In *H. miniata* the spores are ellipsoid, ovoid or -oblong in side-view ($\bar{Q} = (1.4–)1.5–1.75$)) and in majority (>80%) broadened towards the base in face-view, obovoid or obpyriform, and frequently constricted (Fig. 11). In addition the ecology seems to be rather different: *H. miniata* is a typical acidophytic fungus from heathlands and poor grasslands on acid sand and peat (pH 3.5–5); *H. calciphila* is at present only known from basic, loamy or clayey soils (pH 6–8).

Hygrocybe miniata has been described by Orton (1960: 249) as an uncommon species with non-constricted spores measuring 7.5–10(–11) × 5–6(–7) μm. Mr. Orton kindly wrote me (27 Febr. 1976) that his fungus is typical of calcareous soils, so possibly Orton had *H. calciphila* in mind. *Hygrocybe miniata* in my concept is identical with *H. strangulatus* P. D. Orton (see Arnolds, 1986). However, Orton's collections of *H. miniata* studied by me (preserved at Edinburgh) do not contain *H. calciphila*: *Orton 816* (27 Oct. 1956) has spores constricted in all views and broadened-obpyriform in front-view and probably

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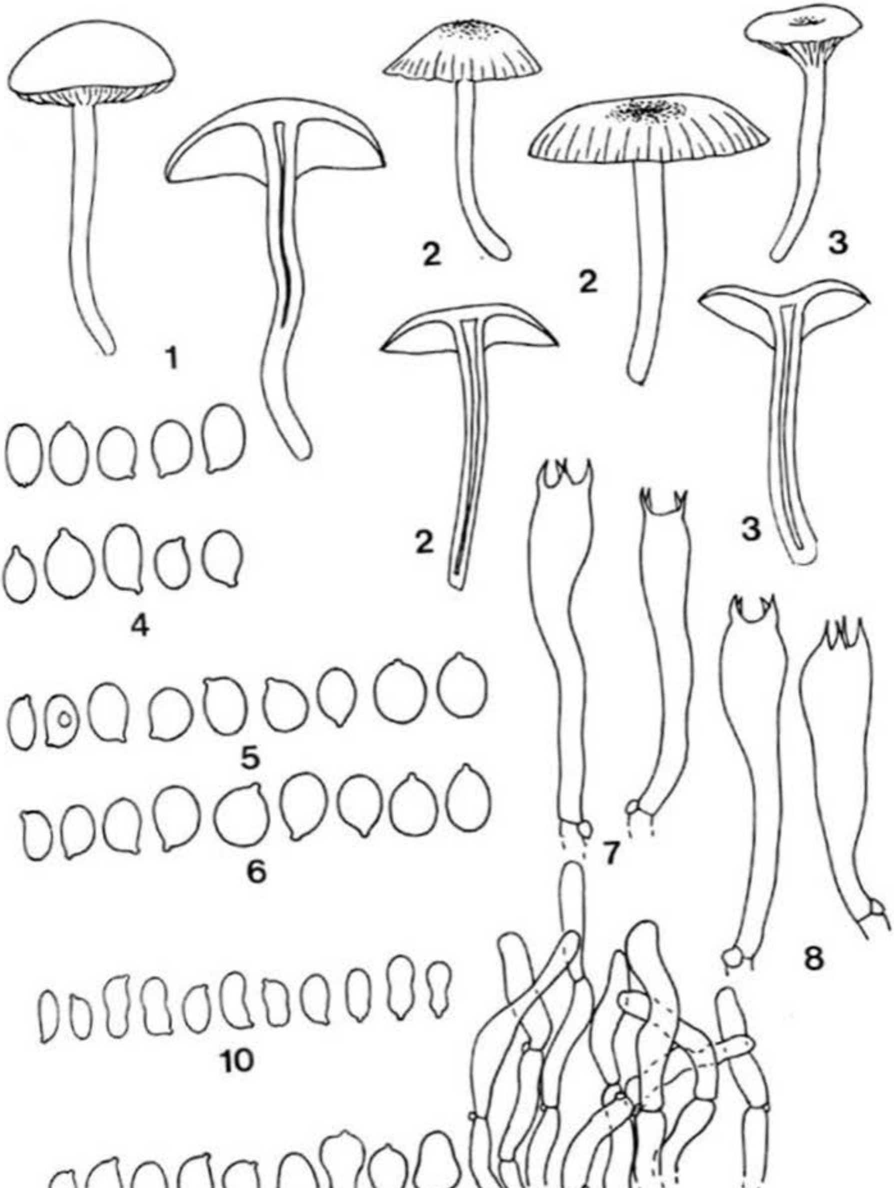
Figs. 1–9. *Hygrocybe calciphila*. — 1–3 Basidiocarps, × 1. — 4–6. Spores, × 1000. — 7–8. Basidia, × 1000. — 9. Radial section of pileipellis at centre of pileus, × 300 (Figs. 1, 4, 7, 9 from *Bas 7101*, holotype; 2, 5, 8 from *Arnolds 4481*; 3, 6 from *Arnolds 20-X-84*).

Fig. 10. *Hygrocybe constrictospora*. — Spores × 1000 (from *Arnolds 3486*, holotype).

Fig. 11. *Hygrocybe miniata*. — Spores, × 1000 (from *Arnolds 3905*, WBS).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concerns *H. miniata; Orton 5091* (31 Oct. 1980) and *Orton 5269* (25 Sept. 1982) certainly belong to that species.

Gröger (1983: 37) included in his key of *Hygrocybe* '*H. calcarum* ined.' He recently sent me a description and one collection from Erfurt (*Gröger 197/84*), which in all important characters proved to be identical with *H. calciphila*. Probably this species is widely distributed in limestone areas in Central Europe.

Hygrocybe miniata sensu Kühner (1976: 484) is rather similar to *H. calciphila* and has non-constricted spores, which apparently are larger and more elongate, measuring 8–11 × (4–)5–6.5 µm, Q = 1.5–1.8. I have not studied exsiccata of that taxon as from a nomenclatural point of view its identity is of no importance.

Hygrocybe biminiata Kühner (1976: 490) differs from *H. calciphila* among other things in the subcylindrical, occasionally constricted spores, measuring 8.5–11 × 5–6 µm, Q = 1.7–1.9.

Hygrocybe constrictospora Arnolds—Fig. 10

Hygrocybe constrictospora Arnolds in Persoonia 12: 476. 1985.

Misapplied name.—*Hygrocybe strangulata* sensu Arnolds, Taxon. Hygrophorus Nederland: 209. 1974; sensu Arnolds in Persoonia 9: 250. 1977.

For a full description and a list of studied collections is referred to Arnolds 1977: 250 (sub nom. *H. strangulata*).

In another paper (Arnolds, 1986) I have demonstrated that *Hygrophorus strangulatus* P. D. Orton sensu P. D. Orton is heterogeneous. However, since the type is identical with *Hygrocybe miniata* (Fr.: Fr.) Kumm., the name *H. strangulatus* has to be regarded as a synonym of that species.

Hygrocybe constrictospora may be confused in the field with weakly squamulose forms of *H. miniata*. However, the structure of its pileipellis is a cutis made up of predominantly repent, slender, cylindrical hyphae, 3.5–6 µm wide, widely different from the trichodermium in *H. miniata* and related species (subsect. *Squamulosae*) which is made up of ± erect, 5–14 µm wide hyphae constricted at the septa and with many free ends. Also the shape of the spores is quite different: in *H. constrictospora* in side-view ellipsoid-oblong to cylindrical, a large proportion constricted in side- and face-view (Fig. 10), in *H. miniata* not constricted in side-view, but in face-view broader towards the base, obovoid to obpyriform and often constricted (Fig. 11).

In view of the structure of the pileipellis, *H. constrictospora* does not belong to subsect. *Squamulosae* but to subsect. *Coccineae*. In that group it is the only species with a large proportion of the spores strongly constricted. *Hygrocybe substrangulata* (P. D. Orton) Mos. has also part of the spore weakly constricted, but differs in the much larger spores: (8–)9–11.5(–12.5) × 4.5–6.5(–7.5) µm, on the average 10.4–11 × 6–6.5 µm. *Hygrocybe marchii* (Bres.) Sing. is closely related, but the pileus in that species is slightly viscid, the uppermost hyphae of the pileipellis being gelatinized, and none or only a small proportion of the spores is constricted in any view (e.g. Arnolds, 1977, figs. 3–6).

HYGROCYBE GRISEOPALLIDA Arnolds = HEMIMYCENA MAIREI (E. J. Gilb.) Sing.

Hygrocybe griseopallida Arnolds in Persoonia 12: 476. 1985.

Camarophyllus nebularis Clémençon in Beih. Z. Mykol. 4: 55. 1982 (not validly published). — *Cuphophyllus nebularis* (Clémençon) M. Bon in Doc. mycol. 14(56): 10. 1984 (not validly published).

Misapplied name.—*Hygrophorus cinereus*? sensu Arnolds, Taxon. Hygrophorus Nederland: 66. 1974.

Hygrocybe griseopallida unites some unusual characters for a representative of *Hygrocybe* subgenus *Cuphophyllus*: the spores are in part subamygdaliform to pip-shaped, the basidia are short (27–34 μm) and the apex of the stipe is provided with many subclavate caulocystidia (Arnolds, 1974). I never saw fresh basidiocarps and first (l.c.) regarded it as identical with or closely related to *H. cinerea* (Fr.) Orton & Watl., which is the name indicated by the collector (E. Kits van Waveren) on the original label. Clémençon (1982) rightly regarded it as a different species and described it as *Camarophyllus nebularis*. This name is invalid since a Latin diagnosis and indication of the holotype are lacking. Although Clémençon never studied this species (he merely translated my description from 1974), he made it the type species of *Camarophyllus* sect. *Nebularini*. I recently (1985) renamed this species *Hygrocybe griseopallida* with a valid diagnosis.

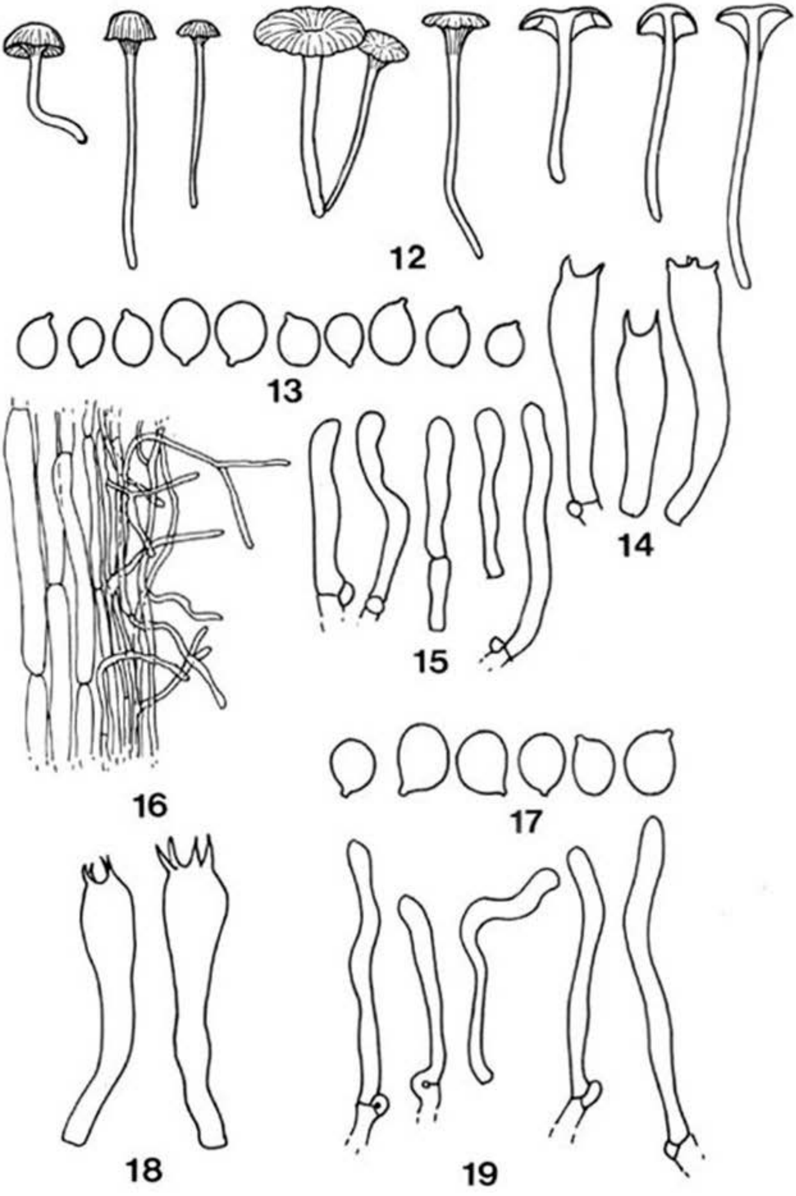
Soon afterwards, however, I received a collection made by Mr. C. B. Uljé (Ter Aar), which according to him might be *H. griseopallida* but also appeared to be very close to *Hemimycena mairei* (E. J. Gilb.) Sing. A study of Uljé's collection and some other exsiccata of *H. mairei* from the Leiden herbarium (*Bas 7039; van de Ham 26 Oct. 1982*) revealed that the size and the shape of spores, basidia and caulocystidia were very similar to those of *Hygrocybe griseopallida*. In macroscopic appearance *H. mairei* with its very distant, thickish lamellae certainly reminds of a *Cuphophyllus*. The only fundamental difference seems to be that the outermost hyphae of the pileipellis are diverticulate ('en brosse') in *H. mairei* and smooth in all species of the Hygrophoraceae. After careful re-examination I found in the type of *Hygrocybe griseopallida* some diverticulate hyphae too. Therefore it is clear now that I blundered when I described this species, since it is undoubtedly identical with *Hemimycena mairei*. The only satisfaction is that I can restore this mistake myself.

Hygrocybe luteolaeta Arnolds—Figs. 12–19

Hygrocybe luteolaeta Arnolds in Persoonia 12: 477. 1985.

Misapplied name.—*Hygrophorus vitellinus* sensu Arnolds, Taxon. Hygrophorus Nederland: 288. 1974.

Pileus 5–14(–17) mm wide, hemispherical at first, soon plano-convex with depressed centre and involute, often crenulate margin, then applanate with straight margin, hygrophanous, when moist chrome- to egg-yellow, gradually fading out to cream-colour, at centre often greyish yellow, translucently striate up to centre, drying pale yellow to whitish, very viscid when moist. Lamellae (L = 18–22, l = 0–1) arcuate-decurrent, rather thick, subdistant, up to 2.5 mm broad, concolorous with cap or deeper egg-yellow, slowly



Figs. 12–19. *Hygrocybe luteolaeta*. — 12: Basidiocarps, × 1. — 13, 17. Spores, × 1000. — 14, 18. Basidia, × 1000. — 15, 19. Cheilocystidia, × 1000. — 16. Radial section of stipitepellis, × 300 (Figs. 12–16 from *Arnolds 3509*, holotype; 17–19 from *Van der Aa 204*).

pallescent to lemon-yellow, finally cream-coloured with age, with hyaline, gelatinous edge. Stipe 13–28 × 1.2–2.5 mm, subcylindrical, stuffed, concolorous with cap, gradually fading from apex downwards to pale yellow or cream-colour but at base persistently bright yellow, strongly viscid. Context in pileus very thin, fragile, concolorous with surface, in stipe pale yellow, fibrillose, but cortex glassy and concolorous with surface. Smell in the field weak, after some hours in a box very distinct, unpleasant, musty, like an animal cage in a zoo, exactly as often in *H. laeta*. Taste mild. Spore print 'white'.

Spores 6.5–8.5(–9.5) × 5–6.5(–7.5) µm, Q = 1.15–1.5(–1.6), $\bar{Q}$ = 1.25–1.4, in majority broadly ellipsoid, a few ellipsoid to ovoid, with large, broad apiculus. Basidia 25–39 × 5–8.5 µm, Q = 3.7–6.0, moderately slenderly to slenderly clavate, 4-spored or 4-, 2- and 3-spored intermixed. Edge of lamellae sterile, made up of erect, slender, branched, strongly gelatinizing hyphae, projecting up to 200 µm, ending in numerous cylindrical to slenderly clavate hairs, 17.5–44 × 2–4(–5) µm. Subhymenium thin, up to 15 µm thick, compact, not gelatinized. Hymenophoral trama subregular, made up of rather short, cylindrical to mostly strongly inflated elements, 30–125 × 14–35 µm. Pileipellis an ixotrichodermium, 70–200 µm thick, made up of erect, branched, loosely interwoven hyphae with slender, cylindrical elements, 1.5–4 µm wide. Stipitepellis similar to the pileipellis but thinner, 30–100 µm broad. Clamps present, often in part medaillon clamps.

Habitat & distribution.—In poor, unfertilized grasslands rich in mosses with short sward on weakly acid, sandy soil. In the Netherlands rare, mainly in the coastal dunes. Also known from Denmark. September–November.

Collections examined.—NETHERLANDS: prov. Friesland, Isle of Schiermonnikoog, dunes near 'Westerplas', 2 Nov. 1975, *E. Arnolds* (no. 3509) & *C. Bas* (holotype, WBS; isotype, L); prov. Utrecht: Baarn, estate 'Groenendaal', in lawn shaded by trees, among the moss *Polytrichum commune*, 13 Sept. 1967, *H. van der Aa 204* (WBS); 11 Sept. 1965, *G. de Vries s.n.* (L); prov. Noord-Holland: Callantsoog, 'Zwanenwater', among mown grass in dunes, 21 Oct. 1979, *C. Bas 7583* (L); Vogelenzang, 'Zwarte Veld', in dry dune grassland, 9 Oct. 1982, *C. Uljé s.n.* (L, WBS).

Hygrophorus vitellinus Fr. (1863: 312) differs from *Hygrocybe luteolaeta* mainly in considerably larger basidiocarps (pileus 13–26 mm wide, stipe c. 52 mm long). It is possible that *H. vitellinus* sensu Orton is identical with Fries' species.

Hygrocybe luteolaeta strongly resembles *H. vitellina* sensu F.H. Møller (1945: 151), P.D. Orton (1964: 51) with its small, egg-yellow, pallescent basidiocarps with glutinous pileus and stipe, decurrent lamellae and broadly ellipsoid spores. However, *H. luteolaeta* is characterized by entirely sterile gelatinous edge of the lamellae (visible with a hand lens), made up of branched hyphae with clavate terminal cells. Moreover it has a characteristic, unpleasant smell. This smell easily escapes the attention unless one preserves fresh basidiocarps for some hours in a closed box.

For comparison I studied two collections of *H. vitellina* made by Orton (no. 2146, 15 Sept. 1960; no. 2366, 2 Oct. 1961), preserved at Edinburgh. In these exsiccata the edge of the lamellae is entirely fertile. Spores measure (6–)6.5–8.5 × 5–7(–7.5) µm, Q = 1.15–1.4, consequently similar to those of *H. luteolaeta*. *Hygrocybe vitellina* sensu Orton may also be different in the structure of the pileipellis: I found only a thin ixocutis, up to 50 µm thick, made up of repent and ascending, 1.5–4 µm wide hyphae. In *H. luteolaeta* it is a thicker ixotrichodermium, made up of predominantly erect hyphae. In view of the variability of this character in many species of *Hygrocybe* it is not yet quite certain that this difference is constant.

For a critical study of *H. vitellina* sensu Møller I refer to Kühner (1977: 75). In view of the bad condition of the exsiccata many characters are not distinct, e.g. the exact structure of pilei- and stipitepellis.

Another related taxon is *H. citrina* sensu Sing. & Kuthan (1976: 7). It agrees in the presence of cheilocystidia, but differs among other things in the orange-yellow pileus, less decurrent lamellae, gelatinized subhymenium and much narrower spores (5.5–7.7 × 3.5–4.5 µm).

Hygrocybe luteolaeta agrees with *H. laeta* (Pers.: Fr.) Kumm. in the sterile edge of the lamellae and the peculiar smell, but differs widely in the bright yellow colours (hence the name), small dimensions, shape and size of spores and cystidia, etc.

Hygrocybe subglobispora forma **aurantiorubra** Arnolds—Figs. 20–22

Hygrocybe subglobispora f. *aurantiorubra* Arnolds in Persoonia 12: 477. 1985.

Pileus up to 50 mm wide, acutely conical then expanded-conical, with undulate margin, first bright orange-red (Kornerup & Wanscher 7 A8), then fading to orange, orange-yellow or bright yellow, short translucently striate, subviscid, drying salmon-orange to sulphur-yellow. Lamellae (L = 34–43, l = 1–3) free or very narrowly adnate, rather crowded, up to 7 mm broad, first whitish, soon sulphur-yellow or pale lemon-yellow (K. & W. 2 A3, 4,5). Stipe 43–60 × 6.5–9 mm, cylindrical with rounded base, stuffed then hollow, orange to yellow, in places orange-red in some specimens, white at base, fibrillose-striate lengthwise, dry to subviscid. Context in pileus yellow, up to 7 mm thick, in stipe whitish, fibrillose. Smell and taste not distinctive.

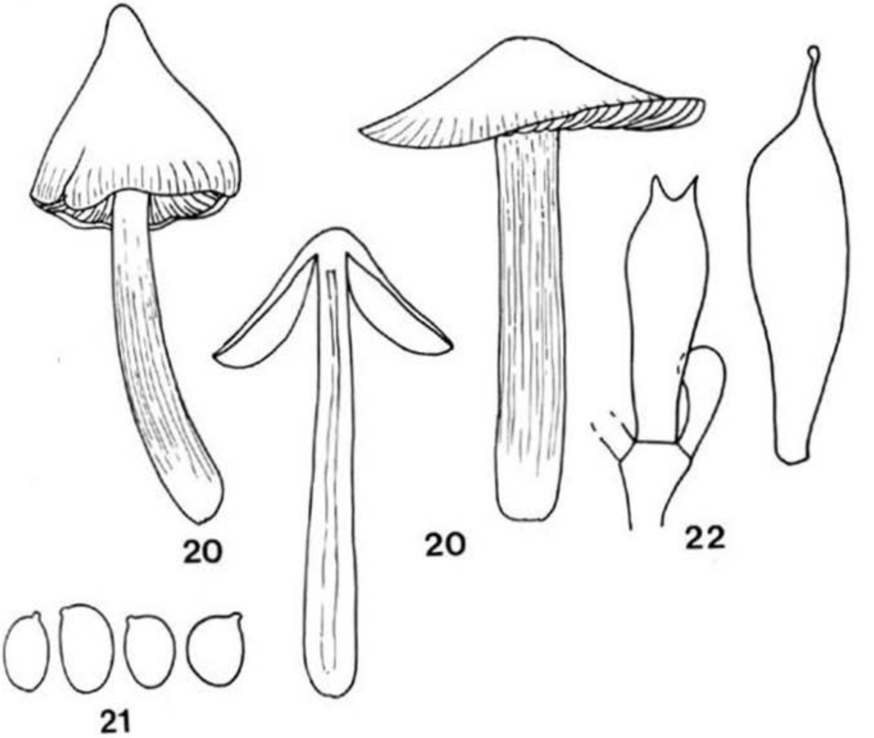
Spores (10–)10.5–12.5(–16.5) × 7–8.5(–10.5) µm, Q = (1.25–)1.3–1.6, $\overline{Q}$ = 1.45, ellipsoid or ovoid with broad, blunt apiculus. Basidia (37–)40–58(–83) × 11–15.5(–20) µm, Q = (2.6–)3–4.5, broadly clavate, in majority (70%) 2-spored, some (20%) 1-spored, a few (10%) 3- or 4-spored. Cystidia absent. Hymenophoral trama strictly regular, made up of broad, tubuliform elements tapering to the ends, up to 25 µm wide and over 500 µm long. Pileipellis an ixocutis up to 100(–180) µm thick, made up of repent to ascending, gelatinized, 3–8 µm wide hyphae. Stipitepellis a slightly gelatinized cutis, made up of cylindrical, 3–6 µm wide hyphae. Clamps not seen.

Habitat & distribution.—Only known from type locality, occurring there together with f. *subglobispora* in hayfield on weakly acid loam. October.

Collection examined.—NETHERLANDS, prov. Noord-Brabant, Drunen, bank of 'Drongelens Kanaal', in unfertilized hayfield on loamy soil, 26 Oct. 1975, *Arnolds 3478* (holotype, WBS).

The only difference with typical *H. subglobispora* is the orange-red colour of the pileus in young basidiocarps. Orton (1960: 267) originally described *H. subglobispora* with the pileus 'chrome or golden-yellow tinged orange in places (especially near margin)'. Since this difference is only gradual and intermediate forms exist, the rank of forma is preferred.

In *Hygrocybe* sect. *Macrosporae* R. Haller ex M. Bon three closely allied species are distinguished, originally described with yellow to orange basidiocarps, but later found to



Figs. 20–22. *Hygrocybe subglobispora* forma *aurantiorubra*. — 20. Basidiocarps, × 1. — 21. Spores, × 1000. — 22. Basidia, × 1000 (from *Arnolds 3478*, holotype).

have counterparts with (orange-)red colours at least in the pileus. Along with *H. subglobispora* and its forma *aurantiorubra* Arnolds these taxa are: *H. konradii* R. Haller and its forma *pseudopersistens* (M. Bon) Arnolds (= var. *pseudopersistens* M. Bon) and *H. acutoconica* (F. Clem.) Sing. and its variety *cuspidata* (Peck) Arnolds (= *H. cuspidata* (Peck) Murrill = *H. aurantiolutescens* P. D. Orton = *H. pseudocuspidata* Kühner, see Arnolds, 1986). I distinguish *H. acutoconica* var. *cuspidata* in the rank of variety since the red form of this species seems to be more widespread, more constant and less easily fading than the red forms of *H. konradii* and *H. subglobispora*.

Orton (l.c.) supposed that *H. subglobispora* is identical with *H. amoena* sensu Haller & Métrod (1955: 35) forma *silvatica*, whereas their forma *pratensis* would be a different fungus. In my opinion it is just the other way round: forma *pratensis* was described with an orange or yellow pileus and matches the diagnosis of *H. subglobispora* better than forma *silvatica* with a blood-red to orange pileus soon fading to orange or yellow, which agrees with *H. subglobispora* forma *aurantiorubra*. In fact Haller & Métrod (l.c.) made the same distinction as proposed here. I have not used their epithet '*silvatica*' as it has not been validly published and is not very appropriate for a fungus mainly growing in grasslands.

Hygrocybe viola Geesink & Bas—Figs. 23–27

Hygrocybe viola Geesink & Bas in Arnolds in Persoonia 12: 478. 1985.

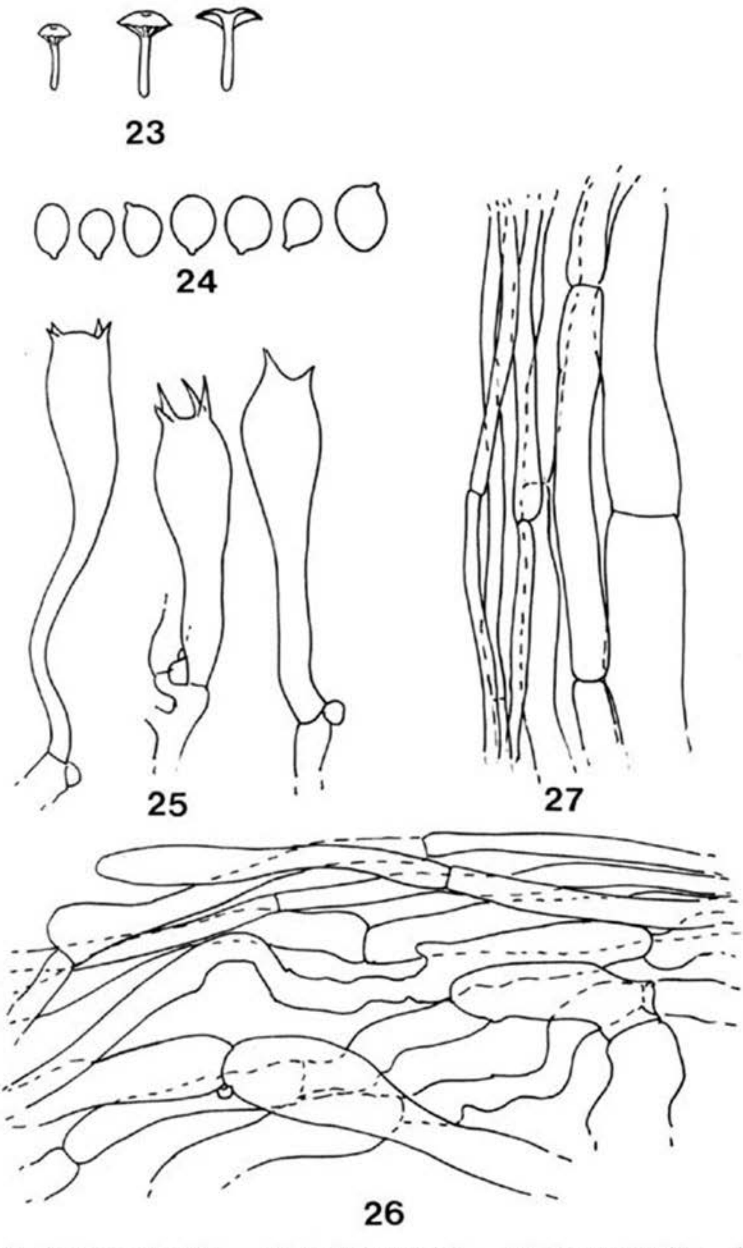
Pileus 4–7 mm wide, hemispherical to plano-convex with flattened, subumbilicate centre and subcrenulate margin, vaguely radially sulcate, deep purple at centre (Kornerup & Wanscher 15 C5/6), paler towards margin with age (K. & W. 15 B4), glabrous. Lamellae (L = 12–14, l = 0–1) broadly adnate to subdecurrent, rather distant, almost without lamellulae, rarely forked, pale lilaceous-violaceous (K. & W. about 14 B3) to sometimes nearly whitish, with entire, concolorous edge. Stipe 7–9 × 0.8–1.1 mm, somewhat tapering downwards, concolorous with centre of pileus or slightly paler, paler towards base and there sometimes very slightly ochraceous, glabrous, dry or perhaps very slightly viscid. Context purple in pileus and stipe. Smell indistinct. Taste unknown. Spore print not obtained.

Spores 6.5–10(–11) × 5–7 µm, Q = 1.15–1.6, $\bar{Q}$ = 1.25–1.5 (broadly) ellipsoid to ovoid, smooth, inamyloid, not congophilous. Basidia (36–)38–60 × 8–13 µm, Q = 3.9–6.3, rather slenderly clavate, in majority 4-spored, a few 2-spored. Hymenial cystidia absent, but sometimes several basidia at edge with one or more strongly elongate sterigmata and thus simulating cystidia. Hymenophoral trama irregular, made up of interwoven, often branched hyphae with cylindrical and inflated elements, (14–)26–125 × 6–20 µm, smooth. Pileipellis a very thin, up to c. 25 µm thick cutis made up of repent, subradial hyphae with cylindrical, 3–14(–20) µm wide elements with the broader hyphae sometimes slightly constricted near the septa, at centre sometimes with tufts of erect, up to 45 µm high, free-ending hyphae, with subclavate terminal, 4–8 µm wide cells; pigment difficult to localize, probably (almost) exclusively intracellular, a few hyphae possibly with very minute encrustrations (see discussion). Pileitrama subirregular; hyphae 4–20 µm wide. Stipitepellis a very thin cutis made up of a few layers of repent, 2–5 µm wide, smooth, hyaline hyphae. Clamps frequent at base of basidia and in subhymenium, scarce in other tissues, in trama sometimes of medallion type.

Habitat & distribution.—Only known from type locality in Belgium.

Collection examined.—BELGIUM, prov. Namur, Vencimont, valley of rivulet Houille: among mosses on moist, acid loam at steep bank of shaded car track in densely wooded valley with small stream, 3 Oct. 1977, *J. Geesink* (Bas 7225) (holotype, L).

This is a very remarkable fungus with dwarfish basidiocarps, omphalinoid habit and purple to violet colours. At first it was considered a species of *Omphalina*, but the long basidia, the obtuse base of the spores, the lack of distinct encrusting pigment and the (scanty) occurrence of refractive vascular hyphae and medallion clamps (both of them absent from *Omphalina* according to Th. Kuyper, pers. comm.) are arguments against *Omphalina* and in favour of *Hygrocybe*. It should be noticed, however, that in the first notes, made by Bas, the spores are described as 'sometimes slightly attenuate towards small apiculus' and the pigment in the pileipellis as '.... in several hyphae a very minute incrustration is visible'. Later, in dried material, these observations, in favour of *Omphalina*, could not be confirmed by Kuyper nor by me (Arnolds). These considerations reveal



Figs. 23–27. *Hygrocybe viola*. — 23. Basidiocarps, × 1. — 24. Spores, × 1000. — 25. Basidia, ×1000. — 26. Radial section of pileipellis halfway the radius, ×1000. — 27. Radial section of stipitepellis, × 1000 (from *Bas 7225*, holotype).

that the differences between *Hygrocybe* and *Omphalina* are not as fundamental and easy as often thought.

Within *Hygrocybe* the species is remarkable by the combination of irregular trama (a character of subgenus *Cuphophyllus*) and bright colours (a character of subgenus *Hygrocybe*). Some other species share this combination of characters, such as *H. lilacina*, *H. xanthochroa*, and *H. citrinopallida*. The closest relative of *H. viola* seems to be *Hygrocybe lilacina* (Laest.) Mos. (= *Hygrophorus violeipes* M. Lange), which has larger basidiocarps (pileus c. 8–20 mm, stipe 10–35 × 1.5–3 mm) with ochraceous lamellae and often also ochre tinges on the pileus and has gelatinized hyphae at the surface of pileus and stipe. *Hygrocybe xanthochroa* (P. D. Orton) Mos. differs strongly in very viscid pileus and stipe always at least in part with yellow colours, and in narrower spores (6–8 × 3.5–5 μm).

ACKNOWLEDGEMENTS

I am much indebted to Mr. C. B. Uljé (Ter Aar) for drawing my attention to the taxonomic position of *Hygrocybe griseopallida* and for sending me some collections of *Hemimycena mairei* on loan. Thanks are due to Dr. C. Bas (Leiden) for making available some valuable collections from the Rijksherbarium and some unpublished, private notes; to Mr. F. Gröger (Warza, East Germany) for providing me with collections and unpublished descriptions of *H. calcarum*, and to the Curator of the Herbarium at Edinburgh for the loan of some collections.

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PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 1, pp. 69–76

NOTES ON HYGROPHORACEAE – VII

On the taxonomy and nomenclature of some species of Hygrophorus

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Taxonomy and nomenclature of some West European species of *Hygrophorus* are discussed. The current use of *Hygrophorus cossus* (Sow.) Fr. as correct name of *H. chrysaspis* Métrod is rejected. Instead the name *H. discoxanthus* (Fr.) Rea is reintroduced. *Hygrophorus barbatulus* Becker is synonymized with *H. penarius* Fr. *Hygrophorus melizeus* (Fr.: Fr.) Fr. is considered as an earlier name of *H. karstenii* Sacc. & Cub. and a neotype from Sweden is indicated and briefly described. *Hygrophorus leucophaeus* (Scop.) Fr. is rejected as a nomen dubium, the valid name of this species in its current concept being *H. unicolor* Gröger. *Hygrophorus quercetorum* P.D. Orton is reduced to a variety of *H. eburneus*. The new combination *Hygrophorus eburneus* var. *quercetorum* is proposed.

In the framework of the 'Flora agaricina neerlandica' (see Bas, 1983) a revision was made of the genus *Hygrophorus* in the Netherlands and adjacent regions (Arnolds, in prep.). Some taxonomic and nomenclatural problems met during this work are discussed in this paper. Most discussions concern the group of whitish species around *H. eburneus*. In spite of recent revisions of this group by Neuhoff (1962) and Bresinsky (1965) some name changes appear to be necessary. These alterations are partly due to modification in the rules of botanical nomenclature adopted at the Sydney congress (Voss & al., 1983), partly because of incorrect interpretations of Friesian names neglecting the original species concepts.

The typification of names sanctioned by Fries is ruled in Art. 7.17 of the Code, but unfortunately more than one interpretation is possible. In my opinion the type must be selected from the older descriptions mentioned by Fries in his protologue if such references are given. Some other authors still prefer to regard Fries' sanctioning descriptions in Systema and Elenchus as the relevant protologues and therefore as type descriptions. They neglect the fact that under the present Code many pre-Friesian names were already validly published before they were sanctioned by Fries.

These two approaches often lead to conflicting interpretations of fungus names. For instance it is demonstrated in this paper that the type species of *Hygrophorus*, *Agaricus eburneus* Bull.: Fr., is differently interpreted by Bulliard and Fries: the concept by Bulliard agrees with current use, but *Agaricus eburneus* sensu Fr. is identical with *Hygrophorus piceae* Kühner.

The nomenclatural and taxonomic notes are arranged in alphabetical order of the epitheta.

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TAXONOMIC AND NOMENCLATURAL NOTES

barbatulus

Hygrophorus barbatulus Becker is a synonym of *H. penarius* Fr. See there.

carpini

Hygrophorus carpini Gröger was described by its author (1980: 162) side by side with *H. unicolor* Gröger as part of the species complex formerly known as *H. leucophaeus* (Scop.: Fr.) Fr. That name was rejected by Gröger (l.c.) as a nomen confusum. I share that opinion, although on partly different grounds (see *leucophaeus*).

According to Gröger (l.c.), *H. unicolor* is a species with a dry stipe, dull orange colour all over the basidiocarps and associated with *Fagus*, whereas *H. carpini* has a weakly viscid stipe, a whitish pileus with orange-brown centre and is associated with *Carpinus*. In the Netherlands and adjacent parts of Belgium and Germany I know only one species, occurring under *Fagus* and answering the description of *H. unicolor*, but some collections are close to *H. carpini* having a whitish pileus with flesh-brown centre; others have a greasy (although not really viscid) stipe, in microscopic section with fascicles of ascending, loosely interwoven, slightly gelatinized hyphae. Among the plates quoted by Gröger (l.c.) for *H. carpini* some agree very well with collections made in beech forests in the Netherlands, e.g. the painting by Konrad & Maublanc (1937: 370).

On the other hand Gröger (priv. comm.) suggested that *H. carpini* may very well be identical with *H. lindtneri* Moser, originally described (Moser, 1967: 3) as associated with *Corylus*. The only morphological differences with *H. carpini* are slightly larger basidiocarps and somewhat larger spores.

On the base of these observations I regard *H. carpini* as a synonym of *H. lindtneri*, whereas the limits with *H. unicolor* have to be critically studied. For the moment I asssign all collections from the Netherlands to *H. unicolor*.

cossus

Agaricus cossus Sow. was listed by Fries in Systema (1821) as an unnamed form of *Agaricus eburneus* under the heading 'b. disco flavescente, stipite longo'. The name was not sanctioned by Fries and consequently the type description is that of *Agaricus cossus* by Sowerby (1799: pl. 121) in any case. That description only says that 'the pileus is covered with a gluten, which constantly gives a strong goatlike odour, exactly resembling the wounded larvae of *Phoel. Cossus*'. His plate shows a slender, white agaric with a habit and size resembling most representatives of the *eburneus*-group. No indication of the habitat or host tree is given.

This name was interpreted by Neuhoff (1962) and Bresinsky (1965) as an earlier valid name for *H. chrysaspis* Métrod, a species associated with *Fagus* and well-characterized by the yellowish discoloration of older basidiocarps and especially by the browning of the lamellae. This interpretation was mainly based on the description of *H. cossus* in the *Hygrophorus* part of Fries' Monographia (1851: 4/124), which may very well be identical with *H. chrysaspis* indeed. The earlier description by Fries in Epicrisis (1838: 321) is less clear and the indication of the habitat 'in pinetis' excludes in my opinion synonymy with *H. chrysaspis*. However, this description too is not relevant from a nomenclatural point of view.

In my opinion Sowerby's description of *Agaricus cossus* (l.c.) may concern several species of the *eburneus*-complex, especially *H. eburneus* itself. Not a single phrase points to the striking characters of *H. chrysaspis*, mentioned above. Moreover, Sowerby (1797: pl. 71) described as a different species *Agaricus nitens*, which perfectly agrees with *H. chrysaspis* (see *nitens*).

Neuhoff (1962: 67) discussed the taxonomic significance of the '*cossus*-smell' and concluded that it cannot be used as a single character since such a smell may be noticed in *H. chrysaspis, H. hedrychii* and in *H. eburneus*. I agree with this point of view.

Orton (1984a: 584) claims to know a fungus from the collecting area of Sowerby that has a strong *cossus*-smell and a pileus discolouring slightly cream with age, quite distinct from *H. chrysaspis*. In my opinion it is not at all sure that *H. cossus* sensu Orton is really different from *H. eburneus*, but Orton's observations support the view that it is impossible to synonymize *H. cossus* and *H. chrysaspis*.

In my opinion an earlier alternative name for *H. chrysaspis* is *H. discoxanthus* (Fr.) Rea. See the discussion on that epithet.

discoxanthus

Agaricus discoxanthus was described by Fries (1815: 15) as an agaric with a whitish, viscid pileus, c. 40–50 mm broad, turning yellowish at the centre ('pileo . . . . viscoso albido, disco flavescente'); broadly adnate to decurrent, white lamellae turning brown ('lamellae albido-fuscescentes'); the stipe c. 5 cm long, white, white squamulose. In Systema (1821: 33) this name was listed under *Agaricus eburneus*, as (forma) 'b. disco flavescente, stipite longo', together with *Agaricus nitens* With., (actually *A. nitens* Schaeff.) *A. cossus* Sow. and *A. elongatus* Schum. In Epicrisis (1838: 321) and later publications *Agaricus discoxanthus* was listed by Fries as a synonym of *Hygrophorus cossus*. The characteristic browning of the lamellae was omitted, however, from the description of that species (see discussion on the epithet *cossus*).

It is perfectly clear that *Agaricus discoxanthus* Fr. is identical with the species associated with *Fagus*, unambiguously described by Métrod (1938: 153) as *Hygrophorus chrysaspis*. The epithet *discoxanthus* was recombined in *Hygrophorus* by Rea (in Smith & Rea, 1908: 45), who gave also a good description: ' . . . . . edge (of lamellae) turning reddish when bruised at first and then finally reddish brown'.

See also discussion on the epithets *cossus* and *nitens*.

eburneus

Agaricus eburneus Bull.: Fr. was at first the only white species included by Fries (1821: 33) in the tribus *Limacium*. From the habitat indication ('in silvis frondosis et acerosis, frequens') and the synonyms listed by Fries it is clear that he used a very broad species concept at that time, including *H. eburneus* sensu stricto, *H. piceae* Kühner and as 'b. disco flavescente . . . . . .' *H. cossus* (Sow.: Fr.) Fr., *H. discoxanthus* (Fr.) Rea and probably *H. hedrychii* (Velen.) Kult. In 1838(:33) *Hygrophorus eburneus* was described by Fries as a common species with a pleasant smell growing in forests, but no associated tree was mentioned.

In Europe most authors regard *H. eburneus* as a purely white fungus, associated with *Fagus*. However, Neuhoff (1962: 64) has argued that the only widespread white species of this group in Sweden is in fact *H. piceae* Kühner, associated with *Picea*. In fact Lundell & Nannfeldt (1939) had drawn the same conclusion by distribution of a collection from *Picea* forest as exsiccates of *H. eburneus* (in fact *H. piceae* Kühner). I agree with these authors that such an interpretation of *Agaricus eburneus* is necessary if that name is typified by the sanctioning description by Fries (1821), which would be a most unfortunate name change.

However, in my opinion *Agaricus eburneus* Bull.: Fr. is to be typified by the oldest plate by Bulliard quoted by Fries, viz. plate 118, published in 1782 or 1783 and accompanied by the Latin name *Agaricus eburneus* and a short description. This plate represents an entirely white, very glutinous agaric without particular smell. I am aware of the fact that the diagnosis is too short for being sure that Bulliard's species is *H. eburneus* in the current sense (and for instance not *H. quercetorum*), but nothing in plate and text pleads against such an interpretation, which in my opinion is sufficient reason for continuing the use of the name in that sense. In the collection areas of Bulliard *H. eburneus* is a common species. The later description by Bulliard & Ventenat (1809: 524) has no nomenclatural importance, but probably concerns the same species.

fagi

Hygrophorus fagi Becker & Bon is discussed under *H. penarius.*

hedrychii

Hygrophorus hedrychii (Velen.) Kult is in my opinion the correct name for the species in the *eburneus* group with pinkish centre of the pileus, pinkish lamellae and growing in association with *Betula*. The epithets *melizeus* and *cossus* must be rejected for this species.

karstenii

Hygrophorus karstenii Sacc. & Cub. is a taxonomic synonym of *Hygrophorus melizeus* (Fr.: Fr.) Fr. See discussion on *melizeus.*

leucophaeus

Hygrophorus leucophaeus (Scop.) Fr. is usually interpreted as a rather slender species with a slimy, pale brown pileus and a dry stipe without veil, mostly associated with *Fagus*, e.g. by Konrad & Maublanc (1937: pl. 370), J. Lange (1940: pl. 163 G), Kühner & Romagnesi (1953: 57) and Moser (1978: 78). Gröger (1980: 157) has convincingly demonstrated that the descriptions of *H. leucophaeus* by Fries (e.g. 1838: 323; 1874: 408) differ strongly from that concept. However, according to the present nomenclatural rules the concept by Fries is not important in nomenclatural respect since the name is not sanctioned and a direct reference (with note of exclamation) is given to *Agaricus leucophaeus* Scop., which is the validly published basionym. In the type description Scopoli

(1772: 423) characterized *A. leucophaeus* as an agaric with a pale yellow, filamentose, humid pileus, c. 100 mm wide; subdecurrent, pale lamellae and a short stipe. No indication of the habitat was given. In my opinion it is impossible to use this name for one of the present species of *Hygrophorus* and it is even not clear, whether it belongs to a species of *Hygrophorus* or not. I reject it as a nomen dubium. One thing is certain: it has nothing to do with *H. leucophaeus* sensu auct., so that the rejection of that name by Gröger (l.c.) is still justified. The correct name is *H. unicolor* Gröger. See also *H. carpini*.

lindtneri

Hygrophorus lindtneri Moser is an older valid name for *H. carpini* Gröger. See there.

melizeus

Hygrophorus melizeus (Fr.: Fr.) Fr. has been interpreted by various authors in different ways, e.g. sensu Ricken (1910: 16, = *H. discoxanthus* (Fr.) Rea), sensu Favre 1960 (= *H. spodoleucus* Mos.), sensu Neuhoff 1962 (= *H. hedrychii* (Velen.) Kult.), sensu Arnolds 1974 (= *H. eburneus* var. *quercetorum* (P. D. Orton) Arnolds). This confusion is mainly caused by distinct changes in the species circumscription applied by Fries himself. The concept of Neuhoff has been accepted by most European authors, e.g. by Bresinsky (1965:13) and Moser (1967: 1).

Here again a different interpretation is in order. The first description, here chosen as lectotype, was published in Observationes (1818: 201). Important diagnostic characters of *Agaricus melizeus* are a smooth, white pileus, c. 51 mm broad; distant, decurrent, yellow lamellae ('. . . . lamellis luteis decurrentibus . . . .'); a solid white stipe, c. 6–8 mm thick, a very weak smell ('Odor valde debilis, sed non distinctus') and the occurrence in *Picea* forests ('In silvis muscosis abiegnis'). This description deviates in several respects from *H. hedrychii*: the latter species has pinkish colours on the glutinous pileus and especially on the lamellae, usually a strong smell and it grows near *Betula*.

The description from 1818 was almost copied in Systema (1821: 83), where *Agaricus melizeus* was placed in tribus *Clitocybe*. In 1838 (:321) the description of *Hygrophorus melizeus* was changed to fit a species with straw-yellow basidiocarps, a viscid pileus, and growing in deciduous forests near Uppsala. A direct reference is given to the description in Systema (with the addition 'pileo exsiccato'), so that *Agricus melizeus* Fr.: Fr. is undoubtedly the basionym of *Hygrophorus melizeus* Fr. Apparently Fries regarded his former descriptions as to refer to a deviating form, since the last sentence in the 1838 description reads: 'Variat pileo albo, lam. luteis'.

In Monographia (1851: 4(124)) and Hymenomycetes europaei (1874: 406) Fries' concept of *H. melizeus* was even more strongly altered, the species now having a viscid pileus, leather-coloured lamellae, a pleasant smell ('Odor gratus') and a habitat in deciduous forests. I agree with Neuhoff (1962) that this fungus is probably identical with *H. hedrychii*, but this is not relevant from a nomenclatural point of view.

Returning to *Agaricus melizeus* Fr. (1818), the question remains which species Fries had in mind in his original diagnosis. In my opinion it is quite obvious that this description relates to *H. karstenii* Sacc. & Cub. (= *H. vaticanus* Heim & Becker), which is a species from coniferous forests with a white pileus and yellow lamellae. Moreover it occurs in the surroundings of Femsjö (pers. comm. M. Moser, Innsbrück) and it is hardly possible that Fries should have overlooked such a striking agaric.

Hygrophorus melizeus sensu Favre (= *H. spodoleucus* Moser) is a related species from *Picea* forests, but characterized by the cream-coloured, soon greyish pileus and the greyish brown, rarely ochraceous lamellae (see Moser, 1967: 1).

It is unfortunate, but in my opinion inevitable, that name changes are necessary for two well-known species. In order to promote stability of names in the future I propose as *neotype* of *H. melizeus* the collection made by Belin on 15 Sept. 1951 near Uppsala, distributed under the name *H. karstenii* as Fungi exsiccati suecici 2320, edited by S. Lundell & J. A. Nannfeldt. Notes on the neotype (UPS):

Pileus in dried basidiocarps 23–60 mm wide, applanate, rather fleshy, dull ochraceous. Lamellae decurrent, distant, characteristically olivaceous grey to bluish black. Stipe 58–68 × 4–10 mm, subcylindrical. Spores 7.5–9.5 × (4.5–)5–6 μm, Q = 1.4–1.7, ellipsoid to obovoid, sometimes subamygdaliform. Basidia 42–74 × 7.5–11 μm, 4-spored. Cystidia absent. Hymenophoral trama bilateral, made up of short elements, 35–85 × 6–11 μm. Pileipellis an ixotrichodermium, c. 100–120 μm thick, made up of ascending and erect, rather crowded hyphae, 2–5 μm wide, with cylindrical, rounded ends. Stipitepellis a compact ixotrichodermium, 45–70 μm thick, made up of repent to erect hyphae, 3–7 μm wide, with many free ends. Warts at the apex of the stipe up to 120 μm high, made up of compact erect hyphae with subcylindrical terminal elements, 32–53 × 4–5.5 μm, in places with clods of yellowish pigment (excretions) at the apices.

nitens

Agaricus nitens Schaeff. (1774: 60, pl. 238) is a species from the *eburneus* group of uncertain identity. Sowerby (1797: pl. 71) described under this name a white species, the pileus turning reddish brown at last, obviously *Hygrophorus discoxanthus* (= *H. chrysaspis, H. cossus* sensu Neuhoff). Although this name is older than *Agaricus discoxanthus* Fr. (1818) it is not available since it is an illegitimate homonym of the sanctioned name *Agaricus nitens* Batsch (1789): Fr. given to a quite different fungus with blackish brown pileus (see also Gams & Kuyper, 1984: 628).

penarius

The first valid description of *Hygrophorus penarius* Fr. is usually assigned to Epicrisis (Fries, 1838: 321), e.g. by Dennis & al. (1960: 75) and Hesler & Smith (1963: 378). However, valid publication was earlier effectuated by Fries in 1836 (: 45) in a more obscure booklet, entitled 'Anteckningar öfver de in Sverige växande ätliga svampar'.

Fries (l.c.) noticed 'Hittills funnen S. Sveriges bokskogar' and mentioned the preference for *Fagus* forests also in later publications. It is therefore difficult to understand why Becker (1954: 91) regarded *H. penarius* as a characteristic species of *Quercus* forests and described *H. barbatulus* as a closey related species, associated with *Fagus* on acid soils. These concepts have been followed by e.g. Bon (1977: 28) and Michael-Hennig-Kreisel (1979: 29 226). In 1974 Becker & Bon (in Bon) added a third species to this complex, viz.

H. fagi, described from *Fagus* forests on calcareous soils. Moser (1978: 76) contributed to the confusion by mentioning *H. barbatulus* from *Quercus* forests on acid soils and *H. penarius* from deciduous forest (on chalk).

From N.W. Europe (Belgium, W. Germany) I know only one species, associated with *Fagus* and mostly (but not exlusively) growing on calcareous soils. This fungus has a pileus (35–)45–90 mm broad, a short compact stipe attenuated to the base, 28–60 × (7–)9–20 mm, and spores 6–8(–8.5) × 4.5–5.5 μm. For a complete description I refer to Arnolds (1986). Not a single discrepancy exists with various descriptions of *H. penarius* by Fries (1836: 45; 1838: 32) and consequently I do not hesitate to use that name. *Hygrophorus barbatulus* Becker is regarded as a synonym.

Hygrophorus fagi Becker & Bon may be a species in its own right, characterized by a much longer stipe, pale pinkish centre of the pileus and larger spores (7–10 × 4.5–5.5 μm). I do not know this fungus. It is not clear whether *H. penarius* sensu M. Bon (1977: 28, = *H. barbatulus* sensu Moser, 1978?), associated with *Quercus*, represents a different taxon.

quercetorum

Hygrophorus querconum was described by Orton (1984a: 585) as a species close to *H. eburneus* but differing in (i) its association with *Quercus*, (ii) its often more robust habit and (iii) its entire basidiocarp becoming pale cream or ivory with age. For nomenclatural reasons this name was later changed into *H. quercetorum* (Orton, 1984b: 56).

In the Netherlands three collections have been made that agree with Orton's description. They will be fully described in a later publication (Arnolds, 1986). In my opinion the morphological differences with *H. eburneus* are so subtle that this taxon does not deserve the rank of species and one must be extremely careful with emphasizing ecological characters since this may lead to circular reasoning (see e.g. discussion under *penarius*). Therefore I propose the new combination: **Hygrophorus eburneus** var. **quercetorum** (P. D. Orton) Arnolds, *comb. nov.* (Basionym: *Hygrophorus quercetorum* P. D. Orton in Doc. mycol. 14 (56): 56. 1984).

ACKNOWLEDGEMENTS

Sincere thanks are due to Mr. F. Gröger (Warza, D.D.R.) and to Thomas Kuyper (Wijster) for their critical reading and improving of this paper. I am indebted to Prof. M. Moser (Innsbruck) for providing me information on the occurrence of several taxa in S. Sweden, and to the director of the Institute for Systematic Botany at Uppsala for the loan of valuable collections.

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PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 1, pp. 77–82 (1986)

NOTES ON PHOLIOTA

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The nomenclatural status of the names of the species of *Pholiota* occurring in the Netherlands is investigated. *Pholiota jahnii* is proposed as a new species, and five new combinations are made, viz. *P. populnea, P. conissans, P. lutaria, P. mixta*, and *P. scamba.*

During the preparation of an account of the species of *Pholiota* occurring in the Netherlands (Tjallingii-Beukers, 1986), we noted that several names in *Pholiota* (Fr.) Kumm. were invalid or incorrect. Accordingly some nomenclatural corrections are proposed here in order to bring *Pholiota* nomenclature into concurrence with the latest edition of the International Code of Botanical Nomenclature (Voss & al., 1983).

Pholiota jahnii Tjall. & Bas, *spec. nov.*

Misapplied names.—*Pholiota muelleri* (Fr.) P. D. Orton sensu P. D. Orton, Moser, Romagnesi, Tjallingii-Beukers.—*Pholiota squarrosoadiposa* J. Lange sensu Cetto.

Pileus 25–45 mm latus, primo convexus vel plano-convexus, postremo applanatus, indistincte umbonatus, margine inflexo dein recto, appendiculato cum velo flavido, in centro brunneolo-flavidus vel aureo-brunneus, versus marginem pallide flavidus, viscidus, confertim obtectus squamis pusillis, acutis, rufo-brunneis, subnigris ad apicem; squamae erectae in centro, versus marginem appressae, apice penicillato. Lamellae emarginato-sinuatae, adnexae, argillaceae vel bubalinae, margine integro, flavido, postremo aureo. Stipes 40–65 × 5–7 mm, cylindricus, ad basim saepe acutus, in parte apicali sericeus, pallide flavidus, in parte basali fibrillosus, fibrillis rufo-brunneis et stramineis alternantibus, in parte mediana pallide flavidus, squarrosus, squarris patentibus, ochraceis, deinde rufo-brunneis. Caro pallide flavida, in stipite versus basim brunneolo-aurea. Odor saporque indistinctus. Sporae 5.0–6.5 × 3.0–4.0 μm, Q = 1.4–1.7, laeves, conspicue pallidae, ovoideae, cum poro germinativo indistincto. Basidia 22–26 × 5–6 μm, tetrasporigera. Cheilocystidia 16–35 × 6–11 μm, cylindrica vel subclavata, saepe irregularia. Chrysocystidia 35–45 × 8–10 μm, frequentia, clavata vel fusiformia, mucronata, marginalia et lateralia. Ad truncos *Fagi.*—Holotypus: '*C. Bas 7050*, 4.X.1976, Beller Holz, Bad Meinberg, Westphalia, Federal Republic of Germany' (L, isotypus in M).

Etymology: dedicated to Dr. H. Jahn, honorary member of the German Mycological Association, in view of his outstanding contributions to the taxonomy and ecology of wood-inhabiting fungi.

This very striking species belongs to subgen. *Pholiota*, sect. *Adiposae*. It has been beautifully depicted by Jahn (1977, 1979) and Ryman & Holmåsen (1984), and amply described by Romagnesi (in Kühner & Romagnesi, 1957) and Tjallingii-Beukers (1977),

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making an English translation of this diagnosis superfluous. So far this species has been known as *P. muelleri* (Fr.) P. D. Orton. However, as already noted by several mycologists (Romagnesi in Kühner & Romagnesi, 1957; Tjallingii-Beukers, 1977; Krieglsteiner, 1985), the application of the epithet *muelleri* to this species is extremely doubtful and both Romagnesi and Krieglsteiner explicitly stated that a new name might well be inevitable.

Fries (1821: 243) provided a very short description of *Agaricus squarrosus* Weigel: Fr. β (unspecified rank) *muelleri* Fr.: Fr. and referred to a description and an illustration by Müller (1780). It seems logical to typify this taxon with Müller's illustration (iconotype). Unfortunately this illustration and this description are hardly interpretable, and the same applies to Fries's protologue. There are, however, several characters that exclude the species currently known as *P. muelleri*, viz. the distinct ring and the whitish pileus with appressed scales. We feel that *A. squarrosus β muelleri* is best regarded as a nomen dubium. The name might well refer to an aberrant variant of *P. squarrosa* (Krieglsteiner, pers. comm.).

The first authors to misapply the epithet *muelleri* were probably Saunders & al. (1871), although we immediately admit that their illustration is not very typical for *P. jahnii*, because of the rather broad and thick scales on the pileus. However, Orton (1960) stated that this illustration was representative for the taxon as it occurs in Great Britain. We were able to study one of Orton's collections (Oxon., Stoke Row, 31.X.1953, *P. D. Orton 82*, L) and noted some macroscopical differences and somewhat larger spores (viz. 5.5–7.0 × 3.0–4.0 μm) than in Central European gatherings of this species. Despite these little discrepancies we consider this collection as conspecific with *P. jahnii* on account of its partly ovoid and pale-coloured spores.

There are several epithets that need to be discussed in this respect, as they could probably refer to the taxon described here as a new species. However, any discussion and subsequent interpretation of those old names must take into account the difficulty of relying on macroscopical characters solely. Moreover, Fries himself was somewhat wavering in his specific delimitation in this group, as can be seen from a comparison between the treatment of *Pholiota* in the Systema mycologicum and the Epicrisis.

Agaricus subsquarrosus was described by Fries (1861: 23) as a taxon intermediate between *A. aurivellus* and *A. squarrosus*. The colour of the pileus was described as rusty brown, the scales were said to be appressed and no mention was made of brush-like tips. A subsequent illustration of this species (Fries, 1877) is in close agreement with the protologue, but is unrecognisable for *P. jahnii*. The interpretation of *P. subsquarrosa* (Fr.) Sacc. remains unclear to date. According to Moser (1983) this species is characterised by its very large spores (viz. 8–12 × 5–6.5 μm), quite unlike those of *P. jahnii*. No recent description of this taxon seems to have been published and it remains unclear for that reason how much significance should be attributed to this spore character.

It seems not unlikely on the other hand that *P. subsquarrosa* sensu Ricken (1912) is identical with *P. jahnii*. Although the macroscopical description is an almost literal translation of the protologue, Ricken added microscopical observations that are in close agreement with those of *P. jahnii*. Ricken also noted that his specimens showed erect scales on the pileus, whereas Fries (1861) described them as 'squamis adpressis'. It seems likely that Ricken used the epithet *subsquarrosa* only hesitatingly, as he was unable to find another, more apt epithet in the literature.

The discrepancy between Fries's and Ricken's description makes clear again that the epithet *subsquarrosa* cannot be used for *P. jahnii*.

Fries (1838: 166) mentioned an illustration by Batsch (1786, sub nom. *Agaricus imbricatus*) under *A. squarrosus β muelleri*. Unfortunately this illustration is uncoloured and although it could well refer to *P. jahnii*, we prefer to regard the name *A. imbricatus* Batsch as a nomen dubium. Moreover, as this name is illegitimate, being a homonym of *A. imbricatus* Fr.: Fr., a possible reintroduction of the Batschian epithet as a new name seems even less useful (ICBN, Recommendation 72A).

One of us earlier (Tjallingii-Beukers, 1977) mentioned the possibility that *P. squarrosoadiposa* J. Lange could be the same as *P. muelleri* sensu P. D. Orton, and Krieglsteiner (1985) recently suggested that *P. muelleri* sensu auct. and *P. squarrosoadiposa* could be synonymous. Unfortunately, no authentic material of *P. squarrosoadiposa* could be obtained from the Copenhagen herbarium. For the time being we regard therefore the illustration by Lange (1938: pl. 109C) as the iconotype.

At first sight Orton's (1960) description of *P. muelleri* seems to be in accord with Lange's illustration, as both taxa were described as having a pileus with rather broad and thick scales. However, Lange's description is deficient in some respects, and data on the colour of the spores under the microscope, a highly important character for the taxonomy of this group, are lacking. Orton's collection was characterised by pale spores (see p. 78), and therefore we regard this material as conspecific with *P. jahnii*.

Any contention that *P. squarrosoadiposa* and *P. muelleri* sensu auct. (= *P. jahnii*) are distinct enough to warrant separation on specific level, cannot of course be based on a comparison of the respective descriptions solely, but should be supported by exsiccate material. As noted above, no authentic material of *P. squarrosoadiposa* could be obtained, suggesting that this species is very rare. Strangely enough, *P. jahnii* is said to be not uncommon in Denmark in *Fagus*-forests (Rald, pers. comm.), whereas Lange knew his species from only one locality, growing in a tree of *Juglans*. This fact makes the identity of *P. squarrosoadiposa* even more unclear.

We came across one collection from the Netherlands and one from Belgium that fitted Lange's description rather well. This taxon is indeed sufficiently different from *P. jahnii* to warrant recognition on specific level, differing from our new species in its spores being brownish under the microscope, for a great part phaseoliform, notably larger (viz. (6.0–)6.5–8.5 × 3.5–4.5(–5.0) μm) and having a more distinct germ-pore. Lange (1938) indicated the spores to be 6–6.75 × 4–4.5 μm, but it should be borne in mind that his measurements are often somewhat too small. Krieglsteiner (1985: 41) mentioned a collection from Oberfranken (Federal Republic of Germany) that is characterised by large spores, and this could possibly also refer to *P. squarrosoadiposa*, especially as this collection was macroscopically different from typical *P. jahnii* too. Although this latter author mentioned the possibility that such collections with larger spores could belong to *P. cerifera*, a species of which the variation has not completely been encompassed, we wish to emphasize that both our collections from the Netherlands and Belgium are distinct also from *P. cerifera* on account of spore form and colour.

For the time being the collections from the Netherlands and Belgium mentioned are referred to *P.* cf. *squarrosoadiposa* (Tjallingii-Beukers, 1986). We have no intention to designate one of these as neotype for Lange's species, feeling that neotypification in this case should be based on well-annotated material from Denmark.

We do not have much doubt on the other hand that *P. squarrosoadiposa* sensu Cetto (1976: pl. 447) actually represents *P. jahnii*, as his photograph clearly shows the blackish, brush-like tips of the pileal scales.

There seem to be several North American taxa that come close to *P. jahnii*, but none of these species described by Smith & Hesler (1968) matches our species completely. Especially *P. abietis* A. H. Smith & Hesler, *P. subvelutipes* A. H. Smith & Hesler and *P. squarrosoadiposa* sensu A. H. Smith & Hesler come very close, but these taxa all possess larger and darker coloured spores. There is a fairly large number of species in this North American monograph and the differences between the various species are rather subtle. Several of these species are separated mainly on account of their habitat (an unreliable character in Europe, cf. Krieglsteiner, 1985) and small differences in the colour of the young lamellae. Reassessment of the autonomy of these taxa by means of compatibility studies (Farr & al., 1977) led to the conclusion that in this case the genetical species concept was broader than the morphological species concept. These latter authors therefore synonymized *P. abietis, P. connata* A. H. Smith & Hesler, *P. squarrosoadiposa, P. subvelutipes*, and *P. limonella* (Peck) Sacc.

We feel therefore that the above arguments give sufficient support to our contention that *P. muelleri* sensu Romagn., P. D. Orton, Tjallingii-Beukers, Krieglsteiner, etc. is in need of a new name and that no existing name is available. It is with great pleasure that we dedicate this species to Dr. H. Jahn, who showed us fine collections of this species during a foray of the Netherlands's Mycological Society at Detmold, Westphalia.

Pholiota jahnii has a wide distribution in Europe, occurring from Denmark to Spain and from England to the German Democratic Republic. No records of it are known from the Netherlands. It prefers calcareous soils, and is mainly found on wood of *Fagus*, but it is known to occur on wood of several other deciduous and coniferous trees too.

cerifera. — *Agaricus ceriferus* P. Karst. in Bidr. Känned. Finl. Natur Folk 25: 369. 1876. — *Pholiota cerifera* (P. Karst.) P. Karst. in Bidr. Känned. Finl. Natur Folk 32: 297. 1879.

The name *P. cerifera* is proposed to replace the well-known but incorrect name *P. aurivella* (Batsch: Fr.) Kumm. *Agaricus aurivellus* was described by Batsch (1786) as having a dry pileal surface, and this character is clearly conflicting with the present circumscription of *P. aurivella*. Karsten's description on the other hand is consistent with the current interpretation of *P. aurivella*.

Both Lange (1938) and Kühner & Romagnesi (1953) recognised two varieties within *P. aurivella*, using for these the epithets '*aurivella*' and '*cerifera*' respectively. The delimitation of these varieties is rather unclear, however, and we frequently encountered specimens that combined characters of both taxa. Collections intermediate between 'var. *aurivella*' and 'var. *cerifera*' are even somewhat more common in the Netherlands than collections possessing the discriminating characters for either variety. A strongly squarrose stipe can be associated with somewhat smaller spores, but many exceptions occur. While admitting that the variability of *P. cerifera* has not yet completely been assessed (cf. p. 79), we do not want to recognise infraspecific taxa within *P. cerifera* for the time being.

populnea. — *Agaricus populneus* Pers., Mycol. eur. 3: 171. 1828 (basionym). — *Agaricus populneus* Pers.: Fr., Syst. mycol., Index: 36. 1832. — **Pholiota populnea** (Pers.: Fr.) Kuyp. & Tjall., *comb. nov.*

This species has so far been known as *P. destruens* (Brondeau) Gillet. Both epithets, viz. *destruens* and *populneus* date from 1828 and it seems impossible to assign priority for one of these. However, it has generally escaped attention that Fries (1832) did sanction the name *A. populneus*, and this clearly establishes *populneus* as the correct epithet. Unfortunately, no type-material of this species could be found at L.

As the following combinations are invalid under ICBN Art. 33.2, which requires the citation of the basionym with a full and direct reference to its author and original publication with page or plate references and date, they are formally validated here:

conissans. — **Pholiota conissans** (Fr.) Kuyp. & Tjall., *comb. nov.* — *Agaricus conissans* Fr., Epicr.: 187. 1838 (basionym). — *Pholiota conissans* (Fr.) Mos. in Gams, Blätter- und Bauchpilze, 1. Aufl.: 196. 1953 (inval.). 3: 443 invalid

lutaria. — **Pholiota lutaria** (R. Maire) Kuyp. & Tjall., *comb. nov.* — *Tubaria lutaria* R. Maire in Bull. trimest. Soc. mycol. Fr. 44: 47. 1928 (basionym). — *Pholiota lutaria* (R. Maire) Sing., Agaricales mod. Taxon., 3rd Ed.: 552. 1975 (inval.).

mixta. — **Pholiota mixta** (Fr.) Kuyp. & Tjall., *comb. nov.* — *Agaricus mixtus* Fr., Epicr.: 185. 1838 (basionym). — *Pholiota mixta* (Fr.) Mos. in Gams, Blätter- und Bauchpilze, 1. Aufl.: 195. 1953 (inval.).

scamba. — **Pholiota scamba** (Fr.: Fr.) Kuyp. & Tjall., *comb. nov.* — *Agaricus scambus* Fr., Observ. mycol. 2: 45. 1818 (basionym). — *Agaricus scambus* Fr.: Fr., Syst. mycol. 1: 504. 1821. — *Pholiota scamba* (Fr.: Fr.) Mos. in Gams, Blätter- und Bauchpilze, 1. Aufl.: 196. 1953 (inval.). 3: 443 inval

ACKNOWLEDGEMENTS

We are grateful to Mrs. E.C. Vellinga and Mr. G.J. Krieglsteiner for their constructive criticisms of an earlier draft of this paper. Dr. R. Watling and Mr. H. Knudsen kindly put important collections at our disposal.

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PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 1, pp. 83–88 (1986)

NOTES ON THE GENUS SORDARIA IN SPAIN

Sordaria elongatispora, a new coprophilous species (Pyrenomycetes)

J.M. BARRASA*, N. LUNDQVIST** and G. MORENO*

Sordaria elongatispora Barrasa, Lundq. & Moreno is proposed as a new species, characterized by its large, narrow spores. It is compared with related taxa and a key is given to the four known, narrow-spored species of the genus, three of which occur in Spain: *S. baltica* Lundq., *S. elongatispora*, and *S. papillata* Urríes.

Sordaria Ces. & De Not. was once a very wide genus including many kinds of mostly coprophilous pyrenomycetes with pigmented spores having all sorts of appendages and gelatinous equipments. The most aberrant species were gradually transferred to other genera, but even as late as in the 1930's Cain (1934) and Rostrup (1935) still incorporated species with appendaged spores. Moreau (1953) was the first to circumscribe *Sordaria* in a modern sense and to restrict it to species having one-celled, dark spores with a basal germ pore and cylindrical asci with an apical ring.

Today *Sordaria* contains c. 20 members, some of which are common cosmopolitans, others known only from more restricted regions. Practically all the taxa are coprophilous with a preference for certain kinds of dung (Lundqvist, 1972: 22, 300).

Sordaria is a well defined genus, but several of its species are difficult to distinguish from one another, at least from a morphological point of view. Perithecia, asci, and spores give remarkably meagre, taxonomic information at the specific level compared to those of species in many other genera in the Sordariaceae sensu lato. The only interspecific variation of the spores seems to be in size, form, and presence of a gelatinous sheath.

Lundqvist (1972) described two new, narrow-spored species, *S. alcina* and *S. baltica*, and drew attention to the length/width ratio of the spores as a useful diagnostic character. These fungi have a ratio of 2–2.5, whereas that of other Sordariae is smaller.

With this study we intend to survey the Spanish *Sordaria* species with narrow spores, proposing *S. elongatispora* as a new species, and also to introduce i.a. a second record of the rare *S. papillata* Urries, once described from Spain.

MATERIALS AND METHODS

Dung samples have been incubated with the moist chamber method except for *S. baltica*. The fungi were then mounted in water and studied with light microscopy. The photographs were taken with a Nikon 'Optiphot' microscope with automatic camera.

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The Spanish material has been filed in the herbarium of the Department of Botany, Alcalá de Henares University. An isotype slide of *S. elongatispora* is preserved at the herbarium of the Swedish Museum of Natural History, Stockholm, Sweden (S).

DESCRIPTIONS

Sordaria alcina Lundq., 1972: 326. — Figs. 1, 5C

Perithecia 385–580 × 380–480 µm with peridial cells 6–8 µm in diam. Asci 240–265 × 12–14 µm. Spores 21–26.5 × 9.5–12 µm, ellipsoidal to cylindrical with a rounded apex and slightly tapering base and with a gelatinous sheath.

Lundqvist (1972: 326) states the spores to be 'usually slightly apiculate below', but this is only just visible in some immature spores.

The species is found on cervine dung from Fennoscandia and Canada and apparently has a circumboreal distribution.

Sordaria baltica Lundq., 1972: 328. — Figs. 2, 5A

Perithecia 530–570 × 385–430 µm with peridial cells 6–18 µm in diam. Asci 240–270 × 14–16 µm. Spores 25–31 × 12–14 µm, narrowly ellipsoidal with tapering ends and a gelatinous sheath.

Specimens examined. — On horse dung (*Equus caballus*), Port of Cotos (Madrid), alt. 1830 m, *J. M. Barrasa* & *F. Esteve-Raventós*, 11 Apr. 1984 (herb. Barrasa-Moreno 3535).

The species is easily distinguished from *S. alcina* by its larger spores with tapering ends. Furthermore, it is known to grow only on horse dung. The species with the greatest resemblance as to spore size and habitat is *S. papillata* Urríes (see below).

The known distribution of *S. baltica* has hitherto been Scandinavia, Iceland and Czechoslovakia. The Spanish record seems to contradict the concept of *S. baltica* as a boreal to north temperate species, but the collection was made early in the year at a high altitude with corresponding optimal temperature and humidity. The Czechoslovakian find also comes from high altitude (Lower Tatra Mts.). It is possible that occurrences of *S. baltica* in central and southern Europe are relicts from a colder period now restricted to montane regions.

Sordaria papillata Urríes, 1932: 221. — Figs. 3, 5B

Specimens examined: On dung of mouflon sheep (*Ovis musimon*) in moist chamber, Sierra Espuña (Murcia), X. Llimona, 25 Jan. 1981 (herb. Barrasa-Moreno 2289). Period of incubation three weeks.

Sordaria papillata is unique in the genus for its spores are papillate at both ends. Urríes described this as 'in utroque apice papillam hyalinam c. 2 µm ferentibus' and 'la papila que llevan en cada extremo'. Lundqvist (1972: 329) investigated the type collection (MA) and found the upper papilla to be hyaline, gelatinous, c. 0.7 µm in diam., situated in the gelatinous sheath and without direct contact with the spore wall. Only with difficulty, if ever, can it be detected in dried specimens. The basal papilla is a protrusion of

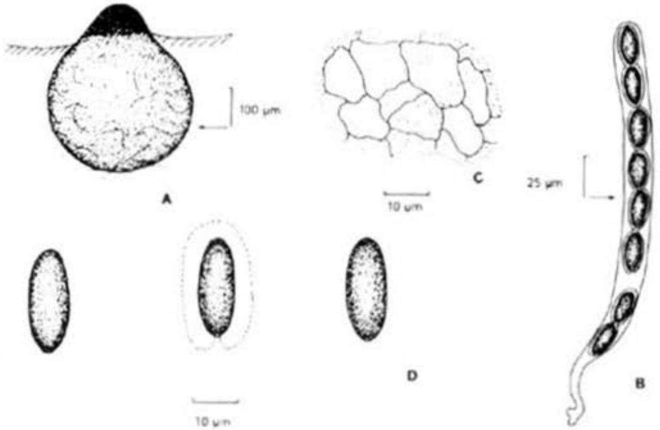

Fig. 1. *Sordaria alcina*, UPS 3343-h. — A. Perithecia. — B. Asci. — C. Cells of peridium. — D. Spores.

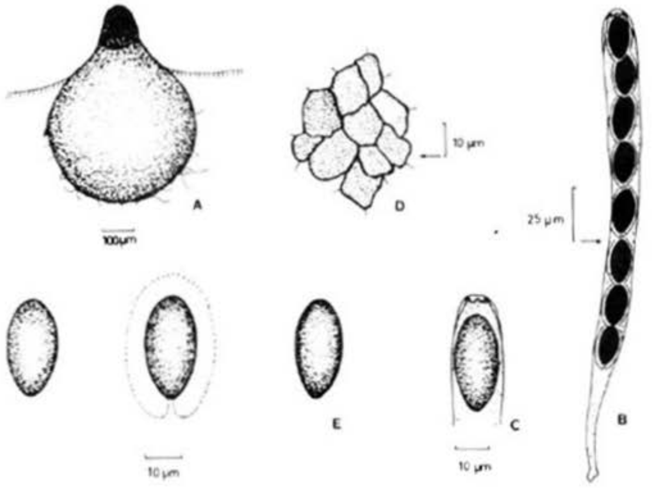

Fig. 2. *Sordaria baltica*, Barrasa & Moreno 3535. — A. Perithecia. — B. Asci. — C. Ascus apex. — D. Cells of peridium. — E. Spores.

the wall around the germ pore, a feature present in some other Sordariae as well. The perithecia of the type were found to be 430–455 × 360 μm with peridial cells 9–15 μm in diam., asci 220 × 16 μm, and spores 25–29 × 13–14 μm with a gelatinous sheath. These observations match fairly well those by Urries, except that he overlooked the presence of the gelatinous cover.

Sordaria papillata may be confused with *S. baltica* having about the same spore size. The best diagnostic difference is the apiculate base and rounded apex of the spores in the former species. *Sordaria baltica* is also bigger in some respects.

Sordaria papillata was described for the first time on horse dung from the province of Huesca, and has not been reported since then, untill Barrasa detected it on substrate from Murcia. We do not think that the difference in habitat matters much, as all the morphological characters, including the upper papilla of the spores, are in accordance with those of the original description and specimens.

Sordaria elongatispora Barrasa, Lundq. & Moreno, *spec. nov.* — Fig. 4

Perithecia semiimmersa, dispersa, ostiolata, ovoidea vel piriformia, 900–1000 × 480–500 μm, atrobrunnea. Collum eiusdem coloris, breve, cylindraceum, cellulis claviformibus, 5–6 μm latis. Venter globosus, pilis flexuosis, leviter pigmentatis, septatis, 3–4 μm latis obtectus. Peridium pseudoparenchymatum atrobrunneum, tristratum; stratum externum cellulis isodiametricis, brunneis, parietibus crassis, 14.5–16.5 μm latis; stratum medium cellulis prismaticis, leviter pigmentatis, parietibus tenuibus; stratum internum cellulis hyalinis, oblongis, parietibus tenuibus. Paraphyses non observatae. Asci unitunicati, octospori, 200–300 × 15–20 μm, cylindracei, apicibus truncatis, annulo apicali incrassato, non amyloideo. Sporae initio hyalinae, postea olivaceae, denique atrobrunneae, uniseriatae, laeves, unicellulares, 32–40 × 12–14(–16) μm, anguste ellipsoideae, in extremis subtiliter acutae, poro germinali basali instructae. Stratum gelatinosum distinctum sporam, poro excepto, cingens.

In stercore vaccino (*Bovis tauri*) in 'Sierra de Alto Rey' (Guadalajara), *J. M. Barrasa & G. Moreno*, 6-II-1982 (herb. Barrasa - Moreno 3194, holotypus).

Perithecia semiimmersed, isolated, ostiolate, ovoid to pyriform, 900–1000 × 480–500 μm, dark brown to black, subglobose, with flexuous, weakly pigmented, septate, 3–4 μm thick hairs. Neck dark brown to black, short, cylindrical, with claviform, 5–6 μm broad cells. Peridium pseudoparenchymatous, dark brown, 3-layered: outer layer with isodiametric, thick-walled, brown cells, 14.5–16.5 μm in diam.; middle layer with weakly pigmented, prismatic, thin-walled cells; inner layer with hyaline, thin-walled and flattened cells. Paraphyses not seen. Asci 8-spored, unitunicate, cylindrical, 200–300 × 15–20 μm with a truncate apex and apical non-amyloid ring. Spores at first hyaline, then ranging through yellow to olivaceous and finally dark brown, narrowly ellipsoidal with somewhat acute ends, 32–40 × 12–14(–16) μm, obliquely uniseriate, smooth, one-celled, with a basal germ pore and a gelatinous sheath.

Specimens examined. — On cow dung (*Bos taurus*) in moist chamber after two months of culture, Sierra de Alto Rey (Guadalajara), J. M. Barrasa & G. Moreno, 6 Febr. 1982 (herb. Barrasa-Moreno 3194, holotypus; isotypus in S).

Sordaria elongatispora deviates from all other *Sordaria* species by its very long and narrow spores. The closest relative seems to be the smaller *S. baltica*, which has the same kind of spores with tapering ends. The difference in size makes them easy to separate.

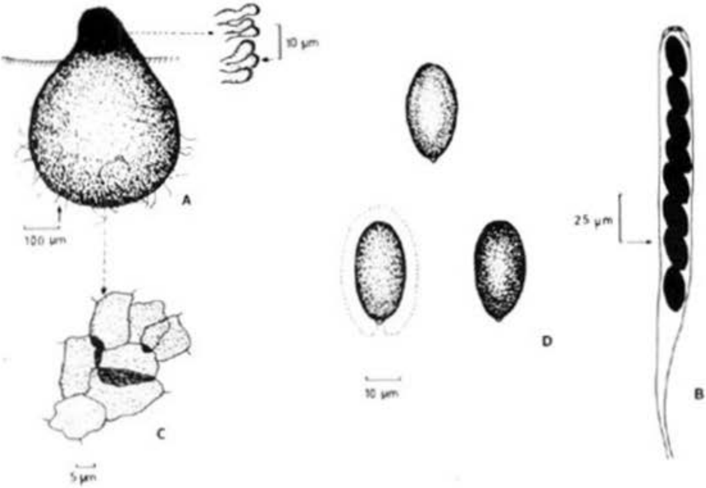

Fig. 3. *Sordaria papillata*, Barrasa & Moreno 2289. — A. Perithecia. — B. Asci. — C. Cells of peridium. — D. Spores.

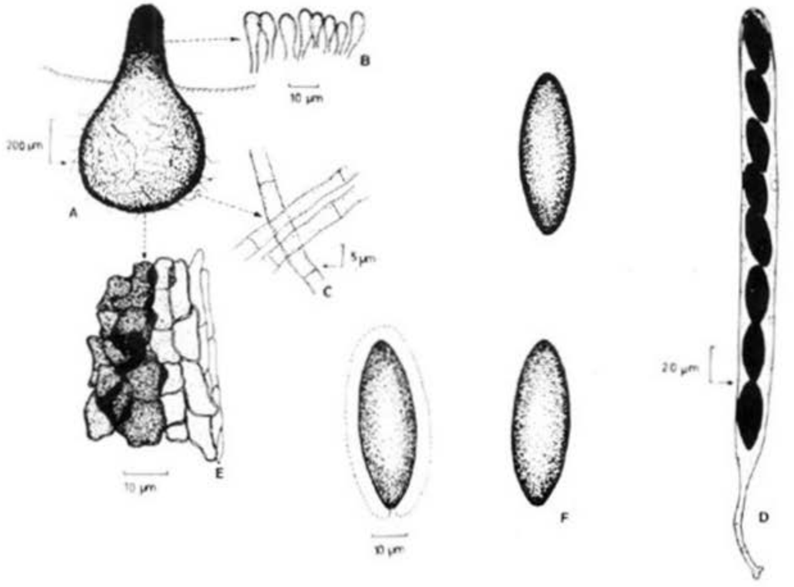

Fig. 4. *Sordaria elongatispora*, holotypus. — A. Perithecia. — B. Neck cells. — C. Hairs of perithecia. — D. Asci. — E. Cells of peridium. — F. Spores.

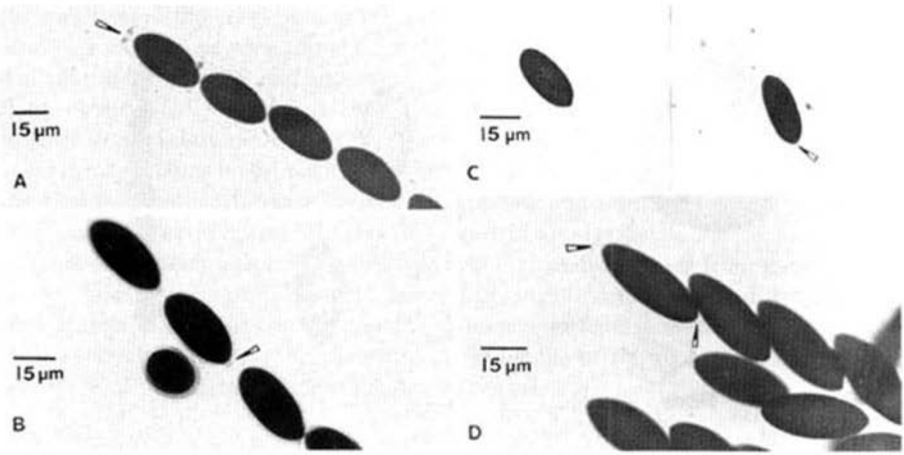

Fig. 5. — A. Spores of *Sordaria baltica*, Barrasa & Moreno 3535. — B. Spores of *S. papillata*, Barrasa & Moreno 2289. — C. Spores of *S. alcina*, UPS 3343-h. — D. Spores of *S. elongatispora*, holotypus.

KEY TO THE NARROW-SPORED SORDARIA SPECIES

(spores with a length/width ratio > 1.8)

1. Spores with rounded apex and tapering base.
    2. Spores 25–29 × 13–14 µm with apiculate germ pore; L/W = 1.8–2.2 . . . . *S. papillata*
    2. Spores 21–26 × 9.5–12 µm with non-apiculate germ pore; L/W = 2.0–2.5 . . . . . *S. alcina*
1. Spores tapering at both ends.
    3. Spores 25–31 × 12–14 µm; L/W = 2.0–2.5 . . . . *S. baltica*
    3. Spores longer 32–40 × 12–14.5(–16) µm; L/W = 2.4–3.3 . . . . *S. elongatispora*

ACKNOWLEDGEMENTS

We are grateful to Prof. Mariner-Bigorra for the Latin diagnosis. We thank Collen Regan for correcting the English text, and M.J. Soláns for typewriting the manuscript of this paper.

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PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 1, pp. 89–96 (1986)

NOTES ON CUP-FUNGI—3
On three species of Cheilymenia

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Three coprophilous species of *Cheilymenia* resembling *Lasiobolus* are redescribed. *Cheilymenia raripila* is reported from Germany; *C. insignis* and *C. pulcherrima* are newly described from authentic material of the Crouan brothers. *Cheilymenia hyalochaeta* is considered to be a synonym of *C. raripila*.

Cheilymenia raripila (Phill.) Dennis.—Fig. 1

Ascobolus raripilus Phill. in Grevillea 7: 23. 1878. — ***Lasiobolus raripilus*** (Phill.) Sacc., Syll. Fung. 8: 537. 1889. — ***Patella raripila*** (Phill.) Seav., N. Am. Cup-fungi (Operc.) 173. 1928. — ***Cheilymenia raripila*** (Phill.) Dennis in Kew Bull. 14: 428. 1960.

Peziza fraudans P. Karst. * ***P. hyalochaeta*** Speg. in Anales Soc. cient. argent. 10: 24. 1880. — *Neotiella fraudans* (P. Karst.) Sacc. * ***P. hyalochaeta*** Speg., Sacc., Syll. Fung. 8: 191. 1889. — ***Cheilymenia hyalochaeta*** (Speg.) Gamundi in Lilloa 30: 326. 1960.

Apothecia gregarious to closely crowded, superficial, sessile 1–1.5 mm diam., 0.4–0.8 mm high. Receptacle cup-shaped to saucer-shaped, rather pale yellowish to yellowish brown; surface covered with only a few rather inconspicuous pale brownish or almost hyaline hairs; margin scarcely differentiated, but sometimes visible as a very narrow irregular, membranous collarette. Disc slightly concave to flat, even, at first deep yellow, then paler. Hymenium up to 210 μm thick. Hypothecium scarcely differentiated, of thin-walled isodiametric cells 6–10 μm wide. Flesh up to 70 μm thick, of polygonal or oblong thin-walled cells, 14–25 × 10–20 μm (textura angularis to globulosa) and hyphae 6–10 μm wide lying at a low angle with the surface of the receptacle. Excipulum 20–70 μm thick, near the base 40–70 μm thick, at the margin 20–35 μm wide, yellowish, consisting of angular or rounded, isodiametric to oblong, slightly thicker walled cells 20–45(–65) × 20–35 μm (textura globulosa to angularis), covered with superficially implanted, isolated hairs. Hairs of a single type, superficial, non-rooting, inflated at the base, simple, 0–5-septate, straight, thick-walled (up to 2.5 μm), 100–280 μm long by 11–20(–25) μm wide at the base, with hyaline or pale brownish walls, with rounded or, very rarely, pointed apices. Asci subcylindrical with a short stalk, rounded above, 180–205 × 24–26 μm, 8-spored; the wall not staining blue with iodine. Ascospores uniseriate, ellipsoid (length/width ratio 1.7–2.0, average 1.9), hyaline (21.5–)23.0–26.0(–27.0) × (12.5–)13.0–14.5(–15.0) μm, without oil globules, smooth, surrounded by an easily loosening and wrinkling secondary spore wall. Paraphyses septate, slender, cylindrical, clavate at the end, unbranched, 2.5–3.7 μm thick, enlarged up to 9 μm at the tip, containing yellowish orange granules of pigment, especially in the upper part.

Habitat.—On cow dung.

Specimen examined.—GERMAN FEDERAL REPUBLIC, Bavaria, near Coburg, 20.X.1983, *B. Hanff s.n.* (L).

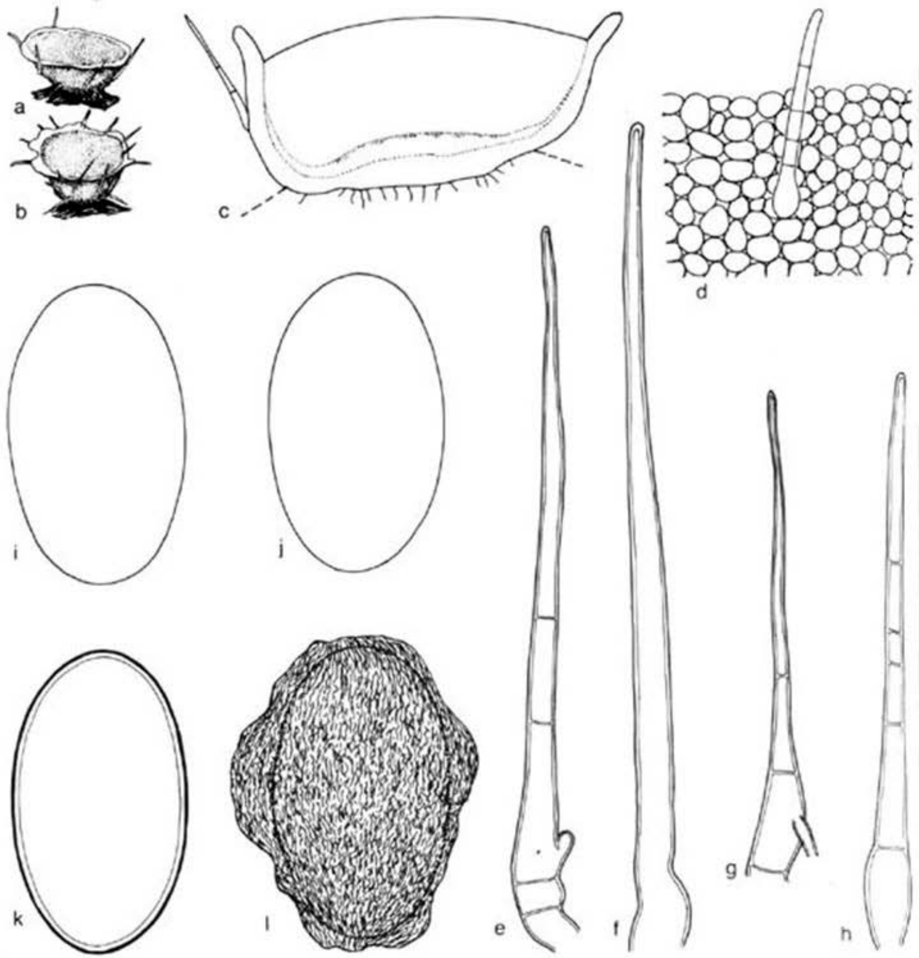

Fig. 1. *Cheilymenia raripila* (leg. *B. Hanff*). — a, b. Habit of fruit bodies × 20. — c. Diagrammatic section of fruit body ×63. — d. Texture of excipulum seen from outside ×160. — e–h. Hairs ×400. — i, j. Ascospores ×1600. — k. Ascospore in optical section ×1600. — l. Ascospore with loose secondary wall (stained with methyl blue in lactic acid) ×1600.

Apparently this is an uncommon species with a wide distribution. It is known from California (Phillips, 1878), Iowa (Seaver, 1905), Venezuela (Dennis, 1960), Argentina (Gamundi, 1975), Australia (Rifai, 1968), and the British Isles (Dennis, 1972, 1979, 1981; Hawksworth, 1976; Clarke, 1980; Kirk & Spooner, 1984). It has not previously been reported from the European Continent.

At first sight, this fungus may be taken for a species of *Lasiobolus* Sacc. because of the non-rooting inflated hair-bases that originate superficially from the outer cell-layer of the excipulum. These hairs, however, perfectly agree with the 'superficial hairs' distinguished by Denison (1964) in his study of the North American species of *Cheilymenia* Boud. According to this author such hairs predominate on apothecia of the 'theleboloides type'.

Several other important characters of this species favour the view of a position in the genus *Cheilymenia* as proposed by Dennis (1960).

The asci are not protruding above the surface of the hymenium at maturity as they do in *Lasiobolus*.

The fruit bodies are paragymnohymenial as in species of *Cheilymenia*. In such fruit bodies no closed sheath is formed over the ascogonium or the hymenium. In *Lasiobolus* the fruit bodies are cleistohymenial and open in the late mesohymenial phase, i.e. not before the ascospores are ripening (van Brummelen, 1967, 1972; Bezerra & Kimbrough, 1975).

The margin of the receptacle often ends in a short hyaline collarette, a phenomenon rather common in certain species of *Cheilymenia*, but unknown in *Lasiobolus*.

The terminal elements of the paraphyses contain many granules of a carotenoid yellowish orange pigment, not present in species of *Lasiobolus*.

The loosening and wrinkling of the otherwise smooth outermost layer of the ascospore wall as an envelope or sheath, when material is heated in lactic acid, is considered a diagnostic feature of the genus *Cheilymenia* (Le Gal, 1953; Denison, 1964). When stained with methyl blue in lactic acid or lacto-phenol the loose ascospore layer seems to show a fine net-work, because of the fine folds standing out from the surface.

Cheilymenia raripila is characterized by sparsely placed superficial, short, non-rooting, blunt hairs, relatively large ascospores, and a crowded growth of its fruit bodies on cow dung or rabbit pellets.

From Gamundi's (1960) detailed description of *Cheilymenia hymenochaeta* (Speg.) Gamundi after Spegazzini's original specimen it is evident that this name is a synonym of *C. raripila*.

Cheilymenia insignis (Crouan) Boud.—Fig. 2

Ascobolus insignis Crouan in Annls Sci. nat. (Bot.) IV 10: 196 pl. 13 H f. 38–43. 1858. — *Humaria stercorea* var. *insignis* (Crouan) Quél., Ench. Fung. 286. 1886. — *Lachnea insignis* (Crouan) Sacc., Syll. Fung. 5: 181. 1887. — *Cheilymenia insignis* (Crouan) Boud., Hist. Class. Disc. Eur. 63. 1907. — *Dasyobolus insignis* (Crouan) Le Gal in Annls Sci. nat. (Bot.) XII 1: 455. 1961. — Holotype: [Finistère, France] s. loc., on cow dung, XII.1857, *Crouan* (CONC-A2394).

Apothecia solitary or gregarious, superficial, sessile, 0.6–1('–4') mm diam., about 0.8 mm high (hairs included). Receptacle at first subglobular to slightly ovoid or urceolate, then hemispherical, yellowish orange; surface covered with many red-brown hairs, often apparently two rows of long hairs near the margin and a few short ones lower down; margin smooth or somewhat crenulate, often ending in a narrow, hyaline collarette. Disc flat or slightly concave, even, bright yellowish orange. Hymenium up to 300 μm thick.

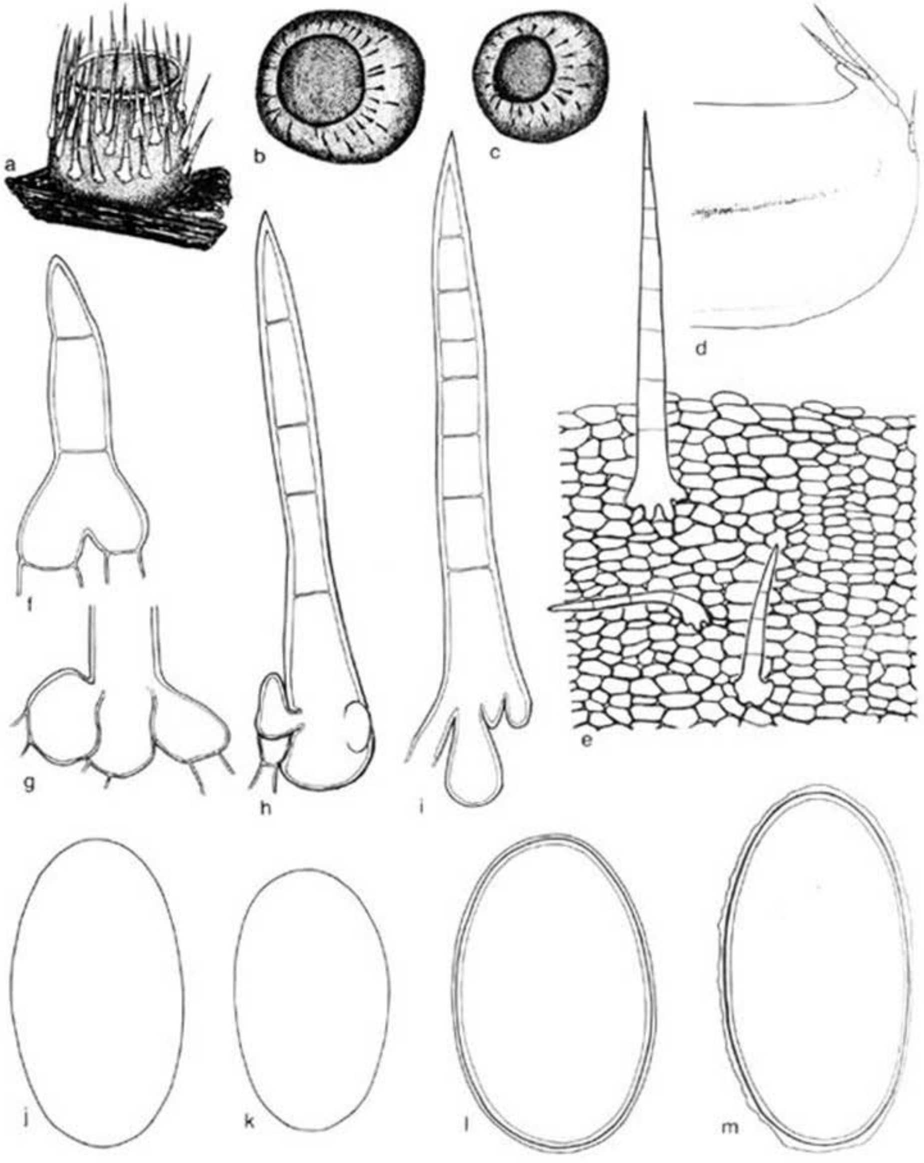

Fig. 2. *Cheilymenia insignis*, holotype. — a. Habit of fruit body × 25. — b, c. Fruit bodies (re-drawn after original drawings in Crouan herbarium, CONC). — d. Diagrammatic section of fruit body × 40. — e. Texture of excipulum seen from outside × 160. — f–i. Short hairs × 400. — j, k. Ascospores × 1600. — l, m. Ascospores in optical section (stained with methyl blue in lactic acid) × 1600.

Hypothecium not clearly differentiated as a distinct layer. Flesh 300–500 µm thick, of isodiametric to oblong thin-walled cells 25–70 × 25–55 µm (textura angularis to globulosa), yellowish. Excipulum clearly differentiated, 55–80 µm wide, hyaline, consisting of vertical rows of polyhedral thick-walled cells 27–70 × 23–40 µm (textura angularis). Hairs of a single type, arising from the two outermost cell layers of the excipulum, 2–18-septate, straight, very brittle, thick-walled (1.8–3.7 µm), (100–)140–400 µm long by 25–37 µm wide at the base, strongly forked and rooting at the base; roots partly inflated like vesicles; apices acuminate, rather sharply pointed, rarely blunt. Asci cylindrical with a short stalk, rounded above, 250–290 × 22–27 µm, 8-spored, not staining blue with iodine. Ascospores uniseriate, ellipsoid, rather variable in shape and size (length/width ratio 1.4–2.0, average 1.8), at first hyaline, with yellowish contents at maturity, (22.1–) 23.0–32.0(–36.4) × (12.6–)13.2–17.3(–18.5) µm (mean size 27.5 × 15.7 µm), without oil-globules or granules, smooth; the outermost layer staining blue with methyl blue, only occasionally separating from the spore in lactic acid. Paraphyses septate, cylindrical, branched, 3.5–5 µm thick, enlarged (up to 8 µm) or diverticulate at the tip, containing orange pigment granules, especially in the upper part.

Habitat.—On old cow dung.

Specimens examined.—FRANCE, Finistère: s. loc., XII.1857, *Crouan* (CONC-A2394, type of *Ascobolus insignis* Crouan); s. loc., 8.II.1862, *Crouan* (CONC-A2380); s. loc., 4.II.1869, *Crouan* (CONC-A2379).

The three specimens in the Crouan's herbarium represent the same species, although there is a considerable variation in the size of the ascospores. In the type specimen, the spores measure 22.1–27.5 × 12.6–17.6 µm, while they are larger in the other specimens. In addition to the herbarium specimens there are at least two original water-colour drawings by the Crouans of this species, which fully agree with the published drawings (Crouan, 1858: pl. 13H). These coloured drawings clearly show the bright yellowish orange contents of the paraphyses and the vividly orange colour of the disc.

No evidence could be found for the presence in this species of ascospores similar to those found in the genus *Ascobolus* Pers.: Fr., as described by Le Gal (1961: 454, fig. 5B).

As stated before (van Brummelen, 1967: 222), this species should be placed in *Cheilymenia* Boud. Especially the flat disc, the carotenoid pigment in the paraphyses, the strongly lobed excipular hairs, and the absence of the staining of the ascus wall with iodine are in favour of such a position.

Mature ascospores show rather homogeneous yellowish contents. With iodine a rather pale, but positive, red staining of these contents could still be observed. This indicates the presence of glycogen, a substance showing greenish opalescence with the earlier methods of microscopy using rather diffuse day-light. This may explain why the Crouans described the ascospores as glaucous green ('vert glauque').

Cheilymenia insignis is a rare species. Only Boudier (1869: 257), Fuckel (1870: 289), and Rehm (1895: 1055) give new records of it for respectively Montmorency (France), Oestrich (German Federal Republic), and Leipzig (German Democratic Republic), but apparently no material has been preserved by them.

It differs from *C. fimicola* (de Not. & Bagl.) Dennis in the larger ascospores and the more frequent excipular hairs.

From *C. stercorea* (Wigg.: Fr.) Boud. it can be distinguished by its larger ascospores and the absence of stellate hairs at the base of the fruit body.

It shows some similarity to *C. pulcherrima*, but differs in having fruit bodies of a different shape, hairs lobed at their base, and larger ascospores.

Cheilymenia pulcherrima (Crouan) Boud.—Fig. 3

Ascobolus pulcherrimus Crouan in Annls Sci. nat. (Bot.) IV 10: 196. 1858. — *Peziza pulcherrima* (Crouan) Cooke, Mycographia 84. 1876. — *Humaria pulcherrima* (Crouan) Speg. in Michelia 1: 37. 1878. — *Lachnea pulcherrima* (Crouan) Gill., Champ. Fr. 76. 1880. — *Scutellinia pulcherrima* (Crouan) O. Kuntze, Rev. Gen. Pl. 2: 869. 1891. — *Lasiobolus pulcherrimus* (Crouan) Schroet., in Krypt.-Fl. Schles. (ed. Cohn) 3(2): 54. 1893. — *Cheilymenia pulcherrima* (Crouan) Boud., Hist. Class. Discom. Europ. 63: 1907. — *Patella pulcherrima* (Crouan) Seav., N. Am. Cup-fungi (Operc.) 172. 1928. — Type: *Crouan*, on cow dung, Brest, Finistère, France, summer (CONC-A2388, holotype; PC-A2355, isotype).

Apothecia gregarious or in small groups, superficial, sessile, 0.5–1.0('–2') mm diam., up to 1 mm high. Receptacle at first subcylindrical, then turbinate, sometimes becoming subhemispherical, yellowish orange ('jaune orangé vif' according to Crouan, 1858); surface covered with numerous pale brown hairs; margin smooth or somewhat dentate, ending in a short hyaline raised collarette. Disc flat, even, bright orange-yellow. Hymenium up to 220 μm thick. Hypothecium scarcely differentiated. Excipulum clearly differentiated, at the margin 35–60 μm wide, less distinct near the base, consisting of angular, subglobular and oblong cells 16–40 × 16–30 μm (textura angularis to globulosa); collarette up to 90 μm high. Flesh rather thin, in the central part up to about 100 μm, of rounded cells 11–18 μm diam., intermingled with irregular hyphae 3.5–6 μm wide. Hairs of a single type, non-rooting, arising from superficial excipular cells, single, 0–2(–3)-septate, straight, 90–200 μm long by 11–18(–25) μm at the base, rather brittle, gradually tapering toward the usually sharp-pointed end; the wall pale yellowish brown, rather thin (0.7–2.4 μm). Asci cylindrical with a short stalk, rounded above, 180–215 × 18–22 μm, 8-spored; the wall not blue with iodine. Ascospore uniseriate, ellipsoid (length/width ratio 1.5–1.9, average 1.7–1.8), at first hyaline, then pale yellowish brown, rather variable in size, (16.7–)18.5–24.9(–26.2) × (10.2–)11.0–13.6(–14.5) μm, without oil-globules or granules, smooth; the outermost layer staining with methyl blue, not separating from the spore in lactic acid. Paraphyses septate, slender, cylindrical, sparsely branched, 3.5–5 μm thick, enlarged up to 7 μm at the tip, containing many small yellow pigment granules.

Habitat.—On old cow dung.

Specimens examined.—FRANCE: Finistère, near Brest, on old cow dung, summer, s. dat., *Crouan* (CONC-A2388, holotype of *Ascobolus pulcherrimus*; PC-A2355, isotype); Finistère, s. loc., on cow dung, 10.VI.1864, *Crouan* (CONC-A2374); Finistère, s. loc., s. dat. (II), *Crouan* (CONC-A2397).—GERMAN FEDERAL REPUBLIC, Nassau, Rheingau, near Oestrich, on cow dung, autumn, s. dat., *Fuckel*, in Fungi rhen. 1859 (L).

The general appearance of this species is much like that of certain species of *Lasiobolus* Sacc., but the mature asci are not protruding above the surface of the hymenium, the fruit bodies are not cleistohymenial, the margin ends in a collarette, the paraphyses contain a granular yellow pigment and most hairs are septate.

The present species should be placed in the genus *Cheilymenia* rather close to *Cheilymenia insignis*, both with superficial excipular hairs, ascospores with yellowish contents,

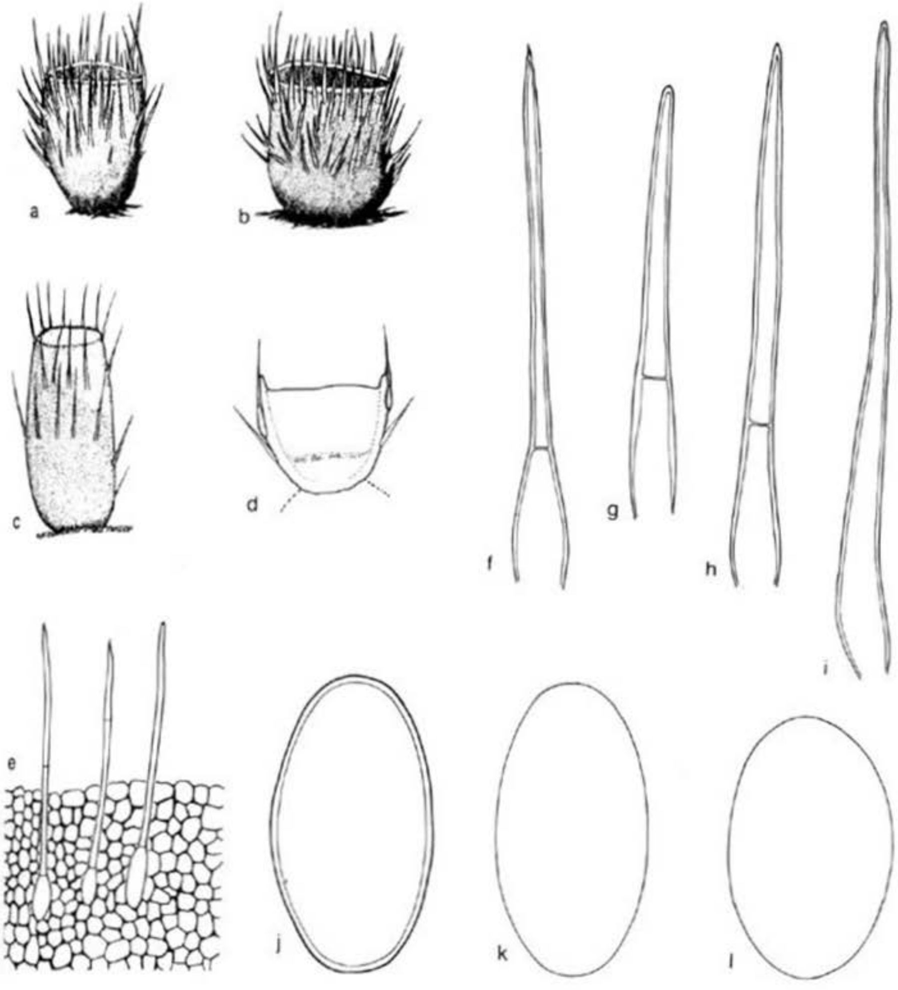

Fig. 3. *Cheilymenia pulcherrima*, holotype. — a, b. Habit of fruit bodies × 25. — c. Fruit body (redrawn after original drawing in Crouan herbarium, CONC). — d. Diagrammatic section of fruit body × 40. — e. Texture of excipulum seen from outside × 160. — f–i. Hairs × 400. — j. Ascospore in optical section (stained with methyl blue in lactic acid) × 1600. — k, l. Ascospores × 1600.

and ascospores of which the outermost layer rarely if ever loosens in lactic acid. But both species differ from each other in the colour and shape of the fruit body, the septation and shape of the hairs, the colour of the paraphyses, and the size of the ascospores.

Good coloured illustrations in the Crouan's herbarium show that the fruit bodies and the pigment of the paraphyses in *C. pulcherrima* are less vividly orange in colour than in

C. insignis. In the former the colour is yellowish orange (about Munsell 2.5 Y 8/13) but in the latter deep orange (up to Munsell 4.5 YR 7/15).

No purplish hue could be found in the colour of the ascospores as mentioned by Le Gal (1961: 451).

Most descriptions of *C. pulcherrima* in literature are difficult to identify without the study of specimens. Even the exemplary description with fine illustrations by Woronin (1866) cannot be identified with certainty. As Woronin already suggests in a foot-note, his fungus is more or less intermediate in its characters between *C. pulcherrima* and *C. insignis*. Schroeter's (1893: 54) knowledge was only based on Woronin's description when he transferred *Ascobolus pulcherrimus* to *Lasiobolus*.

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PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 1, pp. 97–105 (1986)

NOTES ON ZYGORHYNCHUS SPECIES

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An account is given of species of *Zygorhynchus* maintained in the CBS collection, with emphasis on zygospore formation. A key to species is added.

Two difficult to identify isolates of *Zygorhynchus* spp., prompted a study of all CBS strains in the genus for comparison with the original diagnoses and with the descriptions given in the monograph of the genus by Hesseltine & al. (1959). This study, with emphasis on zygospore formation, led to a re-evaluation of some key characteristics used by Hesseltine & al. (1959).

All strains maintained in the CBS collection sub *Zygorhynchus californiensis, Z. exponens* var. *exponens, Z. exponens* var. *smithii, Z. heterogamus, Z. japonicus, Z. macrocarpus, Z. moelleri, Z. psychrophilus*, and *Z.* sp. were examined.

METHODS

Cultures were grown on beerwort agar at temperatures from 15 to 36° C, at 3° C increments; *Z. psychrophilus*, which does not grow at or above 20° C, was grown from 0 to 15° C. For similar reasons, *Z. japonicus* was grown at 5–20° C. Following the methodology of Hesseltine & al. (1959), cultures were also grown on D-glucose and D-xylose medium, and furthermore tested for amylolytic and lipolytic activity (after Hankin & Anagnostakis, 1975).

Media: beerwort agar containing 4% resp. 2% sugar; D-glucose and D-xylose medium, containing D-glucose or D-xylose 20 g, $MgSO_4$ $7H_20$ 0.25 g, L-asparagin 2.0 g, KH2PO4 0.5 g, thiamine-HCl 0.25 g, trace elements solution 1 ml, agar 15 g in 1 l de-ionized water; malt yeast agar: malt extract 10 g, yeast extract 4 g, glucose 4 g per litre; V8 juice agar (200 ml V8 per litre); oatmeal agar: extract of 30 g flakes per litre.

Zygorhynchus Vuillemin (1903)

Type species: *Zygorhynchus heterogamus* (Vuill.) Vuill. (1903) = *Mucor heterogamus* Vuill. (1886).

Vuillemin (1903) distinguished *Zygorhynchus* from *Mucor* on differences of the zygospore-apparatus.

In *Zygorhynchus* the suspensors are unequal, both in size and shape, the smaller one straight and short, the larger long, curving upwards and widening towards a pyriform shape. The most conspicuous feature in *Zygorhynchus* is the occurrence of the com-

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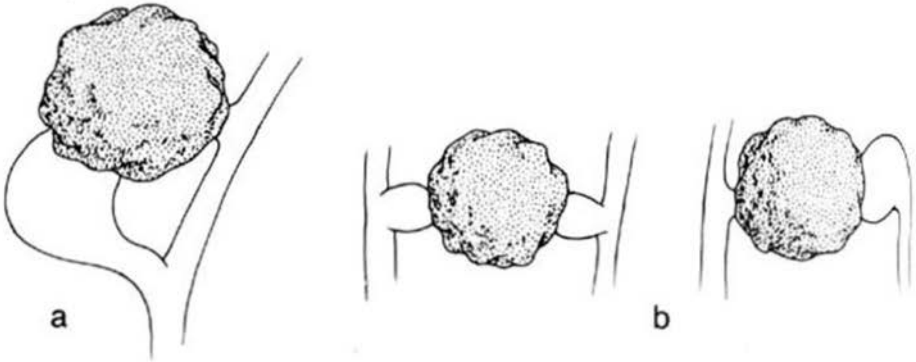

Fig. 1. Zygosporic stages. — a. *Zygorhynchus*. — b. *Mucor*. (Schematic.)

plete zygospore apparatus, with extremely unequal suspensors, on the same aerial hypha.

In the closely related genus *Mucor*, suspensors, varying from equal to rather unequal, always originate from different hyphae, both in heterothallic and homothallic species (Fig. 1). In some species of *Zygorhynchus*, however, some zygospores may be formed following the *Mucor* pattern. Green (1927) found that in *Z. moelleri* Vuill. 'sometimes the gametangia were produced on different zygophores and that one branch might produce two gametangia which might fuse with others on independent zygophores'. Hesseltine & al. (1959) described and discussed the mixture of *Zygorhynchus* and *Mucor* patterns in *Z. exponens* Burgeff, where both patterns are quite common. The same situation was observed in the present study in CBS 154.69, *Z. japonicus* Kominami.

Zygorhynchus exponens Burgeff — Figs. 2, 4e

Zygorhynchus exponens Burgeff in Bot. Abh. 4: 34. 1924.

The three strains of *Z. exponens* maintained in the CBS collection were all derived from the type strain. The strain denoted '*niger*' by Burgeff, a single-spore isolate of the type strain, is (now) not different from the others.

On beerwort agar at 24° C colonies of all three showed grey and white patches, when grown at 27–30° C they were yellow and grey. Zygospores were formed in both the *Zygorhynchus* and *Mucor* fashion, the latter prevailing.

Material examined. — CBS 141.20, type strain of *Zygorhynchus exponens*, ex forest soil, Geisenheim, Germany, *H. Burgeff* = CBS 403.58 = NRRL 1492 = Blakeslee C–972, subculture of 141.20. — CBS 508.48, strain '*niger*', single spore isolate from CBS 141.20, *H. Burgeff*.

Hesseltine & al. (1959) considered zygospore formation in this species intermediate between *Z. moelleri* and homothallic *Mucor* species.

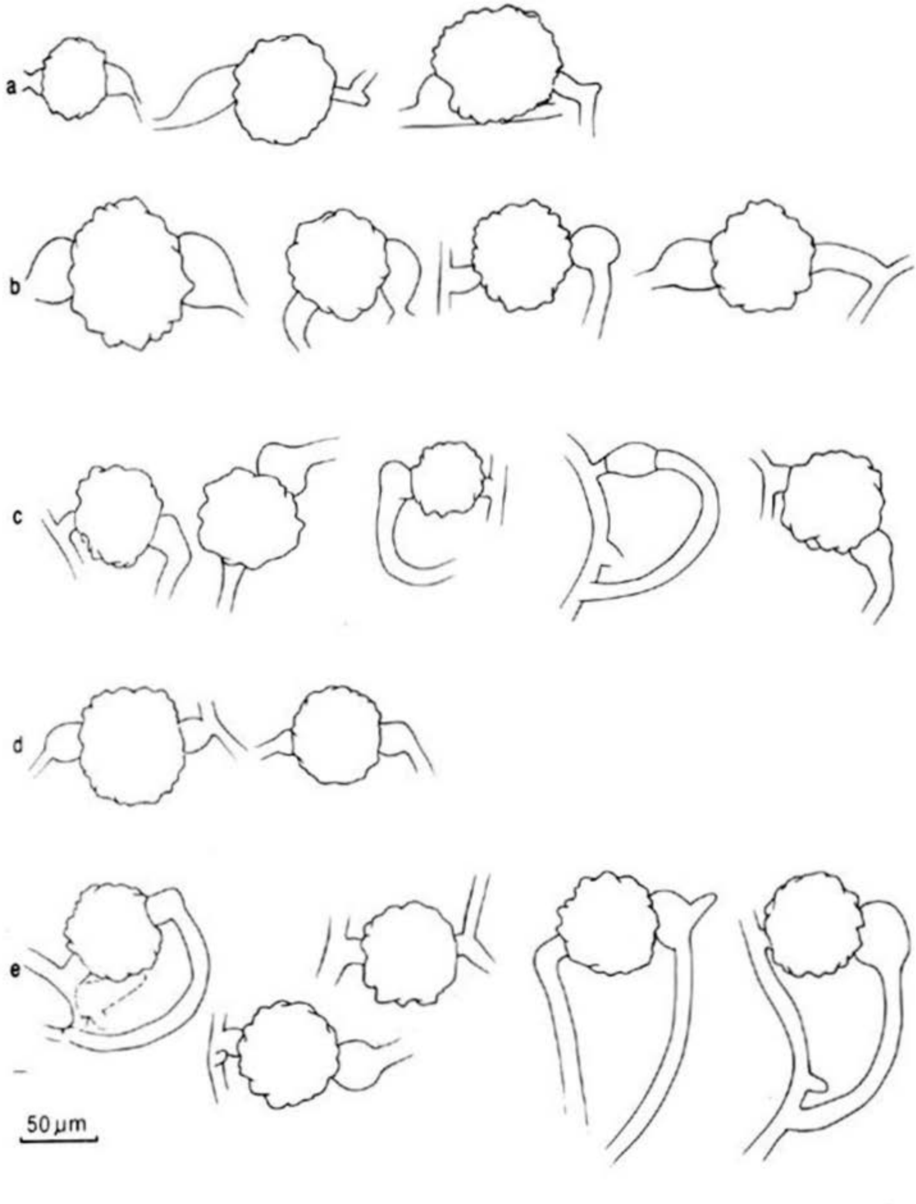

Fig. 2. Zygosporic stages. — a. *Mucor plumbeus*, CBS 213.75 (+) × 848.73 B (–). — b. *Zygorhynchus exponens*, CBS 141.20. — c. *Z. exponens*, CBS 508.48. — d. *Z. exponens*, CBS 403.58 — e. *Z. exponens* var. *smithii*, CBS 404.58.

The patchy colouring of *Z. exponens* colonies is reminiscent of strains with an unbalanced sexual state e.g. azygosporic descendants of normally heterothallic species. Morphologically, *Z. exponens* is most closely related to *Mucor plumbeus*: like *M. plumbeus, Zygorhynchus exponens* has short racemose branches with small sporangia; breaking sporangial wall; (some) conical columellae with a short apical projection; globose, verrucose sporangiospores; brown zygospores which are (often) borne between equal or inequal suspensors originating from different hyphae and zygospore ornamentation of similar patterns (Schipper & al., 1975).

Occasionally sporangia and zygospores are formed on the same hypha. Sporangia, sporangiospores and zygospores of *Mucor plumbeus* and *Zygorhynchus exponens* are of about the same size. The differences between the two species are the shape of the majority of columellae and the occurrence of zygospores borne between suspensors originating from one hypha.

Zygorhynchus exponens in the *Zygorhynchus* stage showed only moderately enlarged suspensors, rather variable in shape (Fig. 2). Unusual though the characters may seem, the species has proved to be stable. After sixty years of repeated culturing, the type strain still fits the author's drawings, and so does the 1948-single spore isolate.

Dr. W. Gauger, University of Nebraska, kindly germinated zygospores of CBS 141.20. Germination was unusually fast: after only 8 days the first germination was observed. Thirteen viable germinations were obtained: two germ sporangia and eleven mycelial germinations. Both single germ spore isolates (five from one germ sporangium) and hyphal tip isolates (nine, taken at random) produced colonies identical to the parental one.

CBS 404.58, the type strain of *Z. exponens* var. *smithii*, shows similar features and is regarded as synonymous.

Material examined. — CBS 404.58, type strain of *Zygorhynchus exponens* var. *smithii* Hesseltine & al. = NRRL 2572 = IMI 79624 = IFO 6665, ex soil, U.K.

Zygorhynchus japonicus Kominami — Fig. 3

Zygorhynchus japonicus Kominami in Mykol. Zentbl. 5: 3. ('1914') 1915.

Kominami's strain is no longer known to exist. In 1968 a similar fungus was isolated by A. A. Milko (Pidoplichko & Milko, 1971) which was available for study: CBS 154.69 (= VKM F-1382, ex forest soil, Chesnovizkaja Region, USSR). In this strain, a *Mucor* zygosporic condition was found to occur alongside the *Zygorhynchus* condition.

CBS 154.69 did not grow at 25°C, however good growth and sporulation occurred between 5 and 20°C. It was grown on 4% beerwort agar, 2% beerwort agar, maltyeast agar, oatmeal agar and V8 juice agar, at 20°C. In each colony the *Mucor* pattern of zygospore formation seemed to prevail. The typical '*japonicus*' pattern, as described by Kominami, was rare, and occurred mixed with the '*Mucor*' pattern on the same hyphae; indisputable azygospores were observed (Fig. 3). Pairs of zygospore-bearing aerial hyphae arising separately from the substratum were distinct in young cultures. Colonies derived from isolated zygospores were similar.

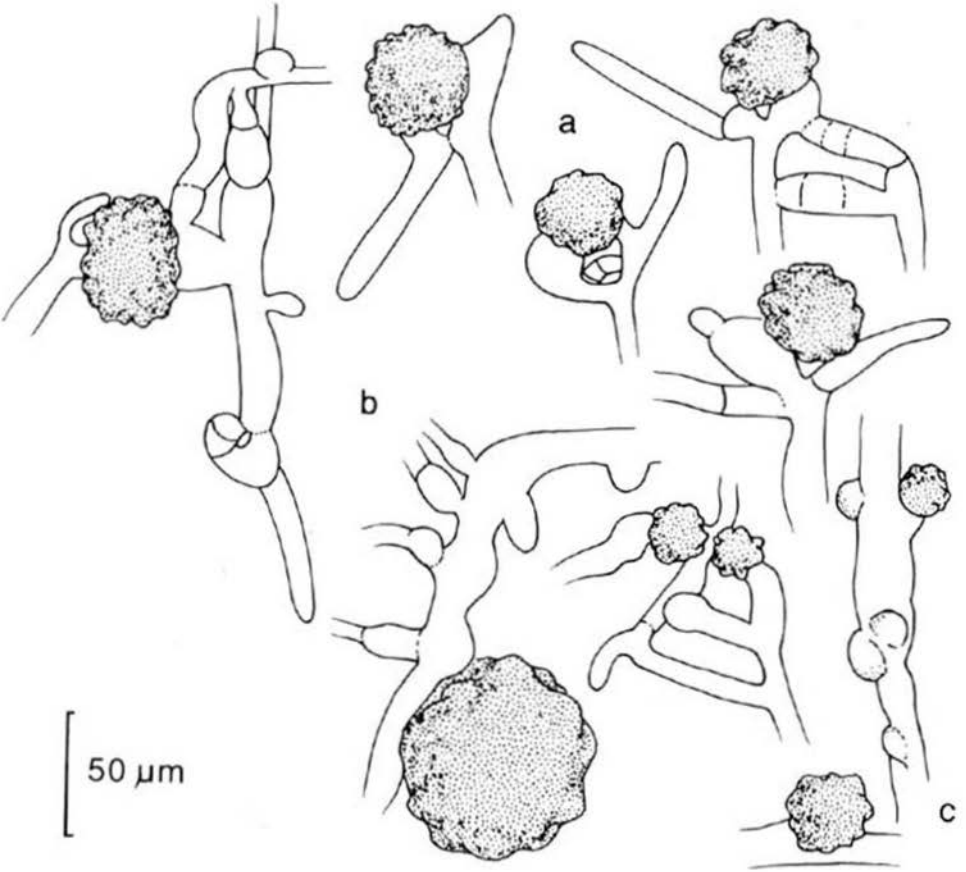

Fig. 3. Zygosporic stages in *Zygorhynchus japonicus*, CBS 154.69. — a. 'Typical' pattern. — b. Prevailing pattern. — c. Azygospores.

Zygorhynchus japonicus does not closely resemble any known *Mucor* species. There are some similarities with *Mucor bacilliformis* Hesseltine (1954). One of these is the attraction of several aerial hyphae by a single one of opposite sex resulting in an arachnoid appearance in undisturbed young colonies.

Zygorhynchus heterogamus (Vuill.) Vuill. & **Z. macrocarpus** Ling — Fig. 4c

Zygorhynchus heterogamus (Vuill.) Vuill. in Bull. trimest. Soc. mycol. Fr. 19: 116. 1903.
Zygorhynchus macrocarpus Ling in Revue gén. Bot. 42: 7. 1930.

Of both species some type material is still in existence:

The holotype material of *Z. heterogamus* = *Mucor heterogamus* Vuill. consists of slides prepared by Vuillemin in 1886. (Hesseltine & al. (1959) studied and described these slides).

CBS 215.27 = NRRL 2663 = type strain of *Z. macrocarpus*, ex soil of peatery, France.

The first description of *Z. heterogamus*, complemented with Vuillemin's drawings, and the observations of the original slides by Hesseltine & al. gave the following features: sporangia av. 50–60 µm diam.; columellae globose (on narrow base); sporangiospores globose to short ellipsoidal, 3–5.5 × 2.1–4 µm; zygospores 45–150, mostly over 100 µm diam, the larger suspensors subglobose.

These features differ slightly from those given by Hesseltine & al. (1959) as a composite after five isolates, identified with *Z. heterogamus* and cultured on SMA viz. sporangia mostly up to 35 (15–55) µm diam.; columellae applanate to almost globose; sporangiospores irregular short oval, a few globose, 2–4 × 4–6.5(5 × 8) µm; zygospores 30–70 µm diam.; the larger suspensors abruptly inflated, globose.

Material examined. CBS 215.27 = NRRL 2663 = type strain of *Zygorhynchus macrocarpus* Ling, ex soil of a peatery, France. — CBS 455.58 = NRRL 1616 = Harvard University Collection no. 202. — CBS 338.74, ex sediment in a drain pipe, Sweden. — CBS 580.83, ex sandy soil, potato-field, Haren, The Netherlands (1981). — CBS 594.83, ex soil, Páramo Cruz Verde, ca. 3000 m alt., Cundinamarca, Columbia, *H. Valencia*; isol. W. Gams.

The type strain of *Z. macrocarpus* fits the above description of *Z. heterogamus*. Ling Young (1930) noted the similarity of zygospores in both species, but omitted to indicate differences. Also fitting this characterization are the recent isolates CBS 580.83 and CBS 594.83.

Influence of temperature: at 30°C no growth in CBS 215.27, 580.83 and 594.83; at 27°C growth and sporangia in CBS 215.27, growth restricted or absent in CBS 580.83 and 594.83; at 15–24°C growth and sporulation, both asexual and sexual

REMAINING SPECIES

The remaining species (strains) fit the original and Hesseltine & al.'s descriptions. This concerns:

Zygorhynchus californiensis Hesseltine & al.: CBS 402.58 = NRRL 2658 = IFO 6663, T, ex soil, California.

Zygorhynchus moelleri Vuill.: CBS 111.10 = NRRL 1497, rec. as *Z. vuillemini* Namyslowski var. *agamus* Namyslowski, *B. Namyslowski*; 216.27 = IMI 21113, Y. Ling; 284.28, CLMR; 380.29, ex wood; 348.37, culture contaminant, CMI; 395.49, ex soil; 581.50, ex root *Gerbera* sp., 460.51 = IMI 47187, culture contaminant; 406.58 = NRRL 2660, ex soil, Wisconsin, 444.56 = ATCC 16388 = VKM F-1366, (T, *Mucor saximontensis* Rall), ex soil, USA, *G. Rall*; 501.66, ex soil, Austria.

Zygorhynchus psychrophilus Schipper & Hintikka 336.68, T, ex brown needles of windblown *Picea* sp., the needles being immersed in snow, Finland, *V. Hintikka*

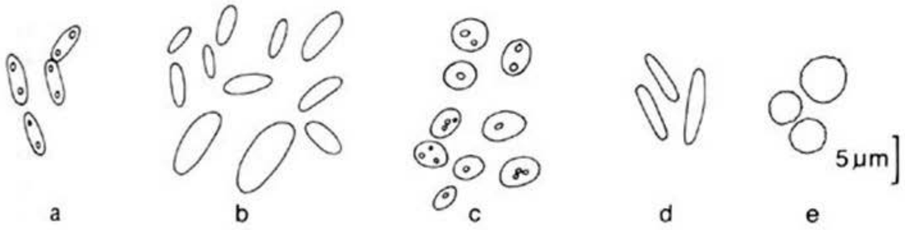

Fig. 4. Sporangiospores. — a. *Zygorhynchus moelleri*. — b. *Z. japonicus*. — c. *Z. heterogamus*. — d. *Z. psychrophilus*. — e. *Z. exponens*.

VARIABILITY OF FEATURES

Hesseltine & al. (1959) used the shape of the larger suspensor, shape of the columellae and shape and size of the sporangiospores as primary characteristics for species delimitation in the genus *Zygorhynchus*.

Columellae: Though applanate, globose and short ellipsoidal columellae are present in most strains, a particular shape prevails in each species.

Sporangiospores: Shape of the sporangiospores is constant in each species. Cylindrical-ellipsoidal sporangiospores, mostly with a droplet at either end, are distinctive for *Z. moelleri*; ellipsoidal-oval sporangiospores, very variable in size, are produced by *Z. japonicus*; in *Z. psychrophilus* sporangiospores are fusiform; globose (or subglobose) sporangiospores are produced in *Z. californiensis, Z. exponens*, and *Z. heterogamus*, verruculose in *Z. exponens* and smooth in *Z. californiensis*, and *Z. heterogamus* (Fig. 4).

Suspensors: Suspensors of a pyriform shape are present in *Z. californiensis* and *Z. moelleri*; abrupt enlargement, resulting in globose, pyriform or intermediate forms, has been observed in *Z. heterogamus* and *Z. psychrophilus*.

The CBS strains developed generally well on D-glucose and D-xylose as carbon source; no lipase activity was detected; amylase activity was weak or absent.

DISCUSSION

Zygorhynchus is closely related to *Mucor*. Differences are relative rather than absolute:

(i) The species of *Zygorhynchus* are always homothallic, whereas homothallism is rare in *Mucor*.

(ii) In *Zygorhynchus* the production of both zygospores and sporangia on the same hypha is usual, in *Mucor* this condition is rare.

(iii) In *Zygorhynchus* (inequal) gametes, borne on the same hypha, are always present; in *Mucor* gametes are on different hyphae.

Schipper & Stalpers (1980), discussing the various aspects of the mating system in Mucorales, stated that neither heterothallism nor homothallism are absolute conditions.

Homothallic strains are known to show a preference for a particular mating type, e.g. Satina & Blakeslee (1930) found a (+)tendency in strains of *Zygorhynchus heterogamus* and a (-)tendency in strains of *Z. moelleri* in mating behaviour; this tendency was confirmed by Werkman & Van den Ende (1974) in their studies on conversion of sex-hormone precursors; Schipper (1971) induced zygospore formation in the *Zygorhynchus* manner in agamic strains of *Z. moelleri* through contrasts with either (+) or (-) 'partners', but not both.

In homothallic *Mucor* species (+) and (-) zygophores are, at some distance, connected through the substrate mycelium. In the *Zygorhynchus* manner of zygospore formation, the location of (+) and (-) is much closer; also, with decreasing distance, the locations are less fixed (see e.g. Schipper & Stalpers, 1980). Still, the difference may be looked upon as a matter of degree.

The major reason for retention of the genus and its intermediate species is the fact that the *Zygorhynchus* pattern has never been observed in *Mucor*, and the stability of this pattern in the species with both the *Zygorhynchus* and the *Mucor* pattern of zygospore production. The species *Z. exponens* and *Z. japonicus* are rare. In the studied strains of the common *Z. moelleri* the *Mucor* pattern was not found, nor was it found in *Z. californiensis, Z. heterogamus/Z. macrocarpus*, or *Z. psychrophilus*. Though some similar species exist in the two genera they are certainly not identical.

EXCLUDED SPECIES

Von Arx (1982) transferred three *Mucor* species to the genus *Zygorhynchus* on the assumption of a closer relationship to *Zygorhynchus* than to *Mucor*, but failed to specify the reasons.

The species considered, viz. *Mucor bacilliformis* Hesseltine (homothallic, suspensors equal), *Mucor amphibiorum* Schipper (heterothallic, suspensors equal) and *Mucor indicus* Lendner (heterothallic, suspensors inequal) produce copulating gametangia that originate from separate hyphae. A '*Zygorhynchus*' pattern of zygospore formation has never been observed in these species.

KEY TO THE SPECIES

1. Sporangiospores globose or subglobose 2
1. Sporangiospores cylindrical-ellipsoidal, ellipsoidal or fusiform 4
2. Sporangiospores rough; sporangial wall breaking at maturity; zygospore production mostly in *Mucor* manner, fewer in *Zygorhynchus* manner . . . . *Z. exponens*
2. Sporangiospores smooth 3
3. Zygospores black, up to 80 µm diam. and beyond; sporangiospores globose, subglobose to short ellipsoidal . . . . *Z. heterogamus*
3. Zygospores brown, up to 60 µm diam.; sporangiospores globose . . . . *Z. californiensis*

4. Sporangiospores cylindrical-ellipsoidal, typically 4 × 2 (5 × 2.5) µm, with a droplet at either end; zygospores 50 µm in max. diam. . . . . *Z. moelleri*
4. Sporangiospores oval-ellipsoidal or fusiform 5
5. Sporangiospores fusiform, rather equal; no growth at 20° C . . . . *Z. psychrophilus*
5. Sporangiospores oval-ellipsoidal, very variable in size, up to 10 µm in length; suspensors (in the *Zygorhynchus* stage) very near to each other; over 20° C no growth. . . . . *Z. japonicus*

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PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 1, pp. 107–112 (1986)

PODOSPORA CARPINICOLA SPEC. NOV., UN ASCOMYCÈTE ISOLÉ DE FEUILLES MORTES DE CARPINUS, ET DEUX AUTRES ESPÈCES DU MÊME GENRE

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Trois espèces du genre *Podospora* Cesati sont décrites et illustrées. *P. carpinicola* spec. nov. et *P. inaequalis* (Cain) Cain ont été isolé de feuilles mortes de *Carpinus* collectées en la forêt de Fontainebleau; l'isolat du *P. minicauda* Faurel et Locquin-Linard provient d'un échantillon de sol de l'oasis de Kharga, désert Occidental de l'Egypte.

La description, en 1975, d'une nouvelle espèce du genre *Podospora* Cesati, *P. faurelii* isolé d'un échantillon de sol de zone aride, nous a permis de nous familiariser avec ce genre réputé pour ses affinités avec du matériel stercoral (Lundqvist, 1972). Depuis, nous avons obtenu plusieurs souches intéressantes de *Podospora*, certaines de sol de région également aride (Mouchacca, 1982), d'autres de litière de *Carpinus* collectée dans la forêt de Fontainebleau (Mouchacca & Geoffroy, 1984).

Cet article concerne deux espèces observées sur la litière de *Carpinus* dont une est nouvelle et une troisième à affinité stercorale de zone aride, à savoir *P. carpinicola*, *P. inaequalis* et *P. minicauda*.

Podospora carpinicola Mouchacca, *spec. nov.* — Fig. 1

Peritheciis superficialibus, piriformibus, obscure brunneis, 300–800 × 250–450 μm, collo paulo distincto; vestitis omnino cum pilis localiter comatis praecipus circa ostiolum. Pilis ex paucis cylindraceis cellulis compositis, dilute brunneis, 10–18 × 7–16 μm, cum cellula apicali acuta; paries peridialis pseudoparenchymatosus, obscure brunneus, paucis stratis angulosarum cellularum compositus.

Ascis octosporis cylindraceis, 170–200 × 16–23 μm, ad apicem rotundatis, evanescentibus, annulo apicali indistincto. Ascosporis uniseriatis, ellipsoideis, latis, obscure brunneis maturitate, 22–27.5 × 14–19.5 μm; primaria appendice hyalina, claviformi vel cylindracea, 8–14 × 2 μm, fugaci; secundaria appendice non visa; foramine germinali apicali, 2–2.5 μm diam.

Forma conidialis assumptiva phialidis lageniformibus, solitariis, sessilibus, dilute brunneis, trophio instructis, 5–12 × 3.5–4 μm, figurata. Phialosporis hyaliniis, ovoideis vel guttuliformibus, 2.5–3 × 2-2.5 μm. — Typus: Ex mortuis foliis *Carpini betuli* L. separatus, Silva Fontainebleau, Junius mensis 1979. (Cultura typica in PC depositus.)

Périthèces superficiels, piriformes à presque cylindriques, brun sombre à noirâtre, 300–800 × 250–450 μm, pourvus d'un col peu différencié; parties apicales des périthèces recouvertes d'une couche continue de poils formant des touffes par endroits, plus

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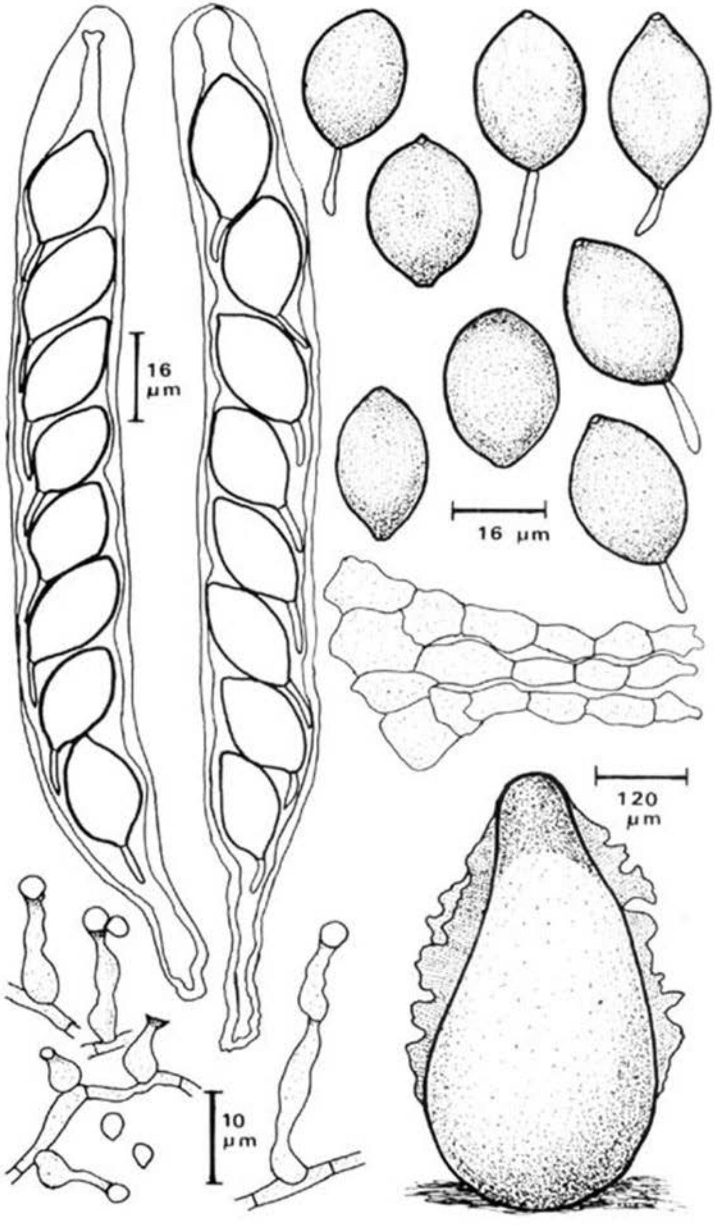

Fig. 1. *Podospora carpinicola*. — A. Jeune périthèce et détails des poils superficiels. — B. Asques octosporés cylindriques. — C. Ascospores ellipsoïdes larges. — D. Forme conidienne accessoire.

particulièrement autour de l'ostiole; poils composés de quelques cellules ovoïdes, cylindriques ou à contour irrégulier, brunâtre claire, 10–18 × 7–16 μm, à cellule distale pointue fimbriée; paroi péridiale pseudoparenchymateuse composée de quelques couches de cellulles à contour anguleux ou irrégulier, brun sombre.

Asques octosporés, cylindriques, 170–200 × 16–23 μm, à apex arrondi et anneau apical indistinct, évanescents. Ascospores unisériées, ellipsoïdes larges, brun sombre à maturité, 22–27.5 × 14–19.5 μm; appendice primaire hyalin, claviforme à cylindrique, 8–14 × 2.0 μm, fugace; appendice secondaire non observé; pore germinatif apical, 2–2.5 μm de diamètre.

Forme conidienne accessoire très discrète, représentée par des phialides lageniformes, solitaires, sessiles, brunâtre claire, quelquefois pourvues d'une collerette, 5–12 × 3.5–4 μm; phialospores hyalines, ovoïdes à guttuliformes, 2.5–3 × 2–2.5 μm.

Croissance très lente en culture à 24° C.

Isolé en culture de feuilles mortes de *Carpinus* incubées en chambre humide; litière collectée en juin 1979, en la forêt de Fontainebleau (France). Culture type déposée à PC et au CBS.

Podospora carpinicola se caractérise principalement par ses asques octosporés cylindriques et ses larges ascospores ellipsoïdes dépourvues d'appendices secondaires. D'après la biométrie de ses ascospores, il pourrait être confondu avec *P. curvula* (De Bary) Niessl; celui-ci s'en distingue cependant par ses asques octosporés claviformes et ses ascospores ellipsoïdes comparativement moins larges et pourvues d'appendices secondaires.

Podospora carpinicola est également proche des *P. glutinans* (Cain) Cain et *P. miniglutinans* Mirza et Cain, deux *Podospora* ayant aussi des asques octosporés cylindriques mais dont les ascospores sont ornées d'appendices secondaires; de plus, les ascospores du *P. carpinicola* sont plus petites que celles du *P. glutinans* et plus grandes que celles du *P. miniglutinans* (Mirza & Cain, 1969). En réalité, de par cette dernière caractéristique, le taxon que nous proposons représente une espèce intermédiaire entre ces deux *Podospora*.

Podospora inaequalis (Cain) Cain — Fig. 2A

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

Périthèces superficiels, ovoïdes étirés à piriformes ou presque cylindriques, brun olivacé sombre à noirâtre, atteignant 400 μm de longueur et 180 μm de largeur, pourvus d'un col peu différencié; périthèces recouverts d'une couche de cellules agglutinées, subglobuleuses à subconiques ou de forme irrégulière, brunâtres, 10–18 μm de largeur; paroi péridiale peu épaisse, membranacée, formée de cellules à contour anguleux, brunâtres.

Asques tétrasporés, cylindriques, 80–110 × 10–14 μm, à apex arrondi et anneau apical non distinct, évanescents. Ascospores unisériées, de forme inégalement ellipsoïdes en vue latérale avec un côté presque droit, ellipsoïdes vue de face, brun olivacé sombre, 17–24 × 10–13 μm; exospore peu marquée et appendice primaire ténu, claviforme, hyalin, 5–8 × 1.5–3 μm, fugace; appendice secondaire absent; pore germinatif légèrement sous-apical, 1.5–2 μm de diamètre, localisé du côté de l'ascospore à courbure accentuée.

Forme conidienne accessoire non observée.

Isolé en culture de feuilles mortes de *Carpinus* incubées en chambre humide; litière collectée en juin 1979, en la forêt de Fontainebleau.

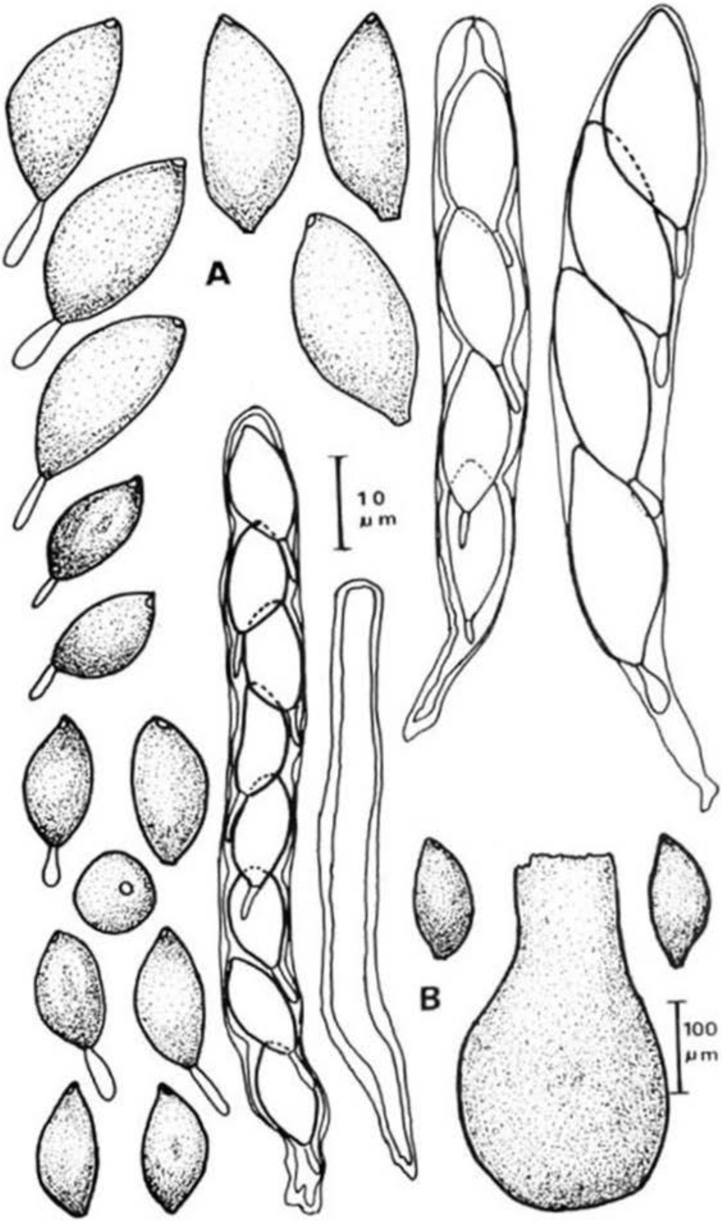

Fig. 2A. *Podospora inaequalis*. — Asques tétrasporés et ascospores en vue latérale.

Fig. 2B. *Podospora minicauda*. — Périthèce, asques octosporés cylindriques et ascospores inégalement ellipsoïdes en vue latérale.

Du groupe de *Podospora* à asques tétrasporés, *P. inaequalis* se distingue aisément par la forme particulière et la biométrie de ses ascospores dépourvues d'appendices secondaires. La culture-type de ce *Podospora* a été isolée de graines de carottes en Amérique du Nord où d'autres isolements de cette espèce ont été également obtenus de graines de diverses plantes (Cain & Groves, 1948; Mirza & Cain, 1969). Par la suite, seuls Udagawa & Muroi (1979), l'ont également observé en culture au Japon à partir de feuilles de Salvia importées des Etats-Unis. Les liens particuliers démontrés par *P. inaequalis* avec des substrats de nature végétale se confirment par les caractéristiques de l'isolat que nous rattachons à cette espèce; celles-ci aboutissent en outre à un élargissement de son aire de répartition géographique.

Podospora minicauda Faurel & Locquin-Linard — Fig. 2B

Podospora minicauda Faurel & Locquin-Linard in Rev. Mycol. 42: 344. 1978.

Périthèces superficiels, épars ou réunis en petits groupes, ovoïdes étirés à piriformes, glabres, brun sombre, atteignant 450 µm de longueur et 260 µm de largeur, généralement pourvus d'un col bien différencié, presque cylindrique, de jusqu'à 160 µm de largeur; paroi péridiale pseudoparenchymateuse, formée de quelques couches de cellules polyédriques, brunâtres, 8–14 × 5–12 µm.

Asques octosporés, cylindriques, 70–110 × 7–10 µm, à apex arrondi et anneau apical indistinct, évanescents. Ascospores unisériées, de forme inégalement ellipsoïdes en vue latérale avec un côté à courbure nettement moins marquée, ellipsoïdes vue de face, à apex pointu et base tronquée, brun-rougeâtre sombre, 11–15 × 6–7.5 µm; appendice primaire cylindrique, hyalin, 3–5 × 1.5–2 µm, fugace; appendice secondaire absent; pore germinatif légèrement sous-apical, localisé du côté de l'ascospore à courbure accentuée.

Forme conidienne accessoire non observée.

Isolé en culture d'un échantillon de sol collecté en 1974, oasis de Kharga, désert Occidental de l'Egypte.

Podospora minicauda fait partie du petit groupe de *Podospora* à asques octosporés, cylindriques ou claviformes, et dont la longueur maximale des ascospores ne dépasse pas 20 $m; c'est essentiellement un *Podospora* à petites spores. A l'intérieur de ce groupe, il est proche des *P. cervina* (Cain) Cain et *P. fimbriata* (Bayer) Cain; le premier s'en distingue cependant par ses ascospores franchement ellipsoïdes, pourvues d'un court appendice primaire triangulaire, et le second par les valeurs biométriques de ses ascospores, comparativement plus élevées. La diagnose récente du *P. minicauda* est fondée sur une culture isolée de matériel stercoral d'herbivores collecté en Afrique du Nord. Notre isolat d'origine tellurique de zone aride de ce champignon représente un deuxième signalement de cet ascomycète.

Summary

Three species of the genus *Podospora* Cesati are described and illustrated. *P. carpinicola*, spec. nov., and *P. inaequalis* (Cain) Cain were isolated from dead leaves of *Carpinus* collected at Fontainebleau. The isolate of *P. minicauda* Faurel & Locquin-Linard was obtained from a soil sample from the Kharga oasis in the Egyptian Western Desert.

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PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 1, pp. 113–121 (1986)

AGARICUS GEESTERANI, SPEC. NOV.
A VERY REMARKABLE AGARIC DISCOVERED IN THE NETHERLANDS

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Rijksherbarium, Leiden

P. HEINEMANN

*Gembloux**

Agaricus geesterani, a new species, is described from material collected at three localities in the Netherlands. It combines strong colour-reactions, a well-developed colouring universal veil, and long (sub)capitate cheilocystidia with *A. bitorquis*-like basidiocarps. The new section *Magici* is created for it.

For several years now a very striking agaric is known to occur in the Netherlands that baffles every mycologist who has the luck to see it. As one of us (P.H.) never had this luck, the present study is based on thorough examinations of the material by the other author, while for the rather precarious taxonomic decisions both authors are to be held responsible.

At first sight the present species resembles a large *Agaricus bitorquis*, but on closer examination the differences are obvious and manifold. There is however no doubt about the fact that it belongs to the Agaricaceae. It combines microscopical characters of the (sub)tropical genus *Micropsalliota* with a type of basidiocarp like that of the heaviest species of *Agaricus*. We think, however, that it should not be classified in *Micropsalliota* but in *Agaricus*, where because of its aberrant characters a new section has to be created for it.

Agaricus section **Magici** Bas & Heinem., *sect. nov.*

Basidiocarpus grossus, firmus, ponderosus. Pileus valde carnosus, margine crasso, involuto praeditus. Lamellae liberae, confertae, sordide cremeae vel purpureo-badiae, in exsiccatis nigrescentes. Stipes crassus solidus, exannulatus, cingulis vel squamis volvae deorsum ornatus. Caro albida, primo confestim flavescens, dein lente vinescens. Sporae glabrae, crassitunicatae, aporae, endosporio apice lentiforme incrassato. Cheilocystidia filiformia, frequenter (sub)capitata. Reactio Schaefferi purpurea. Typus: *Agaricus geesterani* Bas & Heinem., spec. nov.

Etymology: From *magicus* = magic, because of the remarkable colour changes of the context.

Basidiocarps large, firm, and heavy. Pileus very fleshy with margin at first involute and exceeding lamellae with thick sterile rim. Lamellae free, crowded, from sordid cream

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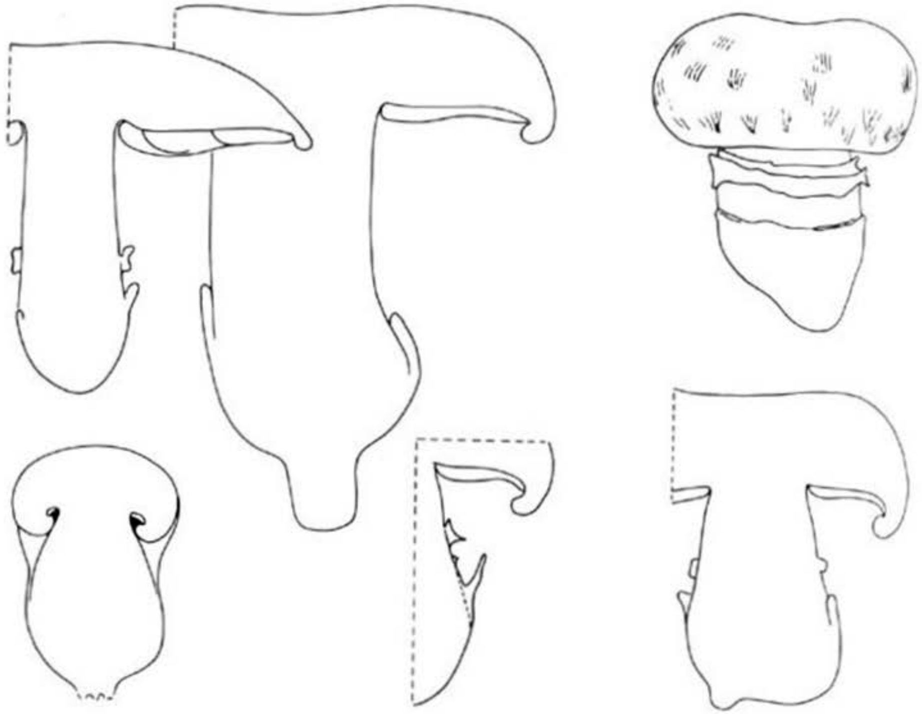


Fig. 1. *Agaricus geesterani* (type). Basidiocarps (× 0.5).

to purplish red-brown, blackening on drying, with pallid edge. Stipe thick, solid, without annulus but with felted-fibrillose volval girdles or scales on lower part. Context whitish but immediately turning bright yellow on cutting, then slowly turning vinaceous pink.

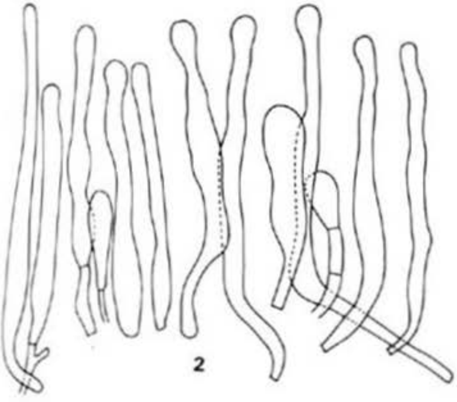
Spores smooth, thick-walled, often with internal lens-like thickening at apex, without pore. Cheilocystidia abundant, long and slender, often (sub)capitate.

Macrochemical colour reactions: NH_4OH 25% immediately bright blue-green to greyish blue-green; aniline rather rapidly dark grey; aniline × HNO_3 (Schaeffer reaction) deep purple.

Type species: *Agaricus geesterani* Bas & Heinem.

Agaricus geesterani Bas & Heinem., *spec. nov.* —Pl. 1, Figs. 1–3

Pileus 90–150(–200) mm latus, valde carnosus, primo hemisphericus, postea convexus, centro applanatus vel leviter depressus, margine sterili 3–5 mm crasso diu involuto, initio volva coacto-membranacea, albida vel roseo-brunnea tectus, sed posterior fragmentis volvae squamiformibus roseo-brunneus vel vinaceo-brunneus fere ornatus, siccus. Lamellae liberae, confertissimae vel confertae, angustae vel modice latae (3–10 mm), longe sordide cremeae vel isabellinae, denique sordide rubro-brunneae vel purpureo-badiae. Stipes 55–180(–250) × 22–40(–60) mm, (sub)cylindraceus, solidus, saepe ad basem connatus, exannulatus, albidus vel sordide vinaceous, deorsum volva coac-



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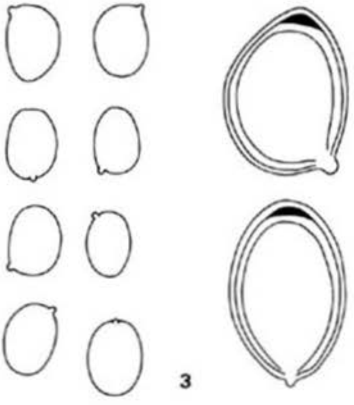

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Fig. 2–3. *Agaricus geesterani* (type). — 2. Cheilocystidia (× 550). — 3. Spores (× 1250 and × 3000).

tato-membranacea, sordide roseo-bubalina vel brunneo-vinacea seu brunneo-lateritia, initio appressa et vaginata, dein cingulis vel squamis diffracta praeditus. Caro perfirma, albida, primo confestim flavescens, dein lente vinescens. Odor leviter gratus tum subfetidus, atque lintea recente lavata ab percisione. Sapor indistinctus vel leviter acidulo-nucioides tum dulcidulus. Sporae in cumulo sordide licacino-brunneae. Reactiones chemici caronis: Anilinum – cinereae; NH_4OH – lazulini-viridae; reactio Schaefferi purpurea.

Sporae 7.1–8.3 × 4.8–5.6 μm, Q = 1.35–1.6, $\overline{Q}$ = 1.4–1.55, pallide brunneae vel brunneae, aporae, glabrae, crassitunicatae, endosporio apicale plus minusve lentiforme incrassato. Cheilocystidia 50–85 × 3–10 μm, filiformia vel anguste lageniformia, (sub)capitata, capitulis 2–4(–6) μm latis. Pleurocystidia nulla. Pileipellis cutiformis, hyphis 4–20 μm latis composita.

Typus: '*C. Bas (6210) & H. J. van der Laan*, 11 Oct. 1973, Netherlands, prov. Noord-Holland, Amstelveen, Amsterdamse bos' (holotypus, L; isotypus, BR).

Etymology: Named in honour of Dr. R. A. Maas Geesteranus, dedicated taxonomist, first of lichens, later of macrofungi, inspiring teacher and colleague.

Basidiocarps large, firm, very heavy (largest specimen found by J. Reijnders: pileus 200 mm, stipe 250 × 60 mm, weight c. 1 kg), long-persisting, growing in clusters arranged in fairy rings, developing rather deep in and bursting out of heavy soil, often lifting large clods of soil on pileus.

Pileus 90–150(–200) mm in diam., thick-fleshed (up to 30 mm thick above proximal ends of lamellae), hemispherical to convex soon becoming (sub)truncate because of early flattened or slightly depressed centre, at first with involute, then inflexed, finally straight margin with conspicuous, 3–5 mm thick, whitish to pale marginal rim, in young stages covered with whitish to very pale or pale brownish-pinkish, but soon darker pinkish brown to sordid vinaceous red-brown (Munsell 5 YR 6/4, 5/6, 2.5 YR 5/4, 4/4) or at centre even dark purple-brown (2.5 YR 3/2, 3/4, 2.5/4) felted layer in some pilei remaining entire and then mature pileus unevenly pale to dark sordid vinaceous red (10 R 5/6, 4/6, 4/4), but mostly with felted layer breaking up into often rather vague ± multangular, appressed patches at centre and more pronounced, appressed, usually pointed, subimbricate, fibrillose scales towards margin on whitish to pinkish, pinkish-brownish or sordid vinaceous background, dry even after rains, without traces of partial veil except perhaps in very young stages with some inconspicuous, fluffy, white tissue between involute part of margin and stipe.

Lamellae free, very crowded to crowded (14–18 .... 22 per 10 mm half-way radius of pileus; l = 0–3), long remaining very narrow to narrow (3–6 mm), but finally moderately broad (up to 10 mm), rounded near stipe, free to just touching but not connected with apex of stipe, acute near margin of pileus, sordid cream when very young, slowly becoming pale isabella (10 YR 7/4, 2.5 Y 7/4 or slightly browner) and long remaining so, then pinkish clay brown (7.5 YR between 5/4 and 5/6), finally dark reddish clay brown (7.5 YR 4/4) to rather dark purplish red-brown (5 YR 4/4 to 4/6), with thin, white to pallid, sometimes somewhat uneven edge, in some freshly picked basidiocarps with watery yellowish-brownish droplets and probably therefore later on with scattered minute red-brown spots along edge, with old bruises becoming very dark dull reddish to purplish brown, after drying completely conspicuously blackish purple-brown (5 YR 2.5/2) sometimes with blue-grey reflexion.

Stipe 55–180(–250) × 22–40(–60) mm, at first somewhat broadening downwards but later (sub)cylindrical with not or hardly enlarged base, rarely tapering downwards, solid, firm, often connate at very base and then basal part slightly bent, from whitish to pinkish cream, later with very pale to rather strong pinkish-brownish to sordid vinaceous pink tinges, minutely concolorously flocculose at upper half or third, exannulate (partial veil absent or rudimentary also in very young stages), but lower part covered with felted-fibrillose, thick volval layer usually breaking up into one, two or three incomplete to complete girdles often with one or two projecting edges, sometimes with rings of flat volval patches, and these volval remnants colouring from sordid pinkish buff (75 YR 7/4) to sordid brownish vinaceous pink (5 YR 5/4) to brownish-vinaceous brick red (2.5 YR 5/6); mycelial fluff at extreme base first yellowish then pale pink.

Context very firm and heavy, whitish but when cut or scratched almost immediately turning deep yellow (chrome-yellow, K. & W. 2A6 to almost 2A7) in centre and outer margin of pileus and in base of stipe, paler in other areas (2A4–A5), after about 1 min. already paling, after about 2 min. merely pale sordid yellowish, then slowly turning vinaceous pink (sometimes as bright as Munsell 10 YR 5/6). Smell spontaneously weak but pleasant, nutty or even somewhat like anise, in old specimens more unpleasant to sometimes fishy, after cutting immediately strong like freshly washed linen, washing powder, or slightly scented soap, but in older specimens somewhat earth-like with unpleasant component. Taste indistinct to weakly sourish nutty when young but later slightly sweetish. Spore print moderately dark lilacinous grey-brown (5 YR between 4/2 and 4/3), later more greyish lilacinous brown (5 YR 4/3–4/4 to 7.5 YR 4/4).

Macrochemical tests on context: Aniline: rather rapidly dark grey, sometimes with slight bluish or greenish tinge. — Formaline 35%: slowly restoring bright yellow colour after changing of context to pink. — Gaiac: no reaction (solution perhaps too old); blue-green according to Dr G. A. de Vries. — Concentrated HCl, HNO_3 and H_2SO_4: no or very weak reaction. — KOH 5%: slowly dark greyish olive; 30%: brown with blue-green outer circle. — NaOH 30%: brown with greyish green outer circle. — NH_4OH 25%: on yellow context immediately bright blue-green; on pink context immediately greyish blue-green; on pileipellis blackish olive. — Phenol and phenol-aniline: no reaction. — Schaeffer-reaction deep purple (K. & W. 12D7–11E7), but on yellow context sometimes weak (when narrow streaks of aniline and HNO_3 are crossed this remarkable colour-change may escape attention because of grey discoloration caused by aniline).

Spores [45/5/3](6.7–)7.1–8.3(–8.9) × 4.8–5.6 µm, $Q = 1.3^5–1.6(–1.7)$, $\bar{Q} = 1.4–1.5^5$, in profile subellipsoid-subovoid to ovoid, in face view ovoid, without germ pore, with rather small, abrupt apiculus, pale to moderately dark brown in water and NH_4OH, pale sordid greenish-yellowish in KOH, thick-walled (c. 0.4–0.6 µm, at least 2-layered) with slight, somewhat lens-like thickening in wall at apex, smooth, in dried material a few spores weakly dextrinoid but stronger so in fresh material, congophilous and cyanophilous when young, only a few relatively young ones somewhat metachromatic in cresyl blue but these with distinctly metachromatic inner wall layer when crushed; in mounts young spores often in tetrads.

Basidia (25–)32–40(–48) × 8.5–11 µm, 4-spored, clampless, narrowly clavate, in dried material resoaked in NH_4OH with scattered, small, dark brown, short rod-like, intracellular particles (necropigment), not siderophilous.

Cheilocystidia very abundant, in tufts, rendering lamella edge sterile, (42–)50–85 (–95) × 3–10(–11.5) µm, with 3–7(–9.5) µm wide capitula and 2–4(–6) µm wide necks, filiform to very slenderly lageniform, more rarely lageniform or clavate, frequently somewhat irregularly shaped, often subcapitate to capitate, thin-walled but wall of capitulum very slightly thickened, metachromatic in cresyl blue. Pleurocystidia absent.

Hymenophoral trama regular, made up of densely packed 4–10 µm wide, thin-walled hyphae often slightly inflated near septa, colourless in water, in resoaked dried material pale brown in NH_4OH, slightly dextrinoid after a few hours in NH_4OH 10%; subhymenium rather narrow, up to 20 µm wide, ramose-subcellular.

Pileipellis consisting of interwoven (particularly near surface) to subradial, 4–20 µm wide, frequently septate, repent hyphae with slightly thickened wall, in outer layer (probably = universal veil) with heavily incrusting pigment (fresh: orange-brown in water; dry: sordid yellow-brown to brown in NH_4OH, olive brown in KOH), in inner layer with small incrusting granules and additional intracellular pigment brownish in NH_4OH.

Trama of stipe regular, made up of up to 20 µm wide, thin- to slightly thick-walled, colourless to (in NH_4OH) pinkish-brownish hyphae. Apical part of stipe with caulocystidia similar to cheilocystidia but somewhat more variable and tending to elongate. Mycelial fluff at base of stipe (among soil particles) pale pink, dimitic, consisting of up to 7 µm wide, thin-walled hyphae and 2–3 µm wide, thick-walled (almost up to 1 µm), non-septate, congophilous and strongly cyanophilous skeletals, with abundant, pale brown, short rod-like, extracellular pigment bodies: skeletals in some samples scarce, in others abundant.

Tissue cultures on malt agar growing very slowly (c. 1–2 mm per week at c. 20° C), pale greyish with pale brown centre, sometimes with pinkish tinge, consisting of septate, clampless, thin- to slightly thick-walled, cylindrical or towards septa slightly swollen hyphae sometimes with contents strongly colouring in cotton blue.

Habitat & distribution. — In rather young, planted deciduous woods and lanes on rich, heavy, clayey soil and rather loose, very humus-rich sandy soil. At type locality under *Fraxinus, Quercus, Crataegus, Sambucus*, etc.; later found under *Populus* (Flevoland) and under *Fraxinus, Quercus, Ulmus, Acer, Crataegus*, etc. (Maarsseveen). Aug.–Oct., but basidiocarps in mild winters persisting till late winter; seems to fruit best after warm summers. Known now from 3 localities in the Netherlands: at Amstelveen observed over a period of more than 10 years and in 1983 on two spots.

Collections examined. — NETHERLANDS: prov. Noord-Holland, Amstelveen, Amsterdamse bos, 11 Oct. 1973, *C. Bas (6210) & H. J. van der Laan* (holotype, L; isotype, BR) and 19 Sept. 1974, *H. J. van der Laan* (L); prov. Utrecht, Maarsseveen, 23 Aug. 1983, *P. J. Keizer* (L); prov. IJsselmeerpolders, Zuidelijk Flevoland, Spiekweg, 23 Aug. & Sept. 1983, *H. J. Wichers* (L).

Agaricus geesterani is highly characterized by: (i) its very heavy, long-persisting basidiocarps, (ii) the absence of a partial veil, (iii) the discolorations of its context as well as its colour reactions to several chemicals, (iv) its long and slender (sub)capitate cheilocystidia, (v) the apical lens-like thickening in the wall of its spores, and (vi) its weak sporulation.

Depending on which of these characters one wishes to emphasize one is led[1] to *Agaricus* sect. *Agaricus* subsection *Bitorques* or to *Micropsalliota*.

As for *Micropsalliota* of which the members have basidiocarps that are typically mycenoid or collybioid and short-lived, we believe the resemblances between *A. geesterani* and that genus are a matter of convergency. It should be mentioned that an apical thickening in the wall of the spores occasionally occur also elsewhere in *Agaricus* (e.g. *A. campestroides, A. bingensis, A. trisulphuratus*) and that rather long, sinuous, even subcapitate cheilocystidia are also to be found in some species of that genus, particularly in several species of subsection *Bitorques* (*A. bernardii, A. maleolens*).

If we neglect the immediate, brightly yellow discoloration of the context and the apical thickening in the spore wall, *A. geesterani* fits subsection *Bitorques* very well on account of the universal veil forming volva-like remnants on the lower part of the stipe (Fig. 1), the reduced or (nearly) absent partial veil, the thick marginal rim of the pileus and the heavy basidiocarps. In view of the fact that the infrageneric classification of *Agaricus* is mainly based on the discoloration of the context, we feel however that in this respect *A. geesterani* differs so strongly that classification in a new section of *Agaricus* is required.

The felted volval layer that in *A. geesterani* at first covers the pileus (and the basal part of the stipe) recalls subgenus *Lanagaricus* in which some species moreover show a bright yellow discoloration of the context. But till now in that subgenus no species are known with volval girdles at the base of the stipe. Nevertheless subordination of sect. *Magici* to subgenus *Lanagaricus* may be considered.

In the basidiocarps studied in fresh condition sporulation started late and was rather weak, causing the lamellae to remain pale for a very long time and making it difficult to obtain a good spore print. We never before encountered in *Agaricus* such a scarcity of spores on mature basidiocarps. It is remarkable that this phenomenon seems to go hand in hand with an aberrant morphology of the subhymenium.

In Agaricaceae, particularly in *Agaricus* the mature subhymenium is typically round-celled, each terminal cell bearing several basidia. Ontogenetically, however, the very young subhymenium is ramose and becomes gradually round-celled when the basidia are maturing (Rammeloo, 1985). This process is also noticeable at the edge of the lamellae of mature basidiocarps where the subhymenium may still be subramose, whereas it is always round-celled at some distance away from the edge.

It seems that in *A. geesterani* the (sub)ramose state of the subhymenium is permanent all through the life of the basidiocarps. This may be a characteristic of the species but may also be due to the species being introduced in the Netherlands and not finding here the optimal conditions for sporulating.

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[1] For a key to *Micropsalliota* and *Agaricus* and its infrageneric taxa, see Heinemann (1979).

It is amazing that such a large and conspicuous unknown agaric could be discovered in the 'Amsterdamse Bos', a park near Amsterdam, only a few decades old and frequently visited by mycologists. The large fairy ring of basidiocarps in 1973 suggested that at that time the species had been growing there already several years. Even more surprising was the discovery of the same species in 1983 at two localities at a distance of about 25 and 45 km from the first and about 35 km apart. Here again this remarkable fungus was found in relatively young forest plantations on rather rich soil.

We must assume that *A. geesterani* has recently been introduced in the Netherlands. The fact that the international airport of Amsterdam is only a few kilometers away from the first discovered locality may have something to do with that. More than 10 years already it is able to survive the climatical conditions of the Netherlands and it seems even to be spreading. Besides at the two new localities mentioned, *A. geesterani* was in 1983 still growing at the first locality and also at another spot at about 200 m distance away from it.

At the original locality *A. geesterani* fruits particularly rich near the base of a small building containing transformers; probably the soil is there slightly warmer and drier. The basidiocarps usually grow in clusters rather deep in the soil and start expanding their pilei already before emerging (in which they do not always succeed). Cracks in the soil indicate places where clusters of basidiocarps have started to expand. In relatively dry periods the basidiocarps persist for a long time and are sometimes still visible, and because of size and reddish colours still recognizable, at the end of the winter.

In literature the only illustration we found somewhat resembling *A. geesterani* is that published under the name *A. pequinii* in the Bollettino del Gruppo Micologico ≪G. Bresadola≫ 26: 192 (1983) and again in Lazzari, Atlanta Iconografico 1981–1983: 240 (1985). Size and colour of the basidiocarp there depicted resemble that of an overmature basidiocarps of *A. geesterani* but the volval remnants at the base of the stipe are hardly visible and the characteristic, rapid, bright yellow discoloration of the context preceding the slow discoloration to pink is not mentioned (collection: Oct. 1982, Bellinzago, Novara, Italy).

The original *Chitonia pequinii* Boud. certainly is different from the present species and is generally accepted as a member of *Agaricus*, viz. as an independent species (e.g. Singer, 1975: 462; Møller, 1950: 16) or as identical with *A. bitorquis* (Pilát, 1951: 27).

An extensive search in literature did not reveal an earlier description of the present species. Singer (1975: 460) mentioned *Pholiota fulvosquamulosa* Peck and *Stropharia kauffmanii* A.H. Smith as a group of fungi suggested by Smith & Hesler (1968: 185) to represent an undescribed genus close to *Agaricus*. But according to Redhead (1984: 250) the first is a true *Agaricus* identical with *A. subrufescens* Peck and the second a good species of *Stropharia*.

Another volvate species of *Agaricus* is *A. volvatus* (A. Pears.) Heinem. described by Pearson (1950) from South Africa, but that has the context immediately turning blood red and shorter more clavate cheilocystidia.

ACKNOWLEDGEMENTS

We are very grateful to Mr. H.J. van der Laan (Amsterdam), who was the first to discover *Agaricus geesterani*, for drawing our attention to this curious fungus. Thanks are also due to Mr. A.M. Brand (Leiden), Mr. P.J. Keizer (Utrecht), Mr. J. Reijnders (Badhoevedorp), Dr J.A. Stalpers (Baarn), Mr. H.R. Visscher (Horst), Dr G.A. de Vries (Baarn), and Mr. H.J. Wichers (Eefde) for material, documents, and pictures kindly put at our disposal.

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Plate 1. *Agaricus geesterani* (type). — Basidiocarps (× 2/3). Discoloration of context in right half of lower basidiocarp immediately after sectioning, in left half about 5 minutes later.

PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 1, pp. 123–125 (1986)

NOTES AND BRIEF ARTICLES

ENTOLOMA JUNIPERINUM: A NEW SPECIES FROM JUNIPERUS HEATHS IN NORTH-WESTERN EUROPE

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During a long-term mycological investigation of *Juniperus* communities in north-western Europe by the first author, a small *Entoloma* species was found, which did not seem to fit with one of the known species of *Entoloma* with a brownish pileus and bluish stipe, because of the small, almost isodiametrical spores and clamped basidia. The only species which seemed to be related was *Entoloma lampropus* in the sense of Kühner & Romagnesi (1953). That species however, turned out to be clearly different in a number of characters such as size and shape of spores and structure and pigmentation of the pileipellis (see Noordeloos, 1982). Therefore the collections of this apparently new species were examined by the second author in the course of a critical revision of *Entoloma* subgen. *Leptonia* in Europe. He also came to the conclusion that this nice small *Entoloma* from *Juniperus* heaths had not been described before, and therefore it is described here as new.

Entoloma juniperinum Barkman & Noordel., *spec. nov.*

Pileus 5–20 mm latus, convexus vel planus, leviter umbilicatus vel papillatus, hygrophanus, in udo translucido striatus, obscure griseo-brunneus vel coeruleo tinctus, in sicco pallescens, radialiter fibrillosus vel villosus vel subtiliter squamulosus; lamellae adnatae vel subdecurrentes vel emarginatae, (griseo)roseae; stipes 20–45 × 1–2 mm, obscure griseo-coeruleus, demum coeruleo-brunneus, glaber, innato-fibrillosus; odor nulla; sapor farinacea.

Sporae 8–10 × 6–8 μm, subisodiametricae; basidia tetrasporigera, fibulata; acie lamellarum fertilis; cystidia nulla; pileipellis cutis hyphis septatis, cylindraceis vel leviter inflatis, 4–15(–20) μm latis pigmento intracelluloso; fibulae abundantia.

Habitat inter muscos in societatis *Juniperi communis*. — Holotypus: '*B. de Vries 1342*, 20-IX-1972, Wiwwelsberg, Rheinland-Pfaltz, W. Germany' (WBS, isotypus in L).

Characteristics. — Basidiocarps small, more or less omphalioid with dark grey-brown pileus, blue-grey stipe, rather small, subisodiametrical spores, and clamped basidia.

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* Communication No. 302 of the Biological Station Dr. W. Beyerinck, Wijster. — Communication No. 94 of the Department of Plant Ecology of the Agricultural University, Wageningen, Netherlands.

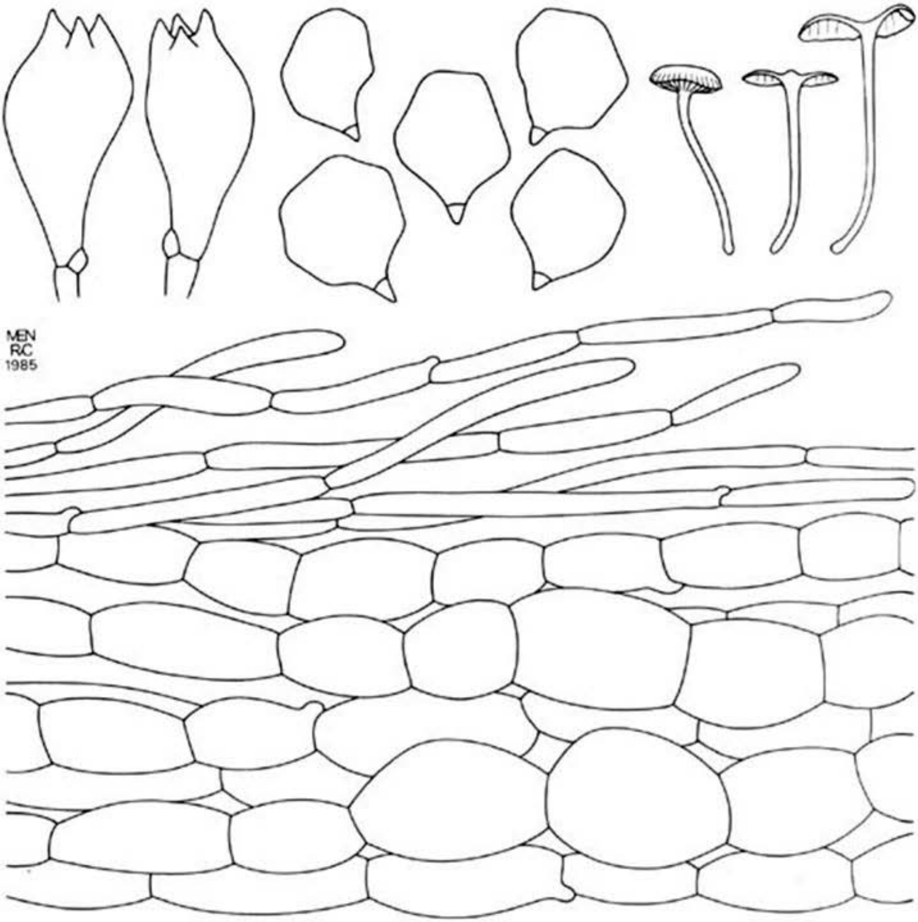

Fig. 1. *Entoloma juniperinum*. — Habit (× 1), spores (× 2000), basidia (× 1000), and pileipellis (× 500). (All Figs from holotype).

Pileus 5–20 mm broad, convex or flattened with weak central depression or distinctly papillate, with almost straight margin, weakly hygrophanous, when moist translucently striate at margin up to 3/4 of radius, dark grey-brown especially at centre and when young, paler towards margin, sometimes, especially when young and fresh, with blue tinge, pallescent on drying, almost smooth, radially fibrillose, subtomentose or subsquamulose especially at centre. Lamellae, L = 10–25, l = 1–5(–7), (moderately) distant, adnate, sometimes slightly emarginate or with decurrent tooth, segmentiform rarely ventricose, up to 3 mm broad, sometimes distinctly transvenose, greyish then grey-pink with entire, concolorous edge. Stipe 20–45 × 1–2 mm, cylindrical, sometimes slightly to distinctly swollen at base, often flexuose, blue-grey fading with age to brownish blue or violaceous brown, smooth, glabrous or with innate fibrillose covering, white tomentose at base, solid or fistulose. Context thin, with same colour as surface or slightly paler, especially in stipe. Smell not distinctive. Taste often distinctly farinaceous.

Spores 8.0–10.0(–11.0) × 6.0–8.0 µm, averages 8.5–9.5 × 7.5–8 µm, Q = 1.05–1.25(–1.3), $\bar{Q}$ = 1.1–1.2, subisodiametrical, 5–7 angled in side-view. Basidia (18–)22–35 × 7.5–11 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Hymenophoral trama regular, made up of cylindrical elements, 75–200 × 4–20 µm. Pileipellis a cutis with transitions to a trichoderm, made up of radially arranged, septate, 4–15(–20) µm wide cylindrical or slightly inflated hyphae with cylindrical terminal elements 30–70 × 5–22 µm; subpellis often distinct, made up of strongly inflated elements, 20–45 × 15–35(–45) µm. Pigment brown, intracellular, especially in subpellis. Brilliant granules abundant to sparse or lacking in pileitrama. Vascular hyphae present or absent. Clamp-connections present.

Habitat & distribution. — Among mosses, needles and grasses, preferably close to *Juniperus* in *Juniperus*-heaths on (calcareous) loam. Known to occur in Denmark (Jylland), German Federal Republic (Eifel and Kaiserstuhl), and the Netherlands (Limburg). Sept.–Nov.

Collections examined.—DENMARK, Jylland: Frederikshavn, station 17a, 14 Oct. 1966, *J.J. Barkman 8454*; idem, Hestvang, 9 Oct. 1969, *J. J. Barkman 9896*; idem, stat. 20a, 10 Oct. 1972, *J. J. Barkman 9816*; idem, stat. 16, 15 Oct. 1980, *J. J. Barkman 10391*; Fjerritslev Svenstrup Lerup, 9 Oct. 1972, *J. J. Barkman 9619*; Silkeborg, Vissingkloster, 25 Oct. 1980, *B. de Vries 4352*; Hjörring, Bjaergby, 14 Oct. 1966, *J. J. Barkman 8491*; Hobro, Bramslev Bakker, 17 Oct. 1969, *J.J. Barkman 9097* and 1 Oct. 1966, *J. J. Barkman 8422*; Egtved, Spjarupgaard, 5 Oct. 1972, *A. K. Masselink*. — GERMAN FEDERAL REPUBLIC: Rheinland-Pfalz, Wiwwelsberg, 20 Sept. 1972, *B. de Vries 1342* (holotype) Baden-Württemberg, Kaiserstuhl, Badberg, 31 Aug. 1982, *W. Winterhoff* (L). — NETHERLANDS, prov. Limburg, Bemelen, Bemeler berg, 3 Nov. 1984, *J. Schreurs 892* (L) (Unless otherwise stated all collections are deposited in WBS).

Entoloma juniperinum belongs to sect. *Leptonia* on account of the clamped basidia and type of pileipellis with septate, more or less cylindrical hyphae. However, it takes a rather isolated position there because of the small, isodiametrical spores and farinaceous taste. *E. splendidissimum* differs among other things in having a distinctly blue pileus, and more elongate spores. The spores of *E. lampropus* are much smaller, and furthermore that species has a totally different habit and type of pigmentation. For details the reader is referred to Noordeloos (1982, 1986).

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PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 1, pp. 127–128 (1986)

ON VONARXIA, KAZULIA AND OTHER FUNGI WITH STAUROCONIDIA

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Four monotypic genera have been described for Deuteromycetes with superficial, crustose or pulvinate, setose conidiomata and hyaline, septate stauroconidia consisting of a main axis and 2–3 apical branches. The types of *Fumagopsis* Spegazzini (1910), *Vonarxia* Batista & Bezerra (1960) and *Kazulia* Nag Raj (1977) are specimens collected in South America. All develop superficially on living or decaying leaves. *Phalangispora constricta* Nawawi & Webster (1982) has been described from a pure culture isolated from conidia collected at Malaya.

Fumagopsis trigliphioides Speg. has been redescribed by Van der Aa & Van Oorschot (1985) from the type specimen collected in 1909 in Argentina on leaves of *Lucuma neriifolia*. It forms a pigmented, setose, superficial mycelium with pustulate or crustose conidiomata covered with dark, thick, apparently aseptate setae. The conidia develop singly on ampulliform or irregular conidiogenous cells with a distinct collar or beak. The conidia are composed of an aseptate or 1-septate main axis and 2–3 apical branches, which are constricted at the septa. The base of the conidia is slightly truncate.

Van der Aa & Van Oorschot (1985) compared *F. trigliphioides* with *Kazulia vagans* (Speg.) Nag Raj and *Phalangispora constricta* Nawawi & Webster, but not with *Vonarxia anacardii* Batista & Bezerra, which was collected on leaves of *Anacardium occidentale* in Brazil. All these species form superficial, sporodochium- or synnema-like conidiomata with a single or a small number of septate setae. The superficial mycelium is pale and not setose. The conidiogenous cells are elongate, cylindrical or slightly clavate, arranged in fascicles and form at their apex a whorl of conidia by simultaneous or sympodial budding. The conidia are rather similar to those of *F. trigliphioides* having a usually 1-septate main axis and 1–3 apical branches which are partly constricted at the septa.

The description of *Vonarxia anacardii* given by Batista & al. (1960) is rather inadequate. They interpreted the main axis of the conidia to represent the upper part of branched conidiophores and considered the conidia to be filiform or whip-like with some transverse septa. The type specimen was studied by the second author of the present paper, when he stayed at the Mycological Institute of the University of Recife in 1960. The material was rather poor, only a few conidiomata could be found, but the available slides proved to be useful. The conidiogenous cells were found to be arranged in superficial fascicles and the conidia are formed in small, apical clusters. Their main axis has a size of 8–14 × 1.8–3 μm and the apical branches are 12–35 μm long and composed of 7–14 μm long and 1.5–2 μm broad cells.

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A good description and adequate figures of a similar fungus were published by Nag Raj (1977), based on the type specimen of *Ypsilonia vagans* Speg., collected in Brazil on leaves of *Spiraea cantonensis*. The fungus was classified in the new genus *Kazulia* and was considered to be the anamorph of a Chaetothyriaceae (*Zukalia* spec.). *Kazulia* has to be synonymized with *Vonarxia*. The following nomenclature change is proposed:

Vonarxia vagans (Speg.) Van der Aa, *comb. nov.*

Ypsilonia vagans Speg. in Rev. Mus. La Plata, sect. Bot. 15: 35. 1908 (basionym) — *Kazulia vagans* (Speg.) Nag Raj in Can. J. Bot. 55: 1621. 1977.

Vonarxia anacardii is closely related to *V. vagans*, which can be distinguished only by the usually 1-septate segments of the apical branches of the conidia; these are predominantly aseptate in the former species.

Cladosporothyrium Katumoto (1984) and *Zelopelta* Sutton & Gaur (1984) have conidiomata without setae. The conidiogenous cells and the conidia are reminiscent to those of *Fumagopsis trigliphioides*. The type specimens of both genera have been collected in Nepal: *C. nepalense* Katumoto on living leaves of *Myrsine semiserrata*, *Z. thrinacospora* Sutton & Gaur on dead leaves of *Hedera nepalensis*. These two species are congeneric.

Phalangispora constricta was described by Nawawi & Webster (1982) from a culture. Nothing is known about its way of growing on the natural substrate. In culture it forms synnematous or sporodochial conidiomata with septate setae. The conidiogenous cells and conidia are similar to those of *V. anacardii* and *V. vagans*, but larger, especially broader. The branching of the conidia is also more irregular.

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PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 1, pp. 129–131 (1986)

PSATHYRELLA SUBUMBRINA A NEW SPECIES OF PSATHYRELLA SECTION HYDROPHILAE FROM SWEDEN

E. KITS VAN WAVEREN* & L. ÖRSTADIUS**

On 22 October 1983 one of us (L. O.) found at Kjugekull in the parish of Kiaby, some 15 km from Kristianstad (Sweden), three carpophores (young and mature stages) of a characteristic species of *Psathyrella*, which, because of its overall brown colours and small spores (6.5–7 × 4.5–5 μm) belongs to section *Hydrophilae* (Kits van Waveren, 1985: 172). As we were unable to find a description of this taxon in the literature it was decided to describe it as a new species.

Psathyrella subumbrina Kits van Wav. & Örstadius, *spec. nov.*—Figs. 1–5

Pileus 9–13 mm latus, primo semiglobatus vel parabolicus, maturitate conico-parbolicus vel conico-convexus, striatus, obscure badius margine flavo-brunneus, colore roseo destitutus, hygrophanus, in sicco pallide brunneo-flavus. Velum crassum, albidum, e fibrilis adpressis, in margine pilei appendiculatum, in stipite, apice excepto, floccosum. Lamellae 2 mm latae, confertae, late adnatae, ferrugineae, acie albae. Stipes 15–30 × 2–3 mm, eradicatus, basi bulbosus, apice laevis, haud striatus, cinnamomeus et pruinosus, infra apicem melleus et dense floccoso-fibrillosus, cavus. Caro pilei 1 mm crassa, concolor.

Sporae 6.5–7 × 4.5–5 μm, late ellipsoideae, haud phaseoliformes, ochraceae, poro germinativo destitutae. Basidia 17.5–30 × 7.5–10 μm, clavata. Pleurocystidia 35–50(–60) × (9–)10–15 μm, numerosa, fusiformia, nonnula submucronata, muco destitutis. Cheilocystidia pleurocystidioidea similia, (25–)32.5–45 × 9–15 μm, abundantia; cheilocystidia spheropedunculata et clavata, 12.5–20 × 7.5–12.5 μm, sparsa. Pileipellis e cellulis (sub)globosis vel ellipsoideis formata. Terrestris inter gramines, muscos et frutices *Callunae*. — Typus: Sweden, Kristianstad, Kjugekull, 22 October 1983, *L. Örstadius* (holotypus L., isotypus herb. Örstadius 339–83).

Cap 9–13 mm, at first semiglobose to paraboloid, at maturity conico-paraboloid to conico-convex, striate up to 1/3 from margin, at centre dark reddish brown (Mu. 2.5 YR 3/4; 10 R 3/4), in a narrow zône round centre paler (Mu. 2.5 YR 5/4), further down towards margin becoming yellowish brown (Mu. 7.5 YR 5/6, 6/6), in marginal area pale yellowish brown (Mu. 10 YR 7/6), hygrophanous, drying out to pale brownish yellow (Mu. 7.5 YR 7/6, 8/6), rugulose, micaceous, without pink. Veil whitish, strongly developed, forming on cap adpressed bundles or patches of fibrils up to 1/2–2/3 from margin, increasing in number towards margin, in early stages forming at margin conspicuous c. 1 mm broad denticles, flocci or appending rags, forming on stem a dense flocculose scaly layer, at upper end without annular zône but rather sharply delimited from smooth upper about 1/4 part of stem, downwards running right to its base. Gills c. 2 mm broad, crowded, ascending, rather broadly adnate, in early stages pale brown (Mu. 10 YR 8/4, 7/6), at maturity reddish brown (Mu. 5 YR 5/3, 5/4), paler towards

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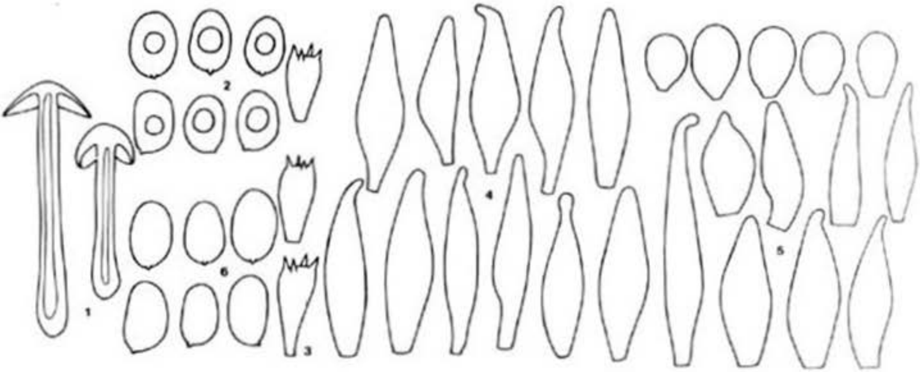

Figs. 1–5. *Psathyrella subumbrina*. — 1. Mature and young carpophore × 0.5. — 2. Spores × 1212. — 3. Basidia × 575. — 4. Pleurocystidia × 575. — 5. Cheilocystidia × 575.
Fig. 6. *Psathyrella umbrina*. Spores × 1212.

margin, with white, minutely fimbriate edge. Stem 15–30 × 2–3 mm, straight, cylindrical but base distinctly bulbous, not rooting, hollow, in non-striate smooth upper (c. 1/4) part yellowish brown (Mu. c. 10 YR 6/4), lower down under the flocculose veil pale brown (Mu. c. 10 YR 7/3), extreme apex coarsely pruinose. Flesh of cap in centre 1 mm thick, concolorous; smell indistinct. Trama of 'washed' gill distinctly coloured in NH_4OH 10%, in basal half pinkish brown, in peripheral half paler (Mu. 10 YR 6/2). Spore print not recorded.

Spores 6.5–7 × 4.5–5 µm (mean values 6.7 × 4.5 µm: 1 collection), in face view broadly ellipsoid, in profile adaxially flattened, not phaseoliform, in water and NH_4OH 10% yellow with slight reddish hue (Mu. 7.5 YR 6/6), in KOH 5% pale sordid olivaceous yellow (Mu. 2.5 Y 6/4), not opaque, with large central oily drop, without germ pore, with distinct hilar appendix. Basidia 17.5–30 × 7.5–10 µm, clavate, 4-spored. Pleurocystidia 35–50(–60) × (9–)10–15 µm, numerous, fusoid, with short and broad pedicel, thin-walled, colourless, with often bent, submucronate and very thin-walled apex. Marginal cells: pleurocystidioid cheilocystidia (25–)32.5–45 × 9–15 µm, abundant, the majority densely packed, intermixed with a small number of spheropedunculate or clavate cells, 12.5–20 × 7.5–12.5 µm; all cells thin-walled and colourless. Hymenophoral trama in NH_4OH 10% sub micr. strongly pigmented from membranal pigment with many yellow and often distinctly thickened hyphal septa and numerous minute encrustations, particularly in basal half. Pileipellis a 3–4 cells deep layer of globose and subglobose, colourless cells, 15–30 µm in diam., and ellipsoid cells, 15–50 × 15–30 µm. Veil consisting of chains of narrow to very broad, colourless, thin-walled cells, 15–50 × 8–35 µm, constricted at both ends.

Habitat & distribution. — Terrestrial, solitary in pasture-land among *Calluna vulgaris* and moss. Known only from type locality.

Collection examined. — Sweden, Kiaby, Kjugekull, 15 km from Kristianstad, 22 October 1983. *L. Örstadius* (holotype L; isotype herb. Örstadius 339–83).

This species is very close to *P. umbrina* from which it differs by its habit, its thick and distinctly bulbous stem, its strongly developed and in early stages conspicuously appendiculate veil and its differently shaped spores. The latter difference hardly finds its expression in the figures for the spore sizes (6.5–7 × 4.5–5 µm, mean values 6.7 × 4.5 µm for *P. subumbrina* against (6.5–)7–8.0 × 4.5–5 µm, mean values 6.9–7.3 × 4.6–4.8 µm for *P. umbrina*), but becomes quite clear at first sight of their pictures (Figs. 2, 6) The spores of *P. subumbrina*, moreover, are provided with a rather striking central oil-drop.

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KITS VAN WAVEREN, E. (1985). The Dutch, French and British species of *Psathyrella*. Persoonia Suppl. 2: 1–300.

PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 13, Part 1, pp. 133–136

BOOKS RECEIVED BY THE RIJKSHERBARIUM LIBRARY

J. Berthier. *Les Physalacriaceae du globe*. (Bibliotheca mycologica 98, J. Cramer, Vaduz. 1985.) Pp. 128, including 26 pp. of line drawings. Price: DM 50.-.

In this monograph the three genera, *Physalacria, Hormitaria*, and *Pseudotyphula*, and the altogether 31 species of the mainly tropical to subtropical Physalacriaceae known in the world are described, illustrated, discussed, and keyed out. Three new species are introduced. This study is based on herbarium material which includes all available types.

The classification adapted is that of Corner. No sides are taken in the controversy between Corner who places the family in the Aphyllophorales and Singer who places it in his Agaricales. But the point is stressed that several species present marasmioid characters.

W.G. Bramley. *A fungus flora of Yorkshire 1985*. (The Mycological Section, Yorkshire Naturalists' Union, c.o. Dr. T. Preece, Agricultural Science Building, The University, Leeds LS2 9JT, England.) Pp. 289, 1 Pl., 1 Map. Price: £ 10.-.

The fungus flora of Yorkshire is perhaps better known than that of any similar sized area in the world. Recording goes back as far as 1788 when J. Bolton's work on the fungi growing around Halifax was printed. This new book lists the myxomycetes and micro- and macrofungi found in Yorkshire during the last 100 years. Distribution data and sometimes the location of herbarium specimens are given. Several specialists contributed and updated the nomenclature.

A. Bresinsky & H. Besl. *Giftpilze mit einer Einführung in die Pilzbestimmung*. Ein Handbuch für Apotheker, Ärzte und Biologen. (Wissenschaftliche Verlagsgesellschaft MBH, Stuttgart. 1985) Pp. 295, 113 Text-figs, 96 Col. Pls. Price: DM 136.-.

This attractively produced book aims at a compilation of all that is known about poisonous European macrofungi and making this information accessible to all those people who by profession or otherwise have anything to do with fungi with certain or supposed poisonous qualities.

In the introductional part the different types of fungal poisoning are summarily characterized and general rules for prevention and treatment of mushrooms poisonings are given.

In the extensive second part the various poisonous macrofungi are arranged in nine groups according to the poisoning syndromes. For each syndrome symptoms, chemistry, biochemistry, pharmacology and therapy are given. The concerning species are fully described and usually illustrated by a colour-photograph.

In the third part instructions for collecting, describing, studying, and preserving macrofungi are followed by identification keys. The very long list of references covers 20 pages.

A. Einhellinger. *Die Gattung Russula in Bayern*. (Hoppea 43, Regensburgische Botanische Gesellschaft, Regensburg. 1985.) Pp. 286, including 50 pp. of line drawings and 32 Col. Pls. Price: DM 45.-.

An account is given of the 153 species and varieties of *Russula* found in Bavaria, of which 38 are illustrated by excellent water-colours of H. Marxmüller. In broad outlines Romagnesi's monograph on *Russula* is followed but much additional information is given. Only critical or otherwise remarkable taxa are fully described, all taxa, however, are extensively discussed with emphasize on delimitation, ecology and phenology, whereas for all taxa biometrical data are given. This publication is distributed together with an additional key to *Russula* in the German Federal Republic by A. Bresinsky (Hoppea 43: 287–342).

G. Gulden, K.M. Jenssen & J. Stordal. *Arctic and alpine fungi–1*. (Soppkonsulenten, Wesselsgt. 3, N–0165 Oslo 3, Norway. 1985.) Pp. 62, including 25 Col. Pls. and 25 Text-figs. Price: NOK. 125.-.

The first fascicle of a planned loose-leaved series of publications on arctic and alpine fungi. It contains descriptions, good colour photographs, and drawings of microscopical characters of 25 species of agarics, mostly found in the mountain areas of South Norway. Several of the taxa treated had not been illustrated in colour before.

P. Konrad & A. Maublanc. *Icones selectae Fungorum. Vols. I and II*. (Reprint edition, Libreria editrice Giovanna Biella, Saronno (It.). 1985.) Together 199 Col. Pls. and accompanying text-pages. Price: Lire 110.000 per volume.

Quite a number of important 'classical' mycological iconographies have become so rare and expensive that even libraries of universities and mycological societies are unable to buy them at the rare occasions that copies are offered for sale. With the increasing interest in the study of macrofungi this is a great handicap, because floras and monographs keep referring to them. Therefore it is a very fortunate development that some of these iconographies are being reprinted these days.

The original work of Konrad & Maublanc does not need any praise. The plates of this new edition are (if compared with the original edition at Leiden) somewhat heavier printed on whiter paper and there are here and there the inevitable slight differences in tinges (particularly the yellows are sometimes slightly too deep), but far from an extent that could lead to misinterpretations. In general the reprinting is very well done. Moreover, the volumes are handsomely bound in red artificial leather.

G. Lazzari. *Atlante iconografico 1981–1983*. (Gruppo micologico ≪G. Bresadola≫, Trento. 1985.) Pp. 297, including 145 Col. Pls. Price: c. DM 52.-.

Under this title a selection is presented of colour plates earlier published in the Bolletino del Gruppo Micologico ≪G. Bresadola≫ over the period 1981–1983. The plates are accompanied by a newly written or rearranged Italian text. Besides very common species a number of great curiosities are depicted and discussed.

E. Michael, B. Hennig & H. Kreisel. *Handbuch für Pilzfreunde. Band 2–Nichtblätterpilze* (Basidiomyzeten ohne Blätter, Askomyzeten.) 3. Aufl. (Gustav Fischer Verlag, Stuttgart & New York. 1986.) Pp. 448, including 30 Text-figs and 125 Col. Pls. Price: DM 58.-.

This is the third Edition of volume 2 of the well-known 'Handbuch für Pilzfreunde', containing the boleti, Aphyllophorales, Gasteromycetes, and Ascomycetes. The general part is completely rewritten and updated by Kreisel; it covers the macroscopical, microscopical, and chemical characters of each of the larger groups of fungi dealt with in this volume, sexual behaviour in fungi, a bibliography, and descriptions of the families and genera, often with keys to the species.

In the special part 67 colour illustrations have been replaced or added. Altogether 290 species are illustrated in colour. The accompanying texts have also been revised.

J. E. M. Mordue & G. C. Ainsworth. *Ustilaginales of the British Isles*. (Commonwealth Mycological Institute, Kew. 1984.) Pp. 103, including 20 pp. with 172 black-and-white photographs. Price: £ 14.-.

In 1950 Ainsworth & Sampson published 'The British Smut Fungi' for which the present work is a replacement necessitated by the discovery of 16 more species on the British Isle, additional information coming available, and changes in the nomenclature. The number of plates has been increased from 2 to 20 mainly depicting spores of the majority of the species described, often with microscopic and SEM photographs of the spores of the same species side by side. Keys to families, genera, and species are given with additional keys to species by families of host plants. The descriptive part is followed by a host-parasite index.

M. Moser & W. Jülich. *Farbatlas der Basidiomyceten/Colour Atlas of Basidiomycetes*. (Gustav Fischer Verlag, Stuttgart & New York. 1985.) Pp. 96, 152 Col. Pls. Price: DM 198.-.

A loose-leaved atlas of colour plates which is complementary to the two volumes of the 'Kleine Kryptogamenflora' (II b/1 and II b/2) with keys to European basidiomycetes by respectively Jülich and Moser. The basidiocarps of the c. 250 species depicted are photographed with flash light against a neutral background and arranged and sectioned in such a way that a maximum of taxonomic information is revealed. Circa 80 pages of text are used for descriptions of genera in German, English, French and Italian. For each genus the most relevant literature is specified.

Ch. H. Peck. *Annual reports of the state botanist 1868–1912. Vol. 2 (1878–1890).* (Reprint edition. Boerhaave Press, P.O. Box 1051, 2302 BB Leiden. 1985.) Pp. 670, including 32 black-and-white plates. Price: Dfl. 200.-.

The second volume of a set of five, containing reprints of Peck's important yearly reports of the state botanist of New York, in which the great majority of Peck's about 2700 new taxa of fungi have been published.

K. Vánky. *Carpathian Ustilaginales*. (Symbolae botanicae upsalienses XXIV: 2. Uppsala. 1985.) Pp. 309, 241 Text-figs., 1 Map. Price: SEK. 150.-.

This work is a taxonomic treatise of the Ustilaginales of the Carpathian area, including Hungary, parts of Austria, Czechoslovakia, Poland, Roumania, the Soviet Union, and Yugoslavia. Altogether 29 genera and 299 species are treated of which 26 genera and 235 species on 418 host plant have been reported from the area. Criteria, trends, and problems in the classification of Ustilaginales are discussed. Keys to and descriptions of genera and species, a very extensive list of references, and a host index of Carpathian Ustilaginales are given.

M. van Vuure. *Checklist van Russula in Nederland*. (Rijksherbarium, Leiden. 1985.) Pp. 24. Price: Dfl. 2.50.

A list of names of the almost 100 species of *Russula* with certainty recorded from the Netherlands, which gives a restricted synonymy, misapplied names, references to selected illustration and descriptions, and data on frequency, period of fructification, and ecology.

ERRATA

The following new names introduced in Persoonia volume 12 fascicle 4 had been published earlier:

p. 430: *Mycenella trachyspora* (Rea) Boekhout has to be replaced by *Mycenella trachyspora* (Rea) Bon in Bon & Chevassut in Docum. mycol. 3(9): 28. 1973.

p. 451: *Russula risigallina* (Batsch) Kuyp. & Vuure has to be replaced by *Russula risigallina* (Batsch) Sacc., Fl. ital. crypt., Hymeniales 1: 430. 1915.

Printed plate