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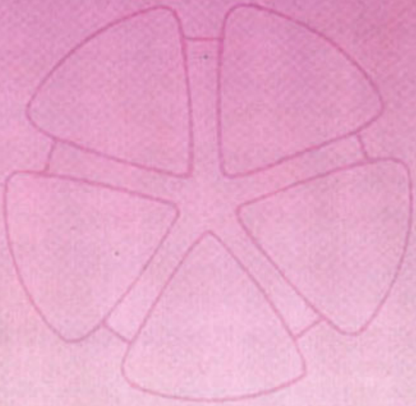

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PERSOONIA
Volume 17, Part 2, 163–164 (1999)

DR. A.F.M. REIJNDERS, CENTENARIAN

C. BAS

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A few weeks ago a reprint was distributed of an interesting paper on the formation of spores by metamorphosis of basidia in fruiting bodies of *Mycocalia* and *Scleroderma*. That in itself was not so remarkable. But it is really a small miracle that this paper was written by Dr. A.F.M. Reijnders at the age of 99 and that it appeared in the outstanding international mycological journal 'Mycological Research' (1999). It may take another 100 years before a mycologist will equal this impressive performance.

Mycology has much to thank Dr. Reijnders for. Soon after he started to publish mycological papers in 1930, his first work on the development of the fruiting body in Agaricales appeared (1933). This publication, in the Dutch language, is to be seen as an introduction to the field of the ontogeny of basidiocarps and presents a survey of the work done by others up to that time. Meticulous case studies followed in his major publications in 1948 and 1952 written in French. A real milestone, however, was the book published in 1963, that covered the whole field of fruit-body ontogeny and its implications for taxonomy and phylogeny of the Agaricales s.l. This book, again in French, with an introduction by Prof. Dr. R. Heim, became the touchstone for all later work in this field of science.

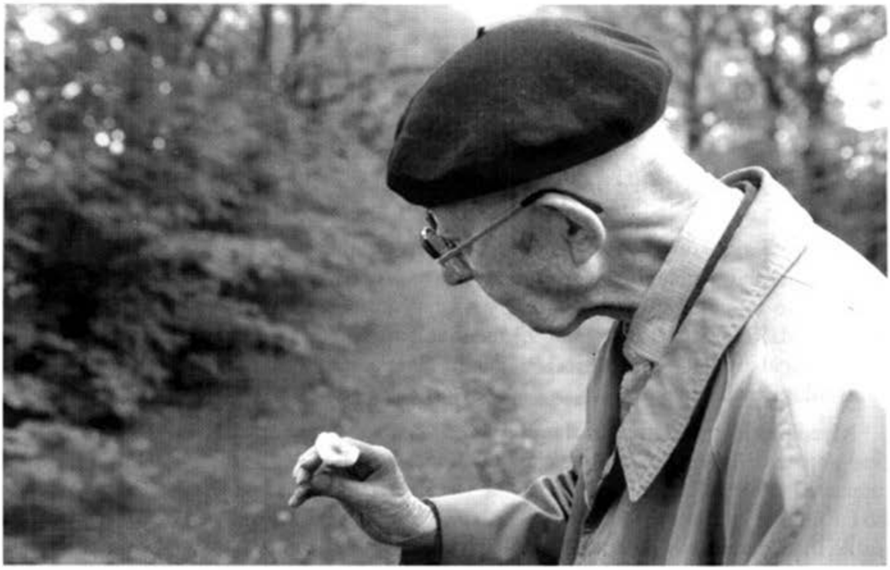
Full recognition of the value of Dr. Reijnders' research came when Dr. R. Singer invited him to write the chapter on the development of the fruiting body of the Agaricales s.l. in the fourth edition of his agaricological bible 'The Agaricales in Modern Taxonomy' (1986). And that was not the end. More publications on fruit-body ontogeny and its problems followed, among others one on the origin of special trama types (1993) and another, with Dr. J.A. Stalpers, on the development of the hymenophoral trama (1992).

But the mycological interests of Dr. Reijnders reach much further. There are many taxonomical and floristic papers on the list of his more than 80 publications that will appear in Coolia 42 (4). (It appears that Dr. Reijnders published in 14 Dutch and 8 foreign journals!) Many taxa new to the Netherlands have been discovered by him, particularly on his favourite hunting grounds: the parks and avenues on clay in the alluvial district.

On account of his great achievements in mycology, Dr. Reijnders was elected honorary president of the 6th European Mycological Congress in Avignon in 1974, received the honorary membership of the 'Nederlandse Mycologische Vereniging' in 1977, and was awarded the Benefactor's Medal 1988 of the British Mycological Society.

Although not many Dutch amateur mycologists are acquainted with Dr. Reijnders' publications on fruit-body ontogeny, many know him very well from field trips and meetings of the 'Nederlandse Mycologische Vereniging', where he showed himself to be an animated teacher and a frequent and alert participant in mycological discussions.

We heartily congratulate Dr. Reijnders and very much hope to have him still some years with us.



REFERENCES

Reijnders, A.F.M. 1933. De studie van de ontwikkeling van de basidiocarpen der Agaricales. Meded. Ned. Mycol. Vereen. 31: 135–208.

Reijnders, A.F.M. 1948. Etudes sur le développement et l'organisation histologique des carpophores dans les Agaricales. Rec. Trav. bot. néerl. 12: 213–396.

Reijnders, A.F.M. 1952. Recherches sur le développement des carpophores dans les Agaricales. Verh. Kon. Ned. Acad. Wetensch. ser. 2, 48 (4): 5–110.

Reijnders, A.F.M. 1963. Les problèmes du développement des carpophores des Agaricales et de quelques groups voisins. Junk, Den Haag.

Reijnders, A.F.M. 1986. Development of the primordium of the carpophore. In: R. Singer, The Agaricales in modern taxonomy, 4th ed. J. Cramer, Vaduz.

Reijnders, A.F.M. 1993. On the origin of specialized trama types in the Agaricales. Mycol. Res. 97: 257–268.

Reijnders, A.F.M. 1999. The formation of spores by metamorphosed basidia in Mycocalia and Scleroderma. Mycol. Res. 103 (5): 521–526.

Reijnders, A.F.M. & J.A. Stalpers. 1992. The development of the hymenophoral trama in the Aphyllophorales and the Agaricales. Studies in Mycology 34: 1–109.

PERSOONIA
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STUDIES IN COPRINUS V – COPRINUS SECTION COPRINUS

Revision of subsection Lanatuli Sing.

C.B. ULJÉ[1] & M.E. NOORDELOOS[2]

A key is given to the species of subsection *Lanatuli* known from the Netherlands or to be expected in the Netherlands on account of records from neighbouring countries. For a key to the subsections in *Coprinus* section *Coprinus* see Uljé & Noordel., Persoonia 16 (1997) 267. *Coprinus bicornis* and *C. spelaiophilus* are described as new species. In addition the following species are fully described: *C. ammophilae*, *C. calosporus*, *C. cinereus*, *C. erythrocephalus*, *C. geesterani*, *C. jonesii*, *C. kriegIsteineri*, *C. lagopus*, *C. macrocephalus*, *C. ochraceolanatus*, *C. pachydermus*, *C. pseudoradiatus*, *C. radiatus* and *C. scobicola*.

This paper is a result of our observations on *Coprinus* subsect. *Lanatuli*, and is a continuation of earlier papers (Uljé & Bas, 1988, 1991; Uljé & Noordeloos, 1993, 1997), also in connection with the preparation of a manuscript for the Flora agaricina neerlandica. All species currently known from the Netherlands and neighbouring countries are fully described and some new species are added.

PRESENTATION AND ABBREVIATIONS

When not indicated otherwise, all collections are deposited in the Rijksherbarium at Leiden (L). Collections made by the first author, but without a collection number, refer to material that has not been preserved. The enlargements of the drawings are × 2000 for spores, × 800 for other microscopical features and × 1 for basidiocarps.

In the descriptions, reference is made to the colour codes of Munsell (1975) and Kornerup & Wanscher (1978), respectively indicated as Mu. and K. & W. Other abbreviations used are:

av. – average
B – breadth of the spores in front view
Bas. – basidia
c. – circa
Cau. – caulocystidia
Ch. – cheilocystidia
diam. – diameter
gh – greenhouse
L. – relating to the lamellae: number of lamellae reaching stipe
L – relating to spores: length
l – number of short lamellae between two lamellae (not reaching stipe).
l.c. – loco citato
Pl. – pleurocystidia
Pp. – pileipellis
Q – length divided by breadth (L : B)
Sp. – spores
St.v. – veil of stipe
Ve. – veil
W – width of the spores in side view

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The terminology in this paper follows the glossary in Flora agaricina neerlandica, vol. 1 (Vellinga, 1988).

A notation like [80, 4, 2] means: 80 spores from 4 specimens from 2 collections were measured. Spore measurements are generally based on samples of 20 spores.

The sizes of the spores as given in the key and the descriptions relate to L × B or L × B × W. The quotient of the spores (Q) relates to L : B.

In the species descriptions the spores are described as seen in frontal view.

The expression 'diverticulate veil' is used for a veil made up of diverticulate hyphae, while 'veil thick- or thin-walled' denotes a veil made up of thick- or thin-walled elements.

ACKNOWLEDGEMENTS

The authors are indebted to the Directors of herbaria B, E, H, WTU, Mr. E. Ludwig, and Dr. R. Courtecuisse for loan of types, members of the NMV and other persons for loan or gift of critical material and Dr. Th. W. Kuyper for critical reading and correcting the manuscript.

TAXONOMIC PART

Coprinus section **Coprinus** subsection **Lanatuli** Sing.

General characteristics

Young basidiocarps cylindric-ellipsoid, ellipsoid or ovoid, sometimes conical, during expanding becoming hemispherical, campanulate or conical, finally flat with upturned margin, covered with whitish or (silvery) grey, in some cases grey-brown, ochre-brown, ochre, yellowish or orange, hairy floccose, often dense veil. Stipe white, hollow, fragile, covered with hairy floccose veil, sometimes minute, more dense towards base. Microscopically veil made up of chains of elongate, sausage-shaped, thin-walled or rarely thick-walled and often incrusted elements with distinct, often clavate or tapering, terminal elements.

Macroscopical characters

Pileus 4–50 × 3–30 mm when still closed, 6–70 mm wide when expanded, whitish, grey or grey-brown below veil, seldom cream or ochre, and often dark at centre. Veil usually densely hairy scaly with upturned tips, less commonly hairy floccose or cobweb-like, whitish or silvery grey in most cases, sometimes cream, ochre, yellowish or orange; if whitish or grey then often darker at centre. Lamellae free but not removed from stipe, crowded. Stipe 15–150 × 0.5–10 mm, hollow, fragile, white and covered with small flocks of veil, rather dense above base; base somewhat bulbous, sometimes rooting. Smell none or indistinct.

Microscopical characters

Elements of veil in chains of narrow, elongate elements, about 6–10 µm wide, becoming broader towards the end of the chain, those elements usually up to 40(–60) µm wide. In some species elements of veil less than 25 µm wide, including terminal elements. Pileipellis a cutis, made up of cylindrical, fusiform or sausage-shaped elements up to 150 µm long and 3–35 µm wide. Pleurocystidia, cheilocystidia and clamp-connections present. Spores ellipsoid, oblong or ovoid and smooth in most of the species, rarely broadly fusiform, in one species amygdaliform and nodulose. Basidia 4-spored, 2-spored in two species. Number of pseudoparaphyses 3–6(–7).

Substrate and habitat

Growing on wood, wood-chips, heaps of (mixed) dung or compost, vegetable refuse, less frequent in lawns, on soil or old fire-places, one species on *Ammophila arenaria*, another on *Yucca*.

KEY TO THE SPECIES IN SUBSECTION LANATULI

1\. Spores with rounded-conical nodules . . . . 3. *C. calosporus*
1\. Spores smooth.
2\. Basidia 2-spored.
3\. On dung; veil with some ellipsoid or subglobose elements; average spore breadth < 7.8 µm . . . . 2. *C. bicornis*
3\. On compost or saw-dust; veil without ellipsoid or subglobose elements; average spore breadth > 7.8 µm . . . . 15. *C. scobicola*
2\. Basidia 4-spored.
4\. Growing on *Ammophila arenaria* in yellow dunes . . . . 1. *C. ammophilae*
4\. Habitat otherwise.
5\. Veil of centre of pileus thick-walled, wall up to 1 µm thick 16. *C. pachydermus*
5\. Veil of centre of pileus thin-walled, wall < 0.5 µm thick.
6\. Veil cream, ochre, yellow, orange or orange-red.
7\. Pileus with beautiful rust-coloured or orange-red veil, visible at least at base of stipe, soon slimy . . . . 12. *C. erythrocephalus*
7\. Veil cream, yellowish or ochre, not slimy.
8\. Veil distinct yellowish or ochre; spores ellipsoid to ovoid, Q > 1.5 on average; on clayey soil, mud or wood-chips; terminal elements of veil up to c. 20 µm wide, strongly pale yellowish incrusted 10. *C. ochraceolanatus*
8\. Veil cream or pale ochre; spores broadly fusiform, Q < 1.5 on average; on wood, often in wounds of trees; terminal elements of veil up to c. 40 µm wide, not yellowish incrusted . . . . 7. *C. spelaiophilus*
6\. Veil white, silvery grey, grey or grey-brown.
9\. Average spore length < 9.2 µm.
10\. Medium species; average spore breadth > 5.8 µm; average Q < 1.3 9. *C. jonesii*
10\. Small species; average spore breadth < 5.8 µm; average Q > 1.3.
11\. On dung or mixed dung; average Q > 1.6; spores ellipsoid, tending cylindrical . . . . 6. *C. pseudoradiatus*
11\. On wood-chips, soil mixed with pieces of wood or vegetable refuse; average Q < 1.6; spores ellipsoid, tending rhomboid . 13. *C. geesterani*
9\. Average spore length > 9.2 µm.
12\. Average spore length < 10.8 µm.
13\. Veil whitish, greyish or grey-brown, hairy floccose; spores ovoid or ellipsoid; on dung, mixed dung or compost-heaps . . . . . 4. *C. cinereus*
13\. Veil whitish, cream or pale ochre, in small flocks; spores very broadly fusiform; in wounds of – often living – trees or on stumps 7. *C. spelaiophilus*

12. Average spore length > 10.8 µm.
  14. Average spore breadth > 8.2 µm .... 11. *C. macrocephalus*
  14. Average spore breadth < 8.2 µm.
    15. Average spore breadth > 7.8 µm; spores ellipsoid, tending cylindrical; on dung or mixed dung .... 5. *C. radiatus*
    15. Average spore breadth < 7.8 µm; spores ellipsoid; on soil, often mixed with rotten pieces of wood, wood-chips, compost-heaps or vegetable refuse.
      16. Veil on pileus thin, cobweb-like, looking silky; average spore breadth < 6.7 µm .... 14. *C. krieglsteineri*
      16. Veil on pileus abundant, hairy fibrillose; average spore breadth > 6.7 µm ....8. *C. lagopus*

1. **Coprinus ammophilae** Courtecuisse — Fig. 1

Coprinus ammophilae Courtecuisse, Doc. mycol. 18 (72) (1988) 76.
Selected icons. Courtecuisse, l.c. 77; Courtec. & Duhem, Guide Champ. Fr. Eur. (1994) 777.

Pileus 5–15 × 3–13 mm when still closed, expanded up to 25 mm in diam., first ellipsoid or (broadly) ovoid, entirely covered with sordid white to pale greyish, hairy floccose veil, then campanulate to (plano-)convex, grey-brown or greyish beige (first Mu. 10 YR 4/3, then between 6/3 and 6/4 with darker centre: 5/4; clefts pale pure grey), strongly sulcate-striate; expanding pileus near margin with copious flocks of whitish, fibrillose veil, towards centre with numerous, strikingly reflexed, squamulose scales of veil, whitish, with pale ochre tips. Lamellae, L = 24–50, l = 0–1, free, up to 4.5 mm wide, crowded, first whitish, then dark reddish brown with conspicuous white edge, finally black. Stipe up to 35 × 1.5–4 mm, usually short and solid, white, hollow, hairy floccose, slightly broadening towards not or slightly bulbous base.

Spores [100, 5, 3] 8.3–12.7 × 6.2–9.3(–10.3) × 6.0–7.8 µm; Q = 1.20–1.75, av. Q = 1.30–1.55; av. L = 10–11.3, av. B = 7.2–8.1 µm, av. W = c. 7.1 µm, (broadly) ellipsoid or ovoid with rounded base and apex, dark red-brown, and central, c. 1.3 µm wide germ pore. Basidia 24–65 × 7–12 µm, 4-spored, surrounded by 3–6 pseudoparaphyses. Pleurocystidia 55–115 × 20–42 µm, oblong, ellipsoid, subglobose or (sub)cylindric. Cheilocystidia 20–100 × 15–32(–40) µm, oblong, (sub)globose, ellipsoid, ovoid, broadly subcylindric or slightly utriform. Pileipellis made up of inflated, sausage-shaped elements, 20–100 × 4–30 µm. Veil made up of long chains of inflate, cylindric, oblong to ellipsoid elements, 25–100 × 5–40 µm. Clamp-connections present.

Habitat & distribution — In yellow dunes, subfasciculate on dead leaves of *Ammophila arenaria*. Very rare in the Netherlands and in France.

Collections examined. FRANCE: reg. Pas de Calais, Stella-Plage, 9 Nov. 1984, *M. Bon, J. Vast et R. Courtecuisse, Courtecuisse 84.1109.01* (holotype, herb. Courtecuisse). — NETHERLANDS: prov. Friesland, Rottumeroog, 'Noorderstrand', 7 Oct. 1993, *E. Arnolds 6473* (WBS); prov. Zuid-Holland, Goedereede, 'Kwade Hoek', 18 Nov. 1989, *M. Nauta* (collection *Bas 8730*).

The small basidiocarps with remarkable short stipe, the rather broad spores with regard to their length and the habitat on *Ammophila arenaria* are characters to identify *Coprinus ammophilae*.

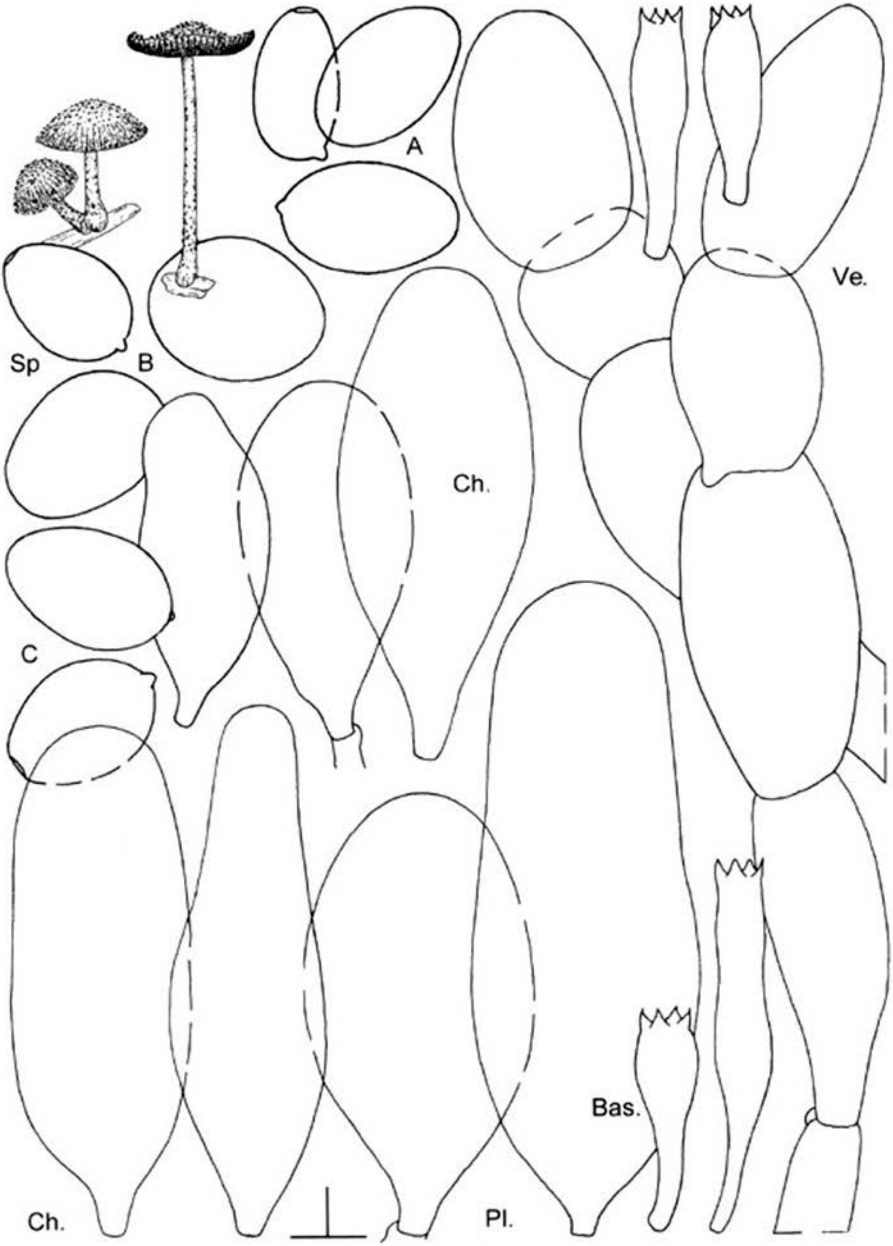

Fig. 1. *Coprinus ammophilae* Courtecuisse. A from *C. Bas 8730*; B from *E. Arnolds 6473*; C from *R. Courtecuisse 84.1109.01* (holotype). Ch., Pl., Ve. & Bas. from *C. Bas 8730*.

The studied type-material was in bad condition. Cystidia could not been found in the material. The spores in collection *Arnolds 6473* are somewhat broader (av. Q = 1.30–1.35) than in the type collection (av. Q = 1.35–1.40). In collection *Bas 8730* the spores are oblong (Q = 1.55) in frontal view, the macroscopical characters either agree in most respects, as well as the habitat. The colours noted in the description are from this collection. Although the basidia, pleuro- and cheilocystidia are larger in collection *Bas 8730* and the spores narrower, we include this collection for this moment in the variability of *Coprinus ammophilae* on account of the small basidiocarps and the typical habitat on *Ammophila arenaria*.

Microscopical specifications of the collections examined:

Holotype: Spores [20, 1, 1] 9.7–12.2 × 7.1–8.4 µm; Q = 1.30–1.50, av. Q = 1.40; av. L = 11.1, av. B = 8.0 µm. Elements of veil 50–100 × 20–30 µm. Basidia, pleuro- and cheilocystidia collapsed.

Collection Arnolds: Spores [60, 3, 1] 8.3–12.7 × 6.7–9.3(–10.3) µm; Q = 1.20–1.45, av. Q = 1.30–1.35; av. L = 10.0–10.6, av. B = 7.5–8.1 µm. Basidia 26–36 × 7–11 µm. Pleurocystidia 56–72 × 24–33 µm. Cheilocystidia 20–50 × 15–25 µm. Elements of veil 8–28(–36) µm wide.

Collection Bas: Spores [20, 1, 1] 9.8–12.7 × 6.2–8.0 µm; Q = 1.40–1.75, av. Q = 1.55; av. L = 11.3, av. B = 7.2 µm. Basidia 24–65 × 9–12 µm. Pleurocystidia 65–115 × 20–42 µm. Cheilocystidia 30–100 × 20–32(–40) µm. Elements of veil 30–100 × 10–40 µm.

2. **Coprinus bicornis** Uljé & Horvers, *spec. nov.* — Fig. 2, Plate 11, 12

Pileus primo 8 × 5 mm, ellipsoideus, cylindraceo-ellipsoideus vel conicus, albus, expansus ad 15 mm latus, campanulatus demum applanatus, griseus vel griseo-brunneus margine revoluto. Velum primitus glabrum, demum fibrilloso-floccosum. Lamellae liberae, tenues, confertae, albae demum griseobrunneae vel atrae. Stipes 30–50 × 1–1.5 mm, albus, velutino-fibrillosus, glabrescens. Sporae 9.1–12.6 × 5.9–8.4 µm; oblongae vel ovoideae poro germinativo obscuro, obscure rufobrunneae. Basidia 14–36 × 7–10 µm, bisporigera. Pseudoparaphyses 3–6. Pleurocystidia 40–80 × 20–40 µm, oblonga, ellipsoidea, ovoidea vel subutriformia. Cheilocystidia 30–80 × 20–35 µm, (sub)globosa vel ellipsoidea, interdum subutriformia. Pileipellis e elementis inflatis, c. 20–100 × 4–20 µm constituis. Velum e elementis cylindraceis vel fusiformibus, incrustantibus constituum 25–100 × 5–40 µm, elementis interdum inflatis ad 60(–70) µm latis. Fibulae presentes. Ad fimum equinum vel bovinum.

Holotypus: *C.B. Uljé 1216*, 4-X-1991, Wassenaar, the Netherlands (L).

Pileus up to 8 × 5 mm when still closed, up to 15 mm when expanded, ellipsoid, cylindric-ellipsoid, often somewhat conical, white in very young stage, soon becoming somewhat grey or grey-brown at centre of pileus, expanding to campanulate or conical, then to convex or applanate, finally plano-concave with revolute margin, very thin. Veil in primordia smooth, mat, pure white, later greyish to grey-brown, covering entire pileus, soon radially splitting into hairy to fibrillose, often pointed and appressed or – especially at centre – recurved flocks. Lamellae, L = c. 16, l = 0–3, free, narrow, rather crowded, first white, soon grey-brown to blackish. Stipe 30–50 × 1–1.5 mm, whitish, somewhat tapering towards apex, up to 2 mm wide at clavate to slightly bulbous base, hollow, hairy flocculose but particularly densely at lowest part, becoming glabrous with age.

Spores [80, 3, 2] 9.1–12.6 × 5.9–8.4 µm; Q = 1.40–1.85, av. Q = 1.50–1.75; av. L = 10.8–11.7, av. B = 6.4–7.4 µm, oblong or ovoid, more or less cylindric with rounded base and apex, dark red-brown, and central, 1–1.3 µm wide germ pore (difficult to observe). Basidia 14–36 × 7–10 µm, 2-spored, surrounded by 3–6 pseudoparaphyses. Pleurocystidia

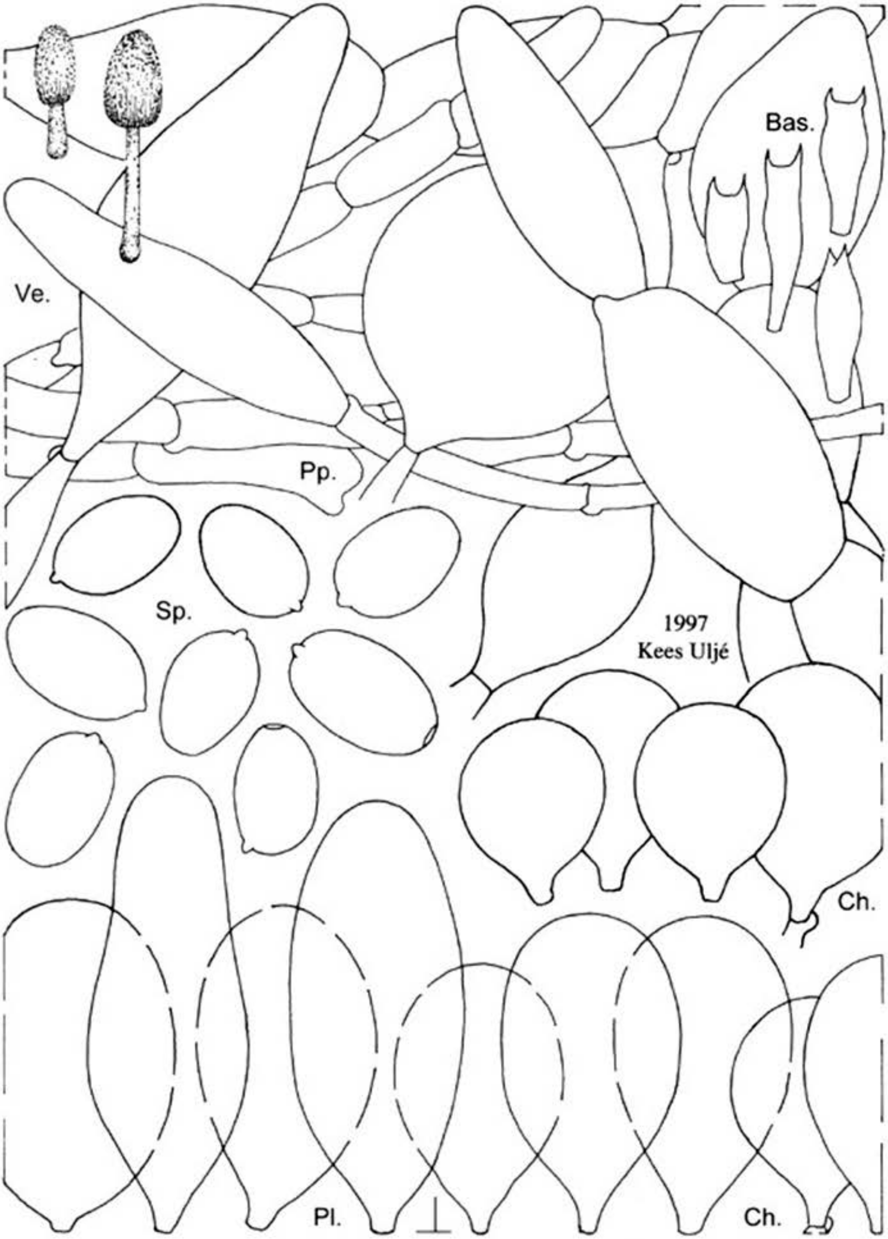

Fig. 2. *Coprinus bicornis* Horvers & Uljé. All figures from *C.B. Uljé 1216* (holotype).

40–80 × 20–40 µm, oblong, ellipsoid, ovoid or subutriform. Cheilocystidia 30–80 × 20–35 µm, (sub)globose or ellipsoid, a few subutriform. Pileipellis consisting of short, inflated elements, c. 20–100 × 4–20 µm. Veil made up of cylindrical or fusiform elements, usually inflated, incrusted and constricted at septa, 25–100 × 5–40 µm, the elements in part strongly swollen, fusiform, ellipsoid or even subglobose and up to 60(–70) µm thick. Clamp-connections present.

Habitat & distribution — Solitary or (sub)fasciculate on dung of cow and horse. Very rare, only found twice in the Netherlands.

Collections examined. NETHERLANDS: prov. Zuid-Holland, Wassenaar, 30 Oct. 1991, *C.B. Uljé 1216* (holotype, L); prov. Noord-Brabant, Tilburg, 'de Sijsten', 4 Dec. 1996 (culture from dung earlier collected), *B. Horvers* (collection *C.B. Uljé 1232*).

Coprinus bicornis can be recognized by the 2-spored basidia, the in part ellipsoid or subglobose elements in the veil and the habitat on dung.

3. **Coprinus calosporus** Bas & Uljé — Fig. 3

Coprinus calosporus Bas & Uljé, Persoonia 15 (1993) 359.

Pileus up to 29 × 12 mm when still closed, up to c. 30 mm when expanded, first ellipsoid, cylindric-ellipsoid, often somewhat conical, white in very young stage, soon becoming greyish or grey-brown, the darkest at centre of pileus, expanding to conical, then to convex or applanate, finally plano-concave with revolute margin. Surface of pileus beneath veil first dark brown (Mu. 10 YR 4/3), later somewhat paler (10 YR 5/4). Veil in primordia smooth, mat, pure white, later grey to grey-brown (10 YR 7/3), covering entire pileus, soon radially splitting into hairy to fibrillose, often pointed and appressed or – especially at centre – recurved flocks. Lamellae, L = 32–46, l = 1–3(–5), free, narrow, rather crowded, first white, soon greyish brown to blackish. Stipe 50–100 × 2–4 mm, whitish, somewhat tapering towards apex, up to 5 mm wide at clavate to slightly bulbous base, hollow, hairy flocculose but particularly dense at lower part, becoming glabrous with age; base clavate with short and narrow pseudorhiza.

Spores [60, 3, 3] 7.3–9.8 × 4.6–5.8 × 4.1–4.8 µm (without ornamentation); Q = 1.35–1.75, av. Q = 1.60; av. L = 8.0–8.4, av. B = 5.0–5.4, av. W = c. 4.4 µm, amygdaliform, towards base often slightly conical, with apical papilla and truncate at apex, covered with many short, but broad and rounded nodules, red-brown, and central, c. 1.3 µm wide germ pore. Basidia 13–24 × 6–8 µm, 4-spored, surrounded by (3–)4–5(–6) pseudoparaphyses. Pleurocystidia 30–150(–145) × 20–40 µm, ellipsoid to oblong or slightly broadly lageniform. Cheilocystidia 30–70(–90) × 20–35 µm, ellipsoid to oblong, sometimes slightly broadly utriform. Pileipellis a cutis, made up of cylindrical or fusiform, more or less parallel, repent hyphae, up to 150 µm long and 4–25 µm wide. Veil made up of inflate, sausage-like elements, 30–150(–250) × (3–)5–25(–40) µm, often somewhat inflated, usually constricted at septa. Clamp-connections present.

Habitat & distribution — Growing fasciculate on stem of *Yucca* (indoors). Only known from the type-locality.

Collections examined. NETHERLANDS: prov. Zuid-Holland, Leiden, Rijksherbarium, 18 April 1991, *C. Bas 8795* (holotype), *C.B. Uljé 1131* (isotype); 30 April 1991, *C. Bas 8795b*.

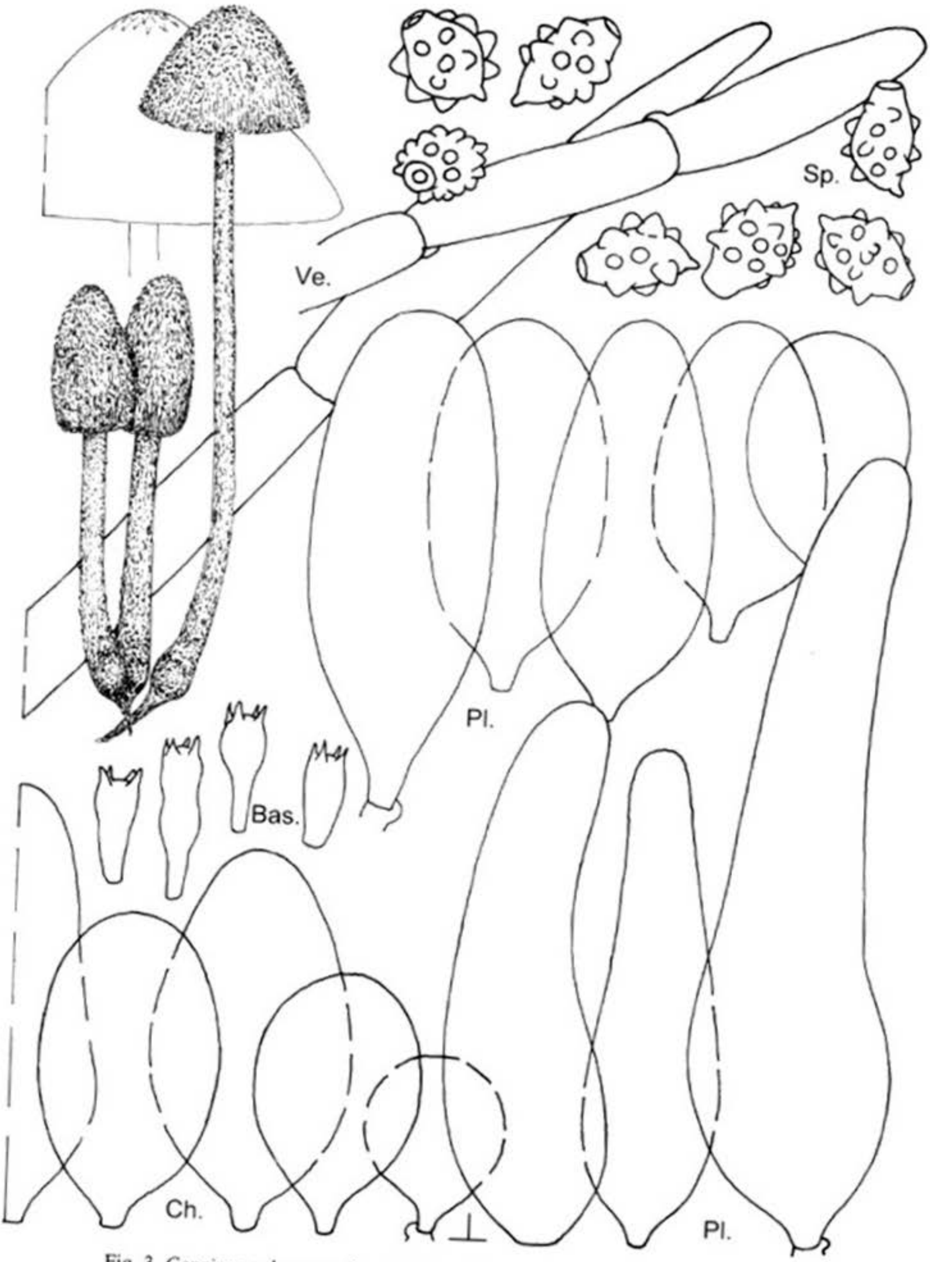

Fig. 3. *Coprinus calosporus* Bas & Uljé. All figures from *Bas 8795* (holotype).

The amygdaloid spores with rounded nodules make it very easy to recognize *C. calosporus*. No other *Coprinus* has such spores. The fact that the species is found indoors, in a flowerpot, makes it probable that it is a species from warmer regions than the Netherlands.

4. **Coprinus cinereus** (Schaeff.: Fr.) Gray — Fig. 4

Agaricus cinereus Schaeff., Fung. Bavariae (1774) 100; *Agaricus cinereus* Schaeff.: Fr., Syst. mycol. I (1821) 310; *Coprinus cinereus* S.F. Gray, Nat. Arr. Br. Pl. I (1821) 634.

Selected icons. Allen & Young, Mycologist 7 (1993) 74; Courtec. & Duhem, Guide Champ. Fr. Eur. (1994) 779; Imazeki et al., Fungi Japan (1988) 203; Jamoni, Funghi e Ambiente 47 (1988) 38; M. Lange, Paddestoelengids (1964) 137 (as *C. fimetarius*); Rocabruna, Bolets Catalunya 2 (1983) 64.

Pileus up to 20 × 15 mm when still closed, up to c. 30 mm when expanded, first ellipsoid, cylindric-ellipsoid, grey-brown (Mu. 10 YR 6/3) at centre beneath the whitish to silvery grey veil, paler towards margin (10 YR 7/3 halfway pileus), expanding to conical, then to convex or applanate, finally plano-concave with revolute margin. Veil in primordia smooth, mat, pure white, later grey to grey-brown (10 YR 7/3), covering entire pileus, soon radially splitting up into hairy to fibrillose, often pointed and appressed or – especially at centre – recurved flocks, the tips becoming brown on drying. Lamellae, L = c. 45–60, l = 3–7, free, narrow, rather crowded, first white, soon greyish brown to blackish. Stipe 50–100 × 2–6 mm, whitish, somewhat tapering towards apex, up to 9 mm wide at clavate to bulbous base, hollow, hairy flocculose, more dense at lower part, becoming glabrous with age; base clavate and often somewhat rooting.

Spores [100, 5, 4] 8.4–11.8 × 5.8–7.8 µm; Q = 1.25–1.65, av. Q = 1.35–1.55; av. L = 9.0–10.6, av. B = 6.1–7.0 µm, ellipsoid or ovoid, seldom somewhat cylindric, with rounded base and apex, dark red-brown, and central, c. 1.3–1.5 µm wide germ pore. Basidia 15–36 × 7–11 µm, 4-spored, surrounded by 3–6 pseudoparaphyses. Pleurocystidia 50–140 × 20–55 µm, subglobose, ellipsoid to oblong, utriform or subcylindric. Cheilocystidia 35–85 × 15–50 µm, (sub)globose, ellipsoid to oblong. Pileipellis a cutis, made up of cylindrical or inflate, more or less parallel, repent hyphae, 20–150 × 3–30 µm. Veil made up of elongate, sausage-like elements, (20–)40–250(–450) × 8–40(–50) µm, often inflated, usually constricted at septa; terminal elements cylindric to almost globose. Clamp-connections present.

Habitat & distribution — Common. Growing solitary or fasciculate on heaps of mixed dung, rotten straw or vegetable refuse. Widespread all over the world.

Collections examined. NETHERLANDS: prov. Drenthe, Beilen, 31 Aug. 1993, *E. Arnolds 6361* (WBS); prov. Zuid-Holland, Alphen a/d Rijn, 7 June 1990, *C.B. Uljé 1069*; Alphen a/d Rijn, Sportlaan, 17 July 1996, *C.B. Uljé*; Hazerswoude, Spookverlaat, 8 June 1990, *C.B. Uljé*.

The size and shape of the spores are the most significant characters to identify *Coprinus cinereus*. The spores are relatively broad with regard to the length. Rather close species are *C. lagopus* having spores more oblong, usually up to 13 µm in length with a quotient > 1.6 and usually growing terrestrial and *C. macrocephalus* with larger spores, up to 16 µm in length and up to 9.5 µm broad.

5. **Coprinus radiatus** (Bolt.: Fr.) Gray — Fig. 5

Agaricus radiatus Bolt., Hist. Fung. Halifax (1788) 39; *Agaricus radiatus* Bolt.: Fr., Syst. mycol. I (1821) 313; *Coprinus radiatus* S.F. Gray, Nat. Arr. Br. Pl. I (1821) 635.

Selected icons. Cetto, Funghi Vero 3, 1st ed., pl. 876 (1979) 49; M. Lange, Paddestoelengids (1964) 139.

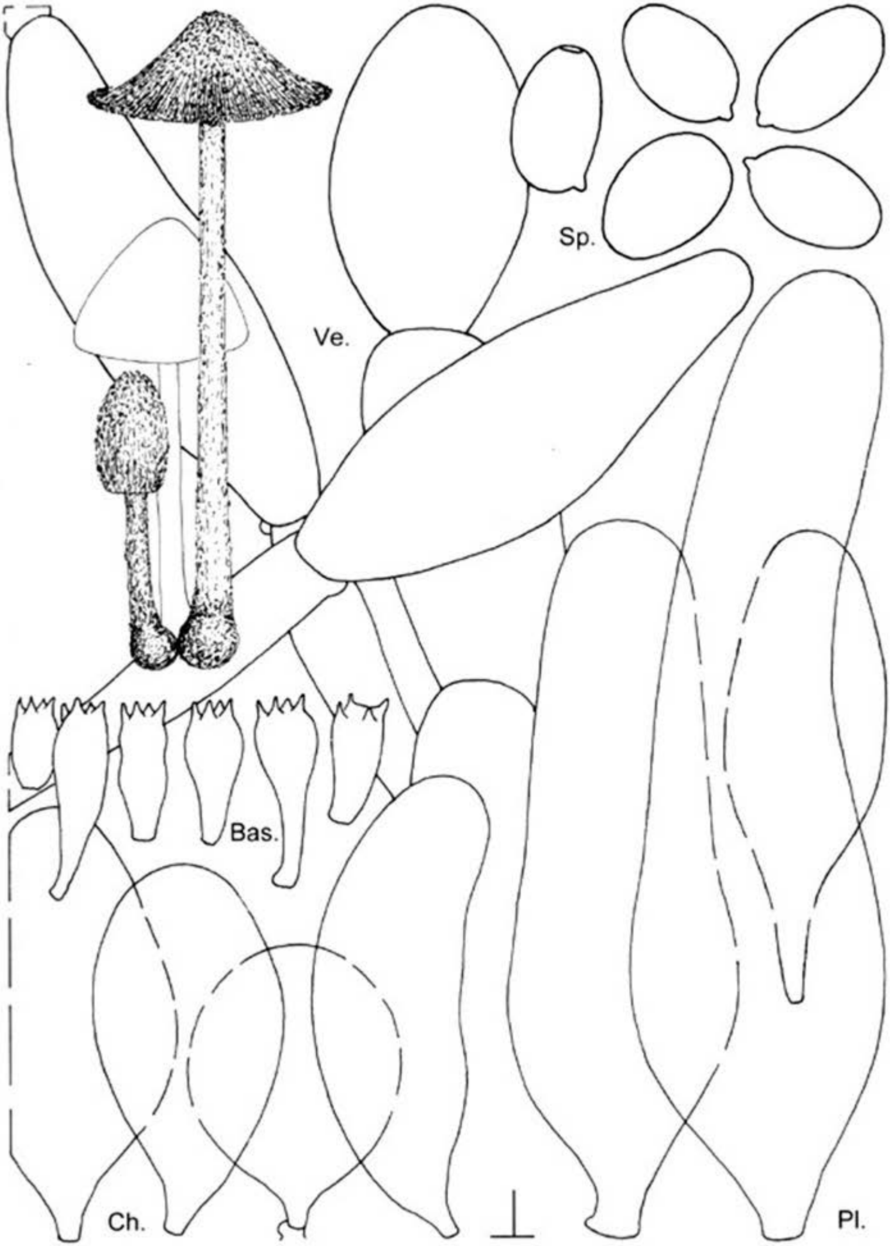

Fig. 4. *Coprinus cinereus* (Schaeff.: Fr.) Gray. All figures from *C.B. Uljé 1060*.

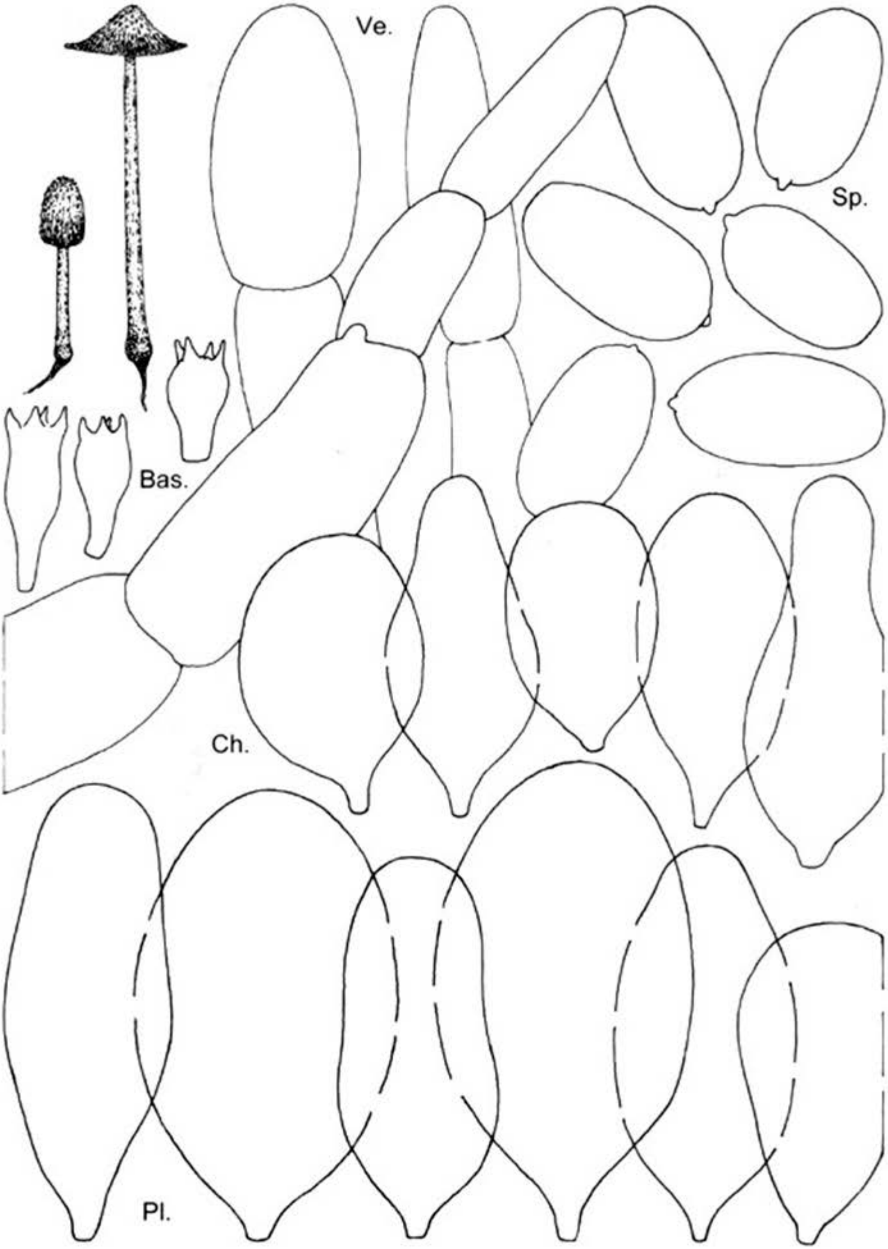

Fig. 5. *Coprinus radiatus* (Bolt.: Fr.) Gray. All figures from collection *C.B. Uljé*, Breukelen, Gunterstein, 26 July 1997.

Pileus up to 10 × 6 mm when still closed, up to c. 15 mm when expanded, first ellipsoid, cylindric-ellipsoid, grey-brown at centre beneath the whitish to silvery grey veil, paler towards margin, expanding to conical, then to convex or applanate, finally plano-concave with revolute margin. Veil whitish to pale (silvery) grey, radially splitting up into hairy to fibrillose, often pointed and appressed or – especially at centre – recurved flocks, the tips becoming brown on drying. Lamellae, L = c. 35, l = 1–5, free, narrow, rather crowded, first white, soon greyish brown to blackish. Stipe 20–50 × 0.5–1.5 mm, whitish, somewhat tapering towards apex, up to 2 mm wide at clavate base, hollow, minutely hairy flocculose, more dense at lower part, becoming glabrous with age; base clavate and often somewhat rooting.

Spores [40, 2, 2] 13.3–15.2 × 7.6–8.5 µm; Q = 1.65–1.90, av. Q = 1.75–1.80; av. L = 14.2–14.6, av. B = 7.8–8.0 µm, cylindric-ellipsoid, with rounded base and apex, very dark red-brown to almost black, and central, c. 1.5–1.8 µm wide germ pore. Basidia 20–36 × 9–11.5 µm, 4-spored, surrounded by 4–6 pseudoparaphyses. Pleurocystidia 50–100 × 20–45 µm, ellipsoid to oblong, utriform or subcylindric. Cheilocystidia 35–80 × 15–40 µm, (sub)globose, ellipsoid to oblong or (sub)utriform. Pileipellis a cutis, made up of cylindrical or fusiform, more or less parallel, repent hyphae, up to 150 long and 3–30 µm wide. Veil made up of elongate, sausage-like elements, 30–250 × 8–25(–30) µm, often inflated, usually constricted at septa; terminal elements cylindric to almost globose. Clamp-connections present.

Habitat & distribution — Growing solitary in groups or subfasciculate on heaps of mixed dung or on pure dung. Rather rare but widespread in Europe.

Collections examined. NETHERLANDS: prov. Utrecht, Breukelen, estate 'Gunterstein', 26 July 1997, *C.B. Uljé*; prov. Noord-Holland, Huizen, 29 Nov. 1986, *C.B. Uljé*.

Coprinus radiatus can be recognized by the rather narrowly, cylindrical-ellipsoid spores with a length of 13–15 µm and the habitat on dung.

6. **Coprinus pseudoradiatus** Kühn. & Joss. ex Watl. — Fig. 6

Coprinus pseudoradiatus Kühn. & Joss., Bull. Soc. mycol. Fr. 60 (1944) 26 (invalid, no Latin description); *Coprinus pseudoradiatus* Watl., Notes R. bot. Gdn Edinb. 35 (1976) 154.

Pileus up to 6 × 4 mm when still closed, up to c. 10 mm when expanded, first ellipsoid, cylindric-ellipsoid, grey-brown at centre beneath the whitish to silvery grey veil, paler towards margin, expanding to conical, then to convex or applanate, finally plano-concave with revolute margin. Veil whitish to pale (silvery) grey, radially splitting up into hairy to fibrillose, often pointed and appressed or – especially at centre – recurved flocks, the tips becoming brown on drying. Lamellae, L = c. 30, l = 1–3(–5), free, narrow, rather crowded, first white, soon greyish brown to blackish. Stipe 20–50 × 0.5–1 mm, whitish, somewhat tapering towards apex, up to 1.5 mm wide at clavate base, hollow, minutely hairy flocculose, particularly densely at lower part, becoming glabrous with age; base clavate.

Spores [40, 2, 2] 7.7–9.7 × 4.9–5.5 µm; Q = 1.55–1.80, av. Q = 1.70; av. L = 8.6–8.8, av. B = 5.0–5.2 µm, cylindric-ellipsoid, with rounded base and apex, red-brown, and central, c. 1.3–1.5 µm wide germ pore. Basidia 18–32 × 8–10 µm, 4-spored, surrounded by 3–6 pseudoparaphyses. Pleurocystidia 30–80 × 20–30 µm, ellipsoid to oblong, utriform or subcylindric. Cheilocystidia 25–60 × 15–28 µm, (sub)globose, ellipsoid to oblong or (sub) utriform. Pileipellis a cutis, made up of cylindrical, sausage-like or fusiform, more or less

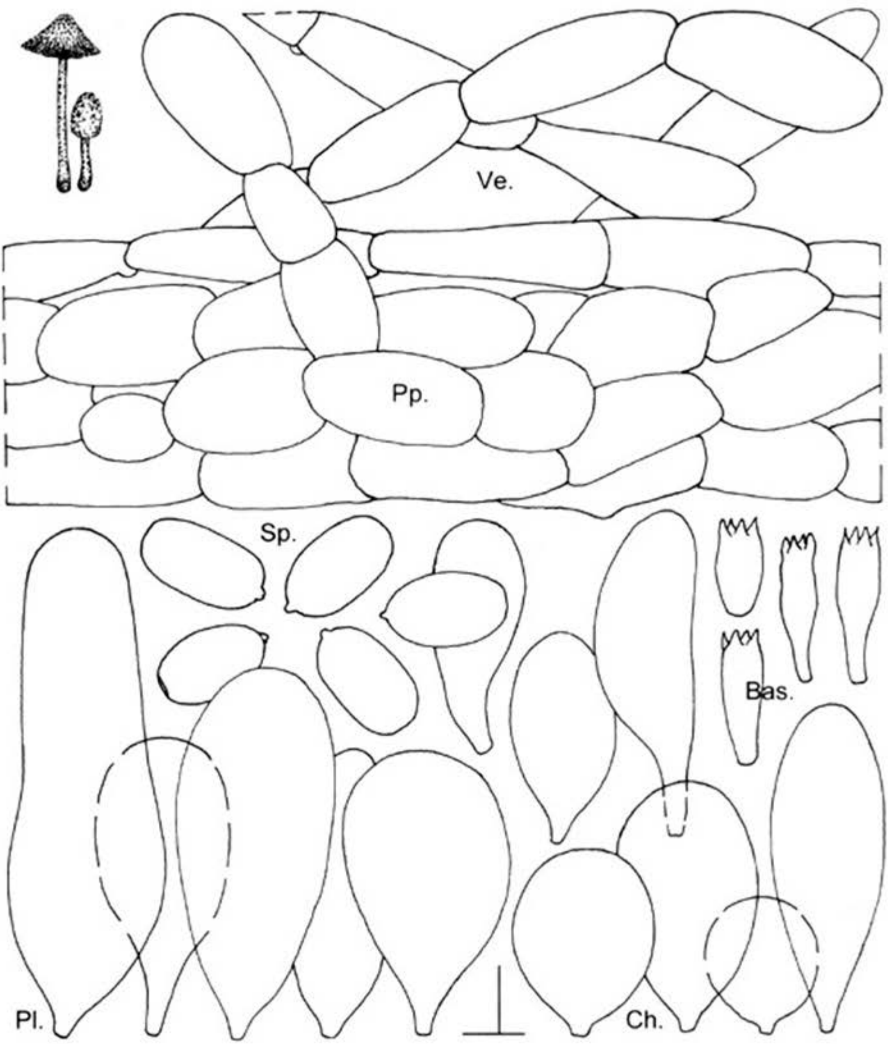

Fig. 6. *Coprinus pseudoradiatus* Kühn. & Joss. ex. Watl. All figures from *C.B. Uljé 629*.

parallel, repent hyphae and 15–70(–100) × 3–25 µm. Veil made up of elongate, sausage-like elements, 30–180 × 8–25(–30) µm, often inflated, usually constricted at septa; terminal elements cylindric to almost globose. Clamp-connections present.

Habitat & distribution — Growing solitary in small groups or fasciculate on pure dung or mixed dung, rarely (seemingly) on soil. Rather rare but widespread in Europe.

Collections examined. NETHERLANDS: prov. Noord-Holland, Vogelenzang, 7 June 1986, *C.B. Uljé 629*; prov. Zuid-Holland, Leiden, 17 March 1971, *Kits van Waveren* (from cult.).

The small basidiocarps, cylindric-ellipsoid spores less than 10 µm long and the habitat on dung are characters to identify *Coprinus pseudoradiatus*. The other 4-spored and dung-inhabiting species *C. radiatus*, *C. macrocephalus* and *C. cinereus* have larger spores and larger fruit-bodies.

7. **Coprinus spelaiophilus** Bas & Uljé, *spec. nov.* — Fig. 7

Misapplied. Coprius extinctorius (Bull.) Fr. sensu Romagn., Rev. Mycol. 6 (1941) 112; Kühn. & Romagn., Fl. anal. Champ. sup. (1953) 387; Mos., Röhrlinge Blätterpilze. 5. Aufl.(1983) 256; Orton & Watl., Br. Fung. Fl. 2 (1979) 39; non *Agaricus extinctorius* Bull., Herb. France, pl. 437. (1790) non *Coprinus extinctorius* sensu Rick.

Selected icons. Cetto, Funghi Vero 6, 1st ed., pl. 2175. (1989) 53 (as *C. extinctorius*); Moreno et al., Guia Incafo Hongos Penins. Iberica I + II (1986) no. 304 (as *C. extinctorius*).

Pileus ad 35 mm latus, initio albus vel isabellinus, postea griseus vel griseo-brunneus, velo fibrilloso vel parce squamuliformi, albo vel argenteo postea brunneolo decoratus. Lamellae liberae, subconfertae, initio albae, mox griseo-brunneae vel subnigrae. Stipes 50–100 × 2–5 mm, basi clavatus vel subbulbosus ad 8 mm latus, albidus, cavus, fibrilloso-flocculosus, postea glabrescens, caro subtenacea.

Sporae 7.8–11.7 × 6.4–8.2 × 5.3–7.2 µm, late fusiformes vel rhombico-ellipsoideae, interdum subamygdaliformes, apice leviter truncatae, poro germinativo centrali, 1.5–1.8 µm lato instructae, obscure rubro-brunneae. Basidia tetraspora. Pleurocystidia 70–150 × 25–60 µm, subglobosa vel utriformia vel subcylindrica. Cheilocystidia 50–140 × 25–50 µm, utriformia vel subcylindrica. Pileipellis ex hyphis repentibus, 3–25 µm latis constans. Velum cellulis allantoideis, 25–150 × 10–40 µm, catenulatis constructum. Fibulae presentes.

Holotypus: *C. Bas 4966*, 14-X-1967, Vogelenzang, A.W. Dunes, the Netherlands (L).

Pileus up to 25 × 20 mm and ellipsoid to cylindric-ellipsoid when still closed, up to c. 35 mm wide when expanded, white to isabelline or pale ochraceous, becoming grey-brown with isabelline to ochre centre, radially sulcate up to centre; finally plano-concave with revolute margin, with veil in primordia smooth, mat, pure white to greyish, covering pileus entirely, but soon breaking up into scattered small, flocculose, fibrillose squamules with tips sometimes recurving and brownish. Lamellae, L = c. 45–60, l = 3–7, free, narrow, rather crowded, first white, soon greyish brown to blackish. Stipe 50–100 × 2–5 mm, whitish, somewhat tapering towards apex, up to 8 mm wide at clavate to bulbous base, hollow, hairy flocculose, and more densely so towards lower part, becoming glabrous with age. Context rather firm and somewhat tough.

Spores [100, 5, 5] 7.8–11.7 × 6.4–8.2 × 5.3–7.2 µm; Q = 1.20–1.50, av. Q = 1.35–1.40; av. L = 9.2–10.4, av. B = 6.5–7.6, av. W = 5.7–6.9 µm, very broadly fusiform or rhomboid-ellipsoid, sometimes somewhat amygdaliform, with (sub)conical or rounded base and slightly truncate apex, and central, c. 1.5–1.8 µm wide germ pore, dark red-brown. Basidia 18–38 × 8–10 µm, 4-spored, surrounded by 3–6 pseudoparaphyses. Pleurocystidia 70–150 × 25–60 µm, subglobose, ellipsoid to oblong, utriform or subcylindric. Cheilocystidia 50–140 × 25–50 µm, utriform, oblong or subcylindric. Pileipellis a cutis, made up of more or less parallel, repent hyphae, consisting of cylindrical to fusiform elements, 40–100 × 3–25 µm. Veil made up of elongate, sausage-like elements, 25–150 × 10–40 µm, often inflated, constricted at septa; terminal elements ellipsoid, oblong or fusiform. Clamp-connections present.

Habitat & distribution — Growing solitary or subfasciculate on wood, often in wounds of living, deciduous trees. Very rare, in the Netherlands only known from a few localities in the western and central parts of the country. In Europe under the name *C. extinctorius* furthermore recorded from England, France, Germany, Spain, Italy, and Turkey.

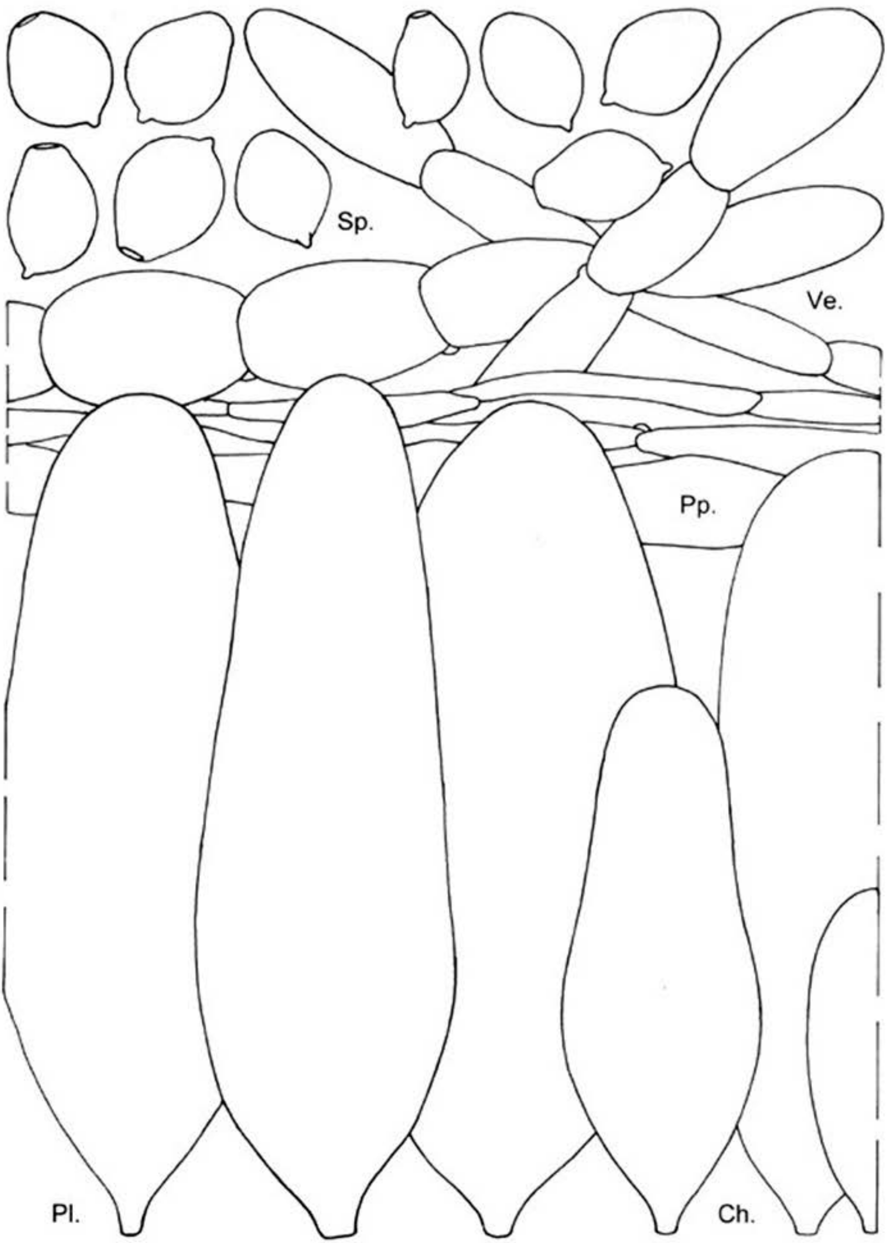

Fig. 7. *Coprinus spelaiophilus* Bas & Uljé. All figures from *C. Bas 4966* (holotype).

Collections examined. NETHERLANDS: prov. Gelderland, Wageningen-Hoog, 23 June 1957, *Ms. Veth.*; prov. Noord-Holland, Amsterdam, Hortus Botanicus, Jan. 1923, *K.B. Boedijn*; Vogelenzang, 31 Oct. 1953, *A.F.M. Reijnders*; idem, 14 Oct. 1967, *C. Bas 4966* (holotype, L); idem, 22 Sept. 1960, *C. Bas 2112*.

Macroscopically *Coprinus spelaiophilus* is a *C. domesticus*-like fungus, but it belongs to subsection *Lanatuli* on account of the structure of the veil, which consists of chains of inflated, thin-walled hyphoid elements. It can be recognized by the *C. domesticus*-like appearance, the initially white to isabelline colours of the pileus, the fairly firm context, the '*Lanatuli*'-like structure of the veil, the very broad, fusiform, 8–11 µm long spores and the habitat, viz. often growing in cavities of the trunk of living, deciduous trees *(Populus, Ulmus, Aesculus,* and *Fagus*).

It is difficult to understand that the name *Coprinus extinctorius* (Bull.) Fr. has been attached to the present species as Bulliard (l.c.: pl. 437, 1792/93: 408) described *Agaricus extinctorius* as very fugacious and growing on dung ('sur les fumiers'). Therefore *C. extinctorius* sensu auct. europ. p.p. maj. is described here as a new species.

8. **Coprinus lagopus** Fr.: Fr. — Fig. 8

Agaricus lagopus Fr., Syst. mycol. 1 (1821) 312; *Coprinus lagopus* Fr., Epicrisis (1838) 250.

Selected icons. Cetto, Funghi Vero 5, 1st ed., pl. 1722 (1987) 55; Courtec. & Duhem, Guide Champ. Fr. Eur. (1994) 776; Imazeki et al., Fungi Japan (1988) 203; M. Lange, Paddestoelengids (1964) 139; Orton & Watling, Br. Fung. Fl. (1979) 40; R. Phillips, Paddest. Schimm. (1981) 179.

Pileus up to 35 × 20 mm when still closed, up to c. 50 mm when expanded, first ellipsoid, cylindric-ellipsoid, pale to very dark grey-brown at centre beneath the whitish to silvery grey veil, paler towards margin, expanding to conical, then to convex or applanate, finally plano-concave with revolute margin. Veil first whitish, then silvery grey or pale grey to grey-brown, covering entire pileus, splitting up into hairy fibrillose, often pointed and appressed or – especially at centre – recurved flocks, the tips becoming brown on drying. Lamellae, L = c. 60, l = 3–7, free, narrow, rather crowded, first white, soon greyish brown to blackish. Stipe 50–100 × 2–5 mm, whitish, somewhat tapering towards apex, up to 8 mm wide at clavate to bulbous base, hollow, hairy flocculose, more dense at lower part, becoming glabrous with age.

Spores [360, 18, 16] 9.8–14.2 × 6.2–8.3 µm; Q = 1.40–1.95, av. Q = 1.55–1.80; av. L = 11.3–12.9, av. B = 6.8–7.8 µm, ellipsoid or ovoid, with rounded base and apex, dark red-brown, and central, c. 1.6–2.0 µm wide germ pore. Basidia 16–42 × 8–12 µm, 4-spored, surrounded by 3–6 pseudoparaphyses. Pleurocystidia 70–150 × 20–60 µm, ellipsoid to oblong, utriform or subcylindric. Cheilocystidia 50–100 × 18–40 µm, ellipsoid to oblong or subutriform. Pileipellis a cutis, made up of cylindrical, sausage-like or fusiform elements, up to 150 µm long and 4–35 µm wide. Veil made up of elongate, sausage-like elements, 40–140(–180) × 10–40 µm, often inflated, usually constricted at septa; terminal elements ellipsoid, ovoid or fusiform. Clamp-connections present.

Habitat & distribution — Common. Growing solitary or fasciculate on wood-chips, compost-heaps or vegetable refuse; one record (*J. Daams 184*) on large burned place. Widespread all over the world.

Collections examined. NETHERLANDS: prov. Overijssel, Oldenzaal, 29 Sept. 1980, *E. Kits van Waveren*; Delden, 27 July 1968, *E. Kits van Waveren*; prov. Utrecht, Amerongen, 16 Oct. 1960, *C. Bas 2271*; 's-Graveland, 22 Sept. 1968, *J. Daams 184*; Baarn, 24 April 1968, *G.A. de Vries*; Breukelen, 23 Aug. 1986, *C.B. Uljé*; Maarseveen, 8 May 1986, *C.B. Uljé*; Zeist, Wulperhorst, 13 Sept. 1953, *A.F.M. Reijnders*;

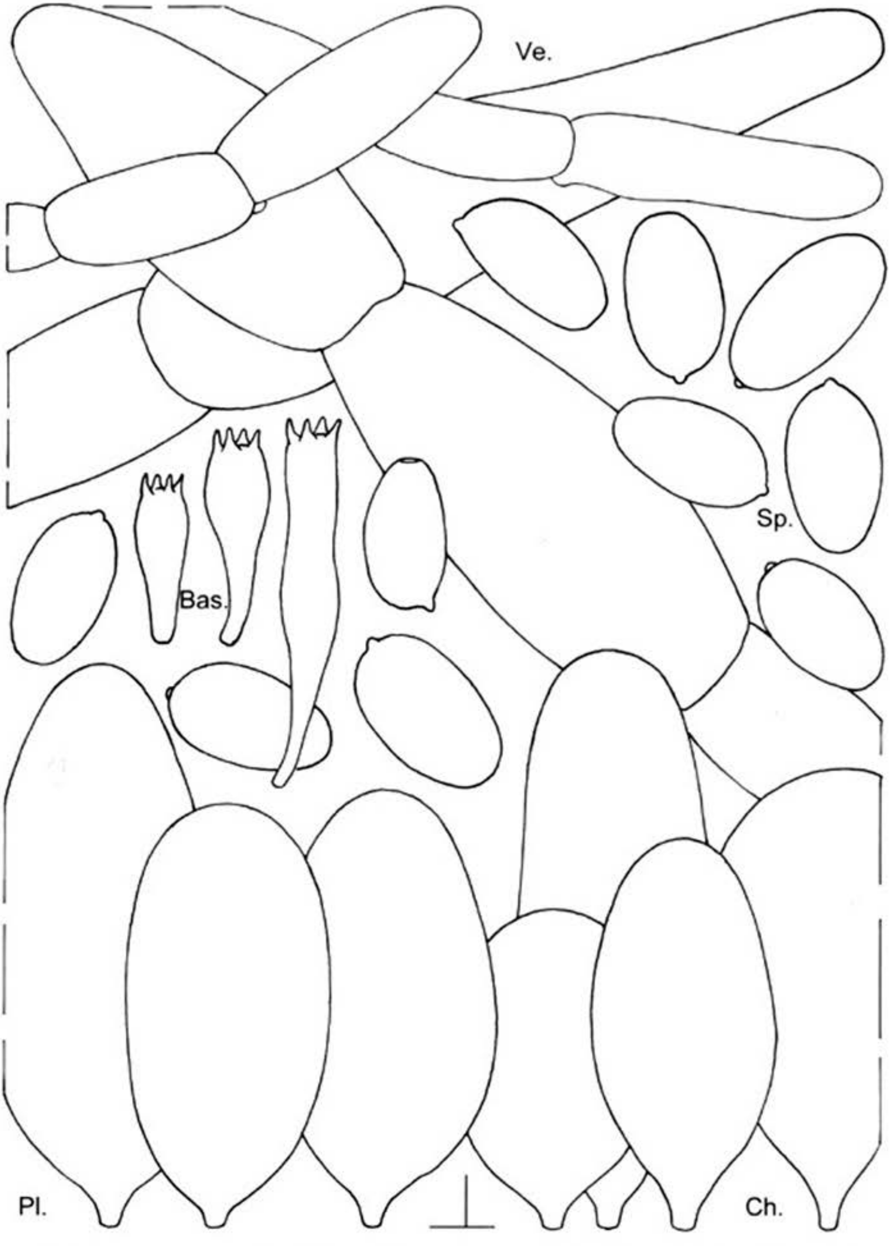

Fig. 8. *Coprinus lagopus* (Fr.: Fr.) Fr. All figures from *C.B. Uljé*, Alphen a/d Rijn, 16 May 1997.

prov. Noord-Holland, Amsterdam, Amsterdamse Bos, 30 April 1960, *E. Kits van Waveren*; idem, 19 May 1962, *E. Kits van Waveren*; idem, 12 Aug. 1967, *E. Kits van Waveren*; Elswout, 20 Oct. 1979, *E. Kits van Waveren*; prov. Zuid-Holland, Alphen a/d Rijn, 7 June 1988, *C.B. Uljé*; idem, 31 Aug. 1995, *C.B. Uljé*, 15 June 1996, *C.B. Uljé*; idem, 16 May 1997, *C.B. Uljé*; Leiden, 30 Aug. 1986, *C.B. Uljé*; Oostvoorne, 19 Oct. 1972, *H.S.C. Huijsman 259*.

Coprinus lagopus can be recognized by the terrestrial habitat, preferably to wood-chips or vegetable refuse, the dense, hairy fibrillose, whitish to silvery grey veil, the average spore length > 11 µm and average spore breadth > 6.7 µm, and the thin-walled veil with terminal elements up to c. 40 µm wide.

Close to *Coprinus lagopus* and exclusively growing in lawns, an aberrant form has been collected, characterized by very fragile basidiocarps that develop during the evening and night and quickly disappear the next morning, leaving only laying, silvery white stipes with collapsed caps and having somewhat larger (12–15 µm long) and very dark spores (collection *Uljé 1264* and *1268*). Also a form is known from greenhouses with larger spores (14–16 µm long), but different from *C. macrocephalus* that has spores of the same length but distinctly broader. For the time being we refrain from describing these taxa awaiting more material.

9. **Coprinus jonesii** Peck — Fig. 9

Coprinus jonesii Peck, Bull. Torrey bot. Club 22 (1895) 206.

Coprinus funariarum Métrod, Bull. Soc. mycol. Fr. 53 (1937) 348.

Coprinus lagopus var. *sphaerosporus* Kühn. & Joss., Bull. Soc. mycol. Fr. 60 (1944) 31.

Misapplied. Coprinus lagopides sensu P. Karst., Symb. Mycol. fenn. IX. Meddn Soc. Fl. Fauna fenn. 9 (1882) 48; sensu auct. eur. major. non *C. lagopides* P. Karst. 1879.

Selected icons. Brand & Pegler, Mycologist 5 (1991) 87; Courtec. & Duhem, Guide Champ. Fr. Eur. (1994) 778; Jahn, Westf. Pilzbr. 7 (1969) 84; R. Phillips, Paddest. Schimm. (1981) 179; Ryman & Holmåsen, Pilze (1992) 425 (all as *C. lagopides*).

Pileus up to 50 × 30 mm when still closed, up to c. 70 mm when expanded, first ellipsoid, cylindric-ellipsoid, pale to dark grey-brown at centre beneath the whitish to silvery grey veil, paler towards margin, expanding to conical, then to convex or applanate, finally plano-concave with revolute margin. Veil first white, later grey to grey-brown (Mu. 10 YR 4–5/3) and radially splitting up into hairy to fibrillose, often pointed and appressed or – especially at centre – recurved flocks, the tips becoming brown on drying. Lamellae, L = c. 55–80, l = 3–7, free, narrow, rather crowded, first white, soon greyish brown to blackish. Stipe 50–130 × 3–10 mm, whitish, somewhat tapering towards apex, up to 13 mm wide at clavate to bulbous base, hollow, hairy flocculose but particularly densely at lower part, becoming glabrous with age.

Spores [120, 6, 5] 6.7–9.7 × 5.8–8.2 µm; Q = 1.05–1.35, av. Q = 1.15–1.30; av. L = 7.2–8.7, av. B = 6.2–7.3 µm, ellipsoid or ovoid, seldom somewhat cylindric, with rounded base and apex, dark red-brown, and central, c. 1.4–1.7 µm wide germ pore. Basidia 16–40 × 7–9 µm, 4-spored, surrounded by 3–6 pseudoparaphyses. Pleurocystidia 50–140 × 20–55 µm, subglobose, ellipsoid to oblong, utriform or subcylindric. Cheilocystidia 35–85 × 15–50 µm, (sub)globose, ellipsoid to oblong. Pileipellis a cutis, made up of cylindrical, sausage-like or fusiform elements, up to 150 µm long and 4–35 µm wide. Veil made up of elongate, sausage-like elements, 50–180 × 15–40 µm, often inflated, usually constricted at septa; terminal elements cylindric to almost globose. Clamp-connections present.

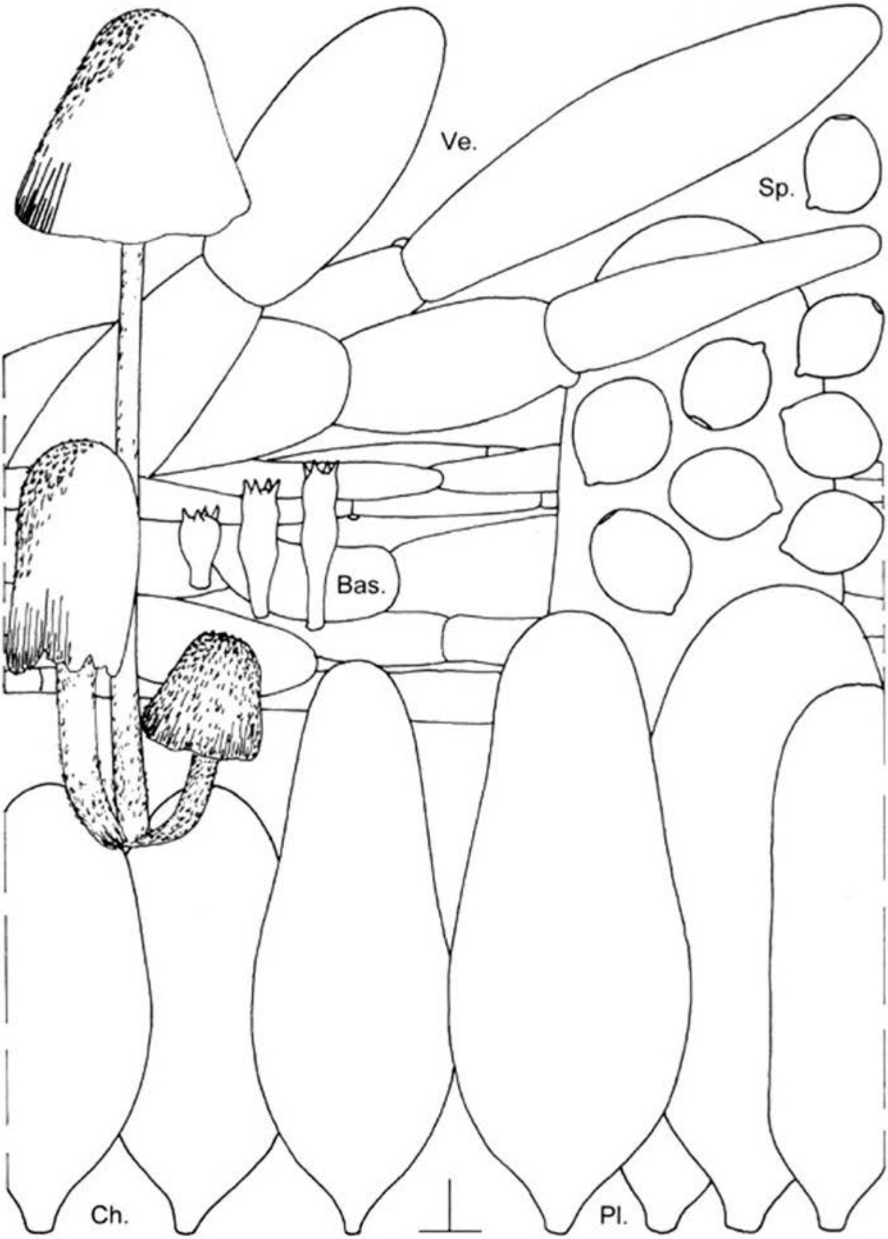

Fig. 9. *Coprinus jonesii* Peck. All figures from *C.B. Uljé 1214*.

Habitat & distribution — Growing solitary or fasciculate on burned places, less frequent on wood-chips or vegetable refuse. Rather rare but widespread in Europe and America.

Collections examined. USA: Burlington, April 1891, *L. R. Jones* (holotype, NYS). — FINLAND: Tammala, Mustiala, 4 Aug. 1884, *P. Karst. 3758* (as *C. lagopides*, H). — NETHERLANDS: prov. Utrecht, Leusden, estate 'den Treek', 2 July 1991, *J. Wisman* (herb. Wisman); prov. Zuid-Holland, Reeuwijk, Reeuwijkse Hout, 24 Oct. 1991, *C. B. Uljé 1214*; prov. Noord-Brabant, Tilburg, 15 March 1997, *B. Horvers* (L).

Additional collection examined. FINLAND: Tammala, Mustiala, 28 Oct. 1878, *P. Karst. 3757*, holotype of *C. lagopides*, H (= *C. phlyctidosporus*).

Karsten described *Coprinus lagopides* twice (Karsten, 1879, 1882). The first time he described a species with warty spores, similar to those of *C. phlyctidosporus* Romagn. (sect. *Alachuani*) for which it represents an older synonym. This synonymy is confirmed by a study of the holotype.

The second time Karsten (1882) described another collection as being *C. lagopides* which represents, however, another species with smooth spores, and it is this concept that generally has been accepted by later mycologists (Moser, 1978, 1983: 255; Orton & Watling, 1979: 41; Citerin, 1992: 23, 1994: 7).

From our studies of the original Karsten material, however, it becomes clear that the name *C. lagopides* cannot be used any more for this species. The oldest available legitimate name must then be *C. jonesii* Peck, which is confirmed by a study of the holotype.

10. **Coprinus ochraceolanatus** Bas — Fig. 10

Coprinus ochraceolanatus Bas, Persoonia 15 (1993) 362.
Coprinus citrinovelatus Ludwig & Roux, Z. Mykol. 61 (1995) 31.
Selected icon. Ludwig & Roux, l. c. 35 (as *C. citrinovelatus*).

Pileus up to 30 × 20 mm when still closed, up to 50 mm when expanded, ovoid, sometimes with truncate apex and irregular somewhat lobed margin, rather pale grey (Mu. 5 Y 6/1) at margin to somewhat darker near apex (5 Y 5/1; 2.5 Y 6/2–5/2; 7.5 YR 3/2 or 10 YR 4/3), deeply and densely sulcate at margin, sulcate striate near centre, with appressed (but in young buds suberect), long, thin, fibrillose, ochraceous to salmon-ochraceous (10 YR 7/4 –7/6) velar scales, condensed to a thin felted salmon-ochraceous patch at centre, sometimes becoming yellow. Lamellae, L = 36–41, l = 1–3 (–5), crowded, free, rather narrow (up to 4 mm wide), already in young buds fairly dark chocolate-brown (7.5 YR 3/2), finally dark greyish purple-brown (5 YR 2/2) with thin, pale ochraceous subflocculose edge. Stipe up to 80 × 5.5 mm, tapering upwards, hollow, subfasciculate to fasciculate, in some specimens with thin, up to 12 mm long pseudorhiza, slightly greyish whitish, densely fibrillose, with ochraceous tinge because of rather deeply ochraceous yellow superficial fibrils (under lens), especially near base sometimes with a few incomplete, pale ochraceous, floccose girdles or many small, similarly coloured scales. Context ± chocolate brown in centre of cap, slightly more greyish purple-brown in base of stipe, and paler along cavity of stipe; rest pale. Smell unpleasant, after dung (l.c.).

Spores [160, 8, 4] 8.3–13.8 × 5.7–7.5 µm; Q = 1.45–2.10, av. Q = 1.55–1.85; av. L = 9.4–12.5, av. B = 6.1–7.1 µm, ellipsoid to ovoid with rounded base and apex, red-brown, and central, 1.5–1.8 µm wide germ pore. Basidia 15–38 × 8–11 µm, 4-spored, surrounded by (3–)4–6(–7) pseudoparaphyses. Pleurocystidia 50–140 × 20–50 µm, elongate ellipsoid, subglobose, cylindric or broadly fusiform. Cheilocystidia 30–120 × 15–50 µm, in very

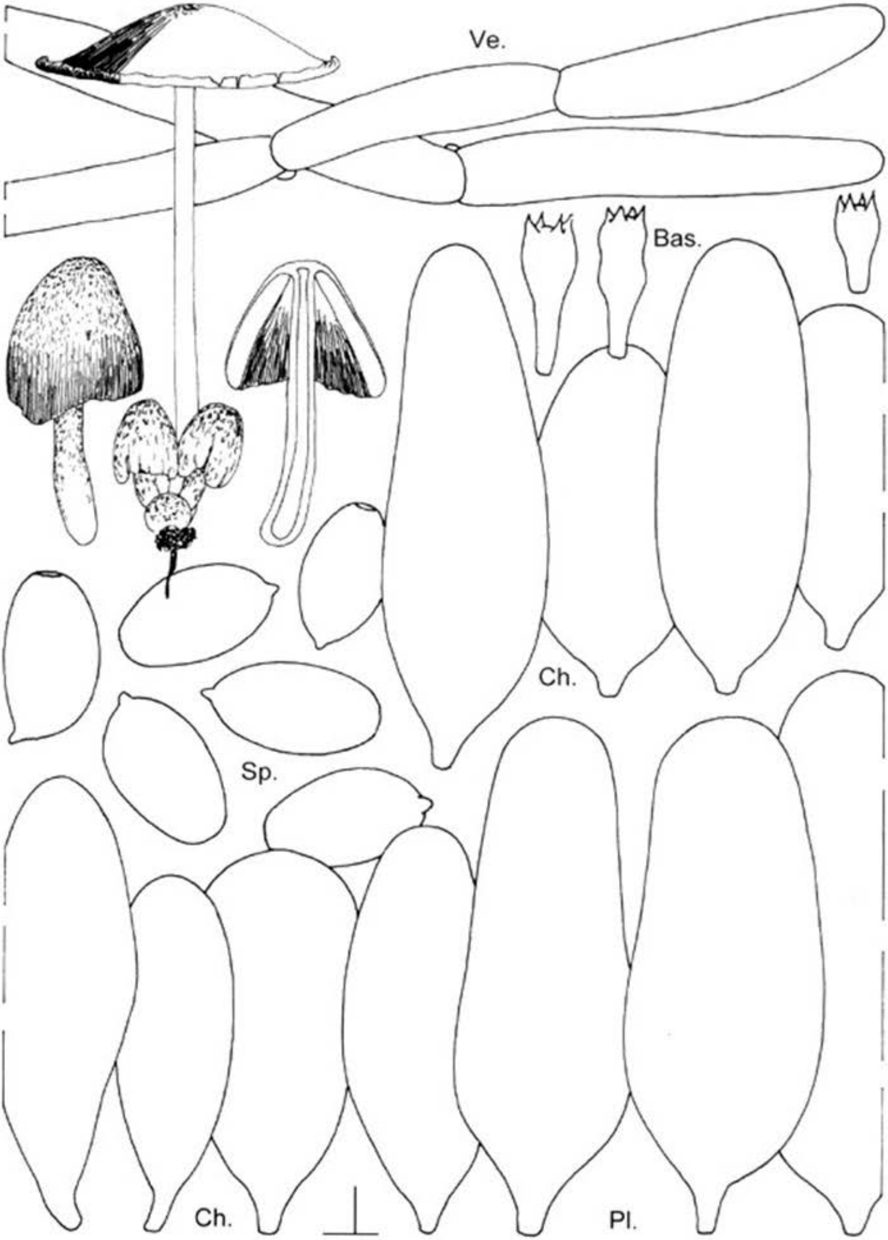

Fig. 10. *Coprinus ochraceolanatus* Bas. All figures from *C. Bas 5813* (holotype).

young pileus subglobose or vesiculose, later rather more elongate or ellipsoid, clavate, oblong, vesiculose or cylindric. Pileipellis consisting of repent radial chains of ± cylindrical to inflate elements, up to 150 µm long and 4–25 µm wide. Veil made up of parallel, yellowish, granular-incrusted hyphae of 45–200 × 7–20 µm large elements, often somewhat fusiform, not or only slightly constricted at septa. Incrustations on velar hyphae persistent in HCl 10% and alcohol, loosening in KOH and NH_4OH and dissolving in Melzer's reagent. Clamp-connections present.

Habitat & distribution — Fasciculate on old mud taken out of ditch one year earlier in old deciduous forest on sandy clay with much humus and forest litter; gregarious on woodchips; near old stump of tree. Rare in Germany and the Netherlands.

Collections examined. GERMANY: Berlin-Düppel, 30 May 1982, *E. Ludwig* (holotype *C. citrinovelatus*, B). — NETHERLANDS: prov. Utrecht, Maarseveen, Zuidplas, 15 May 1982, *C.B. Uljé 313*; prov. Zuid-Holland, Voorschoten, 'Ter Wadding', 31 May 1972, *C. Bas 5813* (holotype, L); Ter Aar, 'de Put', 9 May 1990, *C.B. Uljé 1062*.

Coprinus ochraceolanatus is rather similar to *C. lagopus*, but differs in having more slender and densely incrusted velar elements (up to 20 µm wide), whereas *C. lagopus* has smooth velar elements which are much more inflated (up to 40 µm wide). Macroscopically the colour of the veil of *C. ochraceolanatus* is yellowish ochre, in *C. lagopus* whitish or greyish, more rarely pale yellow but then the hyphal walls are not incrusted. See for extensive discussion on *C. ochraceolanatus* Uljé & Bas (1993: 363).

The macroscopical characters like the colour of the veil, the size of the basidiocarps, and the substrate of wood suggested that *C. citrinovelatus* is identical to *C. ochraceolanatus*. Therefore we studied the type-material of *C. citrinovelatus*. The microscopical features agree very well with those of *C. ochraceolanatus*. In particular the yellow incrusted elements of the veil, less than 20 µm thick [most species in subsect. *Lanatuli* have veil up to 40(–50) µm wide] is a significant character in our opinion. We could not find in the type material the more or less branched veil as depicted in the original description, but only typical '*Lanatuli*'-veil. Therefore we consider *C. citrinovelatus* a synonym of *C. ochraceolanatus*.

Our observations on the holo- and isotype of *C. citrinovelatus*: spores [100, 2, 1] 11.0–13.8 × 6.5–7.5 µm; Q = 1.60–1.95, av. Q = 1.70–1.85; av. L = 11.7–12.5, av. B = 6.7–7.1 µm, with central, c. 1.8 µm wide germ pore, dark red-brown. Basidia 18–34 × 8–10 µm, surrounded by 4–6 pseudoparaphyses. Pleurocystidia not found (poor material) but noticed in original description. Cheilocystidia 50–90 × 18–32 µm, ellipsoid, oblong, subcylindric or subutriform. Veil made up of chains of hyphoid elements, 60–150 × 8–14 µm, yellowish incrusted. Clamp-connections present.

11. **Coprinus macrocephalus** (Berk.) Berk. — Fig. 11

Agaricus macrocephalus Berk., Hooker's British Flora 5 (1836) 122; *Coprinus macrocephalus* (Berk.) Berk., Outl. Brit. Fung. (1860) 180.

Selected icons. Cetto, Funghi Vero 6, 1st ed., pl. 2173 (1989) 49; Elfström, Jordstjärnan 13 (3) (1992) front cover; Krieglsteiner et al., Z. Mykol. 48 (1982) opposite 73; R. Phillips, Paddest. Schimm. (1981) 176.

Pileus up to 30 × 18 mm when still closed, up to c. 40 mm when expanded, first ellipsoid or cylindric-ellipsoid, pale grey-brown to dark grey-brown at centre beneath the whitish to

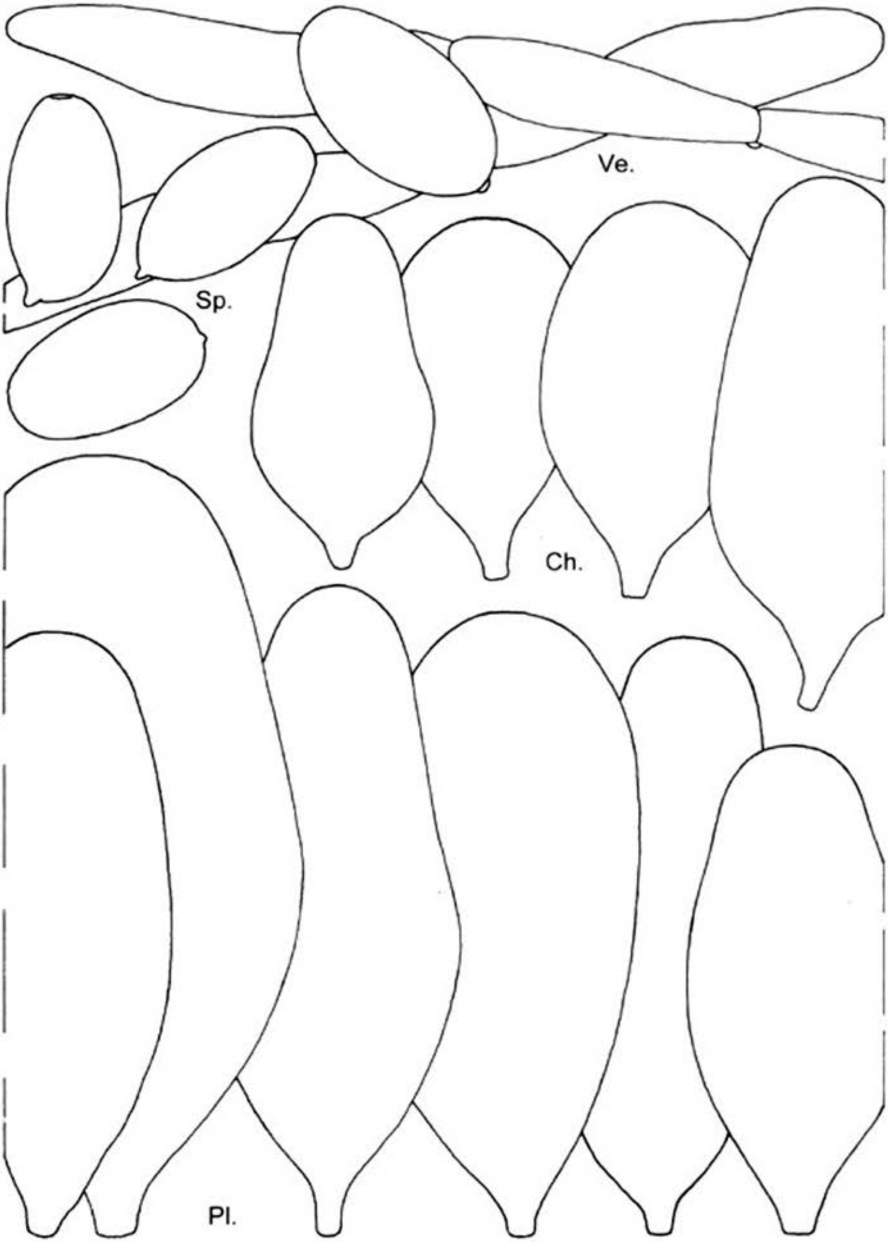

Fig. 11. *Coprinus macrocephalus* (Berk.) Berk. All figures from collection *C.B. Uljé*, Alphen a/d Rijn, 22 May 1985.

silvery grey veil, paler towards margin, expanding to conical, then to convex or applanate, finally plano-concave with revolute margin. Veil pale grey, silvery grey or grey-brown, covering entire pileus, splitting up into hairy to fibrillose, often pointed and appressed or recurved flocks, the tips becoming brown on drying. Lamellae, L = c. 60, l = 3–7, free, narrow, rather crowded, first white, soon greyish brown to blackish. Stipe 50–150 × 2–6 mm, whitish, somewhat tapering towards apex, up to 8 mm wide at clavate to bulbous base, hollow, hairy flocculose but particularly densely at lower part, becoming glabrous with age; base clavate and sometimes somewhat rooting.

Spores [100, 5, 5] 12.2–16.8 × 8.2–9.8 µm; Q = 1.45–1.80, av. Q = 1.55–1.75; av. L = 13.0–14.9, av. B = 8.4–9.3 µm, ellipsoid or ovoid, seldom somewhat cylindric, with rounded base and apex, dark red-brown, and central, c. 2 µm wide germ pore. Basidia 16–36 × 9–11 µm, 4-spored, surrounded by 3–6 pseudoparaphyses. Pleurocystidia 70–150 × 20–60 µm, utriform, ellipsoid, oblong or subcylindric. Cheilocystidia 50–120 × 20–50 µm, utriform, ellipsoid or oblong. Pileipellis consisting of repent radial chains of ± cylindrical to inflate elements, up to 150 µm long and 4–35 µm wide. Veil made up of elongate, sausage-like elements, 40–180 × 10–35 µm, often inflated, usually constricted at septa; terminal elements oblong or fusiform. Clamp-connections present.

Habitat & distribution — Growing solitary or fasciculate on mixed dung, rotten hay or vegetable refuse. Widespread but rare.

Collections examined. NETHERLANDS: prov. Utrecht, Baarn, Feb. 1984, *K. Seaford*; prov. Noord-Holland, Amsterdam, Artis, 3 Dec. 1968, *H. v.d. Aa 1042*; prov. Zuid-Holland, Alphen a/d Rijn, 22 May 1985, *C.B. Uljé*; Ter Aar, Langeraar, 13 May 1982, *C.B. Uljé*; prov. Zeeland, Terneuzen, Driewegen, 25 May 1981, *A. de Meyer 289*.

Coprinus macrocephalus is close to *C. lagopus*, *C. cinereus* and *C. radiatus*. It differs from *C. lagopus* in the habitat on dung, mixed dung or rotten hay and the larger spores. From *C. cinereus* and *C. radiatus* it differs in the larger and broader spores.

12. **Coprinus erythrocephalus** (Lév.) Fr. — Fig. 12

Agaricus erythrocephalus Lév., Ann. Sci. Nat., Series 2, 16 (1841) 237; *Coprinus erythrocephalus* Fr., Hymenomyc. eur. (1874) 327.

Misapplied. Coprinus dilectus s. J. Lange, Dansk bot. Ark. 2 (3) (1915) 36, 40 and Fl. agar. Dan. 4 (1939) 109.

Selected icons. Bender & Enderle, Z. Mykol. 54 (1988) between 48 and 49; Cetto, Funghi Vero 6, 1st ed., pl. 2170 (1989) 45; Donelli & Simonini, Riv. Mycol. 2 (1995) 126; J. Lange, Fl. agar. Dan. 4 (1939) pl. 157A.

Pileus 10–20(–25) × 5–10 when still closed, up to 30(–40) mm when expanded, first ellipsoid or ovoid, then campanulate to convex, finally flat, brown (Mu. 7.5 YR 4/2–5/2) beneath the rust-coloured or orange-red veil (Mu. 5 YR 5/8, 7.5 YR 5/8–4/6), that disappears soon and often forms a slimy layer in wet conditions. Lamellae (number of lamellae not noted) first whitish with rust-coloured edge, soon brown to blackish. Stipe up to 100 × 2–4 mm, white, hollow, sometimes with pinkish tinge, upper part white floccose, lower part covered with orange, rust-coloured veil, dense at base; base up to 5 mm, somewhat rooting and with white mycelium. Smell weak, indistinct or somewhat after apricot (collection *v.d. Aa 10161*).

Spores [300, 15, 15] 7.7–13.2 × 5.0–7.8 µm; Q = 1.45–1.90, av. Q = 1.55–1.70; av. L = 8.7–12.0, av. B = 5.3–7.6 µm, ellipsoid or ovoid with conical or (sometimes) rounded base

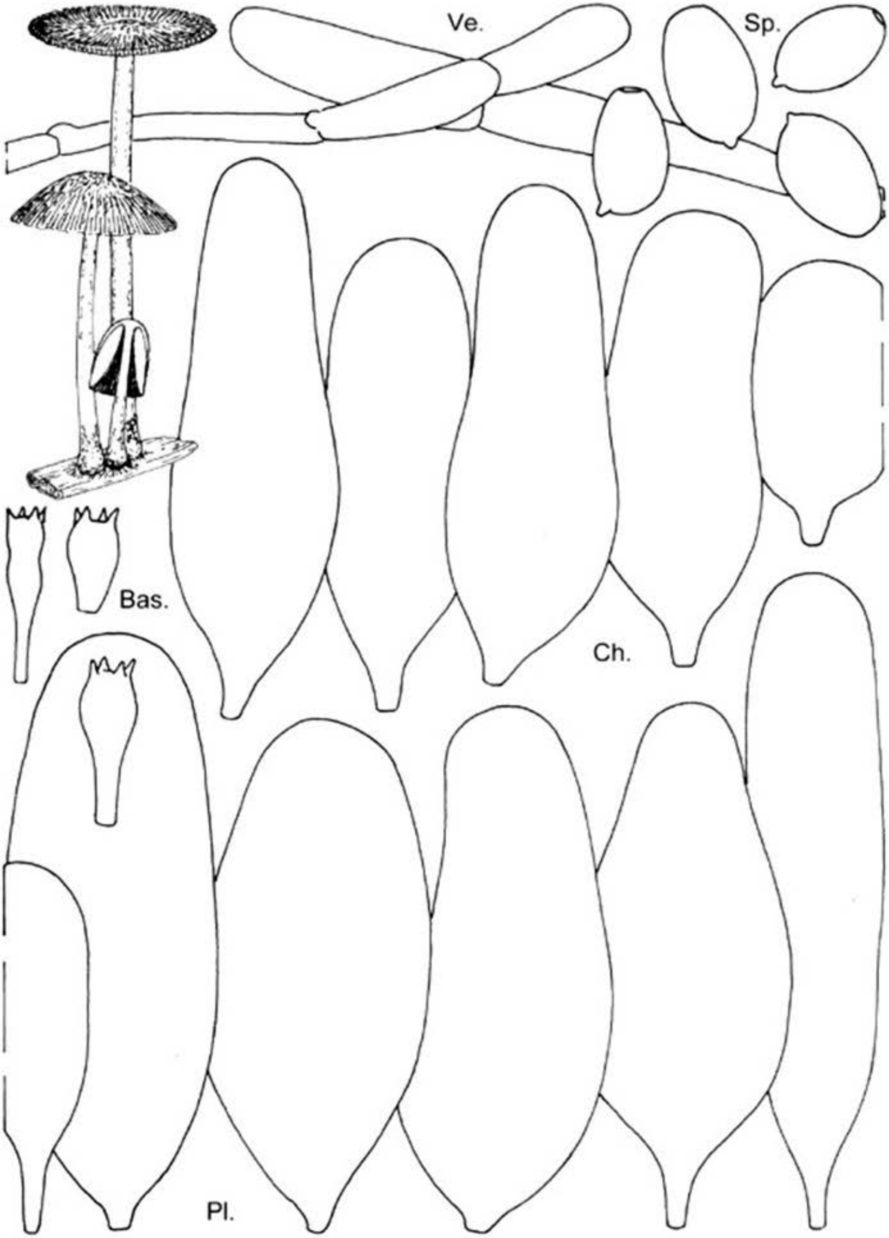

Fig. 12. *Coprinus erythrocephalus* (Lév.) Fr. All figures from collection *W.D.J. Kuijs*, Middelharnis, 26 Nov. 1988.

and rounded or somewhat truncate apex, dark red-brown, and central, c. 1.8 µm wide germ pore. Basidia 16–34 × 8–10 µm, 4-spored, surrounded by 3–6 pseudoparaphyses. Pleurocystidia 80–130 × 25–40 µm, ellipsoid, oblong, subcylindric or (sub)utriform. Cheilocystidia 30–50 × 15–25 µm, subglobose, ellipsoid, less frequent oblong, subcylindric or (sub)utriform. Pileipellis a cutis, made up of cylindrical, more or less parallel, repent hyphae. Veil made up of cylindrical, 3–20 µm wide elements and strongly incrusted. Incrustations of veil and cystidia yellowish or orange-brown pigmented. Clamp-connections present.

Habitat & distribution — Not common, usually gregarious on heaps of wood-chips or vegetable refuse, often at pieces of wood or in grass amidst *Urtica*.

Collections examined. NETHERLANDS: prov. Flevoland, Almere-Nijkerk, 30 Oct. 1976, *J. Daams 76-23*; Muiderzand, 22 Nov. 1976, *H. v.d. Aa 5541/J. Daams 76-57*; prov. Gelderland, Neerijnen, 13 Aug. 1977, *P. Jansen 77-368*; prov. Utrecht, Haarzuilens, 8 Aug. 1987, *J. Daams* (*H. v.d. Aa 10161*); Neerijnen, estate 'Neerijnen', 29 Sept. 1981, *J. Schreurs*; prov. Noord-Holland, Enkhuizen, 17 Oct. 1989, *J. Schreurs & E.C. Vellinga* (*ECV 1643*); Amsterdam, Vondelpark, 22 Oct. 1958, *E. Kits van Waveren*; idem, Nov. 1958; idem Oct.–Dec. 1958; prov. Zuid-Holland, Alphen a/d Rijn, 16 Sept. 1995, *C.B. Uljé*; Leiden, Leidse Hout, 20 Oct. 1983, *C.B. Uljé*; Leiderdorp, 17 Sept. 1967, *P.W. Leenhouts 1713*; Goeree-Overflakkee, Middelharnis, 26 Nov. 1991, *R. Chrispijn*; Schouwen-Duiveland, Westerschouwen, Verklikkersduin, 26 Oct. 1988, *W.D.J. Kuijs*; Hontenisse, 'Den Doolhof', 6 Nov. 1982, *A. de Meijer 672*.

Coprinus erythrocephalus can easily be recognized by the beautiful, orange veil, that, however, quickly disappears, but remains visible at the base of the stipe for a rather long time.

13. **Coprinus geesterani** Uljé — Fig. 13

Coprinus geesterani Uljé, Persoonia 14 (1992) 565.

Pileus up to 9 × 8 mm when still closed, up to 18(–27) mm when expanded, first ellipsoid, cylindric-ellipsoid, ovoid or (sub)globose, expanding to campanulate or conical, then to convex or applanate, finally plano-concave with revolute margin, very thin, soon wilting, white in very young stage, soon becoming grey or grey-brown, the darkest (Mu. 5 YR 2.5/1, 3/2; 10 YR 3/2) at centre of pileus. Veil in primordia smooth, mat, pure white, later grey to grey-brown, covering entire pileus, soon radially splitting into hairy to fibrillose, often pointed and appressed or – especially at centre – recurved flocks. Lamellae, L = 34–40, l = 0–3, free, narrow, rather crowded, first white, soon grey to blackish. Stipe 15–45 × 1–2 mm, whitish, somewhat tapering towards apex, up to 3 mm wide at clavate to slightly bulbous base, hollow, hairy flocculose but particularly densely at lower part, becoming glabrous with age.

Spores [240, 12, 8] 5.6–8.8(–10.6) × 4.3–5.8(–7.1) µm; Q = 1.15–1.70, av. Q = 1.35–1.45; av. L = 6.6–7.8(–9.2), av. B = 4.8–5.4(–6.5) µm, ellipsoid to ovoid tending to mitriform or rhomboid, with rounded or slightly conical base and rounded apex, dark red-brown, and central, 1–1.5 µm wide germ pore. Basidia 18–32 × 7–11 µm, 4-spored, surrounded by (3–)4–5(–6) pseudoparaphyses. Pleurocystidia 70–125 × 22–33 µm, ellipsoid to ovoid, oblong or narrowly utriform, the latter 7–13 µm wide below apex. Cheilocystidia in very young pileus broadly utriform, then rather elongate and ellipsoid, clavate, narrowly (conico-)utriform or oblong, 25–105 × 12–40 µm, the narrowly utriform ones 7–12 µm in diam. below apex. Pileipellis consisting of short, inflated elements, covered

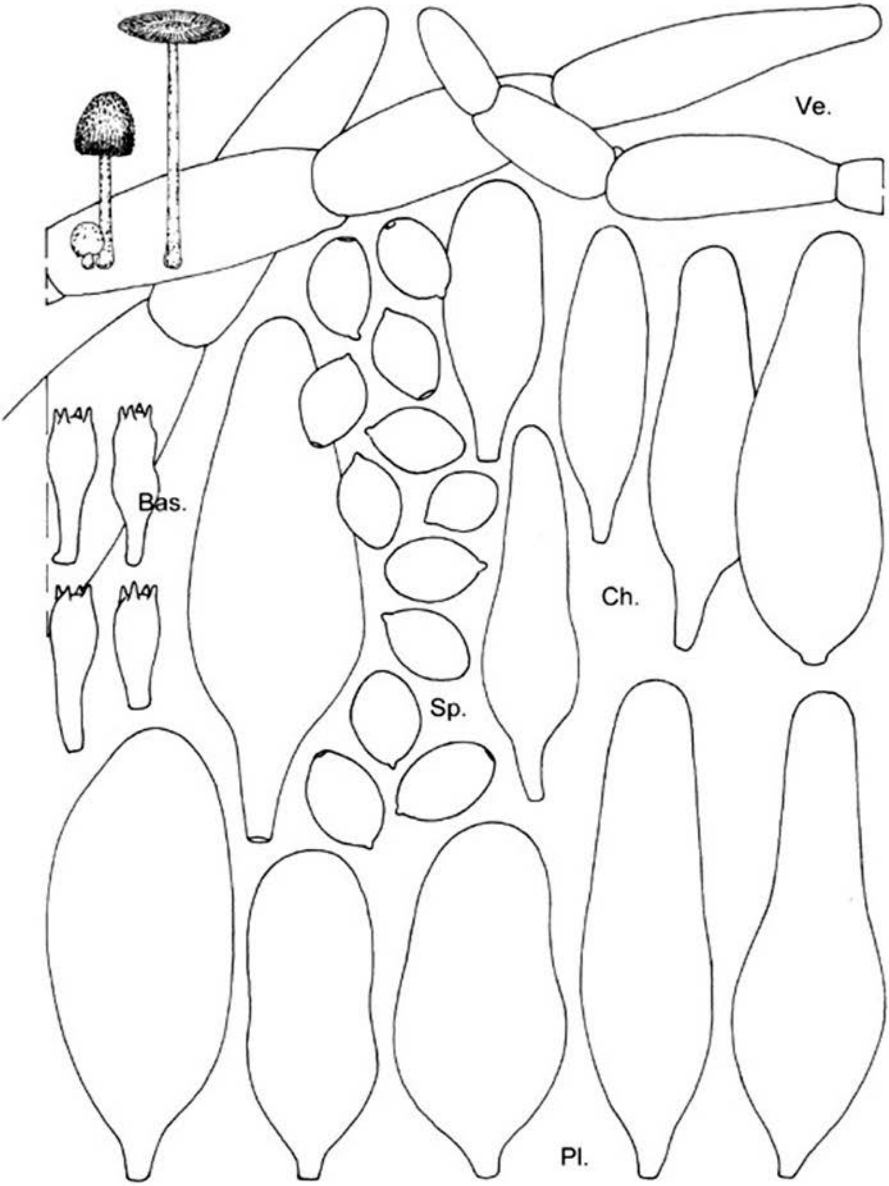

Fig. 13. *Coprinus geesterani* Uljé. All figures from *C.B. Uljé 1078* (holotype).

with a thin layer of filamentous hyphae. Veil made up of hyphae consisting of sausage-like elements, 20–150 × 5–40 µm, often somewhat inflated, usually constricted at septa. Clamp-connections present.

Habitat & distribution — Solitary or (sub)fasciculate on soil mixed with pieces of wood, on very decayed wood-chips and on composted vegetable refuse. Rare. Only known from the Netherlands.

Collections examined. NETHERLANDS: prov. Zuid-Holland, Alphen a/d Rijn, 22 May 1988, *C.B. Uljé 902*; 17 May 1990, *C.B. Uljé 1065*; 7 June 1990, *C.B. Uljé 1069*; 4 July 1990, *C.B. Uljé 1078* (type); 10 July 1990, *C.B. Uljé 1087*; Ter Aar, 24 Oct. 1986, *C.B. Uljé 804*; 3 Sept. 1986, *C.B. Uljé 830*; Boskoop, 12 June 1990, *C.B. Uljé 1074*.

Coprinus geesterani is characterized by the small fruit-bodies and ellipsoid to ovoid spores tending to mitriform or rhomboid, on average less than 9 µm long.

The closest species *C. pseudoradiatus* often grows on dung, less frequent on naked soil (probably mixed with dung) and has more ellipsoid or oblong and usually cylindric spores with a rounded, never somewhat conical base and a quotient more than 1.45. *Coprinus jonesii* has spores similar in shape and size to those of *C. geesterani* (although usually slightly broader), but that species has much larger fruit-bodies and grows generally on burnt ground or on more fresh wood-chips.

14. **Coprinus kriegIsteineri** Bender — Fig. 14

Coprinus kriegIsteineri Bender, Beitr. Kenntn. Pilze Mitteleur. III (1987) 215.
Selected icon. Bender l.c. between 216 and 217.

Pileus up to 8–20 × 4–7 mm when still closed, up to 15–30(–40) mm when expanded, first ellipsoid or cylindric-ellipsoid, whitish to pale grey with hazel- to dark brown centre (Mu. 7.5 YR 3/2; K. & W. 7F8), and covered with very thin, cobweb-like, silky veil (veil more dense at margin), then becoming campanulate or conical and grey-brown, dark at centre (Mu. 10 YR 4/2; K. & W. 6D3), paler towards margin (Mu. 10 YR 6/2; K. & W. 5D3). Lamellae, L = c. 40, l = 0–3, free, first white, then brown, finally black. Stipe up to 80 × 1–2 mm, white, hollow, minute hairy floccose but more densely at equal to clavate, often somewhat rooting base.

Spores [100, 5, 4] 9.7–14.1 × 5.8–7.2 µm; Q = 1.65–2.05, av. Q = 1.80–1.95; av. L = 11.0–12.8, av. B = 6.1–6.6 µm, oblong, ellipsoid or ovoid with rounded base and apex, dark red-brown, and central, c. 1.4 µm wide germ pore. Basidia 22–43 × 9–11 µm, 4-spored, surrounded by 4–6(–7) pseudoparaphyses. Pleurocystidia 70–160 × 28–55 µm, utriform, subcylindric or oblong. Cheilocystidia 35–115 × 18–45(–55) µm, ellipsoid (often conical), subglobose, (broadly) utriform, or subcylindric. Pileipellis a cutis, made up of cylindrical or fusiform, in part inflate, more or less parallel, repent hyphae. Veil 50–150(–200) × 9–18 µm, made up of short chains, up to 4 cylindrical elements; terminal elements often somewhat fusiform; veil elements on stipe often diverticulate. Clamp-connections present.

Habitat & distribution — Growing solitary or a few together (subfasciculate). Very rare on paths with wood-chips. Known only from Germany (3 localities) and the Netherlands (1 locality).

Collections examined. GERMANY: Neersbroich, 24 Aug. 1982, *H. Bender*; Mönchengladbach, Volkgarten, 8 Aug. 1984, *H. Bender*; idem, 6 Sept. 1990, (all collection herb. Bender). — NETHERLANDS: prov. Utrecht, Breukelen, estate Nijenrode, 16 July 1996, *C.B. Uljé 1296/1298*.

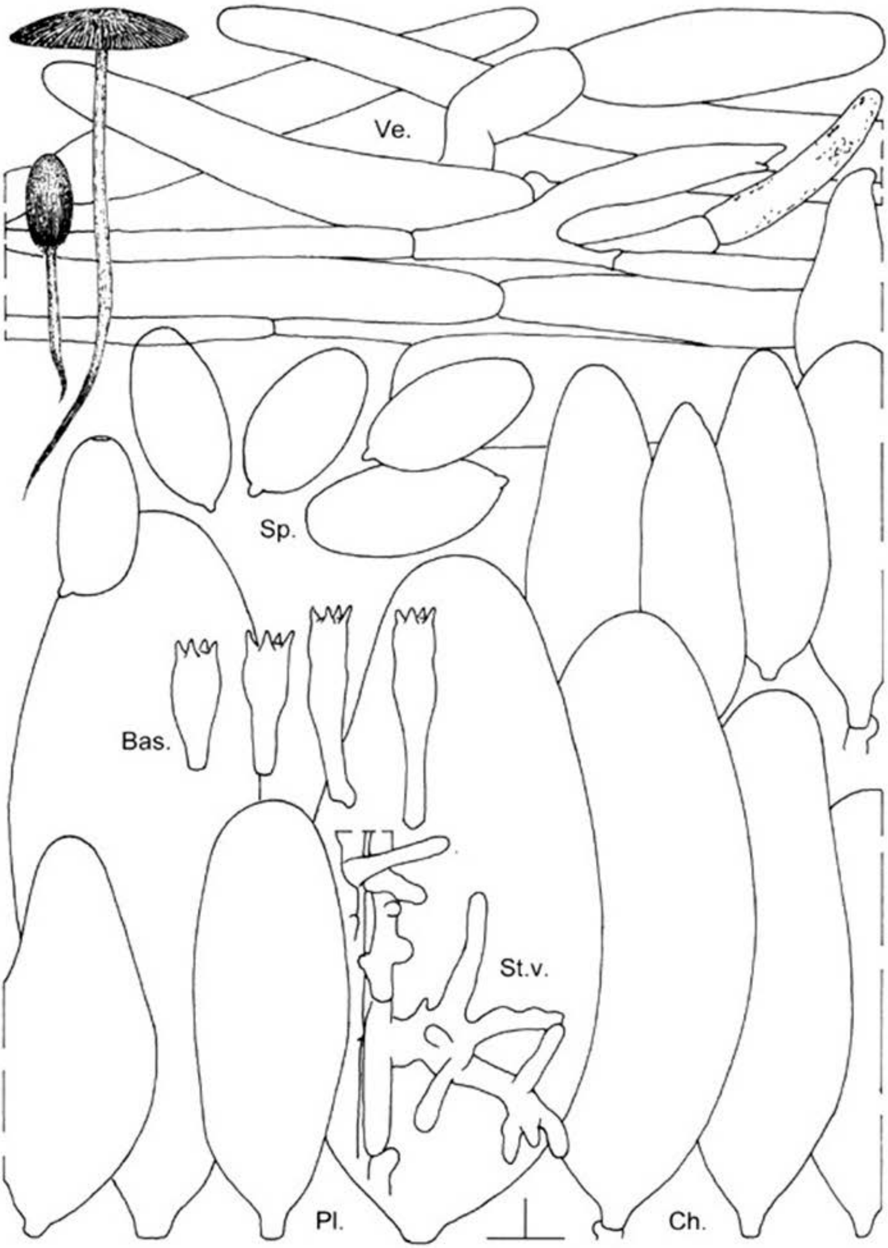

Fig. 14. *Coprinus krieglsteineri* Bender. All figures from *C.B. Uljé 1296.*

Coprinus krieglsteineri can be recognized by the thin, cobweb-like veil on the pileus, which gives the young basidiocarps a silky gloss. The veil soon disappears but remains visible for a long time at margin.

15. **Coprinus scobicola** P.D. Orton — Fig. 15

Coprinus scobicola P.D. Orton, Notes R. bot. Gdn Edinb. 32 (1972) 147.
Coprinus bilanatus Kemp (nom. prov.), Trans. Br. mycol. Soc. 65 (1975) 380 [invalid].

Pileus 5–20 × 3–14 mm when still closed, expanded up to 35 mm in diam., first grey to grey-brown, later at centre becoming pale and greyish or yellowish grey-brown. Lamellae (number not noted) very crowded, white to dark grey-brown, finally black. Stipe up to 100 × 2–5 mm, white, hollow, hairy floccose, especially in lower part, and slightly broadening towards somewhat bulbous base.

Spores [160, 8, 7] (9.0–)9.7–14.0(–16.3) × 7.1–9.8(–10.4) µm; Q = 1.25–1.60, av. Q = 1.30–1.50; av. L = 10.6–13.3, av. B = 8.1–9.1 µm, broadly ellipsoid or ovoid with rounded base and apex, medium to dark red-brown, and central, c. 1.3 µm wide germ pore. Basidia 14–38 × 7–10 µm, 2-spored, surrounded by (3–)4–5(–6) pseudoparaphyses. Pleurocystidia 70–110 × 26–37 µm, elongate ellipsoid, ellipsoid or (sub)cylindric. Cheilocystidia 35–75 × 17–38 µm, (sub)globose, ellipsoid, ovoid, broadly subcylindric or slightly utriform. Veil made up of cylindrical, often inflate or fusoid elements, 40–280 × 4–40(–70) µm. Clamp-connections present.

Habitat & distribution — Growing subfasciculate on sawdust and compost. Very rare. In the Netherlands only known from greenhouses.

Collections examined. UNITED KINGDOM: England, Devon, Plym Bridge, on sawdust, 29 Aug. 1956, *Orton 964* (holotype, E); Scotland, Edinburgh (gh, culture from collection *Daams 71-81*), 3 Febr. 1973, *R.F.O. Kemp 777* (culture). — NETHERLANDS: prov. Gelderland, Huissen, 8 March 1976, *H.F. v.d. Laan* (gh); prov. Utrecht, Maarseveen, 7 Apr. 1971, *J. Daams 71-81* (gh); prov. Noord-Holland, Kortenhoef, 29 March 1972, *J. Daams 72-72* (gh); idem, 25 April 1972, *J. Daams 72-104* (gh); idem, 4 April 1973, *J. Daams 789* (gh); prov. Zuid-Holland, Leidschendam, 31 Dec. 1973, *H. v.d. Laan* (gh).

The 2-spored basidia, hyphoid veil and its habitat on sawdust or compost make *Coprinus scobicola* easily to recognize. The only other species in subsect. *Lanatuli* with 2-spored basidia, *C. bicornis*, differs by having a mixed veil with ellipsoid to subglobose elements, much smaller basidiocarps and growth on dung.

The collections of J. Daams are labelled with the name *C. bilanatus* Kemp nom. prov. (Kemp 1975: 380) but these collections fit well with the type-material of *C. scobicola*.

16. **Coprinus pachydermus** Bogart — Fig. 16

Coprinus pachydermus Bogart, Mycotaxon 8 (1979) 274.

Pileus up to 15 × 8 mm when still closed, 18–25(–30) mm when expanded, cylindric-ellipsoid at first, later campanulate, finally applanate or even revolute at deliquescence, greyish white at first, with a grey or grey-brown disc, covered with hairy fibrillose, greyish veil, brownish at the centre, split up toward the periphery in small upturned browning scales. Lamellae (number not noted) fully deliquescent, ascending, free, narrow, very crowded, 2–5 mm high, white at first, then grey and finally blackish, with a lighter, whitish but turning to pink, scurfy edge. Stipe 40–80 × 1–3 mm, white, up to 4 mm at the base, slightly tapering

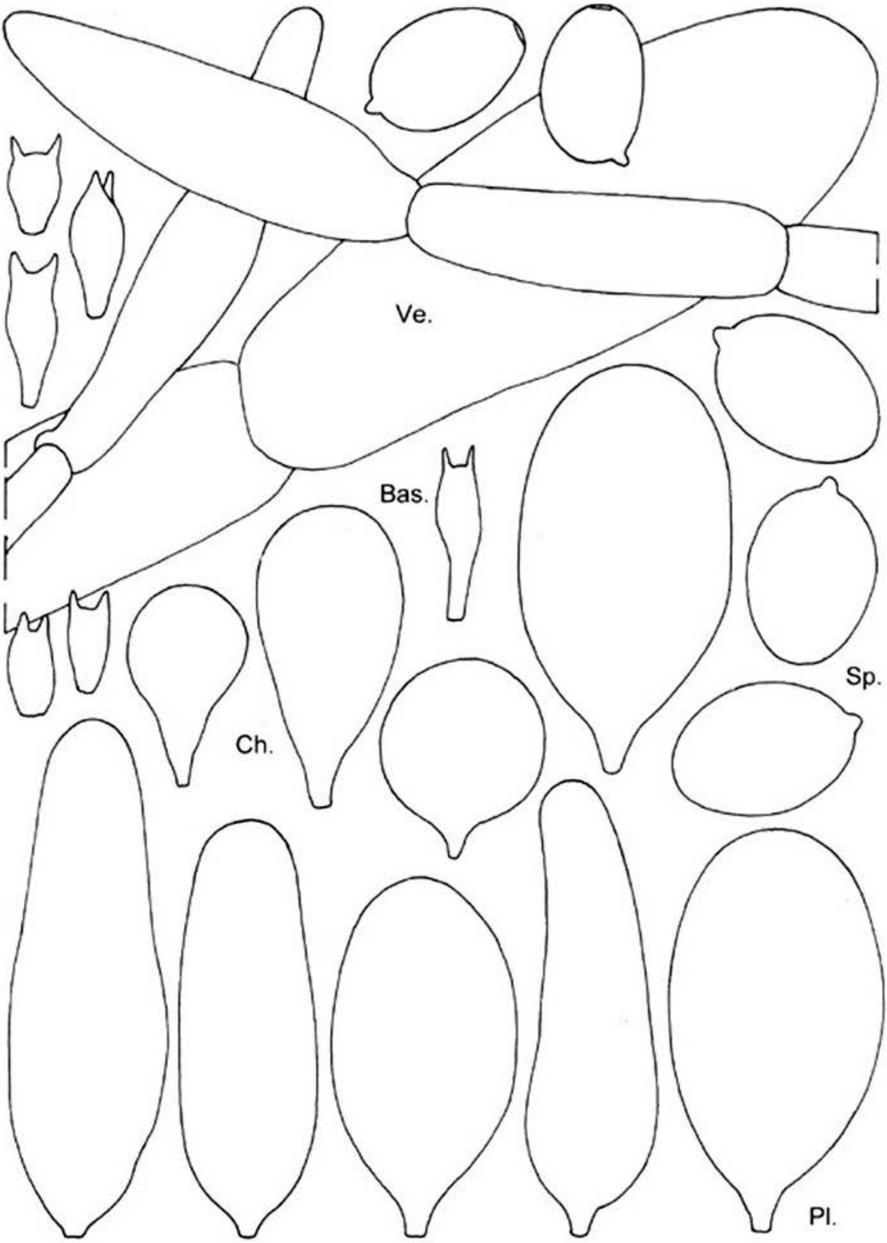

Fig. 15. *Coprinus scobicola* P.D. Orton. All figures from *P.D. Orton 964* (holotype).

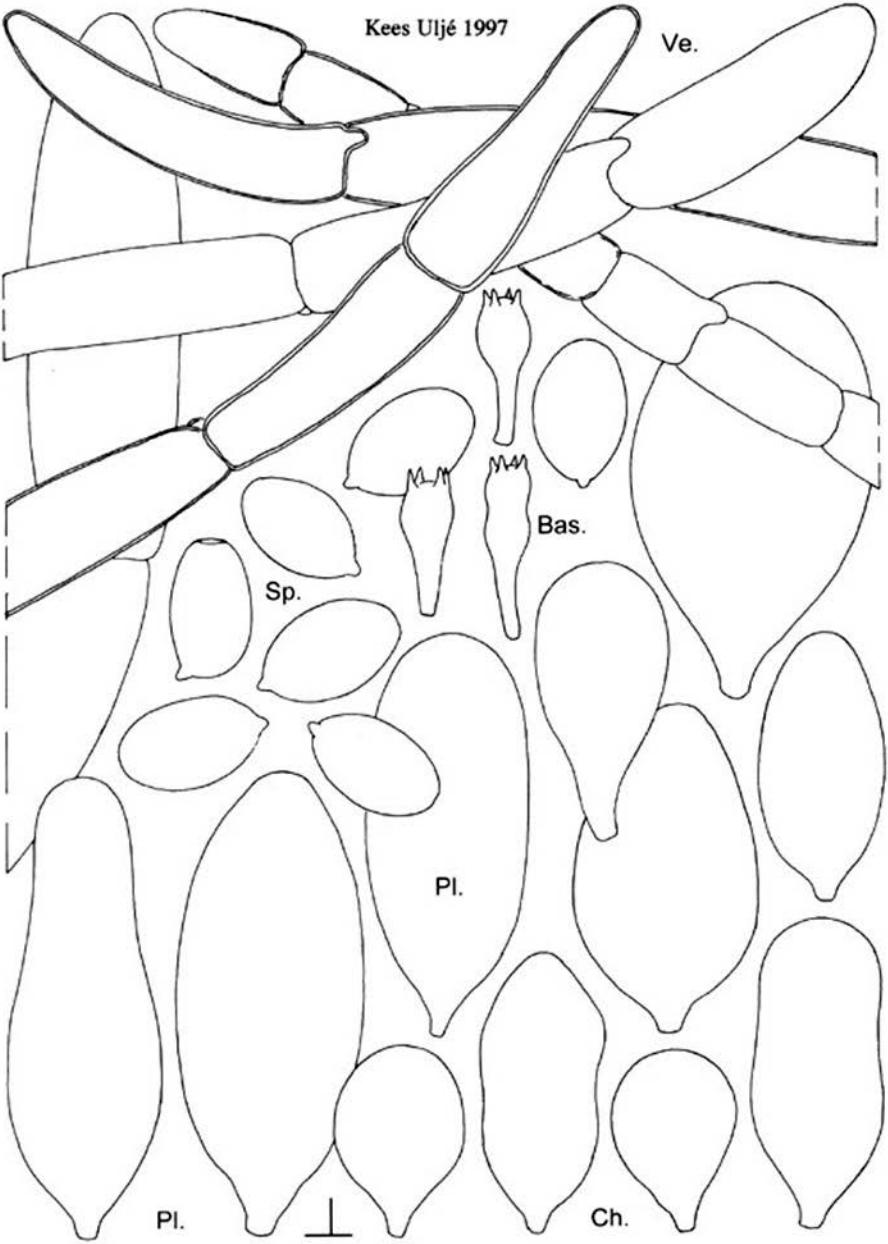

Fig. 16. *Coprinus pachydermus* Bogart. All figures from *F. Van De Bogart 237* (holotype).

towards the apex, at base clavate or slightly bulbous, hollow, vaguely flocculose, more densely towards base.

Spores [50, 3, 2] 9.3–12.7(–13.1) × 5.7–8.3 µm; Q = 1.40–1.75; av. Q = 1.55–1.60; av. L = 10.1–11.6, av. B = 6.5–7.5 µm, ovoid or ellipsoid with slightly conical or (less frequent) rounded base and rounded or somewhat truncate apex, dark red-brown, and central or slightly eccentric, 1.5–1.8 µm wide germ pore. Basidia 24–34 × 6–9 µm, 4-spored, surrounded by 3–5 pseudoparaphyses. Pleurocystidia 60–90 × 24–35 µm, oblong, subcylindric or utriform. Cheilocystidia 30–50 × 18–25 µm, (sub)globose, ovoid, ellipsoid, oblong, utriform or subcylindric. Pileipellis a cutis, made up of cylindrical, more or less parallel, repent hyphae. Veil made up of elongate elements in chains, cylindric or somewhat inflated, often constricted at septum, 20–180 × 6–40 µm, with fusiform, ellipsoid, oblong, ovoid or cylindrical terminal elements, slightly but distinctly thick-walled, walls up to 1 µm thick. Clamp-connections present.

Habitat & distribution — Solitary, fasciculate or gregarious on rotting wood chips. Very rare. Only known from the type locality (State of Washington, USA) and one find from Europe (England).

Collections examined. USA: State of Washington, Univers. Washington, Lewis, Cispus Centre, 5 Oct. 1971, *F. Van De Bogart 237* (holotype, WTU). — UNITED KINGDOM: England, Chichester, 30 June 1998, *D. Reid* (collection *C.B. Uljé 1273*).

Coprinus pachydermus can be recognized by the rather broad spores with slightly conical base and the thick-walled and pale yellow-brown elements of the veil. The spores in the type-collection are somewhat smaller than in the material of Dr. D. Reid.

Microscopical observations:

Type-collection: sp. [20, 1, 1] 9.3–11.0 × 5.7–7.2 µm; Q = 1.40–1.75, av. Q = 1.55; av. L = 10.1, av. B = 6.5 µm.

Collection Reid: sp. [30, 2, 1] 9.6–12.7(–13.1) × 6.2–8.3 µm; Q = 1.45–1.75, av. Q = 1.55–1.60; av. L = 11.5–11.6, av. B = 7.2–7.5 µm.

REFERENCES

Bulliard, J.B.F. 1792 '1793'. Herbier de la France, Champignons, pl. 408 (1792/1793).

Citerin, M. 1992. Clé analytique du genre Coprinus. Doc. mycol. 22 (86): 1–27.

Citerin, M. 1994. Clé analytique du genre Coprinus. Doc. mycol. 24 (95): 8–13.

Karsten, P. 1879. Symb. Mycol. fenn. VI. Meddn Soc. Fl. Fauna fenn. 5: 23.

Karsten, P. 1882. Symb. Mycol. fenn. IX. Meddn Soc. Fl. Fauna fenn. 9: 48.

Kemp, R.F.O. 1975. Breeding biology of Coprinus species in the section Lanatuli. Trans. Br. mycol. Soc. 65: 375–388.

Kornerup, A. & J.H. Wanscher. 1978. Methuen handbook of colour. Ed. 3. London.

Moser, M. 1978. Die Röhrlinge und Blätterpilze. Kleine Kryptogamenflora, 4. Aufl., IIb/2. Stuttgart/New York.

Moser, M. 1983. Die Röhrlinge und Blätterpilze. Kleine Kryptogamenflora, 5. Aufl., IIb/2. Stuttgart/New York.

Munsell. 1975. Munsell soil color charts. Baltimore.

Orton, P.D. & R. Watling. 1979. British Fungus Flora. Agarics and Boleti 2/Coprinaceae. Part 1: Coprinus. Edinburgh.

Saint-Amans, M. de. 1821. Flore Agenaise.

Uljé, C.B. & C. Bas. 1988. Studies in Coprinus I. Subsections Auricomi and Glabri of Coprinus section Pseudocoprinus. Persoonia 13: 433–448.

Uljé, C.B. & C. Bas. 1991. Studies in Coprinus II. Subsection Setulosi of section Pseudocoprinus. Persoonia 14: 275–339.

Uljé, C.B. & C. Bas. 1993. Some new species of Coprinus from the Netherlands. Persoonia 15: 357–368.

Uljé, C.B. & M.E. Noordeloos. 1993. Studies in Coprinus III. Coprinus section Veliformes, subdivision and revision of subsection Nivei emend. Persoonia 15: 257–301.

Uljé, C.B. & M.E. Noordeloos. 1997. Studies in Coprinus IV – Coprinus sect. Coprinus, subdivision and revision of subsection Alachuani. Persoonia 16: 265–333.

Vellinga, E.C. 1988. Glossary. In: C. Bas et al. (eds.), Flora agaricina neerlandica 1: 54–64.

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TYPE SPECIMEN STUDIES IN PLEUROTUS

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An epitype specimen is designated for *Pleurotus cornucopiae*. Morphological examination of Mexican material and the type specimen of *P. opuntiae* showed that the distribution of this species includes North Africa and the highlands of Mexico. The type specimen of *Lentinus* (*Pleurotus*) *eugrammus* reveals that Singer based his proposal of *Nothopanus* on a mistaken interpretation of *L. eugrammus*, and that the concept of *Nothopanus* requires a new name and type species. *Neonothopanus* is proposed to solve this problem. Morphological reports are supplemented with data on mating systems.

Although much literature has appeared, both theoretical and applied, on species of *Pleurotus*, several epithets have been without documented type specimens, and therefore have been potentially open to widely varying interpretations (see Petersen, 1995, for more on this subject and an introduction to the literature). In previous papers, Petersen & Hughes (1993) secured the identity of *P. pulmonarius*, and Petersen & Krisai-Greilhuber (1996) designated an epitype specimen for *P. ostreatus*. In this paper, we report on three additional species, *P. cornucopiae*, *P. eugrammus*, and *P. opuntiae*, securing each to type specimens and modern circumscriptions, including deposition of cultures and reports of mating systems.

MATERIALS AND METHODS

In descriptions below, colours cited by alphanumeric designations are from Kornerup & Wanscher (1973). Colours enclosed in quotation marks are from Ridgway (1912).

Pleurotus cornucopiae (Paulet ex Persoon) Rolland

The earliest binomial referring to this species apparently was proposed by Jean-Jacques Paulet. The circumstances of this name-giving are obscure, however. Paulet (1793) issued two volumes of his *Traité des Champignons*, consisting of text material only, and never mentioning the name he intended, *Dendrosarcos cornucopiae*. Persoon (1828: 37) attributed the basionym to Paulet, but recombined the epithet into *Agaricus cornucopiae*. Fries (1830: 703) rejected Persoon's combination, considering *A. cornucopiae* to be synonymous under *A.* (*Panus*) *conchatus*, but again attributing the basionym to Paulet. To make matters worse, by Fries not adopting the epithet in any sanctioning volume, according to the ICBN the name dates from Paulet, as attested to by Persoon (1828).

But if the epithet was not used in Paulet's (1793) text, where did it appear so as to gain recognition by Persoon? Apparently (see Stafleu & Cowan, 1983: 110–111; Pfister et al., 1990), the original plates to which Paulet referred in 1793 were issued in fascicles over the subsequent decade. Léveillé (1855) discovered Paulet's plates, and knew that very few fasci-

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cles had actually been distributed. He had the plates struck off again, wrote new textual material to accompany them, and distributed the result. In his introduction to the re-issue, Léveillé wrote of the rarity of Paulet's original plates, but as part of the text accompanying the re-issued plates, Léveillé (1855: 14) used the combination *Agaricus cornucopiae* Persoon, with the basionym *Dendrosarcos cornucopiae* Paulet. All told, we are led to conclude that the original proposal of *D. cornucopiae* was by Paulet in text accompanying the original fascicle of plates, including plate 28 (Fig. 1). Inquiries at WU, W, K, NY, and L revealed that none of these libraries owned the original plates, Pfister et al. (1990) did not see them, so they seem not to be at FH, and Pegler (pers. comm.) indicates that they are not at PC. Reluctantly, our conclusion concerning the original proposal of *D. cornucopiae* cannot be verified.

Fig. 1. *Pleurotus cornucopiae*. Plate from Léveillé's reproduction of Paulet's plate 28. — Bar = 1 cm.

Luckily, the Léveillé re-issued plates are faithful to the originals in their black-ink impressions. Colour tinting, of course, was accomplished by hand, and because we cannot find a copy of the original plates, we cannot attest to the accuracy of the colours in the Léveillé (1855) edition. We can report, however, that the NY and WU plate 28 differ in the amount of pink colouration used on the lamellae, with the NY copy distinctly more pink than the copy at WU.

It can be argued that Paulet's original plate 28 can serve as a lectotype, since it was executed under Paulet's direction, and cited in his 'Traité'. This is so, of course, but the plate does not show hyphal construction, spore dimensions, or cystidia. Thus, an epitype specimen should be designated in which all structures are present, and from which cultures have been derived.

Dr. Jean Mouchacca (PC) and Dr. Machiel Noordeloos (L) (pers. comm.) inform us that no Paulet fungus herbarium exists, but at Leiden (L), there is a candidate Persoon specimen (L no. 910.256-1808). Conceivably, it could serve as an epitype together with Paulet's plate as lectotype. The specimen was annotated in Persoon's hand as "*Agaricus cornucopiae. Mycol. Europ.* [the preceding twice], *prope Parisior.*" On another annotation slip in unknown hand [initial R. ?S.: perhaps Rolf Singer]: "Poor material. Spores not found. Hyphae thin-walled as far as seen. Clamps seen."

The specimen comprises two basidiomata, both pressed, and in terrible condition. One basidioma [left side] was glued to the sheet with the pileus surface toward the paper. Although the entire basidioma is now brittle, woody and dark red-brown, it can be seen that the pileus margin is inrolled, and lamellae (or the suggestion which remains) seem close but not crowded. Small portions of stipe tissue were squashed in KOH, revealing: 1) abundant mold spores and slender, septate hyphae in mycelial fragments; 2) spores of appropriate dimensions (9 – 11 × 3.8 – 4.4 µm) for *Pleurotus*; 3) fragments of thin-walled, clamped generative hyphae; and 4) short fragments of refringent, apparently thick-walled hyphae. The second basidioma [right side] seems to be glued on the lamellar side, with the pileus surface outward. A squash of the pileipellis revealed: 1) abundant *Pleurotus* spores as above, but no mold spores; 2) a lattice of refringent, thick-walled hyphae which could be interpreted as skeletal; and 3) fragments of hyaline, thin-walled, clamped generative hyphae.

All in all, although the specimen is no longer totally identifiable, two characters are semi-diagnostic: 1) refringent skeletal hyphae; and 2) characteristic *Pleurotus* basidiospores. These are enough to tie the specimen and the name to the dimitic group within *Pleurotus*, and perhaps, chiefly based on geographic location, to *P. cornucopiae*. Other members of the dimitic clade are either subtropical (i.e., *P. opuntiae*, *P. djamor*) or subcentrally stipitate (i.e., *P. dryinus*).

The specimen is so poorly preserved (in the original drying process) that it can hardly serve to furnish modern characters, especially if future analysis requires more than the diagnosis furnished above. For this reason, we have chosen an Austrian specimen to serve as epitype, as follows.

Epitype specimen: AUSTRIA, Lower Austria, distr. Krems an der Donau Land, 4 km W of Krumau am Kamp, forest SW of the Dobrasperre dam, grid map square 7458/1, 16.VI.96, *I. Krisai-Greilhuber 6467* (IK, WU), culture tracking number at TENN 8763, iso-epitype specimen, no. 54646 (TENN).

Mature basidiomata (Fig. 2) 96 – 200 mm broad; immature pileus slightly convex at first, umbilicate, soon expanding to become plane; margin of immature pileus inrolled; mature

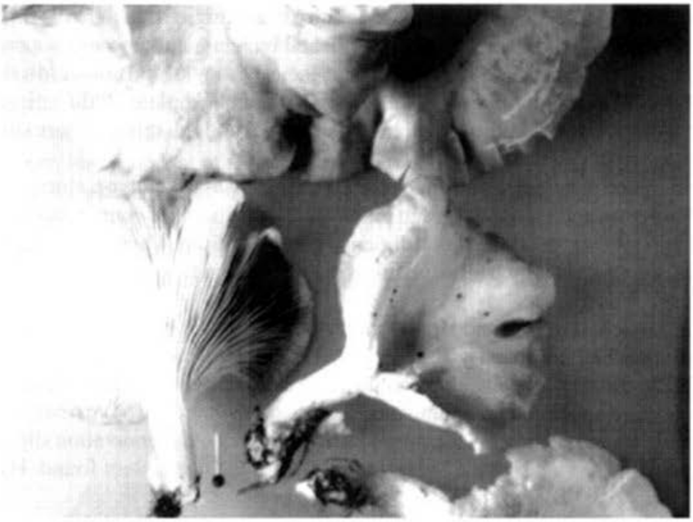


Fig. 2. *Pleurotus cornucopiae*. Basidiomata of epitype specimen (*Krisai-Greilhuber 6467*). — Bar = c. 1.7 cm.

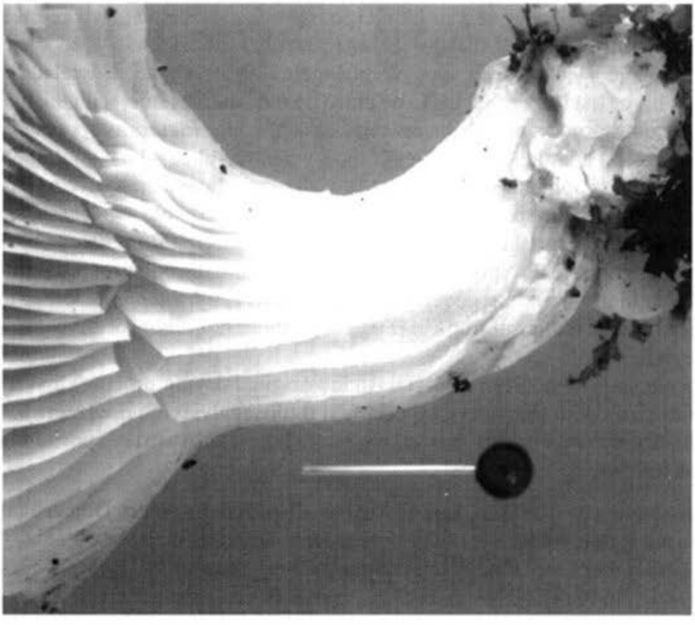


Fig. 3. *Pleurotus cornucopiae*. Epitype specimen: detail of decurrent lamellae (*Krisai-Greilhuber 6467*). — Bar = c. 0.7 cm.

pileus 70–105 mm broad (from attachment to stipe to margin), 20–30 mm thick, more or less circular to pulmonate from above, depressed to infundibuliform, smooth, hygrophanous, colour of fresh, moist areas cream-ochre to greyish ochre (5A4, 5B3–5, occasionally 5B5), older pilei slightly darker, brownish ochre with slight orange tinge (5C4–5), drier areas champagne colour, ivory, platinum blond, sand (4B3–4, 4A2–3), with many fresh basidiomata paler in colour; margin of mature pileus subcrenulate, short-striate, often slightly irregular, lobed. Pileus flesh more or less soft, not fibrous or tough, up to 10 mm thick inward, cream white to cream. Lamellae strongly decurrent (Fig. 3), sometimes to the stipe base, tapering downward from pileus to attachment to stipe, interspersed with shorter costal lamellulae which sometimes anastomose near attachment to stipe, 8–10 mm deep under pileus near stipe attachment, not ventricose, thin, elastic, off-white when young, mellowing to whitish cream or cream [4A2–3(–4)]; lamellar margin entire, concolorous with lamella face. Spore print distinctly pinkish violet. Stipe 35–75 mm long, 13–20 mm thick, when young longer than pileus width, less so in mature specimens, terete, tapering downward, rooting deeply in wood, almost central when young, by maturity eccentric to strongly eccentric, but never lateral, costate with lamella bases, between costae smooth to minutely velutinous, more or less uniformly cream (4A2–3), sometimes slightly darker, ivory to light orange cream (5A4). Stipe flesh tough, off-white to pallid cream. Odour pleasant, somewhat mealy with hint of anise; taste mild. Dried specimen without yellow colouration.

Pileus surface of repent hyphae; hyphae 3.5–6.0 µm diam., yellowish to yellow-ochre under phase contrast microscopy, thin-walled, radially parallel, adherent, with thin (less than 10 µm) film of slime. Pileus trama monomitic; hyphae thick-walled (wall 0.4–1.2 µm thick, yellow and glassy when unusually thick), frequently septate, frequently anastomosed; clamp-connections frequent but not consistent, often obscured by hyphal branching; "cloisons de retrét" common in hyphal fragment with unusually thick wall. Lamellar trama monomitic; hyphae 3.5–9.8 µm diam. (tending to sort into narrow and wide hyphae), thin- to thick-walled (wall up to 0.5 µm thick), hyaline, interwoven, with common clamp-connections. Gloeoplerous hyphae frequent, 3.5–5 µm diam., subrefringent, rarely branched, rarely bending into hymenium as basidiolar pseudocystidia but not emergent. Subhymenium well-developed; hyphae often slightly inflated, frequently branched, giving rise to basidia directly or from clamp-connections; hymenium of basidia. Basidia 28–35 × 7.2–8.2 µm, clavate, clamped, hyaline, thin-walled; contents more or less homogeneous; sterigmata (1–2–3–)4, up to 5.5 µm long, slender, spindly. Pleurocystidia and cheilocystidia not observed.

Basidiospores (n = 22) (7.6–) 8.0–10.4 (–12.0) × (3.6–) 4.0–4.8 (–5.6) µm [Q = 1.82–2.27(–2.60); Em = 2.08; Lm = 9.09 µm], elongate-ellipsoid, slightly more convex abaxially than adaxially, smooth, thin-walled, hyaline; contents more or less homogeneous; hilar appendix small, eccentric, papillate.

Stipe surface a trichodermium; trichodermal hyphae 1.5–2.0 µm diam., emergent up to 300 µm, hair-like, thin- to thick-walled (wall up to 0.4 µm thick near basal clamp-connection, thin near terminus), acerose, hyaline. Stipe trama dimitic; generative hyphae thick-walled (wall 0.4–1.0 µm thick), variously inflated (3.5–6.5 µm diam.), hardly constricted at septa, often but not invariably clamped; skeletal hyphae thick-walled (wall 0.8–2.5 µm thick, often obscuring the cell lumen), aseptate, yellow and glassy or refringent under phase contrast microscopy, rarely branched, ending in acerose terminus.

Habitat — Cespitose in dense clusters to almost solitary on fallen, rotting trunk of *Fagus sylvatica* in almost virgin *Fagus sylvaticus* forest with occasional *Quercus*, on steep, north-east-facing slope, at 540 m elevation, over silicate soil.

Culture characters — Monokaryon and dikaryon cultures white, varying from appressed to loosely plumose but not forming a felt or tomentum; odour floral (similar to the odour of cultures of *P. pulmonarius* but not as brash). Microdroplets large (up to 30 µm diam.), occasional to abundant. Hyphae 2.5–7.5 µm diam., hyaline, occasionally to commonly septate, with clamp-connections in dikaryon state, without evidence of skeletal hyphae.

Mating system — When 12 SBIs were paired in all combinations, a tetrapolar mating system was revealed (Fig. 4). Isolates 5, 9, 10, 11, 13* were A_2B_2; 7* A_1B_1; 1, 2, 3, 4, 6, 8* = A_2B_1; A_1B_2 was not represented in the sample. No distinctive barrage or flat contact zone morphologies were noted, but lethal reactions within the contact zone were common.

Twelve SBIs of the epitype collection were paired with 12 SBIs of a collection from the Caucasus region of Russia (Caucasia, southern slopes of Mt Aichcha, 43° 38.677' N, 40° 26.668' E, 21.IX.96, coll. RHP, on dead *Alnus*, no. 8966, TENN 55626; pairing number = 24), resulting in 100% intercompatibility.

In the vicinity of Vienna, *P. cornucopiae* fruits in large clusters, very similar to that pictured by Paulet in the plate accompanying his description of the organism (from Léveillé's reprint plate). It would appear that the species epithet referred to the umbilicate to infundibuliform shape of somewhat immature basidiomata, vaguely reminiscent of a cornucopia (Figs. 1, 2). Individually, we have consulted the plates re-issued by Léveillé, and in one (WU) the lamellae are virtually devoid of pinkish colouration, being ivory or pallid cream colour. In another copy (NY), the same illustration (pl. 28) shows a distinct rosy tint to the cream-coloured lamellae. Such variation is to be expected in old illustrations which were

	A_2B_1						A_1B_1	A_2B_2				
	1	2	3	4	8	6	7	9	10	11	13	5
1		–	L	–	–	–	L	–	–	–	–	–
2	–		–	–	–	L	–	–	–	–	–	B
3	L	–		–	L	–	–	F	–	–	L	–
4	–	–	–		–	–	–	–	–	L	–	–
8	–	–	L	–		–	–	L	L	L	L	L
6	–	L	–	–	–		L	F	L	–	–	–
7	L	–	–	–	–	L		+	+	+	+	+
9	–	–	F	–	L	F	+		L	–	L	–
10	–	–	–	–	L	L	+	L		L	F	–
11	–	–	–	L	L	–	+	–	L		–	–
13	–	–	L	–	L	–	+	L	F	–		–
5	–	B	–	–	L	–	+	–	–	–	–	

Fig. 4. *Pleurotus cornucopiae*. Self-cross using ex epitypus monokaryon cultures.

hand coloured in aquarelle. Current colour illustrations can be found in Phillips (1981: 184; colour somewhat flat) Dörfelt & Görner (1989; colour without fleshy tint), and the cover photo of The Mycologist [vol. 11 (3) August, 1997; colour about natural].

Persoon (1828) used the phrase "*pileo carnoso albido-pallide rufescente glabro,*" and mature pilei of the epitype basidiomata showed a slight orange tint together with the pallid tan to brownish ochre pileus surface. Of the diagnostic characters furnished by Persoon (1828), the following are fulfilled by the epitype specimen: 1) on deciduous trees; 2) sometimes in cespitose clusters but usually single; 3) pileus pallid-whitish, becoming reddish; 4) stipe villose, thick; 5) pileus usually infundibuliform; and 6) lamellae with non-intervenose bases. Other diagnostic characters are not matched by the epitype specimen, namely: 1) autumnal; and 2) stipe very short. These latter characters, however, are well within the variation for such a species.

One of us (IK-G) has observed that rarely basidiomata of *P. cornucopiae* in nature exhibit bright yellow pilei, perhaps a 'local' mutant within individual cespitose clusters. The yellow form of the species has been given its own binomial, *P. citrinopileatus*, and seems to be the only form of the species present in northern Asia (northern China, northern Japan, and far eastern Russia). Hilber (1982) showed that *P. cornucopiae* was genetically isolated (i.e., incompatible with other *Pleurotus* species), but he lacked monokaryon isolates of *P. citrinopileatus* and could not report on their compatibility. Ohira (1990) demonstrated that *P. citrinopileatus* was intercompatible with *P. cornucopiae*, and this was confirmed by Petersen & Hughes (1993) using other isolates.

Hilber (1982) noted that basidiomata of *P. cornucopiae* produced under laboratory conditions sometimes formed an evanescent veil. This character is similar to the same phenomenon in *P. levis* (= *Panus strigosus*), where virtually no evidence of the veil can be found on basidiomata in nature. The habit of *P. cornucopiae* (i.e., distinct stout stipe) might cause the comparison with *P. levis* to be carried further, but basidiomata of *P. calyptratus* also form a veil: indeed, the taxon is diagnosed by this structure. Basidiomata of *P. calyptratus*, however, are strictly pleurotoid, more closely resembling those of *P. djamor*, another species with dimitic hyphal construction. Vilgalys & Sun (1994) used DNA sequences to construct a generic phylogeny. *Pleurotus cornucopiae* and its variant *P. citrinopileatus* shared identical sequences, with *P. djamor* and *P. calyptratus* within the same clade. The clade was labelled as the *P. djamor-cornucopiae* clade. *Pleurotus levis* was well-separated, appearing within the '*P. ostreatus* clade', in spite of its dimitic hyphal construction.

The large size of microdroplets in cultures of *P. cornucopiae* is consistent with data from other similar species exhibiting dimitic hyphal construction (*P. djamor*, *P. calyptratus*). This is in contrast to the small microdroplets in cultures of monomitic taxa (*P. ostreatus*, *P. pulmonarius*, etc.). The odour of cultures of *P. cornucopiae* is quite similar to that found in cultures of *P. pulmonarius*, however, indicating that the same general chemistry may be present across the genus.

Pleurotus eugrammus (Mont.) Dennis

Fries (1838) placed the species in *Lentinus* but attributed the species epithet to Montagne as "*in sched.*," but Montagne (1845) did not publish the name until later. Thus the nomenclatural position of the basionym is in *Lentinus*, although that generic name was used in a broad sense at that time. Because of Fries' attribution, the type specimen is to be found in herb. Montagne.

Singer (1944) segregated *Nothopanus* from *Pleurotus* based on his own concept of *N. eugrammus*. Horak (1968: 485), placed *Nothopanus* in synonymy under *Pleurotus*, but also (Horak, 1968: 679) furnished a description and illustrations of the 'type specimen' of *N. (Lentinus) eugrammus*. Most recently, Singer (1986) placed *Pleurotus eugrammus* sensu Singer in *Pleurotus* sect. *Pleurotus*, which included both monomitic and dimitic hyphal construction. While such placement can be accepted merely on miticity, other characters disallow placement of Singer's *N. eugrammus* in *Pleurotus* at all.

In examining several specimens (almost all from NY) under various combinations of *eugrammus*, it became evident that most represented small, marasmielloid basidiomata (i.e., stipitate-pleurotoid, often semi-everted), while some comprised or at least included large, pleurotoid basidiomata with only rudimentary stipes. Two taxa obviously were represented. The former was found to agree with the description by Corner (1981), and subsequently to agree with common usage of *Nothopanus* (see below under specimens examined of *Nothopanus* sensu Singer). The two taxa shared a lobate and invariably sulcate-striate pileus margin, but very different hyphal construction and basidiospore shape. This discrepancy led to an investigation of *Lentinus eugrammus*, the type specimen of which is described below.

Lentinus eugrammus Mont. — Fig. 5, 6

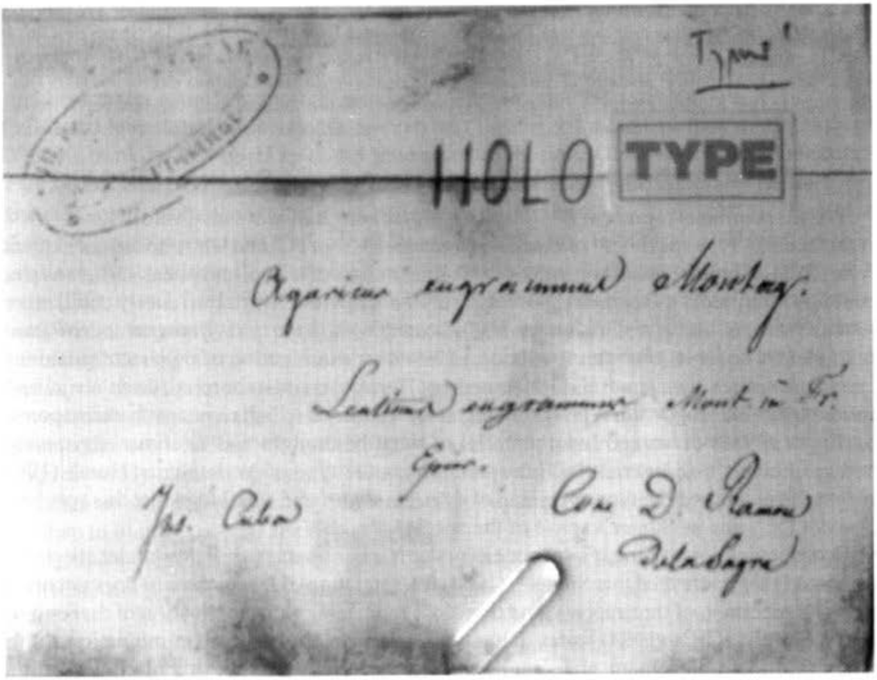
Lentinus eugrammus Mont. *apud* Fries, Epicrisis (1838) 396.
Pleurotus eugrammus (Mont.) Dennis, Kew Bull. (1953) 36, fig. 8.
Nothopanus eugrammus (Mont.) Sing., Mycologia 36 (1944) 364.
Holotypus: Cuba, comm. D. Ramon de la Sagra, no date, on tree stems, herb. Montagne, *s.n.* (PC!), [see also Horak (1968: 679–681)].

Basidiomata up to 12.5 × 8.5 cm, dimidiate to broadly reniform, laterally attached on almost absent stipe, pleurotoid; pileus surface matt, subtly to coarsely sulcate-striate up to 3 cm from margin, apparently white to off-white when fresh, upon drying and storage pallid ochraceous buff with somewhat darker margin; lamellae broad (up to 6 mm deep), apparently tough (not fragmented during drying or long storage), in three ranks, with long lamellae reaching the rudimentary attachment, probably white to off-white when fresh, now dull orange-ochre; stipe represented by a very small knot, white and remaining so, hispid to arachnoid.

Stipe, lamella and pileus trama dimitic; generative hyphae 3.5–8.0 µm diam., hyaline, thin- to thick-walled (wall up to 0.5 µm thick), frequently branched, conspicuously and commonly clamped; skeletal hyphae 4.5–8.0 µm diam., consistently arising from a clamped septum on generative hypha, thick-walled (wall up to 2.4 µm thick, commonly obscuring the cell lumen), highly refringent to yellowish in KOH, often branched dichotomously near terminus, gradually tapering (over more than 1000 µm length) to a flagelliform tip (thin- to slightly thick-walled).

Basidiospores (n = 23; Cuba, Earle/Murrill no. 435, NY) 8.0–11.6 × 3.6–4.8 µm (Q = 2.00–3.11; Em 2.42; Lm = 9.77 µm), [Horak, 1968, ex typus: 8.5–10 × 3–4 µm; Dennis, 1953, 7–10 × 3–3.5 µm], elongate-ellipsoid to subboletoid, smooth, thin-walled, more or less homogeneous in content; hilar appendix small, eccentric.

Additional specimens examined. CUBA: De la Sagra, date and collector unknown, as *Lentinus eugrammus*, annotated D.N. Pegler, holotype (PC); same location, 'type' (PC); prov. Santiago de Cuba, Alto Cedro, 19–20.III.05, coll. *Earle & Murrill 435* [as *Panellus eugrammus* (Mont.) Murrill; type of *Geopetalum album* Earle] (NY); prov. Pinar del Rio, vic. Herradura, 28–31.VIII.10, coll. *N.L. Britton*



Type!

HOLO TYPE

Agaricus eugrammus Montag.

Lentinus eugrammus Mont. in Fr. Epicr.

Ins. Cuba

Com. D. Ramon Delasagra

Fig. 5. *Lentinus eugrammus*. Packet of holotype specimen.

Lentinus eugrammus (Mont.) Fr.
Epicrisis 396 (1838)
Cuba, de la Sagra
HOLOTYPE
= Nothopanus eugrammus (Mont.) Fr.
D.N. Pegler
12.3.82

Fig. 6. *Lentinus eugrammus*. Holotype specimen with annotation by Pegler. — Bar = 1 cm.

& F.S. Earle 6535 (as *Panellus eugrammus*) (NY); prov. Oriente, Gran Piedra, 4–5.III.11, coll. *J.A. Shafer 9120* (as *Panellus eugrammus*) (NY); prov. Pinar del Rio, Havana, Vedado, Sierra de Oluafe, 10.X.16, coll. *G. Leon, P. Mi Roca, T.R. Cazanas 6825* (as *Panellus eugrammus*) (NY). — GUADELOUPE: Basse-terre, 1902, coll. *P. Duss 1885 "sur im Bignonia pentaphylla"* (as *Lentinus eugrammus*) (NY). — UNITED STATES: Florida, Dade Co., Royal Palm Hammock, 'Exploration of the Everglade Keys, tropical Florida,' 29.I.16, coll. *J.K. Small & R.L. Lowe 7107* (NY); same location, same date, coll. *J.K. Small & R.L. Lowe 7116* (NY); Florida, Dade Co., Hammocks, Long Key, 12–13.I.16, coll. *J.K. Small s.n.* (NY); Florida, Dade Co., Goodburn Hammock, 17.III.15, coll. *J.K. Small & C.A. Mosier 5404* (NY).

These specimens represent *Lentinus* (*Pleurotus*) *eugrammus* sensu vero. Horak (1968) examined the 'type specimen' of *Lentinus eugrammus* from PC, and while he did not explicitly describe a dimitic hyphal construction, his illustrations of tramal and pileus surface hyphae could be interpreted as such, his spore measurements (with illustration) surely could represent a *Pleurotus*, and in discussion, Horak indicated *Nothopanus* as a synonym under *Pleurotus*. Horak's observations were correct, and based on examination of much additional material, the spores measured and illustrated by Horak were also correct (there are several spore types adhering to the type specimen, at least three of which represent basidiospores).

Singer (1950) examined fresh material of what he thought was *Lentinus eugrammus*, and used his own (Singer, 1944) interpretation as the type of *Nothopanus*. Horak (1968: 679–681) examined the type specimen of *L. eugrammus*, and concluded that this specimen was not the same as Singer's sense of the species.

Our examination of Singer's specimens under *N. eugrammus* (see below under specimens examined) has confirmed that Singer's (1944) interpretation of *L. eugrammus* does not match the type specimen of that species, and therefore represents a misapplication of that epithet. Art. 7.5 of the ICBN (1994) states that a type specimen applies to all combinations of the epithet. Modern placement of *L. eugrammus* is important because this placement brings the genus name *Nothopanus* with it. Like Horak (1968) we consider the type specimen of *L. eugrammus* to be a *Pleurotus*, and Singer's *Nothopanus* to be a synonym of that genus. Nevertheless, Singer's (1944) concept of *Nothopanus* as taxonomically distinct is correct.

Given this entire situation, two nomenclatural avenues are open: 1) propose conservation of *Nothopanus* Singer with a different type species, requiring a separately published proposal with justification; or 2) accept *Nothopanus* Singer as a synonymous genus name, and propose a new genus name to represent Singer's concept, with a new type species for the concept. We have chosen the latter path, as follows:

Neonothopanus Petersen & Krisai-Greilhuber, *gen. nov.*

Tricholomatacearum genus. Pileo excentrice ad lateraliter stipitato. Lamellis plus minusve adnato ad decurrentibus. Stipite breviusculo vel distincto. Carne tenaci in adultis, ex hypharum crassitunicatis. Sporis in cumulo albis, hyalinis, ellipsoideis ad subglobosis, tenuitunicatis, inamyloideis. Cystidiis nullis. Hyphis fibuligeris. Habitatio in ligno putrida.

Nothopanus Singer sensu Singer, Mycologia 36 (1944) 364–365 [see also Horak (1968: 679)].

Typus: *Neonothopanus nambi* (Speg.) Petersen & Krisai-Greilhuber, *comb. nov.* [see also Singer (1950: 168); Horak (1968: 681)]. Basionym: *Agaricus nambi* Speg., An. Soc. Cient. Argentina 16 (5) (1883) 247.; *Pleurotus nambi* (Speg.) Saccardo, Syll. Fung. 5 (1887) 372.

Basidiomata marasmielloid, eccentrically (not laterally) stipitate, petaloid to somewhat everted, up to 3 cm broad, broadly spathulate, nearly semicircular to broadly reniform; pileus surface white and remaining so or mellowing to pallid ochraceous buff upon storage, with occasional radial dark streaks, matt, broadly sulcate outward but hardly striate; pileus flesh tough, white, very thin over lamellae; lamellae decurrent, shallow, distant, in 2–3 ranks or forking dichotomously, white but mellowing to cream on drying, with common evidence of dark staining in radial streaks on and between lamellae; stipe up to 4 × 3 mm, distinct and invariable, white, very tough, minutely hispid to minutely strigose.

Pileus, lamella and stipe trama monomitic. Hyphae of pileus surface 4–8 µm diam., hyaline, thick-walled (wall up to 1.0 µm thick), often subtly transversely banded (but not encrusted), conspicuously clamped, mostly repent, with integral, generally radial hyphal bundles (up to 75 hyphae) which usually end as blunt, short, erect fascicles (up to 40 × 40 µm); hyphae of pileus trama 3.5–8 µm diam., hyaline, thin- to thick-walled (wall up to 1.2 µm thick), often with wall gelatinizing or with a gelatinous sheath (in KOH squash mounts) extending up to 1.2 µm from the cell wall, conspicuously and commonly clamped, loosely interwoven, frequently branched; gloeoplerous hyphae rare, 3–5 µm diam., yellowish, hardly refringent, aseptate, occasionally branched. Lamellar trama with parallel mediostratum and thick, densely interwoven lateral stratum; hyphae 2–4 µm diam., clamped, hyaline, not gelatinized, thick-walled near pileus trama, thin-walled downward; subhymenium extensive, isodiametric, adherent; hymenium of basidia and pleurocystidia; basidia 17–30 µm long, narrowly clavate, apparently adherent, clamped, with fertile basidia emergent up to 15 µm, four-sterigmate; cheilocystidia and pleurocystidia non-emergent, clavate with subcapitate to bluntly tapered apex.

Basidiospores [Singer B-7497: (n = 10) (4.0–)4.8–5.6 × 2.8–4.0 µm; Q = 1.209–1.86; Em 1.57; Lm = 4.96 µm]; [Watling 52A/95; (n = 15) (5.2–)5.6–6.4 × 3.2–4.0 µm; Q = 1.40–2.00; Em = 1.70; Lm = 5.89 µm]; [Lodge 1308: (n = 22) (4.0–)4.8–5.6(–6.4) × 3.2–4.0 µm (Q = 1.209–1.75; Em = 1.52; Lm = 5.31 µm; Wm = 3.49 µm]; [Honduras, as *Plicatura obliqua*, NY; n = 12. 6.4–8.0 × 4.0–4.8 µm; Q = 1.58–1.82(–1.90); Em = 1.74; Lm = 7.40 µm]; ovate, smooth, thin-walled, inamyloid; contents more or less homogeneous; hilar appendix small, eccentric. Stipitipellis a trichoderm; hyphae 4–8 µm diam., hyaline, thick-walled (wall –0.5 µm thick), clamped, linear or branched in rudimentary penicillus; stipe tramal hyphae monomitic, skeletalized, hyaline, clamped, frequently branched, somewhat tortuous to sinuate, with common protuberances; hyphal branches 1) as parents; 2) gradually tapering to rounded tip (not acerose or flagelliform).

Culture characters — Colonies off-white, rapidly growing (30 mm radius within six weeks), with abundant aerial mycelium, loosely cottony and radially combed. Aerial mycelium roughened with light crystal incrustation, somewhat reminiscent of *Panellus stypticus* etc.; hyaline exudate droplets abundant on aerial mycelium, especially away from the agar surface. Hyphae of two types: 1) 'lead' hyphae (4.5–7.5 µm diam., very long-celled) usually developed away from the agar surface; with 2) narrower side branches (1.5–3.5 µm diam.) and other hyphae nearer the agar (thus appearing like cultures of *Flammulina*). Aerial chains of arthroconidia common to abundant, with conidiophore morphology variable, including simple, oppositely branched, whorled, lax-penicillate, and penicillate. Conidia 3.5–13 × 1.5–3.0 µm, pencil-shaped, bacilliform, ellipsoid, to broadly keg-shaped.

Mating system — [specimen PR-1308, MAD (see below)] When 12 SBIs were paired in all combinations, a tetrapolar mating system was revealed (Fig. 7). Isolates 1*, 4, 6, 24 = A_2B_2; 3*, 15, 18, 21 = A_1B_1; 5*, 22 = A_2B_1; 7*, 19 = A_1B_2. Subordinate mating types were assigned based on scattered clamps on 5/22 × 3/15/18/21 = slight barrage = common-B (although this contact zone morphology was also common in other sectors; i.e., within-group 3/15/18/21).

Two categories of barrage morphology were noted: 1) very narrow zone of increased hyphal branching not within the contact zone, but extending to either side with general appearance of mustaches; and 2) wider, thicker zone of increased hyphal branching covering the contact zone and extending away from it. Category 2 was always associated with compatible pairings; category 1 was common but unpatterned.

Mating system — [specimen Watling 193-95, E (see below)]: When 12 SBIs were paired in all combinations, a tetrapolar mating system was revealed. Isolates 1*, 9, 16, 21 = A_1B_1; 10* = A_2B_2; 15*, 20 = A_2B_1; 6*, 13, 14, 19, 25 = A_1B_2. Ill-defined barrage and flat contact zone morphologies were common and generally patterned, and subordinate mating types were assigned based on these patterns.

Intercollection pairings — Intra-Malaysia [W7399 × Watling 63A]: In a 4 × 4 grid (n = 16); three pairings were compatible, producing luxuriant growth of both donors and contact zone (and there an ill-defined barrage effect). In addition, other compatible pairings exhibited a phenomenon called 'localized compatibility syndrome' by Petersen & Ridley (1995). In this phenomenon 3–4 clamps were produced on single agar-surface hyphae, well-separated from other such hyphae, and with significant lethal reactions. Concomitantly, incompatible pairings showed little or no lethal reaction, and little or no crystal deposition. Flat and barrage contant zone morphologies were quite clearcut; flat comprised a distinct crevasse bordered by 'lips' of increased hyphal branching; barrage was a well-defined single narrow zone of increased hyphae. Intra-Puerto Rico [PR1308 × PR3137]: In a 4 × 4 grid (n = 16), all pairings were compatible. Clamp-connections, while distributed sparsely, were seen on aerial hyphae as well as agar-surface hyphae.

	A_2B_2				A_2B_1		A_1B_1				A_1B_2	
	1	6	4	24	22	5	15	18	3	21	19	7
1		F	–	F	F	–	+	+	+	+	–	F
6	F		F	–	–	–	+	+	+	+	F	F
4	–	F		–	F	–	+	+	+	+	F	F
24	F	–	–		–	–	+	+	+	+	+	–
22	F	–	F	–		–	F	F	F	F	+	+
5	–	–	–	–	–		F	F	F	F	+	+
15	+	+	+	+	F	F		F	F	–	–	–
18	+	+	+	+	F	F	F		F	–	–	–
3	+	+	+	+	F	F	F	F		F	–	F
21	+	+	+	+	F	F	–	F	F		–	–
19	–	F	F	+	+	+	–	–	–	–		–
7	F	F	F	–	+	+	–	F	F	–	–	

Fig. 7. *Neonothopanus nambi*. Self-cross of collection PR-1308.

Puerto Rico [PR3137] × Malaysia [W7399]: In a 12 × 12 grid (n = 24 pairings), universal compatibility was observed. Ill-defined flats and barrages were common, together with lethal reactions, but clamps were consistently seen on agar-surface hyphae and on aerial hyphae. Both donors produced arthroconidia on and in juxtaposition to donor blocks.

Intercollection/interregional pairings of monokaryon isolates confirm that *Neonothopanus nambi* is distributed through large areas of the tropics on both sides of the Pacific Ocean. It might be inferred that minor spore size differences on which Singer (1973) based additional species and varieties (in herb.) are within the species' phenotypic plasticity.

Specimens examined of *Neonothopanus nambi*. BAHAMA ISLANDS: New Providence, Coppice, Waterloo, 12.IX.04, coll. *E.G. Britton 713* (as *Plicatura obliqua*) (NY); New Providence, Lake Cunningham, 8.IX.04, coll. *E.G. Britton 623* (as *Plicatura obliqua*) (NY); New Providence, Coppice, Waterloo, 12.IX.04, coll. *E.G. Britton 718* (NY). — BELIZE (as British Honduras): location unknown, 1906, coll. *Morton E. Peck s.n.* (NY). — COLOMBIA: Valle, Buenaventura, Calima, Camp. Pulpapel, 18.IV.68, coll. *R. Singer*, ad lignum dicotyl., no. B-6225 (F). — CUBA: vic. Santiago de las Vegas, 11.IX.04, collector unknown, on dead stems and roots of *Eugenia ?jambis* no. 185 (type of *Geopetalum eugeniae* auct.) (NY); Alto Cedro, date unknown, coll. *Underwood & Earle 1640* (as *Plicatura obliqua*) (NY); location unknown, Fungi Cubenses Wrightiani, date unknown, coll. *C. Wright 167* (as *Lentinus eugrammus* Montagne) (NY). — ECUADOR: Napo, Lago Agrio, 16.V.73, coll. *R. Singer B-7497*, ad lignum (F). — MALAYSIA: Negri Sembilan, Pasoh Forest Reserve, 12.IX.95, coll. *R. Watling 52A/95* , on rotten log on trail in logged-over area (E no. 26613; TENN 56940) [single-basidiospore isolates and dikaryon culture: TENN]; Negri Sembilan, Pasoh Forest Reserve, 12.IX.95, coll. *R. Watling 63A/95* , on old rotten buttress of tree fallen across trail in unlogged lowland dipterocarp forest (E no. 16614; TENN 56938); location unknown, *Watling 193/95* (CULTENN no. 7399) [single basidiospore isolates and dikaryon: TENN]. — UNITED STATES: Puerto Rico, Colon, 6.I.10, coll. *M.A. Howe s.n.* (as *Plicatura obliqua*) (NY); Rio Piedras, 18.VIII.12, coll. *J.R. Johnston 551* (as *Plicatura obliqua*) (NY); Mayaguez, 22.XII.15, coll. *B. Fink, Murrill 64* (NY); Rio Piedras, 8.IX.12, coll. *J. R. Johnston 743* (NY); Cayey, campus of Collegio Universidad de Cayey, 17.X.93, coll. *D. J. Lodge PR-1308* (MAD; TENN 56940) [basidiomata, single-basidiospore isolates, dikaryon cultures: MAD]; vic. Rio Sabina, 17.I.96, coll. *D.J. Lodge PR-3136* (TENN 56941; cultures as 8281); Luquillo Mts, Bisley Watershed, 27.I.96, coll. *D.L. Lodge PR-3137* (TENN 56939; basidiomata and spore print; cultures as 8282).

On the sheet with the Belize specimen (NY) there are two annotation slips: 1) "*L[entinus]. verae-crucis*. Vera Cruz, Aug. 1854, no. 4. So near 35 & 36 I cannot disting. See description Wrights Cuba all = 35", and 2) "Cub. Fungi 303. Verae-crucis. 169. *L. verae-crucis*, B. ms (40 pro parte). *Pileo tenui flabelliformi farinaceo-tomentoso albo, stipite brevi cylindrico; lamellis distantibus integris latiusculis*. On stumps in woods. November. Pileus 1–1.5 inches across; stems 2 lines high, farinaceous. Hab. Vera Cruz, August 1854". We do not know these handwritings, and so we do not know what these slips mean. Murrill (1911) listed *L. verae-crucis* in synonymy under *Plicatura obliqua*, together with several other names.

Pleurotus opuntiae (Durieu & Lév.) Sacc.

The name *Pleurotus opuntiae* has been used to represent at least three concepts: 1) a North African *Pleurotus* illustrated by Durieu & Léveillé (1846), Malençon & Bertault (1975) and Pegler (1977); 2) fleshy basidiomata with prominent stipe occurring on rotten basal parts of large *Agave* plants in the Mexican highlands, illustrated by Petersen (1995); and 3) basidiomata with negligible stipe, reportedly parasitic on *Cordyline* ('cabbage tree') in New Zealand (Rees-George et al., 1990; Segedin et al., 1995).

The first interpretation must rest on examination of the type specimen, and is taken up below. The third interpretation has been tested. After the first clues on sexual intercompatibility between various morphological variants within *P. djamor* (Petersen & Hughes, 1993), monokaryon isolates cited by Rees-George et al. (1990), together with isolates from other basidiomata with similar morphology were found to be sexually compatible within the group, as well as with monokaryon isolates of other macromorphological forms represented by other names (i.e., *P. djamor* for a white to pallid olivaceous form, *P. ostreatoroseus*, *P. flabellatus*, *P. salmoneostramineus* for pink forms; Petersen & Hughes, 1993; Petersen, 1995; Nicholl, 1997). Corner (1981) had summarized the morphotaxonomic situation, and all these forms could be represented by the oldest name, *P. djamor*.

In order to test the use of the name *P. opuntiae* by Mexican workers, it was again necessary to examine the type specimen, and to compare it to Mexican material. Because authoritative cultures were not available from North Africa, intercompatibility tests could not be performed. Only morphological comparison is possible at this time, and it is reported below.

Pleurotus opuntiae (Durieu & Lév.) Sacc. — Fig. 8, 9

Pleurotus opuntiae (Durieu & Lév.) Sacc., Sylloge Fungorum 5 (1887) 363.

Agaricus opuntiae Durieu & Lév., Exploration scientifique de l'Algérie (1846) 15, pl. 32, fig. 1 (PC!).

Type specimen outside label: *Agaricus flabellatus* Sur ... *vieux tronc pourri de* Cactus opuntia. [?] Balazoan. 22 Janvier 1840. Inside on sheet to which specimen is glued: Cryptogamie, ex herb. Durieu de Maisonneuve. L. Motelay (1878). Annotation: Rev[ised]. Dr. Albert Pilát, Museum Nationale Prague, as *Pleurotus opuntiae* D. et L. 4.VI.1935.

The type specimen comprises three pilei: 1) 70 mm diam., with lamellae exposed (pileus surface glued to sheet); margin thin, lobate to indistinctly lacerate, inrolled, with no evidence of striation, now dark brown; lamellae close, thin, fragile, more or less 3 mm deep, not noticeably marginate, now ochraceous brown; flesh insect-riddled; 2) (left side) fragments of flesh, no lamellae, pileus cuticle glued to sheet; and 3) (right side) pileus surface exposed (lamellae apparently glued to sheet), surface undulate but smooth, apparently inrolled (margin toward mounting sheet); flesh insect-riddled, colour neutral brown. One stipe (40 mm long below lamellar attachment, up to 12 mm thick) with lamellae over upper 45 mm (total basidioma = 85 mm high), apparently solid, expanded somewhat downward, irregular in section, with some evidence of having been rooted; colour neutral brown; lamellae with no evidence of reticulation.

Hyphae of stipe flesh of two types: 1) generative, 1.5–4 μm diam., thin-walled, hyaline, clamped, branched, obscured by skeletals; and 2) skeletal, 1.5–3.5 μm diam., thick-walled (wall < 1.0– > 2.0 μm thick, often obscuring the cell lumen), refractive and glassy under phase contrast microscopy, aseptate, rarely branched, sinuate to undulate, hyaline. Pileus surface (peridermal scalp): blackening in KOH (result of 'poisoning'?), with microscopic amorphous crystalline products in squash mount; hyphae radial, shearing in sheets or fascicles when squashed as though in a coherent skin; generatives only (skeletals restricted to hypodermium and pileus trama), 1–4 μm diam., thin-walled, occasionally clamped, probably hyaline.

Skeletal hyphae extending through hymenophoral trama. Basidia and cheilocystidia not observed. Basidiospores 8.8–11.2 × 3.6–5.2 μm (Q = 1.83–2.80; Em = 2.31; Lm 9.83 μm; Wm = 4.27 μm), cylindrical to elongate-ellipsoid, smooth, hyaline, thin-walled; contents more or less homogeneous (through age?); hilar appendix lateral, not prominent.

Fig. 8. *Agaricus opuntiae*. Illustration from Durieu and Léveillé. — Bar = 1 cm.

Fig. 9. *Agaricus opuntiae*. Holotype specimen. — Bar = 1 cm.

Durieu de Maisoneuve & Léveillé (1846) furnished three illustrations of *Agaricus opuntiae* (Fig. 8), all of macroscopic characters (no spores, cystidia, etc.). The following can be observed from the figures and added to the description of the type specimen above: 1) basidiomata have a prominent stipe; 2) lamellae appear close to somewhat crowded; 3) basidiome margin is inrolled, at least in youth; 4) colour is pale [white to off-white; 3A2–3B2 [Kornerup & Wanscher, 1973]; 5) there seems to be no protrusion of the pileus behind the stipe attachment (i.e., no 'lip'); 6) lamellae are interspersed with at least three ranks of lamellulae; and 7) pileus surface is not glabrous – perhaps radially fibrillose.

A more complete description can be offered using better material from Mexico, as follows.

Pileus (Fig. 10) up to 110 mm broad, distinctly radially fibrillose, occasionally areolate into coarse patches in age, 'pale ochraceous buff' to off-white, patches 'tilleul buff', especially in age and in bright sunlight; margin not striate, inrolled at all ages, tightly so when immature; flesh up to 12 mm thick near stipe, gradually becoming thinner outward, white, solid, homogeneous, prone to insect infestation. Lamellae deeply decurrent, close to subdistant, rather thick but shallow (< 4 mm deep), not reticulate or anastomosing downward, in four ranks, off-white ('pale cinnamon pink'). Stipe stout (up to 120 × 23 mm), rooting into central mass of host plant, tough, strigose below, 'pale cinnamon pink' with distinct tomentum of 'pale smoke gray', with no evidence of asexual spore production; annulus or partial veil absent. Odour and taste distinctly pleurotoid. Hyphae of pileus margin 2.0–6.5 µm diam., more or less parallel, hyaline, thin-walled, commonly septate with clamp-connections, surmounted by common clavate, thin-walled circumcystidia 35–48 × 7–11 µm; hyphae of pileus surface over disc generative, thick-walled (skeletalized; wall up to 1.2 µm thick), remaining septate with clamp-connections, tightly interwoven and somewhat adherent (i.e., as though forming a skin), without circumcystidia; crystalline deposits common at margin, copious over disc; skeletal hyphae absent at margin, abundant over disc but not within 20–50 µm of the pileus surface.

Hyphae of stipe, pileus and hymenophore trama of two types: 1) generative, 1.5–4.5 µm diam., hyaline, thin-walled, commonly septate with clamp-connections, tightly interwoven in pileus and stipe, loosely interwoven in hymenophoral trama; and 2) skeletal, 1.5–4 µm diam., thick-walled (wall usually obscuring the cell lumen), yellowish in KOH, refractive, aseptate, in all tramal tissues; apex acerose, < 1 µm broad. Subhymenium rudimentary, pseudoparenchymatous. Basidia 26–33 × 7–8 µm, broadly clavate to subcylindrical, hyaline, with clamp-connection; contents heterogeneous but without distinct structure; sterigmata 4, up to 6 µm long, subcornute, slender. Pleurocystidia none: cheilocystidia roughly basidiolar, 28–34 × 5.6–6.4 µm, subclavate, often irregularly rounded at apex, hyaline, thin-walled, with clamp-connection, not lecythiform. Basidiospores 9.2–12.0 × 4.4–5.6 µm ($Q = 1.77$–2.42; $Em = 2.10$; $Lm = 10.75$ µm), cylindrical to elongate-ellipsoid, smooth, hyaline, thin-walled; contents heterogeneous but amorphous; hilar appendix lateral, not prominent.

Culture characters (material used: Mexico: Est. Tlaxcala, ET-3313, basidiomata in herb. *Estrada-Torres*, Universidad Autonoma de Tlaxcala; polyspore dikaryon culture) — In rapidly growing colonies, morphology was of sparsely cottony fans, and in slow colonies, growth was by compact fans, often of more compressed hyphae. All colonies produced common to abundant 'microdroplets', with two notable characteristics: 1) microdroplets were extremely large (5–17 µm diam.) when compared to those produced by other species, including *P. djamor* forms; and 2) microdroplets are formed on hyphal tips as well as on shorter side branches, contrary to other taxa which produce microdroplets only on short, slender side branches.

Mating system (same specimen used; monokaryon isolates derived from spore print) — When 11 single-basidiospore isolates were paired in all combinations, a tetrapolar mating system was revealed (Fig. 11). Isolates 2, 5, 6, 8, 9, 12*, 14 = A_1B_1; 3*, 11 = A_2B_2; 7* = A_1B_2; 10* = A_2B_1. Isolate 4 = dikaryon.

Several isolates grew slowly, and were reluctant to make contact, thus mimicking a flat contact zone morphology. When these pairings finally met, however, there was no pattern,

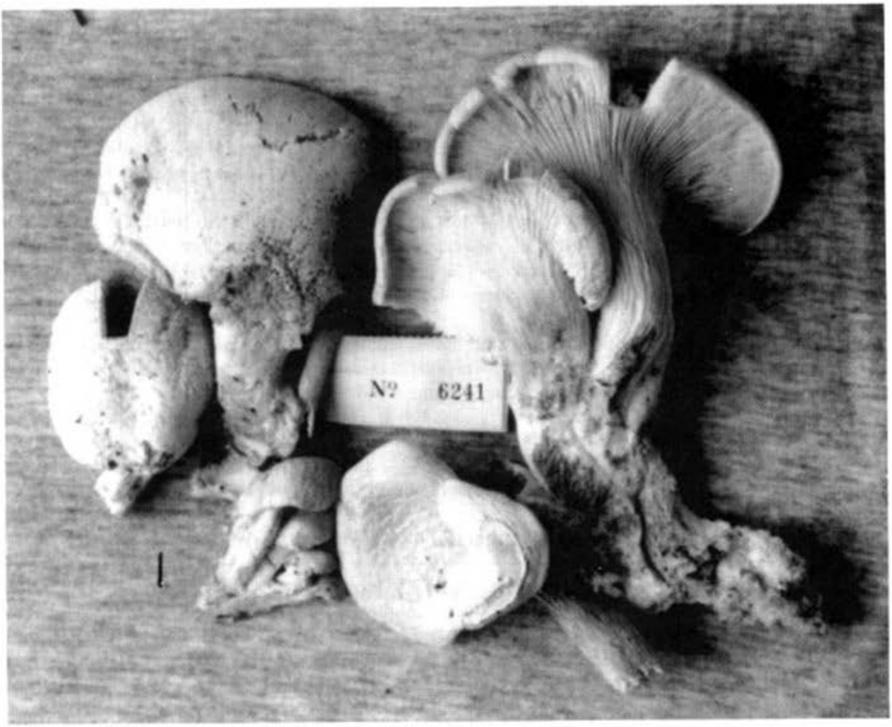


Fig. 10. *Pleurotus opuntiae*. TENN 52368. — Bar = 1 cm.

with several being compatible. No evidence of barrage contact zone morphology was noted, so subordinate mating types were assigned arbitrarily.

Specimens examined. MEXICO: Est Tlaxcala, Ciudad Tlaxcala, purchased in city markets, 18.VII.93, *RHP & K.W. Hughes 6276* (TENN no. 52369); road to Tlaxco, 12.VII.93, coll. *K.W. Hughes 6241* (TENN no. 52368) on basal rotten leaves of *Agave*; same location, date, collector, no. *6277* (TENN s.n.).

Macro- and micromorphological characters from the type specimen and Mexican material are so similar that we conclude that *P. opuntiae* fruits in North Africa and Mexico, and that the Mexican use of the name is correct.

Although generative hyphae are more common than skeletals in the stipe of the type specimen, the generatives do not refract light, crumple easily and shatter in squash mounts, so the eye is drawn to the skeletals as though they were the only hyphal type present.

Pegler (1977) furnished a description and figures under *P. opuntiae*, but the following characters differ from the type specimen: 1) stipe 'usually very short'; and 2) context monomitic. Except for these prominent differences, however, Pegler's description closely fits the type specimen of *P. opuntiae*.

Diagnostic characters for this species are as follows: 1) basidiomata pleurotoid; 2) lamellae deeply decurrent, non-reticulating; 3) stipe prominent; 4) pileus surface pallid; 5) hyphal construction dimitic; and 6) pileus flesh thick.

	A_2B_2		A_1B_1							A_2B_1	A_1B_2
	11	3	5	6	2	8	9	12	14	10	7
11		−	+	+	+	+	+	+	+	−	−
3	−		+	+	+	+	+	+	+	−	−
5	+	+		−	−	−	−	−	−	−	−
6	+	+	−		−	−	−	−	−	−	−
2	+	+	−	−		−	−	−	−	−	−
8	+	+	−	−	−		−	−	−	−	−
9	+	+	−	−	−	−		−	−	−	−
12	+	+	−	−	−	−	−		−	−	−
14	+	+	−	−	−	−	−	−		−	−
10	−	−	−	−	−	−	−	−	−		+
7	−	−	−	−	−	−	−	−	−	+	

Fig. 11. *Pleurotus opuntiae*. Self-cross of collection ET 3313.

No evidence of asexual propagule production has been seen in *P. opuntiae*, but basidiomata of *P. australis* from nature also show no evidence of asexual spore production, although basidiome primordia fruited under laboratory conditions produce a turf of dark gray to black arthospores (see Petersen et al., 1997). Asexual reproduction in *P. opuntiae* cannot be ruled out, therefore.

Basidiomata of *P. levis*, with dimitic hyphal construction, prominent stipe, and pale colours, produce a partial veil, at least in some fruitings. Its range includes at least some Caribbean islands (i.e., Puerto Rico), but the pileus surface is composed of a strigose trichoderm, not repent hyphae. Production of a partial veil and trichodermoid pileus surface separate *P. levis* from *P. opuntiae*. Likewise, *P. dryinus* also is diagnosed by the presence of a partial veil. Moreover, cultures of *P. dryinus* consistently produce brown, thick-walled arthroconidia, and the species seems limited to the North Temperate Zone.

REFERENCES

Corner, E.J.H. 1981. The genera Lentinus, Panus, and Pleurotus. Beih. Nova Hedwigia 69.

Dörfelt, H. & H. Görner. 1989. Die Welt der Pilze. Leipzig.

Durieu de Maisonneuve, C. & J.H. Léveillé. 1846. Atlas de la flore d'Algérie.

Fries, E.M. 1830. Agaricus synonymos in Persoonii Mycologia Europaea III et Systemate suo mycologico reconciliat. Linnaea 5: 689–745.

Fries, E.M. 1838. Epicrisis systematis mycologici, seu synopsis Hymenomycetum. Upsaliae.

Hilber, O. 1982. Die Gattung Pleurotus. Bibltheca mycol. 87.

Horak, E. 1968. Synopsis generum Agaricalium. Beitr. Kryptogam. Schweiz 13.

Kornerup, A. & J.F. Wanscher. 1973. Methuen handbook of colour. 3rd ed. London.

Léveillé, J.H. 1855. Iconographie des Champignons de Paulet. Paris.

Malençon, G. & R. Bertault. 1975. Flore des champignons supérieurs du Maroc. Vol. 2. Rabat.

Montagne, J.F.C. 1845. Criptogamia o plantas celulares in Ramon de la Sagre, Historia fisica politica y natural de la isla de Cuba. IX. Bertrand, Paris.

Murrill, W.A. 1911. The Agaricaceae of tropical North America I. Mycologia 3: 23–36.

Nicholl, D.B.G. 1997. Relationships within the Pleurotus djamor species complex. Master's Thesis, ined., Univ. Tennessee, Knoxville.

Ohira, I. 1990. A revision of the taxonomic status of Pleurotus citrinopileatus Rep. Tottori Mycol. Inst. 28: 143–150.

Paulet, J.J. 1793. Traité des Champignons, ouvrage, vol. II. Paris.

Pegler, D.N. 1977. A preliminary agaric flora of East Africa. Kew Bull., Addit. Ser. 6.

Persoon, C.H. 1828. Mycologia Europaea. Sect. Tertia, Part. Prima. Erlangae.

Petersen, R.H. 1995. Contributions of mating studies to mushroom systematics. Canad. J. Bot. 73 (Suppl. 1): S831–S842.

Petersen, R.H. & K.W. Hughes. 1993. Intercontinental breeding collections of Pleurotus pulmonarius, with notes on P. ostreatus and other species. Sydowia 45: 139–152.

Petersen, R.H. & I. Krisai-Greilhuber. 1996. An epitype specimen for Pleurotus ostreatus. Mycol. Res. 100: 229–238.

Petersen, R.H., D.B.G. Nicholl & K.W. Hughes. 1997. Mating systems of some putative polypore-agaric relatives. Plant Syst. Evol. 207: 135–158.

Petersen, R.H. & G.S. Ridley. 1996. A New Zealand Pleurotus with multiple-species sexual compatibility. Mycologia 88: 198–207.

Pfister, D.H., J.R. Boise & M.A. Eifler. 1990. A bibliography of taxonomic mycological literature 1753–1821. Mycol. Mem. 17.

Phillips, R. 1981. Mushrooms and other fungi of Great Britain and Europe. Pan Books, London.

Rees-George, J., G.I. Robertson & B.T. Hawthorne. 1990. Sudden decline of cabbage trees (Cordyline australis) in New Zealand. N.Z. J. Bot. 28: 363–366.

Ridgway, R. 1912. Color Standards and Color Nomenclature. Washington, DC. Publ. Priv.

Segedin, B.P., P.K. Buchanan & J.P. Wilkie. 1995. Studies in the Agaricales of New Zealand: New species, new records and renamed species of Pleurotus (Pleurotaceae). Austral. Syst. Bot. 8: 453–482.

Singer, R. 1944. New genera of fungi. Mycologia 36: 358–368.

Singer, R. 1950. Type studies of basidiomycetes. IV. Lilloa 23: 147–246.

Singer, R. 1973. Diagnoses fungorum novorum Agaricalium. III. Beih. Sydowia 7.

Singer, R. 1986. The Agaricales in modern taxonomy. Koeltz, Koenigstein.

Stafleu, F.A. & R.S. Cowan. 1983. Taxonomic Literature, 2nd ed., Vol. IV. The Hague.

Vilgalys, R. & B.L. Sun. 1994. Ancient and recent patterns of geographical speciation in the oyster mushroom Pleurotus as revealed by phylogenetic analysis of ribosomal DNA sequences. Proc. Nat. Acad. Sci. 91: 4599–4603.

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NOTULAE AD FLORAM AGARICINAM NEERLANDICAM – XXXIII

Notes on Agaricus section Spissicaules

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The subsection *Spissicaules* of *Agaricus* section *Sanguinolenti* is raised to section level. It is mainly characterised by the simple annulus, the presence of yellowing rhizomorphs, yellow discolouration of the context or surface at the base of the stipe and a positive Schaeffer-reaction, and the slightly reddening context in the higher part of the stipe. Section *Spissicaules* comprises three species in the Netherlands, viz. *Agaricus lanipes*, *A. litoralis*, and *A. bresadolanus*. Both *A. maskae* and *A. spissicaulis* are considered synonymous with *A. litoralis*; *A. romagnesii* is regarded as conspecific with *A. bresadolanus*. A new species is described from the Netherlands and Great Britain, *A. rufotegulis*, which is tentatively placed in subgenus *Lanagaricus* on account of the covering of the pileus and stipe.

Section Spissicaules

The group of species related to *Agaricus lanipes* is characterised by the presence of a simple, thin annulus, yellowing rhizomorphs, and the usual yellow discolouration of the context or surface at the base of the stipe, in combination with a positive Schaeffer-reaction (cross-reaction of Anilin and concentrated nitric acid) there. The Schaeffer cross-reaction is negative on the surface of the pileus. Heinemann (1978) considered the group to be a subsection of the section *Sanguinolenti* J. Schaeff. & F. Møller, viz. subsection *Spissicaules*. It differs from section *Sanguinolenti*, however, in the only faintly reddish discolouration of the context, in combination with a yellow discolouration in the base, and the structure of the annulus, which has in section *Sanguinolenti* a double margin or large marginal squames at the underside. It may be regarded as an intermediate between the group in *Agaricus* with reddening context or surface of pileus or stipe, and the group with yellowing context or surface of pileus or stipe. The species have also characters in common with section *Xanthodermi* Sing., viz. the yellow discolouration in the base of the stipe, but have a less persistent annulus which is not double at the margin and, in contrast to the species of *Xanthodermi*, a positive Schaeffer-reaction on the base of the stipe. Because of its separate position, and no clear affinities to other sections, in particular not with *Sanguinolenti*, the subsection is raised to section level here.

Agaricus section Spissicaules (Heinem.) Nauta, *stat. nov.*

Basionym: *Agaricus* sect. *Agaricus* subsect. *Spissicaules* Heinem., Sydowia 30 (1978) 11.

Pileus whitish with pale brownish squames or brown to yellowish or reddish brown, occasionally slightly yellowing on handling, Schaeffer-reaction on surface negative; annulus thin, simple and often evanescent; context not discolouring or faintly reddish when cut; in base of stipe usually yellowish; Schaeffer-reaction orange on base of stipe; base of stipe with yellowing rhizoids; lamella-edge heterogeneous with scattered cystidia, or with zone of sterile elements, cheilocystidia inconspicuously basidioliform or clavate and small.

In the Netherlands and adjacent regions three species are recognised within the section *Spissicaules*, to which a key is given below. Bon (1985) considers also the following species to belong to the subsection *Spissicaules*: *Agaricus ludovici* Remy, *A. duchemini* M. Bon, *A. vinosobrunneus* P.D. Orton and *A. luteolorufescens* P.D. Orton. *Agaricus ludovici* Remy resembles the species of this section in the morphology of the ring, but is more similar to *A. campestris* in other aspects, a.o. the presence of a germpore (Remy, 1964). The name is invalidly published since no type was designated (ICBN, 1994, art. 37.1). *Agaricus duchemini* M. Bon (1985) probably belongs to section *Spissicaules*, but its identity is uncertain to the author. It may be a synonym of *Agaricus litoralis*. It is characterised by a white, distinctly yellowing pileus, and spores of 7–8.5 µm long. It was, however, originally described as a subspecies of *Agaricus ludovici* (*A. ludovici* subsp. *littoralis* Duchemin, 1979), and therefore also invalidly published (ICBN, 1994, art. 43.1). Types were studied of *Agaricus vinosobrunneus* P.D. Orton, which is a form of *A. silvaticus* J. Schaeff.: Fr., and *A. luteolorufescens* P.D. Orton, which proved to be a clear synonym of *A. lanipes*.

KEY TO THE SPECIES OF SECTION SPISSICAULES, OCCURRING IN THE NETHERLANDS AND ADJACENT REGIONS

In this key also *Agaricus rufotegulis*, a newly described species, is included because of its strong superficial resemblance with *A. lanipes*. Microscopic examination of the covering of the pileus and lower part of the stipe revealed, however, that this species may be better placed in subgenus *Lanagaricus* Heinem. emend. A.E. Freeman.

1. Pileus predominantly brown to yellowish or reddish brown squamose; lamella-edge with a 50–80 µm broad sterile layer, composed of catenulate cheilocystidia 2
    2. Pileus with dark brown centre, with broad brown to yellowish brown squames on paler background; stipe clavate to regular bulbose, below annulus with brown girdles; annulus narrow, persistent, squamulose at underside; veil composed of hyphae *A. lanipes*
    2. Pileus entirely reddish brown squamulose; stipe irregular subbulbose, below annulus pruinose, without brown girdles; annulus broad, longly attached to pileus, later evanescent; veil composed of hyphae with inflated elements, intermixed with semiglobose elements .... *A. rufotegulis*
1. Pileus predominantly whitish to pale brownish, usually with appressed brownish squames at centre; lamella-edge usually partly fertile, composed of basidia and inconspicuous cheilocystidia 3
    3. Pileus with appendiculate veil; average spore size (7.1–)7.4–8.0 × 5.5–6.0 µm *A. litoralis*
    3. Pileus without appendiculate veil; average spore size 6.0–6.7 × 4.2–4.7 µm *A. bresadolanus*

DESCRIPTIONS AND NOTES ON THE SPECIES

Agaricus lanipes (F. Møller & J. Schaeff.) Sing., Lilloa 22 (1951) 432 — Fig. 1

Psalliota lanipes F. Møller & J. Schaeff., Ann. mycol. 36 (1938) 65; *Psalliota lanipes* var. *verecunda* F. Møller, Friesia 4 (1950) 26. — *Agaricus luteolorufescens* P.D. Orton, Trans. Br. mycol. Soc. 43 (1960) 182.

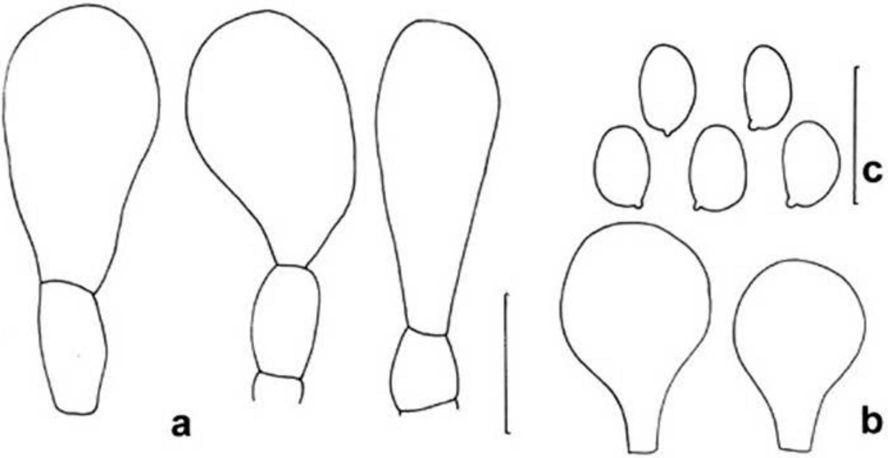


Fig. 1. *Agaricus lanipes*. a. Cheilocystidia, coll. *Brand 8433*; b. cheilocystidia, coll. *Nauta 7445*; c. spores, coll. *Nauta 7445*. Bar = 10 µm.

Pileus 50–100(–140) mm, at first convex, expanding to plano-convex, often with depressed centre, with broad, appressed, fibrillose, brown to yellowish brown squames on a paler background, in centre densely dark brown fibrillose-squamose, not discolouring on handling; veil present when young as whitish appendiculate fringe. Lamellae crowded, free, up to 9.5 mm broad, at first beige to pinkish grey, later blackish brown, with whitish serrulate to denticulate edge. Stipe 40–70(–87) × (8–)10–18 mm, annulate, regularly broadly clavate to bulbose, at base up to 29 mm broad, usually with one or a few short to long whitish to yellowing rhizomorphs, stuffed, whitish, not discolouring, but often yellow or brownish yellow at base on handling, sometimes slowly pale brownish red on scratching; above annulus white then greyish, smooth to very minutely squamulose, below annulus velutinous or fibrillose to floccose, towards base usually with some girdles of brownish, fibrillose, appressed squames, often at base smooth; sometimes entire surface of stipe brownish. Annulus at (0.58–)0.70–0.76 of height of stipe, (5–)10–18 mm wide, descending, slightly spreading to patent, thin, relatively persistent, whitish to yellowish brown (10 YR 6/4), with smooth to striate upperside; underside floccose to squamose or lanate. Context whitish to pale brownish, hardly discolouring to discolouring slowly and slightly reddish or brown when cut in upper part of stipe and pileus, occasionally yellowish in base of stipe. Smell like nuts to somewhat like almonds when cut, especially in base of stipe. Taste not tried.

Macrochemical reactions — KOH/NaOH negative on surface of pileus, yellowish on base of stipe; P-cresol red (context, surface of pileus, stipe); Schaeffer-reaction negative on surface of pileus and stipe, often orange on surface of base of stipe, usually in connection with a yellow discolouration there.

Spores (5.4–)5.6–8.0(–8.2) × (3.3–)3.5–5.4(–5.6) µm, av. l × av. b = (5.8–)6.6–7.1 × (3.6–)4.4–4.7(–5.0) µm, Q = 1.30–1.77(–2.00), av. Q = (1.42–)1.47–1.59(–1.62), ellipsoid, without germpore. Basidia 16–17.5 × 5.5–6.5 µm, usually 4-spored, often some 2-spored also present. Lamella-edge with a 75–80 µm broad sterile layer; cheilocystidia usually in short chains of more or less rounded rectangular elements, with globose to clavate hyaline terminal elements, (12–)14–30 × 9–16(–22) µm. Pileipellis a cutis of 4–9.5 µm wide hyphae with cylindrical, slightly inflated elements, gradually passing into pileitrama, with pale brownish, parietal pigment. Squames consisting of curved, up to 11 mm wide hyphae with cylindrical, up to 11 mm wide terminal elements, with parietal or intracellular pale brownish pigment. Stipitipellis a cutis of slightly gelatinised, 3.5–4.5 µm wide hyphae with cylindrical elements, with parietal yellowish pigment. Clamp-connections absent in all tissues.

Habitat & distribution — Gregarious to sometimes caespitose, in mixed woods or gardens on nutrient-rich sandy or clayey soil. Rather rare in the Netherlands, more or less restricted to the regions on nutrient-rich soil as the new polders, southern Limburg, river region and the western part of the country. Rare in the rest of Europe.

Collections examined. THE NETHERLANDS (all L): prov. Flevoland, Noordoostpolder, Kuinderbos, 1 Sept. 1980, *A.M. Brand 8433*; ibid. 7 Oct. 1981, *A.M. Brand 19601*; prov. Gelderland, Wilp, 19 Aug. 1987, *G. & H. Piepenbroek 1613*; Oosterbeek, De Lichtenbeek, 7 Oct. 1978, *R. van Crevel*; prov. Noord-Brabant, Eindhoven, 27 Sept. 1989, *H. Huyser*; prov. Noord-Holland, Amsterdam, Amsterdamse Bos, 29 Oct. 1958, *H.J. van der Laan*; prov. Zuid-Holland, Oegstgeest, 23 Sept. 1997, *E. Schlatmann (Nauta 7445)*.

The name *Psalliota lanipes* F. Møller & Schaeff. is here regarded as validly published, since it was accepted by the authors as a new species (ICBN, 1994, art. 34.1), even though it was presented as "*Psalliota lanipes* n.sp. (vel subsp. *P. silvaticae*) Møller et Schaeffer." (Schaeffer & Møller, 1938).

Agaricus lanipes var. *verecunda* (F. Møller) F. Møller, differing according to Møller in paler colours and more gracile habit, is considered a synonym here.

The type of *Agaricus luteolorufescens* was studied from Herbarium Kew (Sussex, Friston, 17-11-1957, *P.D. Orton 1112*). The macroscopical features show strong resemblance with *Agaricus lanipes*, something Orton himself already noticed. Also, the spores, measuring 5.8–7(–7.5) × 4–5 µm, and the lamella-edge with a broad sterile layer of short chains of globose, up to 12 µm wide, cheilocystidia, fall within the range of *A. lanipes*. Therefore this taxon is considered synonymous with *Agaricus lanipes*.

Agaricus litoralis (Wakef. & A. Pears.) Pilát, Klíč urc. hub hřib. bedl. (1951) 403 — Fig. 2

Psalliota litoralis Wakef. & A. Pears., Trans. Br. mycol. Soc. 29 (1946) 206. — *Psalliota spissa* F. Møller, Friesia 4 (1950) 53; *Agaricus spissicaulis* F. Møller, Friesia 4 (1952) 203. — *Agaricus maskae* Pilát, Česká Mykol. 8 (1954) 165.

Pileus (52–)60–112(–125) mm, at first hemispherical, expanding to irregularly convex with flattened centre to plano-convex, white to whitish, often with greyish, brownish or, sometimes, reddish tinges, later often with yellowish or brownish spots, also on handling; margin appendiculate; surface fibrillose, with usually faintly delimited, large, light grey to greyish brown or yellowish brown appressed fibrillose squames at centre; veil sometimes present as arachnoid flocks at margin. Lamellae free, 5–10 mm broad, at first pink to pinkish brown or brownish grey, only later dark blackish brown, with paler, entire edge. Stipe shorter

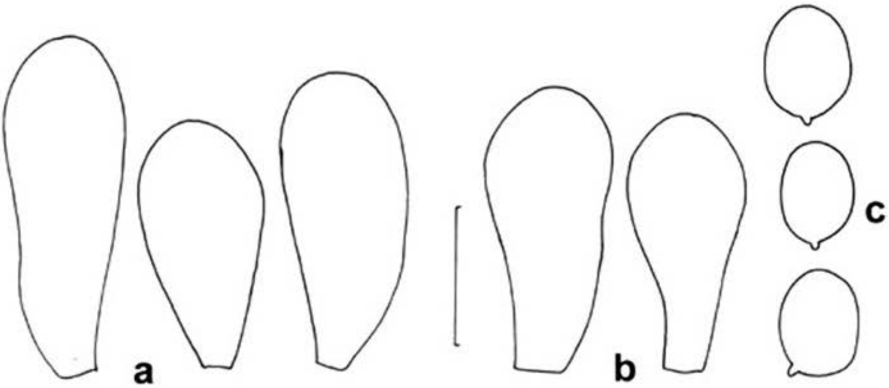
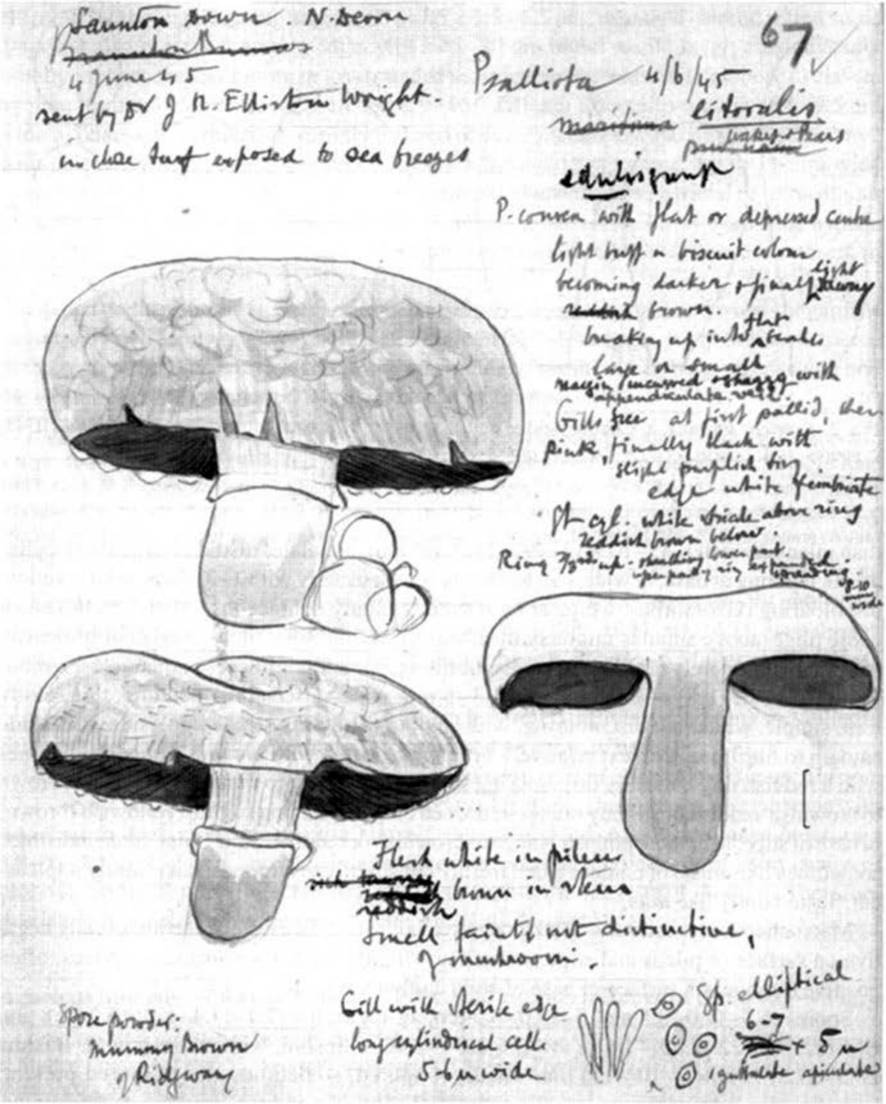


Fig. 2. *Agaricus litoralis*. a. Cheilocystidia, coll. *Loerakker 219*; b. cheilocystidia, coll. *Brand 10545*; c. spores, coll. *Loerakker 219*. Bar = 10 µm.

than pileus diameter, 35–70 × 11–19(–23) (top) mm, annulate, fusoid to irregularly cylindrical, tapering at base, at widest up to 28 mm broad, usually with 1–3, thick, white, yellow discolouring rhizomorphs, white, at base usually faintly ochraceous, often with brownish ochre tinge, above annulus minutely fibrillose-striate and sometimes greyish or brownish, below annulus merely fibrillose to lanose-fibrillose, sometimes floccose-squamulose. Annulus at 0.5–0.6(–0.8) of height of stipe, 3–5 mm wide, descending, pending, thin, easily torn, simple, white, not discolouring, with smooth to slightly striate upperside; underside smooth to fibrillose. Context relatively firm, white, often with brownish tinge, sometimes with a reddish tinge, usually discolouring slowly and faintly to faintly pale pinkish brown to brownish-reddish or slightly orange-red when cut; often at first slightly yellowish (brown) in base of stipe, later there pinkish orange to brownish or reddish. Smell faint, often indistinct, sometimes like anise, of context when freshly cut slightly to almonds, later faintly unpleasant. Taste faintly like nuts.

Macrochemical reactions — KOH negative (all parts); Schaeffer-reaction usually negative on surface of pileus and stipe, sometimes slightly reddish on surface of pileus, often positive (orange) on surface of base of stipe and rhizomorphs.

Spores (6.5–)7.0–8.5 × (4.5–)5.0–6.5 µm, av. l × av. b = (7.1–)7.4–8.0 × 5.2–5.8 µm, Q = (1.17–)1.22–1.55(–1.67), av. Q = 1.34–1.46, ellipsoid, without germpore. Basidia 20.5–27.5(–31) × 7–10(–11) µm, usually 4-spored, sometimes also 2-spored present. Lamella-edge heterogeneous, usually composed of basidia and few, usually inconspicuous, basidioliform, clavate cheilocystidia of (14–)16.5–22(–28) × (4.5–)6–10(–13) µm; sometimes lamella-edge almost sterile; rarely with scattered, conspicuous, clavate, up to 13 µm wide, cheilocystidia. Pileipellis a cutis of 4–5.5 µm wide hyphae with cylindrical elements, with slightly ascending, clavate terminal elements, with pale yellow parietal and intracellular pigment. Stipitipellis a slightly irregular cutis of 3–6.5 µm wide hyphae with cylindrical elements, with up to 8 mm wide, cylindrical terminal elements; with yellowish parietal pigment. Clamp-connections absent in all tissues.



Saunton Down. N. Devon
~~Braunton Burrows~~
4 June 45
sent by Dr J. R. Elliston Wright.
in close turf exposed to sea breezes

Psalliota 4/6/45
67 ✓
~~maritima~~ litoralis
[illegible] others
~~[illegible]~~
edulis group

P. convex with flat or depressed centre
light buff or biscuit colour
becoming darker & finally light ~~tawny~~
~~reddish~~ brown.
breaking up into flat scales
large or small
margin incurved & shaggy with
appendiculate veil.
Gills free at first pallid, then
pink, finally black with
slight purplish tinge
edge white fimbriate
St. cyl. white striate above ring
reddish brown below.
Ring [illegible] up - sheathing lower part,
upper part of ring [illegible] spreading.
8-10 wide

Flesh white in pileus
~~[illegible]~~ ~~reddish~~ brown in stem
Smell faintly not distinctive,
of mushrooms.

Spore powder:
mummy brown
of Ridgway

Gill with sterile edge
long cylindrical cells
5-6µ wide

Sp. elliptical
6-7 × 5µ
1 guttulate apiculate

Fig. 3. *Psalliota litoralis* Original notes made by Pearson. Bar = 1 cm. Published with permission of the Royal Botanic Gardens, Kew.

Habitat & distribution — Solitary or in groups, often in dry pastures, or lawns on sandy soil, in mossy areas in dry coastal dunes; sometimes along roads in grass. Widespread in the Netherlands and elsewhere in Europe, in the Netherlands rather rare, probably in Europe more common in the Balkan area.

Collections examined. HUNGARY: Hortobagy, Szolnok, 16 Sept. 1981, *A.M. Brand 10545* (L, as *A. spissicaulis*); Kölesd, Kajdacs-Nagydorog, com. Tolna, 22 Aug. 1959, *G. Bohus & L. Imreh* (L, as *A. maskae*, duplicate of Bud.). — GERMANY: Meppen, Meppener Weiden, 30 Oct. 1978, *B.W.L. de Vries 3622* (WBS; as *A. arvensis*). — GREAT BRITAIN: England, Surrey, Richmond, Royal Botanic Gardens, Kew, 5 Sept. 1997, *E. Brown* (*Nauta 8047*; L; as *A. maskae*); ibid. (*Nauta 8048*). — THE NETHERLANDS (all L): prov. Noord-Holland, Texel, De Slufter, 7 Nov. 1979, *A.M. Brand 8289* (as *A. spissicaulis*); Texel, Loodmansduinen, 24 Sept. 1998, *M. Nauta 7496*; prov. Gelderland, Wageningen, Bosrandweg, 14 June 1979, *W.M. Loerakker (Brand 8048)*; prov. Utrecht, Amersfoort, 9 July 1984, *J. Wisman*; Leusden, 1 Oct. 1978, *J. Wisman* (as *A. romagnesii*); prov. Zuid-Holland, Oostvoorne, Heveringen, 18 Oct. 1978, *W.M. Loerakker 219* (as *A. spissicaulis*); ibid., 7 Oct. 1989, *A.M. Brand 8493* (as *A. spissicaulis*); Vogelenzang, 16 Sept. 1965, *C. Bas 4528* (as A. aff. *spissicaulis*).

The lamella-edge was never entirely sterile in the examined collections. The amount of cheilocystidia on the lamella-edge seems to be rather variable, but they are always narrow and resemble young basidia. In dried fruit-bodies the cystidia are often inconspicuous, in fresh fruit-bodies the cheilocystidia are more easily seen, and are even shortly catenate sometimes. Also, in dried material, the lamella-edge is very often agglutinated.

Some authors (a.o. Bon, 1985; Cappelli, 1984; Knudsen, 1992) considered *Agaricus litoralis* merely a form of *A. devoniensis* P.D. Orton. Study of the type material of *Agaricus litoralis* (K, Saunton Down, North Devon, 4 June 1945, leg. F.R. Elliston Wright) revealed that the spores are slightly larger than stated in the type description (Pearson, 1946), i.e. 7.7–8.4 × 5.5–6.4 µm, and the lamella-edge is only partly sterile with inconspicuous basidioliform cheilocystidia which measure 16–24 × 5–7 µm. *Agaricus devoniensis*, which belongs to section *Edules*, has a sterile lamella-edge with conspicuous globose, 9–13 µm wide, cheilocystidia, and spores which are in general smaller than those of *A. litoralis*, viz. 5.6–7.4 × 4.3–5.7 µm. Also, the original notes and drawings of Pearson (Fig. 3) show a much sturdier fruit-body, which much resembles the plate of *Psalliota spissa* by Møller (1950).

Agaricus spissicaulis was described by Møller as a species with spores 5–7 × 4–5.5 µm. Two collections present in Herbarium Kopenhagen which were identified by Møller have, however, average spore sizes of 6.9–7.1 × 5.2 µm resp. 7.6 × 5.1 µm (pers. comm. M. Brand), much closer to those given of *Agaricus maskae* (Pilát, 1954: 7.2–7.8 × 3.8–4.3 µm). Wasser (1979) also noticed that the spores of these collections were larger than mentioned in the type description.

The difference between *Agaricus maskae* Pilát and *A. spissicaulis* F. Møller is, apart from the supposed difference in spore size, the size of the pileus which is larger in *A. maskae*. This is here considered of no taxonomical importance but due to ecological circumstances. The two species are considered conspecific. *Agaricus litoralis* is regarded as a synonym because of the strong macroscopical resemblance and the similarity in microscopical characters. Since it is the oldest name it has priority.

Agaricus bresadolanus Bohus, Ann. Hist.-Nat. Mus. Natl. Hung. 61 (1969) 154 (as '*A. bresadolianus*') — Fig. 4

Agaricus campestris β *radicatus* Vittad., Fungi Mang. (1835) 42; *Agaricus radicatus* (Vittad.) Romagn., Bull. trimest. Soc. mycol. Fr. 53 (1937) 129 (nom. illeg., a later homonym of *A. radicatus* Relh.: Fr.). — *Agaricus romagnesii* Wasser, Ukr. Bot. J. 34 (1977) 305. — *Psalliota infida* Alessio, Micol.

ital. 4 (2) (1975) 21 (invalidly published); *Agaricus infidus* (Alessio) M. Bon, Doc. mycol. 11 (44) (1981) 28 (invalidly published, based on an invalidly published name); *A. romagnesii* var. *infidus* (Alessio) M. Bon & Cappelli, Doc. mycol. 13 (52) (1983) 16 (invalidly published, based on an invalidly published name).

Pileus 36–85(–100) mm, convex to plano-convex, sometimes with depressed centre, at first white, later greyish white with light brown centre, fibrillose, later at centre with indistinct, darker greyish brown, lanate squames; slightly yellowing on handling, later with yellowish spots; veil present when young as appendiculate fringe, disappearing with age. Lamellae crowded, free, up to 10 mm broad, at first greyish pink, finally blackish brown, with concolorous, entire edge. Stipe 30–70(–80) × 7.5–16(–20) mm, annulate, clavate to cylindrical with bulbous base, at base up to 30 mm broad, stuffed, straight, with one thick rhizomorph, white, discolouring yellow to yellowish brown at base, above annulus striate, below annulus fibrillose to fibrillose-squamulose. Annulus at 0.67–0.75 of height of stipe, 3 mm wide, descending, pending, simple, thin, often evanescent, white, with striate upperside; underside smooth. Context white, discolouring faintly reddish when cut, in base of stipe faintly yellow. Smell indistinct or sometimes faintly like iodine.

Macrochemical reactions — Schaeffer-reaction negative (surface of pileus), or orange (surface of base of stipe).

Spores 5.5–7.5 × 4.0–5.0(–5.5) µm, av. l × av. b = 6.0–6.7 × 4.2–4.7 µm, Q = 1.22–1.63(–1.75), av. Q = (1.29–)1.38–1.50, ellipsoid, without germpore. Basidia 17–25 × 7–9 µm, 4-spored, sometimes with some 2-spored. Lamella-edge not sterile, usually in majority composed of basidia, with a variable amount of sterile elements; cheilocystidia usually inconspicuous and resembling young basidia, usually clavate, rarely more globose, hyaline, rarely with faint brownish contents, sometimes in very short chains, 13–25 × 7–11(–13) µm. Pileipellis a regular cutis of radially arranged, 4.5–7 µm wide hyphae with cylindrical, sometimes inflated up to 8.5 µm, elements, with clavate, slightly ascending terminal elements, gradually passing into pileitrama, with parietal pale yellowish pigment. Stipitipellis a cutis of sometimes curved, 4–8.5 µm wide hyphae with cylindrical elements, with pale yellowish, parietal pigment. Clamp-connections absent in all tissues.

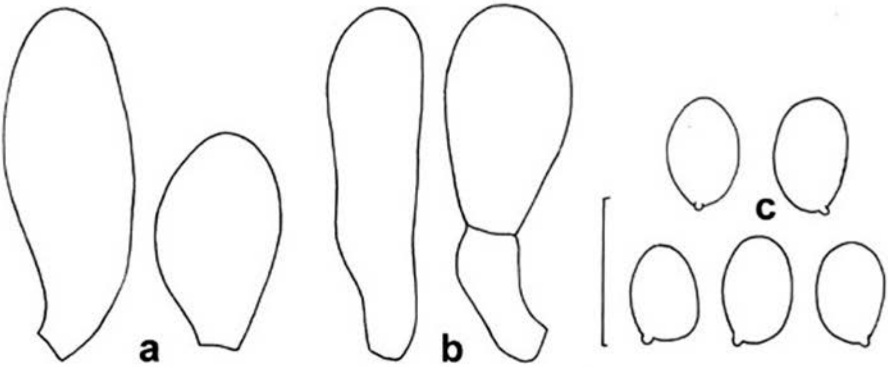


Fig. 4. *Agaricus bresadolanus*. a. Cheilocystidia, coll. *Brand 11316*; b. cheilocystidia, coll. *Brown* 17 Aug. 1997; c. spores, coll. *Brown* 17 Aug. 1997. Bar = 10 µm.

Habitat & distribution — Solitary or in small groups on (nutrient-rich and calcareous) soil. Along paths or on grassy spots in deciduous woods or in gardens, sometimes in meadows. Rare in the Netherlands, and in the whole of Europe, probably not occurring in northern Europe. April, Aug.–Nov.

Collections examined. HUNGARY: Ócsa, Com. Pest, 2–6 Sept. 1964, *I. Ferencz & E. Véssey* (L, duplicate of BP; as *A. campester* var. *radicatus*). — GREAT BRITAIN: England, Berkshire, Abindon, Kingston Bagpuize, 2 Oct. 1969, *G. McLean* (K); Kent, Beacon wood country park, 30 Sept. 1994, *B. Bullen* (K); Horton Kirby, 30 Aug. 1992, *J. Weightman* (K, 20490); Oxford, 2 Oct. 1989, *A. Lack* (K); Surrey, East Ewell, Howell hill nature reserve, 17 Aug. 1997, *E.W. Brown* (L); Fetcham Downs, 19 April 1998, *E.W. Brown* (K, 42288). — THE NETHERLANDS: prov. Zuid-Holland, Leiden, 20 Oct. 1980, *A.M. Brand* (L).

Psalliota infida Alessio (1975) is invalidly published since no type was cited (ICBN, 1994, art. 37.1), therefore also *Agaricus infidus* (Alessio), M. Bon (1981) and *A. romagnesii* var. *infidus* (Alessio) M. Bon & Cappelli (1983) are invalidly published (ICBN, 1994, art. 43.1). Apart from this, *Agaricus infidus* (Alessio) M. Bon would also have been a later homonym of *A. infidus* Peck.

According to Romagnesi (1937) *Psalliota campestris* var. *radicata* Vittad. differed from *Agaricus campestris* in the presence of marginal cystidia and the yellow discolouration of the pileus. Consequently, he raised the taxon to species level and named it *Agaricus radicatus*, unfortunately a later homonym of *A. radicatus* Relh.: Fr. Bohus (1961) noticed that material collected in Hungary resembled this taxon but differed in the absence of cystidia and the yellowing of the pileus. Also, the base of the stipe is more or less bulbous. Later a new species was described, based on the material from Hungary, named *A. bresadolanus* Bohus (1969; as *A. bresadolianus*), but the surface of the pileus was also said to discolour slightly yellow.

Wasser created a new species, *Agaricus romagnesii* Wasser (1977), based on Ukrainian material, differing from *A. bresadolanus* only in the presence of cystidia and a less bulbous base of the stipe. Wasser refers, in so doing, also to the interpretation of Romagnesi (1937) of *Agaricus radicatus*. Remarkable is that Wasser says that the cheilocystidia are absent and that the pleurocystidia are 30–40 × 8–15 µm. Wasser also refers to the interpretation of Reid (1972) of *A. bresadolanus*, who describes and depicts a collection from Kingston Bagpuize in England with clavate sterile elements on the lamella-edge of 20–32 × 5.75–8.75 µm. But, as Reid already stated, it may be that the discrepancies between the descriptions of *A. bresadolanus* and the British material are caused by a different interpretation of the nature of the elements on the lamella-edge. The collection which was cited by Reid was studied from Herbarium Kew, but the lamella-edge was agglutinated and the sterile elements could not be seen clearly, suggesting a heterogeneous lamella-edge with scattered sterile, up to 8 µm wide, clavate elements.

The collections which were examined in this study show a variable amount of sterile elements on the lamella-edge, sometimes only dispersed narrow sterile elements are found, sometimes the edge is almost sterile and the elements are up to 14 µm wide. Also, some collections seem to have a sterile lamella-edge when studied fresh, but have a minority of sterile elements when studied after drying. Since this only possible distinguishing character proved to be that variable, all collections are considered to belong to the same species, *A. bresadolanus*, and *A. romagnesii* is considered to be synonymous.

Agaricus rufotegulis Nauta

In June 1997 Mr. J. Wisman found an *Agaricus* on a rotting heap of leaves in Amersfoort, the Netherlands, and sent it to the author at the Rijksherbarium. No name for the specimens could be found then. Shortly after, a similar collection of *Agaricus* was shown to the author during a visit to the Kew Herbarium. It was collected by Mr. E. Brown from a rotting heap of leaves in Claremont landscape park, Surrey, Great Britain, in August 1997. The two collections proved to belong to the same taxon, and a thorough research did not provide a name for it. Therefore it is described here as new.

Agaricus rufotegulis superficially resembles *A. lanipes*, but differs in the more evanescent annulus and the absence of the brown girdles at the base of the stipe, the smaller reddish squamules on the pileus and the pruinose stipe. It also reminds somewhat of the brownish form of *Agaricus moelleri*, because of the remarkable small fibrillose reddish brown squames on the pileus. It differs from this taxon a.o. in the large but non-persisting annulus, and the positive Schaeffer-reaction on the base of the stipe. The species may show some similarity with old fruit-bodies of *A. porphyrizon*, which has a more persistent, narrower annulus with smooth underside and more vinaceous brown squames on the pileus.

This taxon is macroscopically characterised by the reddish brown squamulose pileus, the large annulus remaining for long attached to the margin of the pileus with a brown, squamose underside, the presence of yellowing rhizoids and the yellow discolouration of the base of the stipe, and the pruinose surface of the lower part of the stipe.

Close examination of the pruinose covering of the lower part of the stipe showed loosely connected chains of almost globose elements, similar to the elements at the underside of the annulus, which are remnants of the general veil (Fig. 5d). Most species occurring in northwestern Europe have a pileus covering composed in majority of cylindric, up to 8 µm wide elements, intermixed with some broader, inflated elements. In most examined species veil or squames on the pileus or stipe cannot be distinguished microscopically from the pileipellis which is a cutis.

Subgenus *Lanagaricus* is distinguished from subgenus *Agaricus*, to which most European species belong, by the presence of a cottony general veil, covering the pileus and lower part of the stipe (Heinemann, 1956). According to the interpretation of Freeman (1979), the general veil is composed of inflated, up to 11 µm wide, elements.

The structure of the general veil of this species is so strikingly different from the other species, that it is tentatively placed in the subgenus *Lanagaricus* section *Laeticolores* Heinem., close to *A. ficophilus* Heinem. or *A. rufoaurantiacus* Heinem., even though the pileus is not covered with cottony veil. The subdivision into subgenera within *Agaricus* needs careful evaluation, preferably based on morphological as well as molecular data.

Agaricus rufotegulis Nauta, *nov. spec.* — Fig. 5, Plate 13, 14

Pileus 80–115 mm latus, irregulariter convexus, dense fibrillo-squamulatus squamis rubro-brunneis; velum plerumque pileus et stipes conjungens, demum fimbriis albis margine appendiculatis. Lamellae liberae, initio pallide subrosae brunneae. Stipes 60–95 mm longus, 12–23 mm latus, plerumque annulatus, albus, infra annulum pruinosus, basi luteola ubi scalpturata vel laesa, mycelii flavidi caespite magno, rhizomorphis lutescentibus. Annulus ad 25 mm latus nutans saepe evanescens, infra flocculoso-brunneus. Caro alba, stipitis basi lutescens. Pileus post reactionem Schaefferi luteolus, stipitis basi aurantiaca.

Sporae 5.0–6.6 µm longae, 3.6–5.1 µm latae, Q = 1.17–1.64, ellipsoideae, sine poro germinativo. Basidia 4-sporigera. Cheilocystidia catenulata partibus terminalibus globosis ad clavatis, 9–21 µm longis, (6–)8–13 µm latis. Pileipellis ab cute hyphis 4–8 µm latis, partibus inflatis ad 19 µm latis. Stipitipellis ab cute hyphis 4.5–7.5 µm latis, infra annulum partim fasciculis laxe connatis partibus fere globosis 10–20 µm longis, 10–17 µm latis obtecta. Annulus e hyphis of 6.5–9.5 µm latis compositus, partibus brevibus inflatis ad 13 µm latis, localiter partibus subglobosis (8.5–)11–16 µm longis, (7.5–)11–14 µm latis.

Holotypus: The Netherlands: prov. Utrecht, Amersfoort, 11 June 1997, *J. Wisman* (L 988.202-263).

Pileus 80–115 mm, at first hemispherical, expanding to slightly irregularly convex, sometimes with depressed centre, with margin exceeding lamellae, at centre reddish brown (5 YR 4/4 diluted), smooth, otherwise densely covered with small reddish brown to brown fibrillose squames on paler background, not discolouring to slightly yellowish orange on handling; veil for a long time connecting pileus and stipe, later present as white fringe. Lamellae free, up to 10 mm broad, at first pale pinkish brown, later dark brown, with slightly paler, entire edge. Stipe 60–95 × 12–23 mm, with broad annulus or without annulus, cylindrical to subclavate, young subbulbose, at base up to 25 mm broad, often with large clump of yellowish mycelium, usually with more or less yellowing relatively thick rhizomorphs, straight to curved, stuffed, white, at base yellowish when scratched, below annulus pruinose to minutely squamulose. Annulus at 0.75–0.85 of length of stipe, up to 25 mm wide, de-

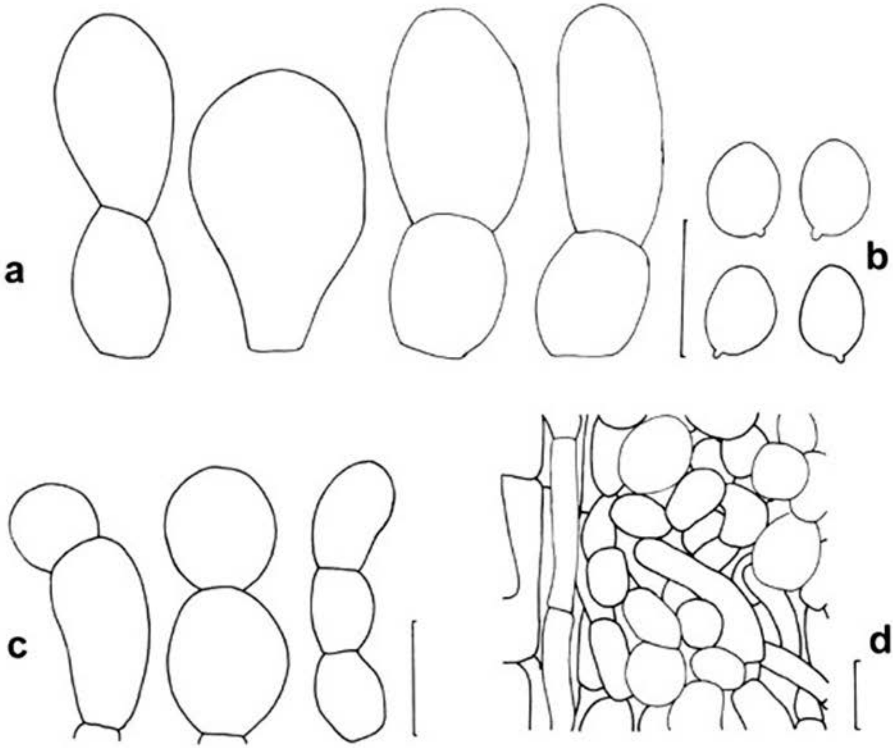


Fig. 5. *Agaricus rufotegulis*. a. Cheilocystidia; b. spores; a & b from type coll. (L 988.202-263); c. cheilocystidia, coll. *KM 53683*; d. stipitipellis, type coll. Bar = 10 µm.

scending, pending to slightly spreading, for a long time partly attached to pileus, often evanescent, white, with smooth upperside; underside with numerous, whitish to often brownish floccose squames. Context 7–10 mm thick in pileus, white, not discolouring when cut, except for a yellowish discolouration in base of stipe. Smell slightly to almonds or anise when cut, sometimes unpleasant. Taste not tried.

Macrochemical reactions — Schaeffer-reaction yellowish (surface of pileus) to orange (surface of base of stipe).

Spores 5.0–6.6 × 3.6–5.1 µm, av. l × av. b = 5.7–6.1 × 4.0–4.6 µm, Q = 1.17–1.64, av. Q = 1.32–1.44(–1.51), ellipsoid, without germpore. Basidia 18–24 × 7–8.5 µm, 4-spored. Lamella-edge with a 45–50 µm broad sterile layer; cheilocystidia in chains of rounded rectangular to globose elements, 7–12 × 4.5–11 µm, with globose to clavate terminal elements, 9–21 × (6–)8–13 µm. Pileipellis a cutis of radially arranged, 4–8 µm wide hyphae with often inflated elements of 16–47 × 11–19 µm, with slightly ascending clavate terminal elements of 20–40 × 20–23 µm, gradually passing into pileitrama, with pale yellowish, parietal pigment. Squames not distinguishable. Stipitipellis a regular, slightly gelatinized cutis of 4.5–7.5 µm wide hyphae with cylindrical, sometimes slightly inflated elements, with pale yellow, parietal pigment, below annulus intermixed or partly covered with clusters of loosely connected, almost globose elements of 10–20 × 10–17 µm. Annulus composed of irregularly arranged, somewhat curved, 6.5–9.5 µm wide hyphae with short, inflated elements up to 13 µm wide, in places resulting in chains of subglobose elements of (8.5–) 11–16 × (7.5–)11–14 µm which are often detached. Clamp-connections absent in all tissues.

Habitat & distribution — Gregarious on heaps of rotting dead leaves in deciduous woods. Very rare, known from the Netherlands (type locality, Amersfoort) and England (Surrey, Esher, Claremont landscape park). June–Nov.

Collections examined. THE NETHERLANDS: prov. Utrecht, Amersfoort, 11 June 1997, *J. Wisman* (holotype L 988.202-263); ibid., Aug. 1997 (L). — GREAT BRITAIN: England, Surrey, Claremont Park, 10 Aug. 1997, *E.W. Brown* (K, 53683); ibid., 20 Aug. 1997 (L); ibid., 21 Sept. & 4 Nov. 1998 (L).

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REFERENCES

Alessio, C.L. 1975. Psalliota radicata Vitt. sensu Bres. e P. radicata sensu Essette: nome nuovo per la seconda: Psalliota infida (= Agaricus infidis) sp. n. Micol. ital. 2: 16–22.

Bohus, G. 1961. Psalliota studies I. Critical species, critical notes. Ann. Hist.-Nat. Mus. Natl. Hung. 53: 187–194.

Bohus, G. 1969. Agaricus studies II. Ann. Hist.-Nat. Mus. Natl. Hung. 61: 151–156.

Bon, M. 1981. Combinaisons et noms nouveaux. Doc. mycol. 11 (44): 28.

Bon, M. 1985. Clé monographique du genre Agaricus L.: Fr. (Sous-genre Agaraicus). Doc. mycol. 15 (60): 1–37.

Bon, M. & A. Cappelli. 1983. Combinaisons et taxons nouveaux. Genre Agaricus. Doc. mycol. 13 (52): 16.

Cappelli, A. 1984. Agaricus L.: Fr. ss. Karsten (Psalliota Fr.). Candusso, Saronno.

Duchemin, T. 1979. Champignons supérieurs de Normandie. Macromycètes (Ascomycètes & Basidiomycètes) rares, peu connus ou nouveaux (1ère note). Bull. Soc. linn. Normandie 107: 27–39.

Freeman, A.E.H. 1979. Agaricus in the southeastern United States. Mycotaxon 8: 50–118.

Heinemann, P. 1956. Champignons récoltés au Congo Belge par Madame M. Goosens-Fontana. II. Agaricus Fries s.s. Bull. Jard. Bot. Bruxelles 26: 1–127.

Heinemann, P. 1978. '1977'. Essai d'une clé de détermination des genres Agaricus et Micropsalliota. Sydowia 30: 6–37.

Knudsen, H. 1992. Agaricus L.: Fr. In: L. Hansen & H. Knudsen (eds.), Nordic Macromycetes: 206–214.

Møller, F.H. 1950. Danish Psalliota species. Friesia 4: 1–60.

Pearson, A.A. 1946. New records and observations III. Trans. Br. mycol. Soc. 29: 191–210.

Pilát, A. 1954. Pečárka Maškova – Agaricus Maškae Pilát, nový druh z blízkého příbuzenstva P. velkový trusé. Česká Mykol. 8: 159–165.

Reid, D.A. 1972. Fungorum rariorum icones coloratae. VI. Cramer, Vaduz.

Remy, L. 1964. Contribution à l'étude de la Flore mycologique Briançonnaise (Basidiomycètes et Discomycètes). Bull. trimest. Soc. mycol. Fr. 80: 459–585.

Romagnesi, H. 1937. Liste des Champignons supérieurs receuillis à Paris. Bull. trimest. Soc. mycol. Fr. 53: 117–133.

Schaeffer, J. & F. Møller. 1938. Beitrag zur Psalliota-Forschung. Ann. mycol. 36: 64–82.

Wasser, S.P. 1977. Novi ta ridkisni vidi s rodini Agaricaceae Cohn. Ukr. Bot. J. 34: 305–308.

Wasser, S.P. 1979. Fungorum rariorum Icones coloratae X. Cramer, Vaduz.

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FURTHER NEW SPECIES OF MYCENA FROM SPAIN – II

M. VILLARREAL[1], M. HEYKOOP[1] & R.A. MAAS GEESTERANUS[2]

In this paper, again, three new species of section *Fragilipedes* are described, *Mycena olivaceoflava*, *M. rubidofusca* and *M. vicina*. *Mycena hepatica* is a new species of section *Rubromarginatae*. The circumscription of section *Insignes* is slightly altered, as a result of which *Mycena quinaultensis*, *M. conspersa*, *M. mitis* and *M. corrugans* are transferred to section *Fragilipedes*.

Mycena olivaceoflava Villarreal, Heykoop & Maas G., *spec. nov.* — Figs. 1–6

Basidiomata gregaria. Pileus 4–8 mm latus, e conico conico-campanulatus, umbonatus, striatus, haud sulcatus, siccus, e pruinoso glabrescens, olivaceoflavus. Caro tenuis, pileo concolor, odore indistincto. Lamellae 13–15 stipitem attingentes, adscendentes, adnatae, haud dente decurrentes, albae, margine convexae, albidae. Stipes 40–75 × –1 mm, cylindraceus, fragilis, e pruinoso glabrescens, apice excepto, siccus, pileo concolor vel basi satis brunneo-olivaceus, radicans, basi dense albofibrillosus.

Sporae 9.5–***10.54***–11.5 × 5.5–***6.43***–7 µm, ellipsoideae, leves, amyloideae. Basidia 4-spora, 20–23 × 9.5–14 µm, late clavata, efibulata, sterigmatibus usque ad 8 µm instructa. Cheilocystidia 25–45 (–60) × 7–13 µm, hyalina, subutriformia, lageniformia vel fusiformia, efibulata, collis 1–3(–pluribus) munita. Lamellarum margo sterilis. Pleurocystidia nulla. Hymenophori trama dextrinoidea, e hyphis usque ad 23 µm latis. Hyphae pileipellis 2.5–4 µm latae, efibulatae, haud in materiam gelatinosam inmersae, surculis simplicibus vel ramosis (4–)8–22 × 1.5–2.5 µm instructae. Hyphae stipitipellis 2–4 µm latae, efibulatae, verrucis 1.5–3 × 0.8–1.2 µm instructae. Caulocystidia usque ad 20 µm lata, stipitis parte superiore sparsa.

In *Salicis atrocinereae* sarmenta.

Holotypus: no. 22264 AH.

Etymology: olivaceoflavus, olivaceous-yellow.

Basidiomata gregarious. Pileus 4–8 mm diam., conical to conical-campanulate, with a large umbo, translucent-striate, not sulcate, dry, pruinose, glabrescent, evenly olivaceous-yellow (Mu. 5 Y 7/6) except at centre which is olivaceous (Mu. 5 Y 6/4, 6/5), turning pale olivaceous (Mu. 5 Y 6/4) when drying. Context thin and concolorous. Odour not distinctive. Lamellae 13–15 reaching the stipe, ascending, adnate, without a decurrent tooth, white, whitish to yellowish in dried material, lamella-edge convex and whitish. Stipe 40–75 × –1 mm, cylindrical, fragile, pruinose, glabrescent except at the apex, dry, concolorous to pileus or slightly more brown-olivaceous (Mu. 5 Y 5/3) towards the base, rooting, at the base densely covered with thin and whitish fibrils which lump together the surrounding organic matter.

Spores 9.5–***10.54***–11.5 × 5.5–***6.43***–7 µm; Q = 1.4–***1.64***–1.9 (n = 21), ellipsoid, smooth, amyloid. Basidia 4-spored, 20–23 × 9.5–14 µm, broadly clavate, clampless, sterigmata up to 8 µm in length. Cheilocystidia 25–45(–60) × 7–13 µm, hyaline, subutriform, lageniform to fusiform, clampless, with one to three (or more) necks, the latter up to 5 µm wide, with more or more irregularly shaped necks towards the margin of pileus. Lamella-edge sterile. Pleurocystidia absent. Hymenophoral trama dextrinoid, consisting of hyphae up to 23 µm

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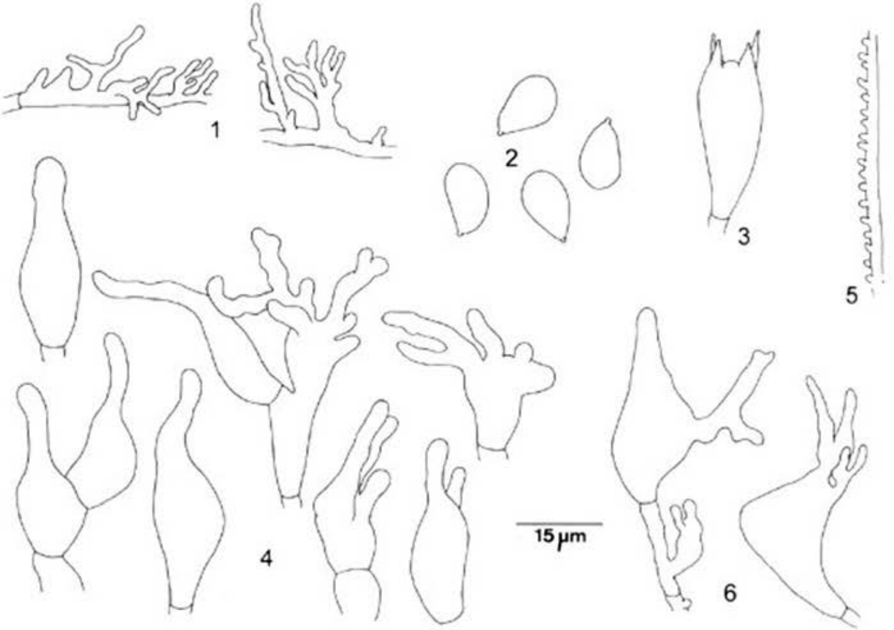


Figs. 1–6. *Mycena olivaceoflava* (holotype). 1. Hyphae of the pileipellis; 2. spores; 3. basidium; 4. cheilocystidia; 5. hyphae of the stipitipellis; 6. caulocystidia.

diam. Hyphae of the pileipellis 2.5–4 µm wide, clampless, not embedded in gelatinous matter, covered with simple or more or less ramified excrescences (4–)8–22 × 1.5–2.5 µm, usually forming dense coralloid masses. Hyphae of the stipitipellis 2–4 µm wide, clampless, densely covered with warts (1.5–3 × 0.8–1.2 µm) at the lower portion of the stipe, the latter more scattered towards the upper portion. Caulocystidia scattered, up to 20 µm wide, only present at the upper portion of the stipe.

Habitat — On humus of *Salix atrocinerea* Brot.

Material examined. Madrid, Pto. de Canencia, 24 Oct. 1996, leg. *F. Esteve-Raventós, C. Sánchez, J.N. Campoamor & M. Villarreal*, on humus of *Salix atrocinerea*, AH 22264 (holotype).

This material represents a new species belonging to section *Fragilipedes*. It is characterized by the bright olivaceous-yellow colour of both the pileus and stipe, its rooting stipe, absence of clamps and pleurocystidia, its apically divided cheilocystidia in two or more long necks and its fructification on humus of *Salix*. Besides, the caulocystidia are only present at the upper portion of the stipe. This feature should be taken into consideration when trying to include this new taxon into future keys.

When following the key to the section *Fragilipedes* (Maas Geesteranus, 1988), the present taxon keys out close to *Mycena chrysocorypha* Singer, a species described from alpine and subalpine zones of the former Soviet Union, fruiting on *Betula rotundifolia* Regel & Tiling.

Mycena chrysocorypha differs, however, from *M. olivaceoflava* because of its narrower spores (8.1–9.7 × 4.3–5.4 µm), presence of pleurocystidia and very different aspect of the ornamentation of the hyphae of the pileipellis. The differences between *M. olivaceoflava* and *M. chrysocorypha* are tabulated in Table I.

Table I. Differences between *Mycena olivaceoflava* and *M. chrysocorypha*.

	Spores	Pleurocystidia	Length of cheilocystidia	Lamella-edge	Width of caulocystidia	Lamellar insertion	Habitat
M. olivaceoflava	Q = 1.59–1.71	–	25–60 µm	homogeneous	–20 µm	without decurrent tooth	not alpine
M. chrysocorypha	Q = 1.77–1.81	+	18–33 µm	heterogeneous	–6.5 µm	with decurrent tooth	(sub) alpine

Another close species seems to be *Mycena lutea* Bres. which is apparently very similar to *M. olivaceoflava* from a macroscopical point of view but, although it was described originally as lacking clamps and with bisporic basidia, later Örstadius (1993) found a tetrasporic and clamped form. In addition, *M. lutea* differs from *M. olivaceoflava* because of its smaller spores (7–8 × 4–5 µm in the tetrasporic form), differently shaped caulocystidia and its habitat in coniferous woods.

Mycena rubidofusca Villarreal, Heykoop & Maas G., *spec. nov.* — Figs. 7–11

Basidiomata gregaria. Pileus 10–14 mm latus, conicus usque ad conico-campanulatus, subumbonatus, e pruinoso glabrescens, hygrophanus, striatus, madidus subviscidus, obscure rubidofuscus, centro atrobrunneus. Caro albida, stipite grisea, odore saporeque indistinctis. Lamellae c. 18–20 stipitem attingentes, c. 15 mm latae, crassae, adscendentes, adnatae vel dente subdecurrentes, isabellinogriseolae, margine convexae. Stipes 30–65 × –2 mm, radicans, cylindraceus vel deorsum subincrassatus, apice pruinosus, cartilaginosus, griseobrunneus, nitens, basi dense albofibrillosus.

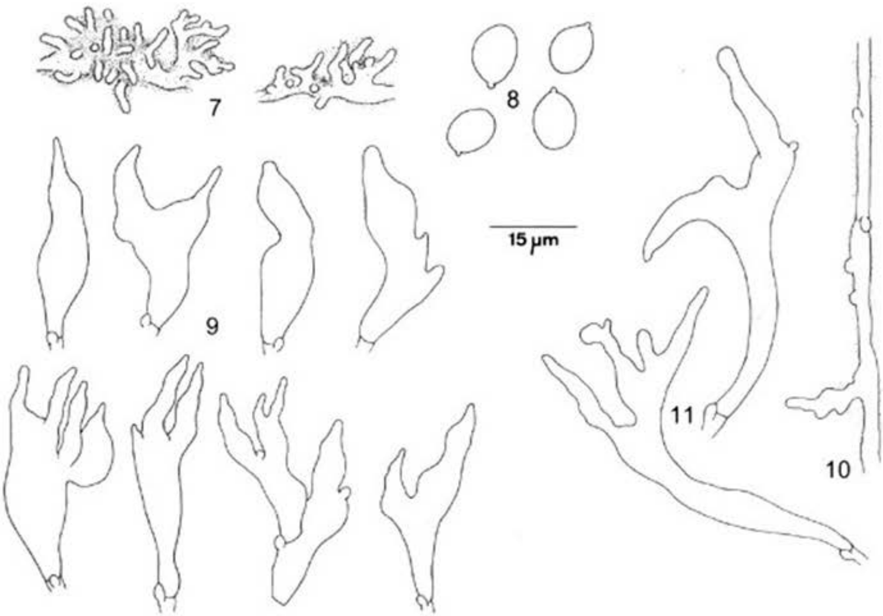
Sporae 8.5–***9.40***–10.5 × 6.5–***7.05***–8 µm, latae ellipsoideae, leves, amyloideae. Basidia 4-spora, 28–30 × 11–13 µm, clavata, fibulata, sterigmatibus usque ad 5 µm instructa. Cheilocystidia 25–42 × 8–15 µm, hyalina, fusiformia, fibulata, apice attenuata, plerumque 2–pluribus collis praedita, haud in materiam gelatinosam inmersa. Lamellarum margo sterilis. Pleurocystidia nulla. Hymenophori trama subdextrinoidea, e hyphis usque ad 10 µm latis. Hyphae pileipellis 2–3 µm latae, fibulata, in materiam gelatinosam inmersae, dense diverticulatae, surculis –10 × 0.8–2 µm, valde ramosis munitae. Hyphae stipitipellis 3–4 µm latae, fibulatae, in materiam gelatinosam inmersae, surculis dispersis 2–13 × 1–3 µm praeditae. Caulocystida 38–85 × 6–12 µm, versiformia, levia vel surculis nonnullis stipitis parte superiore instructa.

In *Coryli avellanae* sarmenta.

Holotypus: no. 22265 AH.

Etymology: rubidofuscus, because of its dark reddish brown colour.

Basidiomata gregarious. Pileus 10–14 mm diam., conical to conical-campanulate, slightly umbonate, pruinose, glabrescent, hygrophanous, translucent-striate, slightly viscid when wet but without separable layer, dark reddish brown (Mu. 10 YR 3/2) to dark reddish grey (10 Mu. YR 4/2), the centre black-brown (Mu. 10 YR 2/1–2/2). Context whitish under



Figs. 7–11. *Mycena rubidofusca* (holotype). 7. Hyphae of the pileipellis; 8. spores; 9. cheilocystidia; 10. hyphae of the stipitipellis; 11. caulocystidia.

the cuticle, greyish in the stipe. Odour and taste not distinctive. Lamellae c. 18–20, approximately 1.5 mm wide, thick, ascending, adnate or slightly decurrent with a tooth, beige-greyish, lamella-edge convex and whitish. Stipe 30–65 × –2 mm, rooting, cylindrical or slightly thickened towards the base (–3 mm wide), pruinose at the apex, cartilaginous, greyish brown to brown (Mu. 10 YR 5/2 to 10 YR 5/3), shining, the base densely covered with long and whitish fibrils.

Spores 8.5–***9.40***–10.5 × 6.5–***7.05***–8 µm, Q = 1.2–***1.33***–1.4 (n = 21), broadly ellipsoid, smooth, amyloid. Basidia 4-spored, 28–30 × 11–13 µm, clavate, clamped, with sterigmata up to 5 µm in length. Cheilocystidia 25–42 × 8–15 µm, hyaline, fusiform, clamped, with attenuated apex, frequently divided into two or more necks (especially towards the margin of lamella), not embedded in gelatinous matter. Lamella-edge sterile. Pleurocystidia absent. Hymenophoral trama slightly dextrinoid, consisting of hyphae up to 10 µm wide. Hyphae of the pileipellis 2–3 µm wide, clamped, embedded in gelatinous matter, densely diverticulate with excrescences –10 × 0.8–2 µm, strongly branched, usually forming dense coralloid masses. Hyphae of the stipitipellis 3–4 µm wide, clamped, embedded in gelatinous matter, with scattered excrescences 2–13 × 1–3 µm. Caulocystidia 38–85 × 6–12 µm, versiform, smooth or with excrescences and isolated projections, only present in the upper part of stipe.

Habitat — In humus of *Corylus avellana* L.

Material examined. Madrid, Pto. de Somosierra, 16 Oct. 1996, leg. *F. Esteve-Raventós, C. Sánchez, J.N. Campoamor* & *M. Villarreal*, in humus of *Corylus avellana*, AH 22265 (holotype).

Mycena rubidofusca was at first thought to be a member of section *Insignes* Maas G. (Maas Geesteranus, 1989: 343) on account of the gelatinous layer covering the hyphae of both the pileipellis and the stipitipellis. A similar coating, however, is also known in *Mycena stipata* Maas G. & Schwöbel (Maas Geesteranus & Schwöbel, 1987: 147), a species of section *Fragilipedes* (Fr.) Quél. (Maas Geesteranus, 1988: 43). All species of this section have invariably ascending lamellae, with their lamella-edge ventricose. This feature, in the authors' opinion, places *M. rubidofusca* in section *Fragilipedes*, very close to *Mycena stipata*, but it entails the following important changes. *Mycena quinaultensis* Kauff. apud A.H. Smith (Maas Geesteranus, 1989: 350) and *M. conspersa* Maas G. & de Meijer (Maas Geesteranus & de Meijer, 1997: 84), former members of the *Insignes*, must for the same reason (ascending lamellae; hyphae of both the pileipellis and the stipitipellis embedded in gelatinous matter) be transferred to the *Fragilipedes*. This strengthens the homogeneity of section *Insignes* and, however slightly, alters its diagnosis.

Mycena sect. *Insignes* Maas G. emend. Villarreal, Heykoop & Maas Geesteranus

Mycena sect. *Insignes* Maas G., Proc. Kon. Ned. Akad. Wet., C 92 (1989) 343.

Lamellae invariably arcuate (instead of: arcuate or ascending).

Two further species, *Mycena mitis* Maas G. (Maas Geesteranus, 1992: 469) and *M. corrugans* Maas G. (Maas Geesteranus,1992: 471), formerly placed not without some doubt in section *Insignes*, are now best included in section *Fragilipedes*. It is certainly true that, while some of the features of *M. mitis* and *M. corrugans* are intermediate between those of the two sections under discussion, they are equally transitional to those of other species of the *Fragilipedes* whose surface hyphae are not embedded in gelatinous matter.

Mycena vicina Villarreal, Heykoop & Maas G., *spec. nov.* — Figs. 12–17

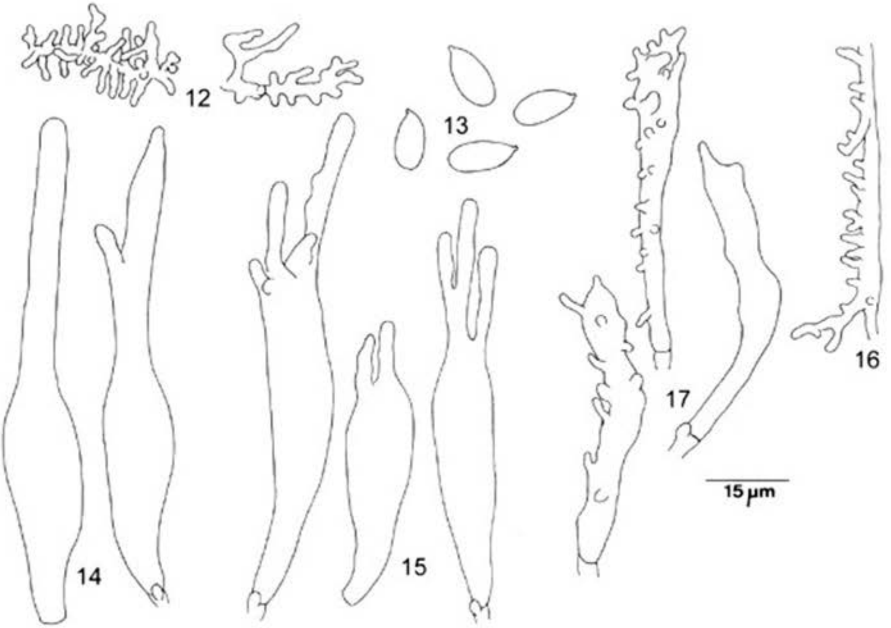
Basidiomata caespitosa. Pileus 3–17 mm latus, e hemisphaerico conico-campanulatus vel campanulatus, sulcatus, striatus, hygrophanus, siccus, e pruinoso glabrescens, initio obscure brunneus, deinde griseobrunneus, demum fere albidus. Caro tenuis, albida, odore saporeque nullis. Lamellae c. 22 stipitem attingentes, usque ad 1.5 mm latae, albidae, tenues, valde pruinosae, adscendentes, adnatae vel dense modice decurrentes, margine convexae, concolores. Stipes 35–75 × 0.5–2 mm, cylindraceus, fragilis, apice pruinosus, initio griseolobrunneus, deinde pallide flavobrunneus, basi obscurior, fibrillis longis, tenuibus, albidis instructus.

Sporae 8–***9.18***–10.7(–11) × 4.5–***4.95***–5.5 µm, ellipsoideae, leves, amyloideae. Basidia 4-spora, 27–32 × 7–10 µm, anguste clavata, fibulata, sterigmatibus usque ad 5 µm longis munita. Cheilocystidia (32–)56–92 × 6.5–11 µm, hyalina, cylindracea, fusiformia usque ad anguste lageniformia, collis 2–5 vel apice surculis crassis munita. Pleurocystidia crebra, cheilocystidiis similia. Hymenophori trama dextrinoidea, e hyphis usque ad 32 µm latis. Hyphae pileipellis 1.8–3 µm latae, fibulatae, haud in materiam gelatinosam inmersae, surculis 2.5–15 × 1.5–2.5 µm simplicibus vel ramosis dense praeditae. Hyphae hypodermii usque ad 23 µm latae. Hyphae stipitipellis 1.5–4 µm latae, fibulatae, haud in materiam gelatinosam inmersae, surculis 3–18 × 1.5–2.2 µm dense instructae. Caulocystidia usque ad 72 × 9 µm, clavata vel cylindracea, surculis obtecta.

Ad *Scirpi holoschoeni* stipites.

Holotypus: no. 22268 AH.

Etymology: vicinus, neighbouring, because of its occurrence together with *M. scirpicola* on the same substratum.



Figs. 12–17. *Mycena vicina* (holotype). 12. Hyphae of the pileipellis; 13. spores; 14. pleurocystidia; 15. cheilocystidia; 16. hypha of the stipitipellis; 17. caulocystidia.

Basidiomata cespitose. Pileus 3–17 mm diam., at first hemispherical, becoming conical-campanulate to campanulate, sulcate, hygrophanous, translucent-striate, dry, pruinose, glabrescent, at first dark brown, later greyish brown, progressively becoming clearer towards the margin, finally nearly whitish. Context thin, whitish. Odour and taste none. Lamellae c. 22, up to 1.5 mm wide (dried material), ascending, adnate to slightly decurrent with a tooth, whitish, thin, strongly pruinose under lens, lamella-edge convex and concolorous. Stipe 35–75 × 0.5–2 mm, cylindrical or becoming slightly wider towards the apex, fragile, pruinose at the apex, at first greyish-brown, later beige, the base always somewhat darker, with long, thin and whitish fibrils at the base.

Spores 8–***9.18***–10.7(–11) × 4.5–***4.95***–5.5 µm; Q = 1.6–***1.85***–2.2 (n = 21), ellipsoid, smooth, amyloid. Basidia 4-spored, 27–32 × 7–10 µm, narrowly clavate, clamped, with sterigmata up to 5 µm in length. Cheilocystidia (32–)56–92 × 6.5–11 µm, hyaline, cylindrical, fusiform to narrowly lageniform, with one or 2–5 necks or at the apex with coarse excrescences. Pleurocystidia very abundant, similar to the cheilocystidia, but usually less branched at the apex. Hymenophoral trama dextrinoid, consisting of elements up to 32 µm wide. Hyphae of the pileipellis 1.8–3 µm wide, clamped, not embedded in gelatinous matter, densely covered with simple or branched excrescences usually forming dense coralloid masses, excrescences 2.5–15 × 1.5–2.5 µm. Hyphae of hypodermium consisting of elements up to 23 µm wide. Hyphae of the stipitipellis 1.5–4 µm wide, clamped, not embedded in gelatinous matter, densely covered with excrescences 3–18 × 1.5–2.2 µm. Terminal cells of the cortical layer of the stipitipellis consisting of clavate to cylindrical caulocystidia, up to 72 × 9 µm, covered with few or more or less numerous excrescences.

Habitat — On stems and dead culms of *Scirpus holoschoenus* L., in the dry river bed of a stream.

Material examined. Toledo, La Iglesuela, 20 Nov. 1996, leg. *F. Esteve-Raventós, C. Sánchez & M. Villarreal*, AH 22268 (holotype); ibidem, 17 Dec. 1996, leg. *F. Esteve-Raventós, C. Sánchez, J.N. Campoamor & M. Villarreal*, AH 22267.

Both collections (AH 22268 and 22267) were found growing together with *Mycena scirpicola* (described recently by Villarreal et al., 1998), and some material even turned out to contain both species which were not recognized due to the similarity of their macroscopical characters. However, both species can be separated without problems according to their very different microscopic characters. The principal differences between *Mycena vicina* and *M. scirpicola* are tabulated in Table II.

Table II. Differences between *Mycena vicina* and *M. scirpicola*.

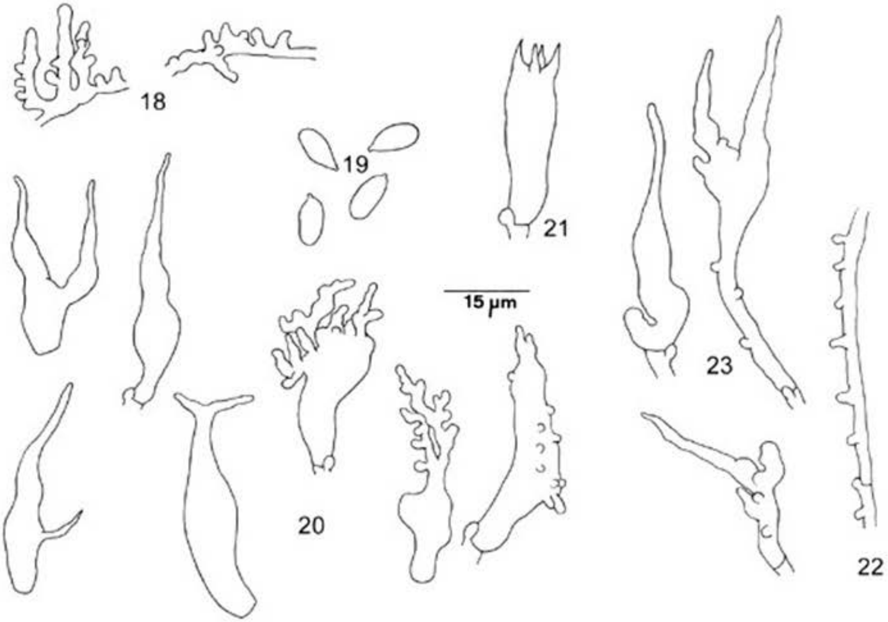
	Basidiomata	Pleurocystidia	Cheilocystidia	Stipitipellis	Caulocystidia
M. vicina	cespitose	present only near to the lamella-edge	up to 92 µm long, with 1 or 2–5 necks or at the apex with coarse excrescences	densely covered with excrescences	up to 73 µm long, with few or more or less numerous excrescences
M. scirpicola	gregarious	very abundant	up to 65 µm long, smooth	smooth or with some isolated thick excrescences	up to 300 µm long with apical furcations or lateral excrescences

Following the key to the section *Fragilipedes* (Maas Geesteranus, 1988) we arrive to key number 6 where *Mycena vicina* keys out as *M. alnicola* A.H. Smith, a completely different species because of its habitat on *Alnus* logs, bluish to violaceous grey pileus, differently shaped cheilocystidia and lack of caulocystidia.

Mycena hepatica Villarreal, Heykoop & Maas G., *spec. nov.* — Figs. 18–23

Basidiomata gregaria vel subcaespitosa. Pileus 7–9 mm latus, paraboloideus vel planoconvexus, sulcatus, siccus, hygrophanus, striatus, e pruinoso glabrescens, centro, margine, striis obscure rubris. Lamellae 17–21 stipitem attingentes, c. 1 mm latae, tenues, adscendentes, adnatae, albidoroseae, margine convexae, valde obscure rubrobrunneae. Caro tenuis, concolor, odore indistincto, sapore haud notato. Stipes 11–17 × 1–2 mm, cylindraceus, deorsum latior, interdum longitudinaliter sulcatus, rubro-tincto griseobrunneus, deorsum obscurior, e pruinoso glabrescens apice excepto, basi fibrillis longis, tenuibus, albidis instructus.

Sporae 7.5–***8.74***–10 × 4.3–***4.76***–5.5 µm, ellipsoideae, leves, amyloideae. Basidia 4-spora, 26–28 × 7–10 µm, hyalina, clavata, fibulata, sterigmatibus usque ad 5.5 µm longis munitus. Cheilocystidia 29–55 × 6.5–13 µm, polymorpha, 1) conico-fusiformia, fibulata, levia vel cum surculis dispersis tum collis simplicibus vel partitis instructa; vel 2) clavata, utriformia vel irregularia, vulgo breviora, apice dense diverticulata, sucum rubrobrunneum continentia. Lamellae margine steriles. Pleurocystidia nulla. Hymenophori trama dextrinoidea, e hyphis usque ad 35 µm latis. Hyphae pileipellis 2–3 µm latae, fibulatae, haud in materiam gelatinosam inmersae. Hyphae stipitipellis 2–2.8 µm latae, haud in materiam gelati-



Figs. 18–23. *Mycena hepatica* (holotype). 18. Hyphae of the pileipellis; 19. spores; 20. cheilocystidia; 21. basidium; 22. hypha of the stipitipellis; 23. caulocystidia.

nosam inmersae, surculis dispersis, 1.6–3.2 × 1.8–2.5 µm preditae, cellulis terminalibus 37–65 × 6–14 mm, fusiformibus, apice simplicibus vel 2-partitis, levibus vel surculis obtectis munitis.

Ad *Scirpi holoschoeni* rhizomata vel stipites inhumatos.

Holotypus: no. 20900 AH.

Etymology: hepaticus, because of its liver-colour.

Basidiomata gregarious to subcespitose. Pileus 7–9 mm diam., paraboloid to plano-convex, sulcate, dry, hygrophanous, translucent-striate, pruinose, glabrescent, dusky red (Mu. 10 R 3/4) at centre, margin and the striation, the rest somewhat reddish grey-brown (Mu. 10 R 4/4), becoming darker when drying out. Lamellae 17–21, c. 1 mm wide, thin, ascending, adnate, whitish-pink, lamella-edge convex and strongly dark reddish-brown. Context thin, concolorous. Odour not distinctive. Taste not recorded. Stipe 11–17 × 1–2 mm, cylindrical or progressively wider towards the base in some specimens (–2.5 mm wide), sometimes sulcate longitudinally, somewhat reddish grey-brown (Mu. 10 R 4/4) at the apex, progressively darker towards the base, where it becomes dusky red (Mu. 10 R 3/4) or very dusky red (Mu. 10 R 2.5/2), at first pruinose, later pruinose only at the apex, the base densely covered with entangled long, thin and whitish fibrils when fresh, later brown-pinkish in dried material.

Spores 7.5–***8.74***–10 × 4.3–***4.76***–5.5 µm; Q = 1.6–***1.83***–2.1 (n = 21), ellipsoid, smooth, amyloid. Basidia 4-spored, 26–28 × 7–10 µm, hyaline, clavate, clamped, with sterigmata up to –5.5 µm in length. Cheilocystidia 29–55 × 6.5–13 µm, extremely polymorphic and apparently of two types, i.e. i) conical-fusiform, clamped, smooth or with only very few scattered excrescences and simple or frequently divided into two or more acute necks; ii) clavate, utriform to irregularly shaped, generally shorter and densely diverticulate at the apex, with reddish-brown intracellular pigment. Lamella-edge sterile. Pleurocystidia absent. Hyphae of the hymenophoral trama dextrinoid, up to 35 µm wide. Hyphae of the pileipellis 2–3 µm wide, clamped, not embedded in gelatinous matter. Hyphae of the stipitipellis 2–2.8 µm wide, not embedded in gelatinous matter, with more or less isolated excrescences, 1.6–3.2 × 1.8–2.5 µm. Terminal cells of the cortical layer 37–65 × 6–14 µm, fusiform, apically simple or divided into two necks, smooth or with scattered excrescences.

Habitat — On rhizomes and partially buried stems of *Scirpus holoschoenus* L.

Material examined. Toledo, La Iglesuela, 20 Nov. 1996, leg. *F. Esteve-Raventós, C. Sánchez* & *M. Villarreal*, AH 20900 (holotype).

Mycena hepatica is a typical member of section *Rubromarginatae* Singer ex Maas G. Following the key of this section (Maas Geesteranus, 1986), it keys out close to *M. seynesiella* Malençon apud Malençon & Bertault. However, the latter is completely different from *M. hepatica*, because of the lack of liver-colour, its viscous separable elastic pellicle on the pileus, odour of chlorine or nitrous, broader spores (5.5–6.8 µm), clavate caulocystidia covered with coarse rounded warts, as well as its habitat on conifers. *Mycena hepatica* is also close to *M. albidolilacea* Kühner & Maire apud Kühner, a species only known (?) from France (Kühner, 1938: 419) and Germany. The macroscopic description of the latter does not seem to differ much from that of *M. hepatica* except for the colour of the margin of pileus ("..., whitish towards the margin ...") and the clearly nitrous odour. The microscopical differences do not seem to be very sharp either, though the width and extent of diverticulation of the caulocystidia is completely different in both species. The principal differences between *M. albidolilacea* and *M. hepatica* are tabulated in Table III.

Table III. Differences between *Mycena albidolilacea* and *M. hepatica*.

	Pileus colour	Odour	Spore length	Stipe colour	Habitat
M. albidolilacea	pale	nitrous	9–12 µm acc. Kühner	pale	on remains of leaves
M. hepatica	dark	–	7.5–10 µm	dark	*Scirpus*

Mycena hepatica, because of its name, should not be confused with *M. hepaticarum* Dennis (1961: 104), a species which fruits on old trees covered by hepatics in Venezuela, and which does not belong to the section *Rubromarginatae*.

REFERENCES

Dennis, R.W.G. 1961. Fungi Venezuelani: IV. Kew Bull. 15: 67–156.

Kühner, R. 1938. Le Genre Mycena (Fries). Encycl. Mycol. 10.

Maas Geesteranus, R.A. 1986. Conspectus of the Mycenas of the Northern Hemisphere – 8. Sections Intermediae, Rubromarginatae. Proc. Kon. Ned. Akad. Wet. (Ser. C) 89: 279–310.

Maas Geesteranus, R.A. 1988. Conspectus of the Mycenas of the Northern Hemisphere – 9. Section Fragilipedes, species A–G. Proc. Kon. Ned. Akad. Wet. (Ser. C) 91: 43–83.

Maas Geesteranus, R.A. 1989. Conspectus of the Mycenas of the Northern Hemisphere – 12. Sections Fulliginellae, Insignes, Ingratae, Euspeireae, and Caespitosae. Proc. Kon. Ned. Akad. Wet. (Ser. C) 92: 331–365.

Maas Geesteranus, R.A. 1992. Two new Mycenas of section Insignes from the Netherlands. Proc. Kon. Ned. Akad. Wet. (Ser. C) 95: 469–472.

Maas Geesteranus, R.A. & A.A.R. de Meijer. 1997. Mycenae paranaenses. Kon. Ned. Akad. Wet., Verhand. Afd. Nat. II 97.

Maas Geesteranus, R.A. & G. Schwöbel. 1987. Über zwei auf Koniferenholz wachsende, nitrösriechende Helmlingsarten. Beitr. Kenntn. Pilze Mitteleur. 3: 147–152.

Örstadius, L. 1993. Mycena lutea, found in Sweden. Windahlia 20: 63–65.

Villarreal, M., M. Heykoop, F. Esteve-Raventós & R.A. Maas Geesteranus. 1998. Further new species of Mycena and a new section from Spain. Persoonia 16 (4): 527–535.

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NOTULAE AD FLORAM AGARICINAM NEERLANDICAM – XXXIV
Further notes on Psilocybe

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A key to the species is given of *Psilocybe* subgenus *Stercophila* (Romagn.) Noordel., with a full description of *Psilocybe dorsipora*, new to the Netherlands, and the status of subgenus *Stercophila* is discussed. Within subgenus *Hypholoma* section *Psilocyboides* four new subsections are presented, viz. subsect. *Elongatae*, subsect. *Marginatae*, subsect. *Tuberosae*, and subsect. *Ericaeae*. A key is given to the species of subsect. *Elongatae*, with comments on the species and full descriptions of *Psilocybe olivaceotincta* Kauffm., new to Europe, and a still unnamed dark-coloured species. New combinations within subgen. *Stropharia* and *Melanotus* are given.

I. SUBGENUS STERCOPHILA

The species of subgenus *Stercophila* [Romagn. ex Noordel., Persoonia 16 (1995) 127] are characterized by the presence of a slimy veil, which forms a sticky-glutinous layer on the surface of pileus and stipe. Additional characters of this group are the very dark, large spores with a very distinct germ pore. The best known species of this group is *Psilocybe semiglobata* (Batsch: Fr.) Noordel., a widespread and locally common dung-inhabiting species. Traditionally, this species has been placed in the genus *Stropharia*, mainly because of the presence of an annulus and the occurrence of chrysocystidia on the sides of the lamellae. *Psilocybe luteonitens* (Fr.: Fr.) Park.-Rhodes which is very similar in morphology and ecology, has no chrysocystidia, and was therefore placed in the genus *Psilocybe* sensu stricto by some authors. However, Romagnesi (1936) considered both taxa very closely related because of the glutinous veil on pileus and stipe, and placed them together in the genus *Stercophila*. Singer (1986) made *Stercophila* Romagn. a section of *Stropharia*. Noordeloos (1995), uniting the genera *Stropharia*, *Hypholoma* and *Psilocybe* sensu stricto in one large genus *Psilocybe*, gave *Stercophila* the rank of subgenus. Recently Esteve-Raventós & Barassa (1995) described a new species in this group, viz. *Stropharia dorsipora*, characterized by spores with an eccentrically placed germ pore. During the revision of this group for the Flora agaricina neerlandica, several collections of this species were detected in the herbaria from the Netherlands, Switzerland and California, which are described below. According to personal observations and those of Dr. I. Kytövuori (University of Helsinki, Finland), more taxa of subgenus *Stercophila* can be expected to occur in Europe.

An interesting species in this respect is *Pholiota myosotis* (Fr.: Fr.) Sing. This species, in the rather isolated subgenus *Phaeonematoloma* Sing., has very similar glutinous veil on pileus and stipe, pleurocystidia as chrysocystidia, and also very large spores, which, however, are red-brown in mass, not as dark as in the species around *Psilocybe semiglobata*, and have only a small, inconspicuous germ pore. Also the habitat is different, as it grows as saprophytic or possibly necrotrophic among *Sphagnum* in peat-bogs.

There are several examples in the Strophariaceae, where species with thin- and thick-walled spores, with or without distinct germ pore appear to be closely related. Good examples are *Psilocybe* section *Psilocybe*, where species with thin-walled spores (*P. inquilinus*, *P. crobula*) are closely related to *P. montana* with dark, thick-walled spores (Noordeloos et al., in prep.). In *Psilocybe* subgenus *Hypholoma* section *Psilocyboides* thin-walled spores occur in the group of *Psilocybe elongatipes*, which obviously are related to *P. ericaeum* and *P. udum* with thick-walled spores. It is to be expected that future experimental research would prove that *Pholiota myosotis* is closely related to the *Stercophila* group in *Psilocybe*.

KEY TO THE EUROPEAN SPECIES OF PSILOCYBE SUBGENUS STERCOPHILA

1. Chrysocystidia absent; basidia 2-spored .... *Psilocybe luteonitens*
1. Chrysocystidia present; basidia 4-spored.
    2. Pileus brown with olivaceous tinge; lamellae brown with olivaceous tinge; spore print red-brown; among *Sphagnum* and other mosses in moist places (*Pholiota myosotis*)
    2. Pileus yellow to ochre, often rather pale; lamellae blackish brown when mature; spore print purplish black; on dung or on strongly manured soil.
        3. Spores with central germ pore; cheilocystidia 40–100 × 5.0–15 µm, cylindrical-flexuous to narrowly lageniform or lecithiform .... *Psilocybe semiglobata*
        3. Spores with distinctly eccentric germ pore; cheilocystidia 20–40 × 3.5–10 µm, clavate to lageniform with broad, rounded apex .... *Psilocybe dorsipora*

Psilocybe dorsipora (Esteve-Rav. & Barassa) Noordel., *comb. nov.* — Fig. 1

Basionym: *Stropharia dorsipora* Esteve-Rav. & Barassa, Rev. Iberoamer. Micol. 12 (1995) 70.

Pileus 5–25 mm, hemispherical to convex or conico-convex, finally expanding to irregularly (plano-)convex, yellowish white, straw-yellow to ochraceous yellow, sometimes with olivaceous tinge, with paler margin, viscid, dull to slightly shining. Lamellae, L = 18–26, l = 3–7, distant, broadly adnate, often with decurrent tooth, ventricose, greenish-whitish when young, then sordid purplish-grey, sometimes with olivaceous tinge, spotted, with white, fimbriate edge. Stipe 10–90 × 2–3 mm, cylindrical, slender, often with an up to 6 mm wide, (sub-)bulbous base, very pale yellowish at apex, yellow-olivaceous to brownish yellow below, with narrow, membranaceous, sticky annulus, at apex pruinose, slightly grooved, below annulus finely floccose on viscid surface. Smell farinaceous, particularly when bruised. Taste farinaceous. Spore print colour deep purple to violaceous black.

Spores (11.5–)13–21.5 × 7.0–10(–10.5) µm, Q = (1.5–)1.7–2.4, av. Q = 1.7–2.0, ellipsoid in side-view, ovoid in frontal view, with relatively small, up to 3.0 µm wide, eccentric germ pore. Basidia 20–40 × 8.0–12.5 µm, 4-spored, clamped. Lamella edge sterile. Cheilocystidia 20–40 × 3.5–10 µm, clavate to lageniform with broad, rounded apex. Pleuro-chrysocystidia abundant, 20–50 × 4.0–11.0 µm, clavate-mucronate. Pileipellis an up to 200 µm thick ixocutis of narrow, cylindrical, 2.0–7.0 µm wide hyphae, embedded in a hyaline, gelatinous matrix. Pigment yellow, parietal and finely incrusting the hyphae of pileipellis. Stipitipellis an ixocutis of narrow, cylindrical hyphae. Caulocystidia abundant at apex of stipe, 20–50 × 3.0–9.0 µm, subcylindrical to lageniform with rounded apex, often mixed with caulo-chrysocystidia similar to pleurochrysocystidia. Clamp-connections present in all tissues.

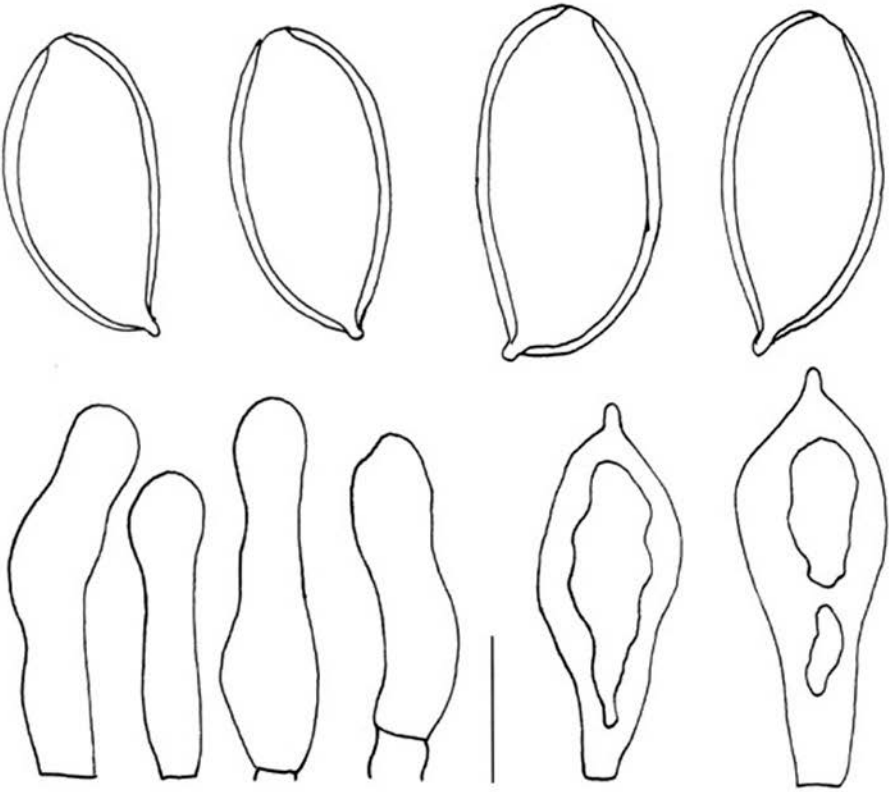

Fig. 1. *Psilocybe dorsipora*. Spores, cheilocystidia, and chrysocystidia (bar = 10 μm).

Habitat & distribution — Saprotrophic, gregarious on horse-dung in poorly manured grasslands and meadows. Rare, but widespread and probably overlooked. June–Nov. Widespread in Europe, but real distribution unknown. Also occurring in California.

Collections examined. NETHERLANDS: prov. Overijssel, Stokkum bij Markelo, northern bank Twentekanaal, 9-VI-1956, *C. Bas 1026* (L); Vorden, 5-VII-1959, *E. Kits v. Waveren* (L); prov. Noord-Holland, Den Helder, Van Ewijksluis, autumn 1972, *P. Polderman* (L); prov. Zuid-Holland, Katwijk aan Zee, 15-XI-1953, *R.A. Maas Geesteranus 9594* (L). — SWITZERLAND: Valais, Val d'Anniviers, 18-VII-1962, *J.Th. Koster 7101* (L). — USA: California, Lagunitas Creek, Marin County, 20-III-1939, *T.T. McCabe* (L).

Psilocybe dorsipora has recently been described from Spain (Esteve-Raventós & Barassa, 1995), based on only one collection. However, this taxon has been known already several years to Dr. I. Kytövuori (University of Helsinki) who showed the author maps with numerous localities from Fennoscandia during the Finnish-Estonian Mycological Meeting at Kevo, August 1995. Intrigued by this, the author studied collections labelled *P. semiglobata* in the Rijksherbarium and found some specimens of *P. dorsipora* from a wide geographical range. *Psilocybe dorsipora* is very similar to *P. semiglobata* from which it mainly differs in the spores with a small, eccentric germ pore, and slightly smaller cheilocystidia with rounded to capitate apex. So far no clear macroscopic differences with *P. semiglobata* have been discovered, but some collections have a distinct farinaceous smell and taste, a feature that is unknown from *P. semiglobata*. Future morphological and experimental studies may hopefully throw more light on the specific delimitation.

II. SUBGENUS HYPHOLOMA SECTION PSILOCYBOIDES

Subgenus *Hypholoma* section *Psilocyboides* [(Sing.) Noordel., Persoonia 16 (1995) 127] is characterized by solitary basidiocarps or basidiocarps in small groups, on wood-chips or in vegetal debris, frequently also among mosses, often in peaty habitats.

KEY TO THE SUBSECTIONS

1. Basidiocarps growing on a lobate, brown sclerotium, 2–5 mm across on decayed wood or wood-chips . . . . subsect. *Tuberosae*
1. Basidiocarps not growing from a sclerotium 2
  2. Spores pale, thin- or slightly thick-walled, with small, often indistinct germ pore; lamellae brown without or with very faint violaceous-purple tinge when mature, brown in exsiccate . . . . subsect. *Elongatae*
  2. Spores dark, thick-walled, with distinct germ pore; lamellae dark violaceous-black when mature, also in exsiccates 3
    3. Veil present as white flocks adhering to margin of pileus and girdles and/or an annuliform zone on stipe . . . . subsect. *Marginatae*
    3. Veil absent . . . . subsect. *Ericaeae*

Psilocybe subsect. **Elongatae** Noordel., *subsect. nov.*

Sporae pallidae, tenuitunicatae vel leviter crassitunicatae, poro germinativo parvo; lamellae in statura maturitate haud vel leviter violaceo-tincto.
Holotypus: *Psilocybe elongata* (Pers.: Fr.) J. Lange.

Spores pale, thin- or slightly thick-walled, with small, often indistinct germ pore; lamellae brown without or with faint violaceous-purple tinge, brown in exsiccates.
Holotype species: *Psilocybe elongata* (Pers.: Fr.) J. Lange.

Psilocybe elongata can be recognized in the field by the yellow colour of the pileus and brownish lamellae, and microscopically by the relatively thin-walled spores with a small, often indistinct germ pore. *Psilocybe ericaoides*, which is similarly yellow-coloured, can easily be differentiated by the violaceous-grey tinges in the mature lamellae, caused by the thick-walled spores with distinct germ pore.

As noted by Singer (1986) the complex of *P. elongata* contains several very similar taxa, and is still in need of a revision. As a whole they can be distinguished from other species in sect. *Psilocyboides* by the lack of veil combined with relatively pale, thin-walled spores with small, often indistinct germ pore. Accordingly the mature lamellae are usually a shade of (grey-)brown, rarely with a slight violaceous-purple tinge. The group of *P. marginata* (subsect. *Marginatae*) can be distinguished by the prominent veil, and thick-walled spores with distinct germ pore, and the species in subsect. *Ericaeae* have dark, thick-walled spores and grey-violaceous mature lamellae. *Psilocybe tuberosa* (Redh. & Kroeger) Walleyn is rather aberrant by its growth from sclerotia, and is therefore placed in its own subsection *Tuberosae*. Subsect. *Elongatae* contains several taxa, some of which occur both in Europe and in North America. Important diagnostic features to separate taxa are found in the size and shape of spores and cystidia and in the presence or absence of cheilochrysocystidia. Additional macroscopic features are mainly found in the presence or absence of yellow pigments in pileus and lamellae. Up to now about six taxa have been distinguished from Europe (Moser, 1983; Watling & Gregory, 1987), viz. *Psilocybe elongatipes*, *P. xanthocephalum*, *P. laeticolor*, *P. longisporum* and *P. politrichi*. In addition, Smith (1951) records some other related taxa from North America, viz.: *Hypholoma humidicola* (Murrill) A.H. Sm., and *Hypholoma olivaceotinctum* (Kauffm.) A.H. Sm.

While sorting out material for the Flora agaricina neerlandica it became evident that within subsection *Elongatae* also some dark coloured taxa could be found which were not known from Europe before. Both are characterized by having a dark pileus and lack of yellow tinges in the lamellae. One could be identified as *Psilocybe olivaceotincta* Kauffm., the other remains unnamed for the time being due to the poor state of the material.

KEY TO THE SPECIES IN SUBSECTION ELONGATAE IN EUROPE

1. Spores small, 7.0–9.0 × 4.0–5.5 µm; lamella edge yellow-green, with a mixture of chrysocystidia and leptocystidia . . . . *Psilocybe polytrichi*
1. Spores larger, length ranging from 8.5–14(–14.5) µm; lamella edge not yellow-green, with or without chrysocystidia.
    2. Pileus moderately dark to dark brown with olivaceous tinges, at centre sometimes reddish brown.
        3. Cheilochrysocystidia abundant; spores (9.0–)10.0–14.0(–14.5) × 4.5–6.0(–6.5) µm; pileus very dark brown-olivaceous with paler margin . . . . *Psilocybe spec.*
        3. Cheilochrysocystidia absent; spores 8.5–11.0(–11.5) × (4.5–)5.0–5.5(–6.0) µm; pileus moderately dark to dark brown-olivaceous with more brown to orange brown centre . . . . *Psilocybe olivaceotincta*
    2. Pileus pale yellowish at margin, at centre reddish brown.
        4. Lamellae pale grey, without yellow tinges when young; cheilochrysocystidia absent; spores narrow, oblong, 5.5–6.5(–7.0) µm wide . . . . *Psilocybe laeticolor*
        4. Lamellae with yellow tinges when young; cheilochrysocystidia present; spores slightly broader, (6.0–)6.5–8.0 µm wide.
            5. Spores amygdaliform in side-view . . . . *Psilocybe xanthocephala*
            5. Spores ellipsoid-oblong in side-view . . . . *Psilocybe elongata*

NOTES ON THE SPECIES

Psilocybe elongata (Pers.: Fr.) J. Lange, Dansk bot. Ark. 9 (11) (1936) 30.

This species widely occurs in the peaty areas of the temperate-boreal zones of Europe and North America.

Örstadius & Huhtinen (1996) claim that *Psilocybe gilletii* P. Karst. is a synonym of *P. elongata*. However, in the original description, the spore size is different (9.5–11 × 5.5–6.5 μm) and cheilochrysocystidia absent. This indicates that probably another taxon might be involved.

Hypholoma humidicola (Murrill) A.H. Sm. is very similar (Smith, 1951). It is said to differ in having longer pleurochrysocystidia and another habitat. Considering the rather large variability found in the size and shape of pleurochrysocystidia in European material the differences in size as indicated by Smith may appear insignificant. The difference in habitat (*Sphagnum*-bogs for *Psilocybe elongata*, among moss in coniferous forest for *Hypholoma humidicola*) may also be of minor importance. Several collections of *Psilocybe elongata* have been made in damp places in coniferous forest in the Netherlands, without *Sphagnum*.

Psilocybe laeticolor (F.H. Moeller) Noordel., Persoonia 16 (1995) 129.

This species is distinguished by the lack of yellow tinges in the lamellae and narrow spores. It has only been found a few times in the Netherlands, in mossy grasslands on peaty soil, but without *Sphagnum*. So far it has been recorded from the Faeröes, Scotland and the Netherlands. Moeller (1945) described also *Naematoloma subfusisporum* which is very similar, but differs in even narrower, fusiform spores. So far this taxon is only known from the type-locality.

Psilocybe xanthocephala (P. D. Orton) Noordel., Persoonia 16 (1995) 129 — Fig. 2

Hypholoma xanthocephalum P.D. Orton, Notes R. bot. Gdn Edinb. 41 (1984) 586.
Selected descriptions and figures. Watl. & Gregory, Br. Fung. Fl. 5 (1987) 18–19.

Pileus 10–30 mm, convex, expanding with age, sometimes umbonate, with deflexed then straight margin, hygrophanous, deeply translucently striate, saffron, pale yellow to ochraceous, sometimes with sienna tinge at centre, often with rather persistently darker olivaceous, lemon-yellow, or pale citrine-olivaceous margin when moist, pallescent on drying. Lamellae moderately crowded, adnate-emarginate, lemon-yellow, then with brown-olivaceous tinges, finally violaceous grey, with pruinose, white edge. Stipe 30–65 × 1–4 mm, cylindrical, yellow in upper part, reddish brown below, pruinose-floccose at apex, downwards silky-striate; at base white tomentose. Spore print dark fawn, purplish-date or brown-vinaceous.

Spores 9.0–11.5(–12) × 6.0–8.0 μm, Q = 1.4–1.6, av. Q = 1.5, ellipsoid-amygdaliform in side-view with only slightly thickened wall and small, indistinct germ pore. Basidia 4-spored. Lamella edge sterile. Cheilocystidia 30–45 × 5.0–8.0 μm, lageniform to utriform with 3.5–6.0 μm wide, obtuse neck; chrysocystidia along edge and on sides, 30–50 × 6.0–15 μm, clavate or lageniform, scattered to fairly abundant. Pileipellis a cutis of narrow cylindrical hyphae, 2.0–6.0 μm wide; subpellis made up of inflated elements, up to 15 μm wide with yellow, incrusting pigment. Caulocystidia scattered, 20–60 × 4.0–10 μm, subcylindrical to narrowly lageniform. Clamp-connections abundant.

Habitat & distribution — Saprotrophic, solitary or in small groups, originally described from bare clayey soil, also known from dense humus layer in *Juniperus* heath with *Molinia* and *Eriophorum*. Known from the southern parts of England and Germany.

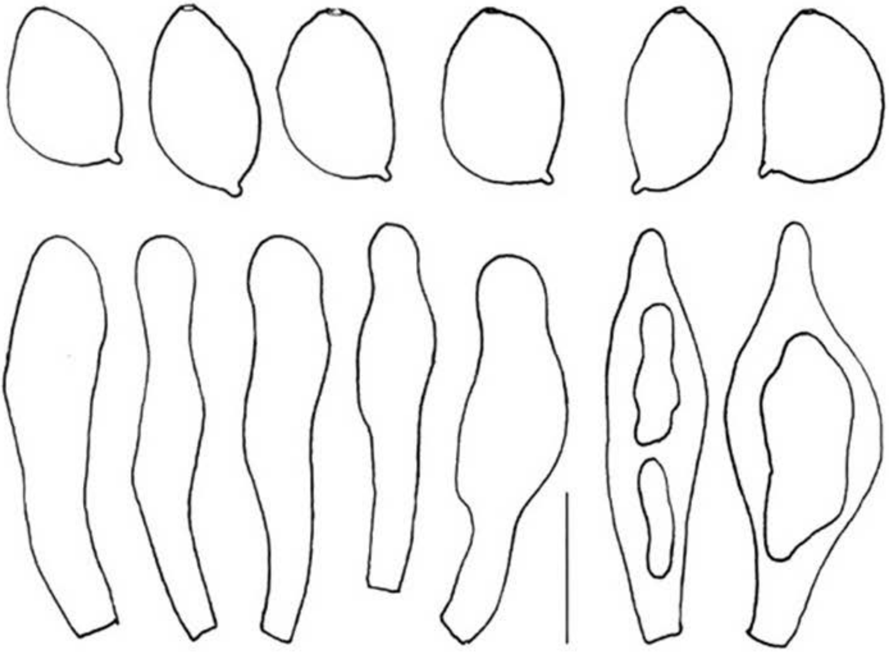

Fig. 2. *Psilocybe xanthocephala*. Spores, cheilocystidia, and chrysocystidia (bar = 10 µm).

This species is very similar to *Psilocybe elongata* differing mainly by the amygdaliform spores.

Psilocybe polytrichi (Fr.: Fr.) Pears. & Dennis, Trans. Br. mycol. Soc. 31 (1948) 184.

This species has the smallest spores in this group. It can be recognized in the field by its yellow-green lamella edge. It has been recorded from both Europe and North America.

Psilocybe olivaceotincta Kauffm., Pap. Mich. Acad. Sci. 5 (1926) 144 — Fig. 3

Hypholoma olivaceotinctum (Kauffm.) A.H. Sm., Mycologia 43 (1951) 488. — *Hypholoma intermedium* Arnolds, nom. prov. in Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 2 (1983 '1982') 392.

Type-study of *Psilocybe olivaceotincta* Kauffm.
USA, Oregon, Clackamas, Mt Hood, 6 Oct. 1922, C. H. Kauffman (holotype, MICH).

One basidiocarp (part of the holotype) has been received for study. The following characters have been observed:

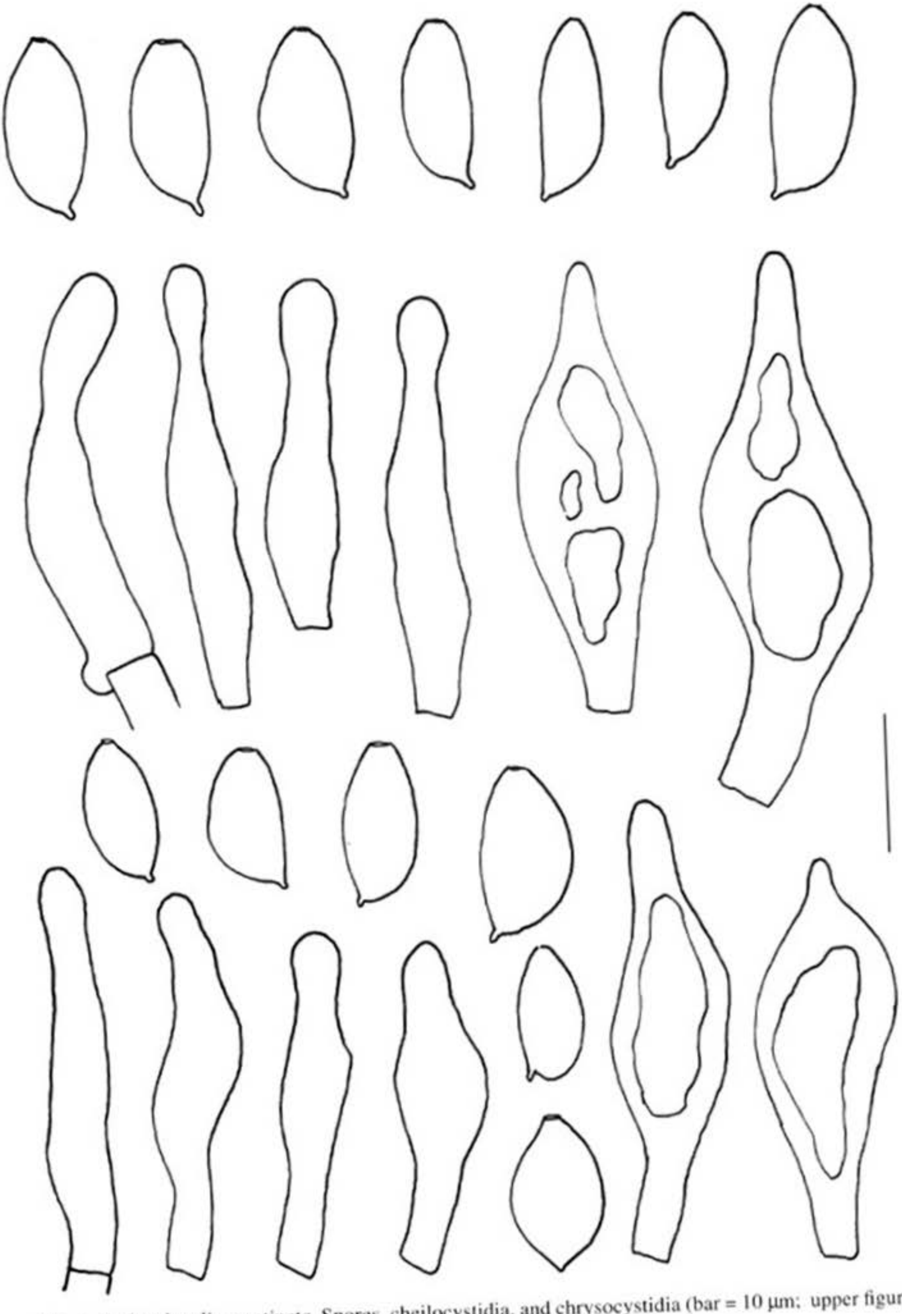

Fig. 3. *Psilocybe olivaceotincta*. Spores, cheilocystidia, and chrysocystidia (bar = 10 µm; upper figures from holotype, lower figures from *Sullock-Enzlin 96010*).

Spores 10.5–12 × 4.0–6.0 µm, av. 11.1 × 5.3 µm, Q = 1.9–2.3(–2.8), av. Q = 2.2, elongate to subcylindrical, often somewhat fusiform, occasionally with narrower conical apex, thin-walled, yellow-brown in ammonia, with small, hardly visible apical germ pore. Basidia 20–32 × 8.0–11 µm, 4-spored, clamped. Lamella edge sterile, consisting of leptocystidia and scattered chrysocystidia. Cheiloleptocystidia 28–40 × 5.5–9.0 µm, narrowly lageniform to utriform with 4.0–6.0 wide, rounded to subcapitate apex. Cheilo- and pleurochrysocystidia similar, 44–77 × 14–18 µm, clavate-mucronate or lageniform, with yellow-brown content. Pileipellis a cutis of 2.0–4.0 µm wide hyphae, subpellis well-differentiated, compact, made up of globose elements, up to 22 µm wide. Clamp-connections abundant.

Description of the Netherlands' collections:

Pileus 12–18 mm, convex then plano-convex with flattened centre, sometimes with small umbo, with deflexed margin, hygrophanous, when moist moderately dark to dark brown-olivaceous (K. & W. 4D4; Mu. 10 YR 4/3–4) with more brown to orange brown centre (5D7; 7.5 YR 5/6–4/4), paler towards margin, translucently striate up to 3/4 of radius, strongly pallescent on drying to greyish-ochre, slightly greasy to touch when moist. Lamellae, L = 18–20, l = 3–7, moderately distant, narrowly adnate, ventricose, up to 3 mm wide, pale grey then brownish grey, finally violaceous-grey, with white, strongly contrasting, floccose edge. Stipe 30–60 × 1–2 mm, cylindrical, sometimes curved towards base, pale ochre-cream at very apex, pale brown to reddish brown below, pruinose at apex, subglabrous, innately fibrillose below. Veil absent. Context concolorous with surface. Smell indistinct or somewhat unpleasant, dusty. Taste indistinct. Spore print purplish grey.

Spores 8.5–11.0(–11.5) × (4.5–)5.0–5.5(–6.0) µm, Q = 1.5–2.0, av. Q = 1.7–1.8, ellipsoid-oblong, sometimes slightly amygdaliform in side view, with rather thin, pale brown to violet-brown walls in water, with small, apical germ pore. Basidia 13–25 × 6.0–8.0 µm, 4-, rarely 2-spored, clamped. Lamella edge sterile, without chrysocystidia. Cheiloleptocystidia 20–40 × 7.0–15 µm, lageniform to utriform, often with rather brown basal part and moderately long to long, blunt to capitate neck, thin-walled. Pleurochrysocystidia rare to abundant, 20–53 × 5.0–16 µm, clavate-mucronate to lageniform with 4.0–8.0 µm wide, blunt to subcapitate neck, thin-walled, with yellowish content in KOH. Pileipellis a narrow cutis or ixocutis of cylindrical, 1.0–4.0 µm wide hyphae; subpellis well-differentiated, compact, made up of strongly inflated, globose or irregularly shaped elements, 10–30 (–40) × 7.0–17(–20) µm with yellow-brown intracellular pigment and minutely incrusted walls. Stipitipellis a cutis of narrow, cylindrical, minutely incrusted, 2.0–7.0 wide hyphae. Caulocystidia abundant at apex of stipe, subcylindrical to lageniform, 15–35 × 4.0–13 µm, thin-walled, colourless. Clamp-connections abundant in all tissues.

Habitat & distribution — Saprotrophic, single or in small groups, on decaying grasses in short grassland moist sandy soil (Cynosuro-Lolietum) and in moist place on dead fragments of *Phragmites australis*. Very rare, only known from two localities in the north of the Netherlands.

Collections examined. NETHERLANDS: prov. Groningen, Winsum, Potmaer, 25-V-1996, *R.A.F. Sullock-Enzlin 96010* (L); prov. Drenthe, Beilen, 20-X-1975, *E.J.M. Arnolds 3461* (WBS).

Psilocybe olivaceotincta clearly belongs to the complex of *P. elongata* on account of the relatively thin-walled, medium-sized spores, but differs from that species by the relatively dark colour of the pileus and lack of yellow tinges in the lamellae, narrow spores, and lack of cheilochrysocystidia. Our collections fit rather well with the description given by Smith (1951), but more material and study of North American collections is needed to get a better impression of the variability of the various taxa within this species complex. *Psilocybe laeticolor* and *Hypholoma humidicola* (Murrill) A.H. Sm. are also very similar, but differ by paler basidiocarps.

Psilocybe spec. — Fig. 4

Pileus 20 mm broad, conico-convex with straight margin, hygrophanous, when moist translucently striate at margin, very dark olivaceous-brown with paler, yellowish-olivaceous marginal zone, strongly pallescent to pale alutaceous when dry, not viscid, smooth, glabrous. Lamellae, L = 28, l = 1, moderately distant, narrowly adnate almost free, ventricose, up to 4 mm broad, olivaceous-yellow (2.5 Y 4/4), with entire, concolorous edge. Stipe 30 × 2 mm, cylindrical, straight, narrowly fistulose, olivaceous-yellow (2.5 Y 4/4) with slightly paler apex and slightly darker base, smooth, dull.

Spores (9.0–)10.0–14.0(–14.5) × 4.5–6.0(–6.5) μm, in average 12.3 × 6.0 μm, Q = 1.9–2.1, av. Q = 2.0, ellipsoid to amygdaliform in side-view with relatively pallid, thin wall, with small, distinct germ pore. Basidia 2- and 4-spored, clamped. Lamella edge sterile, consisting of chrysocystidia and leptocystidia. Leptocheilocystidia, 22–30 × 7.0–15 μm, utriform to lageniform with long, blunt or subcapitate neck. Cheilo- and pleurochrysocystidia abundant, 30–70 × 5.0–14 μm, clavate-mucronate, often with brown, thickened wall and dark yellow brown inclusions. Pileipellis a narrow cutis of cylindrical hyphae, 3–10 μm wide, subpellis well-differentiated, made up of inflated, up to 20 μm wide elements. Clamp-connections present in all tissues.

Habitat & distribution — Solitary in grazed dune meadow with *Salix repens* on acid sand. Only found once.

Collection examined. NETHERLANDS: prov. Friesland, Vlieland, Lange Paal, 22 Oct. 1994, *N. Dam* (L).

The present collection is microscopically very similar to *Psilocybe elongata*, with respect to the abundant cheilochrysocystidia, and size and shape of the spores. However, macroscopically the dark colour of the fruit-body is very aberrant. So far no description in literature has been found that fits with the present collection. The material is too poor, however, to give a formal description as a new species.

Psilocybe subsect. **Ericaeae** Noordel., *subsect. nov*.

Sporae obscure violaceo-brunneae, crassitunicatae poro germinativo distincto; lamellae in statura maturitate violaceo-tincto, in exsiccatae sordide brunneae.

Holotypus: *Psilocybe ericaea* (Pers.: Fr.) Quél.

Spores thick-walled with distinct, often rather large germ pore; lamellae dark brown with violaceous grey to greyish olivaceous tinge when mature, dark chocolate or grey-brown in exsiccates.

Holotype: *Psilocybe ericaea* (Pers.: Fr.) Quél.

European species: *Psilocybe ericaea*, *P. ericaeoides*, *P. subericaea*, *P. uda*.

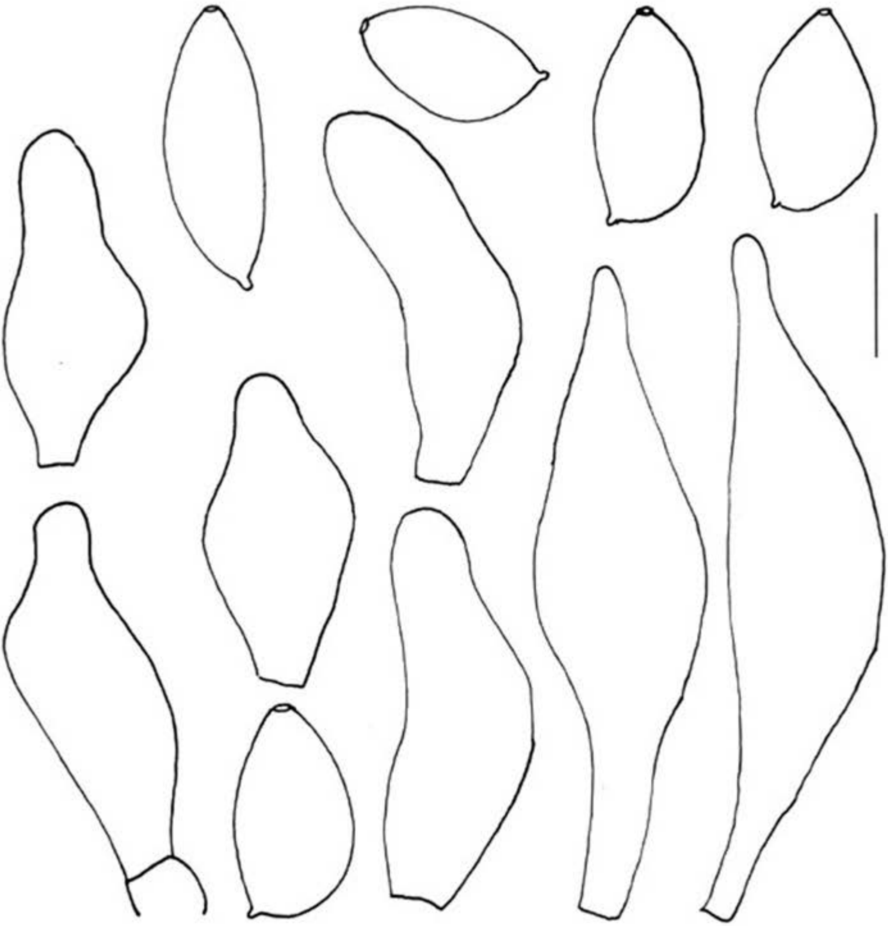

Fig. 4. *Psilocybe* spec. Spores, cheilocystidia, and chrysocystidia (bar = 10 µm).

Psilocybe subsect. **Marginatae** Noordel., *subsect. nov.*

Basidiomata cum velo copioso; sporae ad 10 µm longae, crassitunicatae, poro germinativo distinctae. Holotypus: *Psilocybe marginata* (Pers.: Fr.) Noordel.

Veil well-developed, visible as appendiculate patches along the pileal margin and annuliform zone to small annulus on stipe; on wood; spores smaller than 10 µm, thick-walled, with distinct germ pore.

Holotype: *Psilocybe marginata* (Pers.: Fr.) Noordel.

Only one species in Europe.

III. NEW COMBINATIONS

1. Subgenus **Stropharia**

Some authors distinguish *Psilocybe pseudocyanea* and *P. ochrocyanea* as two different species (Bon, 1972), Glowinski & Gumbinger (1982), Orton (1976). However, the differences given are difficult to use. Environmental factors, such as height of the vegetation, and exposure to sunlight seem to have great effect on the macromorphology of the basidiocarps. Jahnke (1984) demonstrated that strains of both taxa have a DNA homology close to 100%, which supports the contention that only one genetic taxon is involved. For that reason both taxa are distinguished here as forms of one, variable species:

Psilocybe pseudocyanea forma **ochrocyanea** (Bon) Noordel., *comb. & stat. nov.*

Basionym: *Stropharia ochrocyanea* M. Bon, Doc. mycol. 3 (1) (1972) 28.

2. Subgenus **Melanotus** (Pat.) Noordel., *comb. nov.*

Basionym: *Melanotus* Pat., Essai taxon. (1900) 175.

While preparing the manuscript for *Psilocybe* subgenus *Melanotus* for the Flora agaricina neerlandica vol. 4, it appeared to be necessary to make the following new combination:

Psilocybe phillipsii forma **megaspora** (Mos.) Vellinga, *comb. nov.*

Basionym: *Melanotus phillipsii* forma *megaspora* Mos., Fung. rar. Ic. col. 7 (1978) 28.

The range of the spore length of *Psilocybe phillipsii* f. *phillipsii* covers 5.5–7.0 (–7.5) µm, while forma *megaspora* has spores 7.0–9.0 µm long. The latter is much rarer than the typical forma.

IV. NEW TAXA IN SECTION PSILOCYBE

Extensive studies in section *Psilocybe*, combining morphology with genetic and molecular characteristics have been performed by S.J. Verduin as a PhD student under supervision of the present author. The results of this study have been incorporated in the flora, and will also be published extensively in a future paper [Noordeloos, et al., Persoonia 17 (in prep.)]. Since some new taxa will be presented in volume 4 of the Flora agaricina neerlandica, the Latin diagnoses are given here.

Psilocybe montana var. **macrospora**, Noordel. & Verduin, *var. nov.*

A varietate typica differt spores magis grandis, 8.5–11(–11.5) × 6.0–8.5 × 5.0–7.0 µm.
Holotypus: *Arnolds 6677*, 5-X-1995; 'the Netherlands, Beilen, Holthe, Schepping' (L).

Psilocybe subviscida var. **velata** Noordel. & Verduin, *var. nov.*

A varietate typica pileo velo appendiculato ornato vel sporis crassitunicatis differt.
Holotypus: S. Verduin & M.E Noordeloos, 28-VII-1996, United Kingdom, Scotland, Perthshire, Dunked, Trochry, Borelick Farm (V 136, L).

Psilocybe micropora Noordel. & Verduin, *spec. nov.*

Pileus 5–16 mm latus, conico-convexu demum expansus margine deflexus, hygrophanus, margine striatus, fulvus, siccus cum velo appendiculato vel fibrilloso-arachnoideo; lamellae, L = 20–26, l = 5–7, moderate distantes, late adnatae vel leviter decurrentes, fuligineae; stipes 10–25 × 1–2 mm, cylindriceus, flexuosus, flavobrunneus versus basim obsucioir; fibrillosus.

Sporae 5.5–7.5(–8.0) × 4.5–6.0 × 4.0–5.5 µm, ovoideae vel mitriformae, tenuitunicatae, cum poro germinativo obscuro. Basidia 15–24 × 6.0–9.0 µm, tetrasporigera, fibulata; aceis lamellarum sterilis; cheilocystidia 17.5 × 23 × 4.5–6.0 µm, lageniformia, tenuitunicata. Pileipellis cutis hyphis cylindraceis constituis; fibulae abundantes. Habitat in pratis inter muscos (*Rhytidiadelphus squarrosus, R. squarrosus,* et *Brachythecium rutabulum*).

Holotypus: '*M.E. Noordeloos 9710* (*Verduin 236*), 30-VI-1997, the Netherlands, Wassenaar, Estate Zuidwijck'(L).

REFERENCES

Bon, M. 1972. Macromycetes du Littoral Boulonnais. Doc. mycol. 1 (3): 9–46.

Esteve-Raventós, F. & Barassa. 1995. Coprophilous agaricales from Spain II. The genus Stropharia and Stropharia dorsipora. Rev. Iberoamer. Micol. 12: 70–72.

Glowinski, H. & K. Gumbinger. 1982. Drei seltene und z. T. neue Makromyzeten aus der Bundesrepublik Deutschland. Z. Mykol. 48: 35–40.

Jahnke, H. 1984. Artsabgrenzung durch DNA-Analyse bei einigen Vertreter der Strophariaceae (Basidiomycetes). Biblthеca mycol. 96.

Moeller, F.H. 1945. Fungi of the Faeröes, part. 1. Basidiomycetes. Copenhagen.

Moser, M. 1983. Die Röhrlinge und Blätterpilze, 4. Aufl. in Gams, Kl. Kryptog.Fl. 2 (b/11). Stuttgart.

Noordeloos, M.E. 1995. Notulae ad floram agaricinam neerlandicam – XXIII. Psilocybe and Pholiota. Persoonia 16: 127–129.

Noordeloos, M.E., J. Stalpers & S.J. Verduin (in prep.). Taxonomy of Psilocybe sect. Psilocybe based on morphology and compatibility tests. Persoonia 17.

Örstadius, L. & S. Huhtinen. 1996. The psathyrelloid taxa described by P. A. Karsten. Österr. Z. Pilzk. 5: 131–148.

Orton, P.J. 1976. Notes R. bot. Gdn Edinb. 35: 152–153.

Romagnesi, H. 1936. Essai d'une classification générique des Agarics Ianthinosporés et Mélanosporées. Rev. Mycol. 1: 27–36.

Singer, R. 1986. The Agaricales in Modern Taxonomy, 4th ed. Koenigstein.

Smith, A.H. 1951. The North American Species of Naematoloma. Mycologia 43: 467–521.

Watling, R. & N. Gregory. 1987. Strophariaceae and Coprinaceae p.p. British Fungus Flora 5: 1–121.

PERSOONIA
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NOTES ON TYPE MATERIALS OF TULOSTOMA (TULOSTOMATACEAE)

T. macrosporum, T. meridionale and T. utahense

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A study of the macroscopic and microscopic characters of type materials of *Tulostoma macrosporum*, *T. meridionale* and *T. utahense* is presented. The synonymy of the two latter species, that was proposed some years ago, is now verified. *Tulostoma macrosporum* is very close to them, but shows enough differential features to be maintained as an autonomous species. SEM photographs of the spore ornamentation are provided.

This report is a continuation of a series of studies on type materials of species described in the genus *Tulostoma* Pers.: Pers. in an attempt to resolve some taxonomic problems. It is relatively frequent in this genus to find species named with different epithets in various geographical areas, which increases very much their apparent number. We have already demonstrated some of these synonymies, based principally on the study of the spore ornamentation under SEM, in other papers: Altés & Moreno (1993, 1995), Moreno et al. (1992, 1995, 1997), Altés et al. (1999). We thus believe it is feasible to reduce the number of specific epithets of *Tulostoma* to a more realistic level.

In the present paper we compare the types of three species with very similar macroscopic characteristics and spores greater than 6.5 µm diameter (exceptional in the genus), to clarify their possible synonymy: *Tulostoma macrosporum* G. Cunn. (Cunningham, 1925) from Australia, and *T. meridionale* J.E. Wright (Wright et al., 1972) and *T. utahense* J.E. Wright (Wright, 1987) from the USA. The author of the two latter species already mentioned their great similarity and their possible synonymy (Wright, 1987). Later, this synonymy was proposed by Moreno et al. (1995) based on several Mexican collections and literature.

MATERIALS AND METHOD

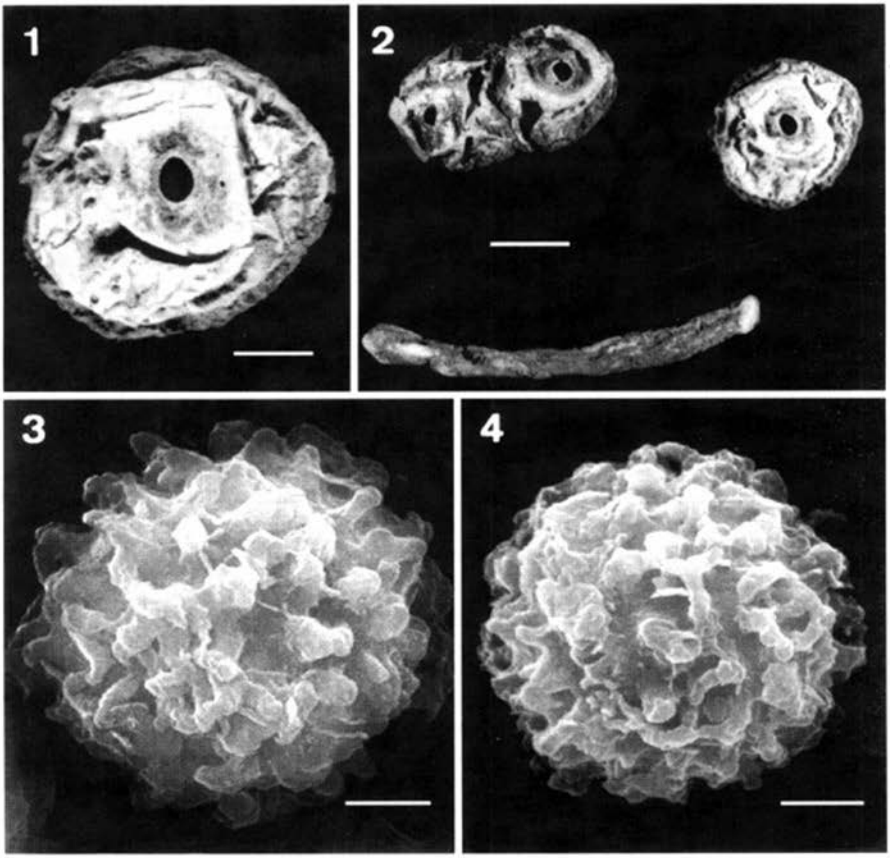
The studied type materials are deposited in the State Herbarium of South Australia, Adelaide, Australia (AD), the National Fungus Collections, Beltsville, Maryland, USA (BPI), and the New York Botanical Garden, New York, USA (NY).

Photographs using scanning electron microscopy (SEM) were made following Moreno et al. (1995).

1. **Tulostoma macrosporum** G. Cunn. — Figs. 1–4

Tulostoma macrosporum G. Cunn., Proc. Linn. Soc. New South Wales 50 (1925) 252.

The holotype collection is made up of five basidiocarps, two of them united laterally (Fig. 2); the stems are separated and fragmented in all the basidiocarps, excepting one,



Figs. 1–4. *Tulostoma macrosporum*, holotype (AD 17278). 1. Detail of a spore-sac with its slightly tubular mouth and some adhering remains of the exoperidium; 2. spore-sacs, two of them laterally united, and a separated stem; 3 & 4. basidiospores under SEM. — Scale bars: Fig. 1 = 2.5 mm; Fig. 2 = 5 mm; Figs. 3 & 4 = 2 µm.

which is incompletely developed. Spore-sac 7–9 × 4–6.5 mm diam., deformed by compression (Figs. 1 & 2). Mouth shortly tubular (Fig. 1), well developed in three spore-sacs and more or less immature in the remaining two. Exoperidium membranous, formed by a thin layer encrusted with soil, persisting at the base and other areas of the spore-sac (Fig. 1). Endoperidium smooth when exposed, cream-coloured. Gleba ferrugineous. Stem fragmented in most cases (the only complete one is not well developed), the larger pieces 26 × 2 mm, cylindric, greyish brown, striate, widened to 4 mm diam. at the base.

Basidiospores 8–12.5 µm diam., mostly 9–9.5 µm, globose, yellowish-ochre, distinctly spiny under LM, spines up to 1 µm long; under SEM the ornamentation is verrucose to spiny, but always dense (Figs. 3 & 4). Capillitium made up of filaments of a diameter generally narrower than the spores, 2–8 µm diam., thick-walled, frequently septate, branched, subhyaline, broadened at the pale ochraceous septa, up to 11 µm diam. Exoperidium formed by interwoven, relatively thick-walled, scantily branched, pale yellow threads, 2–4 µm diam., hardly broader at the infrequent and uncoloured septa. Endoperidium formed by filaments similar to those of the capillitium, 2–5 µm diam., densely interwoven, thick-walled, branched, pale yellow, broader at the uncoloured septa, up to 6.5 µm diam.

Collection studied. AUSTRALIA: New South Wales, Dubbo, leg. *J.B. Cleland*, 16-VII-1915, AD 17278, holotype.

2. **Tulostoma meridionale** J.E. Wright — Figs. 5–9

Tulostoma meridionale J.E. Wright in Wright et al., Ciencia (Mexico) 27 (1972) 117.

This collection consists of eight basidiocarps, five of them practically complete and three with fragmented stems (Fig. 5). Spore-sac 7–14 mm diam., subglobose (Figs. 5–7). Mouth circular, slightly projecting (Figs. 6 & 7). Exoperidium persistent, very thinly membranous with particles of soil externally adhering (Fig. 7). Endoperidium smooth, cream-coloured. Gleba ferrugineous. Stem 7–22 × 1–2 mm, greyish brown, widened to 4 mm diam. at the base (Fig. 5).

Basidiospores 6.5–8 µm diam., but 5.4–8(–12.6) or 7.6–9 × 6.7–8 µm diam. in the original description (Wright et al., 1972), globose-subglobose, pale ochraceous, with a clearly verrucose ornamentation under LM; the ornamentation under SEM consists of big and well developed verrucae, which sometimes form groups fused at the apices (pyramidal aspect) (Figs. 8 & 9). Capillitium 2–6 µm diam., thick-walled, frequently septate, branched, subhyaline, broader at the slightly ochraceous septa, up to 9 µm diam. The microscopic features of the exoperidium were obscured by the presence of soil.

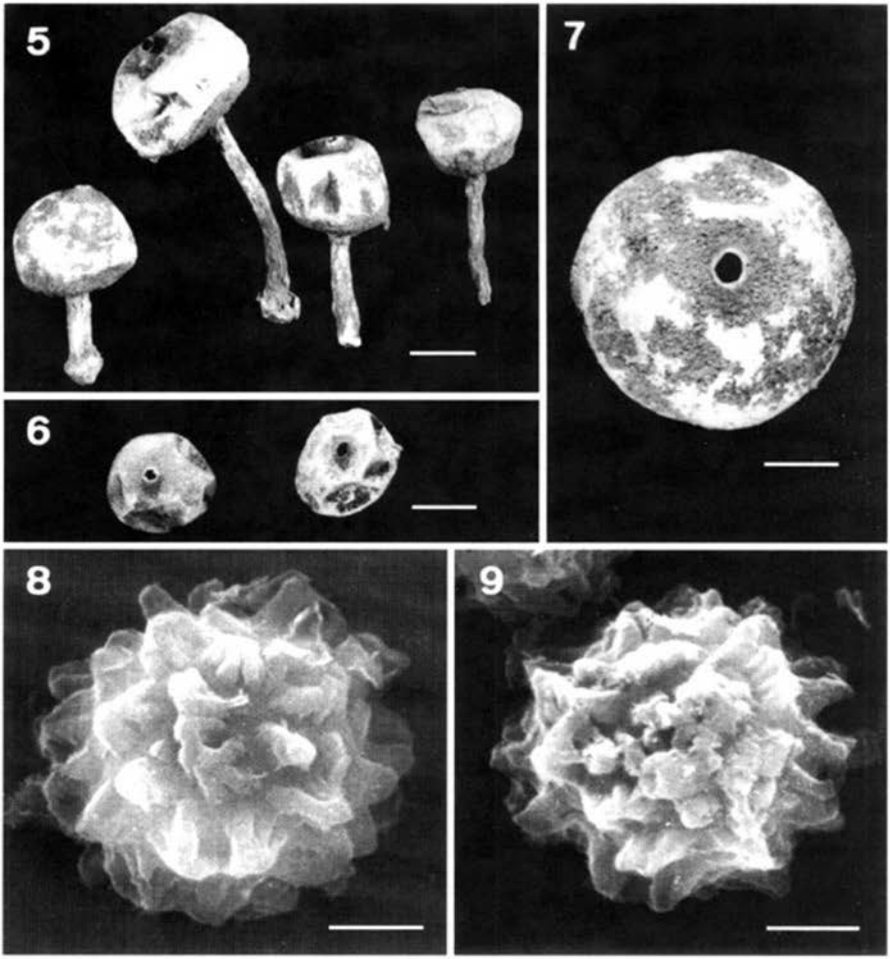
Collection studied. USA: Texas, Denton, leg. *W.H. Long*, XII-1907, Herb. Lloyd 53153 (BPI), holotype.

3. **Tulostoma utahense** J.E. Wright — Figs. 10–14

Tulostoma utahense J.E. Wright, The genus Tulostoma (Gasteromycetes), A world monograph (1987) 204.

The type material consists of seven basidiocarps with their stems quite fragmented (Fig. 10). Spore-sac 8–12 mm diam., deformed by compression (Figs. 10–12). Mouth circular, slightly projecting (Figs. 10–12). Exoperidium thinly membranous internally (where in contact with the endoperidium), but outwardly its aspect is rather hyphal and mixed with sand grains. Endoperidium smooth, cream-coloured. Gleba ferrugineous. Stem fragmented, up to 2.5 mm diam., greyish brown, but whitish where decorticated, increasing to 7 mm diam. at the base.

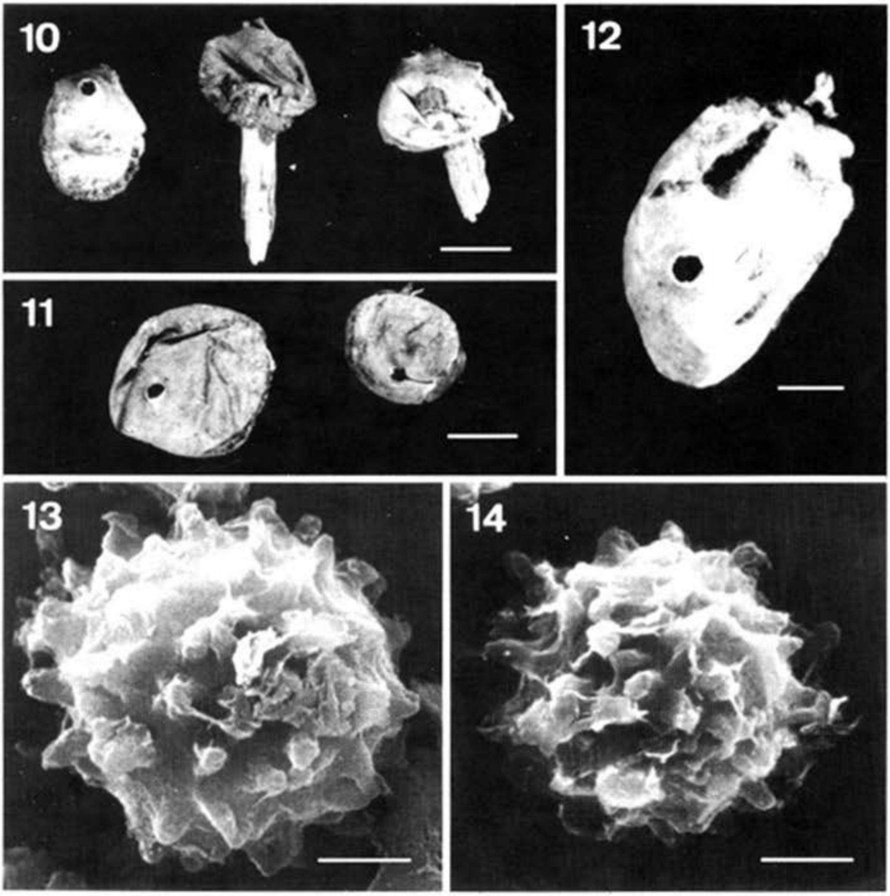
Basidiospores 7–9 µm diam., averaging 8 µm, globose-subglobose, pale ochraceous, with notable verrucose ornamentation under LM. The basidiospores usually appear collapsed under SEM, not very well developed, or covered with abundant remains from the disintegration of the mature gleba; these are the reasons why it is difficult to demonstrate clearly the type of ornamentation that characterize this species. However, the spore ornamentation seems to consist of large verrucae (Figs. 13 & 14) which sometimes form groups fused at the apices, like those in *T. meridionale*. Capillitium 2–7 µm diam., thick-walled, branched, subhyaline, usually broadened at the slightly ochraceous septa, up to 10 µm diam. Exoperidium formed by collapsed or degenerated hyphae.



Figs. 5–9. *Tulostoma meridionale*, holotype (Herb. Lloyd 53153, BPI). 5 & 6. Basidiocarps and spore-sacs; 7. detail of a spore-sac with its slightly tubular mouth and persistent remains of the exoperidium; 8 & 9. basidiospores under SEM. — Scale bars: Figs. 5 & 6 = 6 mm; Fig. 7 = 3 mm; Figs. 8 & 9 = 2 µm.

Collection studied. USA: Utah, Salt Lake City, beaches above City Creek, leg. *A.O. Garret 2585*, 21-III-1920, NY, holotype.

In our opinion, *T. meridionale* and *T. utahense* must be considered synonymous on account of the absence of significant differences between their type collections. *Tulostoma meridionale* has been reported only from North America, definitely from the USA and Mexico (Wright, 1987; Moreno et al., 1995).



Figs. 10–14. *Tulostoma utahense*, holotype (NY). 10 & 11. Basidiocarps and spore-sacs; 12. detail of a spore-sac with its slightly tubular mouth; 13 & 14. basidiospores under SEM. — Scale bars: Figs. 10 & 11 = 5 mm; Fig. 12 = 2 mm; Figs. 13 & 14 = 2 µm.

Tulostoma meridionale J.E. Wright in Wright et al., Ciencia (Mexico) 27 (1972) 117 = *T. utahense* J.E. Wright, The genus Tulostoma (Gasteromycetes). A world monograph (1987) 204.

Though *T. macrosporum* is macroscopically very similar to *T. meridionale*, it must be maintained as an autonomous species on account of the differences in size and ornamentation of its spores. *Tulostoma macrosporum* has been recorded, other than in Australia, in South Africa, California (doubtfully) (Wright, 1987), and Mexico (Guzmán et al., 1992), fruiting in xeric zones.

ACKNOWLEDGEMENTS

We wish to express our thanks to the curators of the herbaria AD, BPI and NY for the loan of the type collections of *Tulostoma macrosporum*, *T. meridionale* and *T. utahense*, respectively. G.M. especially thanks the Ministerio de Educación y Ciencia, Spain, for financial assistance to make a sojourn in Dr. J.E. Wright's laboratory in Buenos Aires, Argentina. This research has been possible through DGICYT PB 95-0129, and also the Programa de Cooperación con Iberoamérica sponsored by the mentioned Ministry. Our gratitude is additionally expressed to Mr. J.A. Pérez and Mr. A. Priego, of the SEM Service of the University of Alcalá, for their assistance, and to Mr. J.T. Palmer for revising the English text.

REFERENCES

Altés, A. & G. Moreno. 1993. Tulostoma beccarianum Bresad., the correct name for T. simulans Lloyd. Mycotaxon 48: 223–227.

Altés, A. & G. Moreno. 1995. Tulostoma fimbriatum, the correct name for T. readerii. Mycotaxon 56: 421–425.

Altés, A., G. Moreno & J.E. Wright. 1999. Notes on Tulostoma volvulatum and T. giovanellae. Mycol. Res. 103: 91–98.

Cunningham, G.H. 1925. Gasteromycetes of Australasia. II. A revision of the genus Tulostoma. Proc. Linn. Soc. New South Wales 50: 245–259.

Guzmán, G., L. Montoya & V.M. Bandala. 1992. Adiciones al conocimiento del género Tulostoma (Basidiomycotina, Gasteromycetes) en Mexico y descripción de una nueva especie. Bol. Soc. Argent. Bot. 28: 113–121.

Moreno, G., A. Altés & J.E. Wright. 1992. Tulostoma squamosum, T. verrucosum and T. mussooriense are the same species. Mycotaxon 43: 61–68.

Moreno, G., A. Altés, C. Ochoa & J.E. Wright. 1995. Contribution to the study of the Tulostomataceae in Baja California, Mexico. I. Mycologia 87: 96–120.

Moreno, G., A. Altés, C. Ochoa & J.E. Wright. 1997. Notes on type materials of Tulostoma. Some species with mixed spores. Mycol. Res. 101: 957–965.

Wright, J.E. 1987. The genus Tulostoma (Gasteromycetes). A world monograph. J. Cramer, Berlin, Stuttgart.

Wright, J.E., T. Herrera & G. Guzmán. 1972. Estudios sobre el género Tulostoma en México. Ciencia (Mexico) 27: 109–122.

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A NEW SPECIES OF BOUBOVIA (PEZIZALES) FROM THE HVALER ARCHIPELAGO IN NORWAY

J. VAN BRUMMELEN[1] & R. KRISTIANSEN[2]

Boubovia vermiphila spec. nov. (Pezizales) is described from the mycologically interesting Hvaler archipelago in southern Norway, occurring on casts of earthworms. The relationship with *Pulvinula* and *Boubovia luteola* is discussed. Some distinctive characters between *Pulvinula* and *Boubovia* are considered.

The Hvaler archipelago is a small group of islands situated in the temperate zone of Norway, close to the Swedish border, about 100 km south-east of Oslo, up to 75 m above sea-level. The geographical position and their ecological and phenological conditions make them favourable for the growth of a wide variety of operculate discomycetes (Pezizales, *Ascomycota*). The geology is Precambrian, and consists of granites and gneisses. The landscape is covered with marine sediments, sand- and shell-beds, sand-dunes, fields of heather, shallow marshes, calcareous clay and earth which often fill the cavities and open spaces between rocks. The forests consist of coniferous and deciduous trees. The soil is rich in nutrients and lime, giving rise to a great diversity of phanerogams, including numerous rare calcicolous species.

The second author has studied the fungi of this region, with special emphasis on the Pezizales, for more than fifteen years. Thus far, over 130 species among 46 genera of Pezizales and Thelebolaceae have been recorded, the most noticeable of which are: *Aleuria bicucullata* (Boud.) Gill., *Boudiera acanthospora* Dissing & T. Schumach., *Rhodoscypha ovilla* (Peck) Dissing & Sivertsen (Kristiansen, 1985); *Marcelleina georgii* (Svrček) J. Moravec (Moravec, 1987); *Scutellinia paludicola* (Boud.) Le Gal (Schumacher, 1990); *Lamprospora maireana* Seaver, *Boubovia luteola* (Velen.) Svrček, *Neottiella ricciae* (Crouan) Le Gal, *N. hetieri* Boud., *Peziza lividula* W. Phillips in Cooke, *Pseudascozonus racemosporus* Brumm. (Kristiansen & Schumacher, 1993); *Lamprospora kristiansenii* Benkert (Benkert, 1991); *Chalazion helveticum* Dissing, *C. sociabile* Dissing & Sivertsen (Kristiansen, 1990); *Ascodesmis nana* Brumm., *A. nigricans* Tiegh., *A. sphaerospora* Obrist (Kristiansen, 1994); *Octospora leucoloma* (Hedw.) Korf var. *tetraspora* (Fuckel) Benkert, *O. coccinea* (Crouan) Brumm. var. *tetraspora* Benkert (Benkert, 1998); *Thecotheus holmskjoldii* (E.C. Hansen) Eckblad, *Caccobius minusculus* Brumm., *Ascozonus woolhopensis* (Renny) J. Schröt. (Landvik et al., 1998a; van Brummelen & Kristiansen, 1998); and *Moravecia hvaleri* Benkert & Kristiansen (Benkert & Kristiansen, 1999).

In 1983 an enigmatic minute discomycete was discovered, which did not seem to fit any known species at that time. Additional material was found at the same locality in 1989, 1990, and 1998, but was not found in the intervening years. Study of the latest rich collection confirmed earlier suspicions that it was a new species of *Boubovia* Svrček.

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Boubovia vermiphila Brumm. & R. Kristiansen, *spec. nov.* — Figs. 1, 2

Apothecia eugymnohymeniale, sparsa vel dense gregaria, sessilia, (0.1–)0.2–0.5(–0.1) mm diam., (0.1–)0.3–0.5(–1.0) mm alta. Receptaculum initio subglobulare, deinde cylindricum vel doliiforme, denique pulverulentum vel subscutellatum, hyalino-albidum, lutescens, fragile, laeve. Excipulum medullare ex textura intricata. Excipulum corticale ex textura globulosa. Asci late clavati, apice rotundati, maturitate protrusi, operculo lato, 130–160 × 20–27 µm, 8-spori, pariete iodo non caerulescente. Ascosporae uni- vel bi-serratae, ellipsoideae, 17.8–20.2(–23.2) × 9.1–10.6 µm (excl. ornamenti), verrucis admodem grossis granulisque irregularibus instructae, plerumque pileis apicalibus grandibus instructae. Paraphyses simplices vel raro ramosae, filiformae, 2.0–2.5 µm crassae, apice non dilatatae, sed fortiter vel spiraliter contortae.

Ad terram humidam mixtus ad excrementae vermium.

Typus: *R. Kristiansen RK 89.18*, prope Putten, Kirkøy, Hvaler comm., Østfold comitatus, Norvegia, 12–17.VI.1989 (holotypus L; isotypus O, TRH).

Etymology: From Latin, vermis, a worm, and Greek, φιλεω (phileo), to love: with preference for (substrata with) worms.

Apothecia eugymnohymenial, solitary or in small groups or caespitose, sometimes aggregating, superficial, sessile on a narrow base, (0.1–)0.2–0.5(–1.0) mm diam., (0.1–)0.3–0.5 mm high. Receptacle at first subglobular, then cylindrical or doliiform, finally becoming pulvinate to subscutellate, whitish hyaline becoming yellowish on drying; consistency rather loose, fragile; surface smooth; margin not differentiated. Disc flat to convex, roughened by protruding ends of mature asci, hyaline. Hymenium 145–160 µm thick. Hypothecium not clearly differentiated as a distinct layer, of groups of isodiametric and elongated thin-walled cells 2–5 × 2–3 µm. Medullary excipulum up to 70 µm thick, of intermingled hyphae 4.5–9 µm wide (textura intricata). Cortical excipulum clearly differentiated, near the base up to 50 µm thick, at the margin 15–25 µm wide, hyaline, consisting of globular and subglobular thin-walled cells 10–25 × 6–20 µm (textura globulosa), without hairs or hyphoids.

Asci rather broadly clavate, attenuated at the base, rounded above, with a large operculum about 8 µm across, 130–160 × 20–27 µm, 8-spored, but often with only some of the spores properly developed; the wall not blue with iodine. Ascospores uni- or bi-seriate, ellipsoid (length/width ratio 1.9–2.1(–2.3), average 2.04), 17.8–20.2(–23.2) × 9.1–10.6 µm (without ornamentation), with 1 or 2 oil globules when young and occasional air bubbles, ornamented with a pattern of large and small irregularly shaped warts staining with methyl blue, usually with large apical caps. Paraphyses rather frequent, septate, filiform, scarcely branched, hyaline, 2.0–2.5 µm thick, with strongly or spirally curved, not enlarged ends, containing small colourless vacuoles and granules staining red with iodine.

Habitat — On damp soil mixed with excrements of earthworms (Lumbricidae).

Specimens examined. NORWAY: Østfold county, Hvaler comm., Kirkøy, near Putten, on damp soil mixed with excrements of earthworms (Lumbricidae), 12–17.VI.1989, *R. Kristiansen RK 89.18* (holotype of *Boubovia vermiphila*, L; isotypes O, TRH); same locality, 18–22.VI.1983, *R. Kristiansen RK 83.145* (L); same locality, 19–24.VI.1990, *R. Kristiansen RK 90.15* (L); same locality, 13.VI.1998, *R. Kristiansen RK 98.30* (L).

The fruitbodies of *B. vermiphila* were collected four times from the same locality in the Hvaler archipelago in June. These were found growing on the rounded surface and in the crevices of wormcasts, surrounded by black calcareous soil with minute fragments of sea shells, and often covered with fallen leaves of *Populus tremula* L., one of the species of trees shading the locality. More details on the vegetation of the locality were described by Kristiansen (1990: 93).

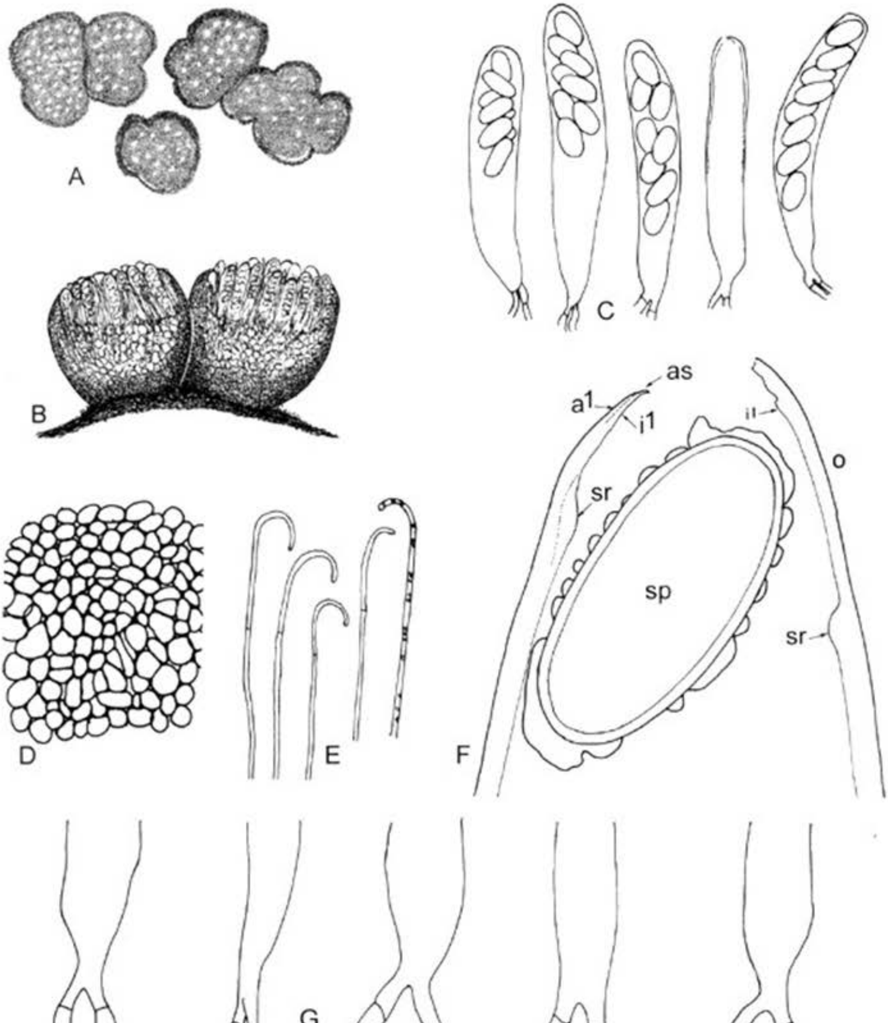

Fig. 1. *Boubovia vermiphila*. A. Habit of fruit-bodies from above, × 12.5; B. id., more detailed in lateral view, × 100; C. asci, × 300; D. detail of excipulum seen from outside, × 300; E. paraphyses, × 500; F. detail of top of dehisced ascus, × 2700 (as = ascostome; il = inner layer; o = operculum; ol = outer layer; sp = ascospore; sr = subapical ring); G. bases of asci, × 750 (A & E from *RK 83.145*; B from *RK 98.30*; C, D & G, from *RK 90.15*; F from *RK 89.18*, holotype).

Boubovia vermiphila is often found growing together with *Chalazion sociabile* Dissing & Sivertsen and *Ascobolus denudatus* Fr. Macroscopically, its minute apothecia have the appearance of a *Chalazion* and are, in the field, difficult to distinguish from those of *Chalazion sociabile.* The apothecia of *C. sociabile* are, however, white to greyish, without yellowish tints, showing only a weakly developed excipulum, broadly clavate asci with huge opercula, as well as different, larger ascospores, and rather thick, straight paraphyses with thickened ends.

Boubovia vermiphila differs also from the recently described coprophilous *Chalazion erinaceus* Doveri et al. (Doveri et al., 1998), as we could confirm from a study of the type specimen. *Chalazion erinaceus* has much smaller (75–100 µm diam.) orbiculate to pulvinate white to dirty white apothecia; the excipulum is very restricted, showing cells that easily stain with methyl blue; while the asci are broadly clavate and smaller (62–72 × 23–34 µm) with an operculum about 24 µm across; the paraphyses are not curved and slightly swollen near the ends.

It shows great similarity in growth and structure with species of *Pulvinula* Boud. and especially with *Boubovia luteola* (Velen.) Svrček (Velenovský, 1934, as *Humaria luteola*; Svrček, 1977, 1978; Kristiansen & Schumacher, 1993).

Chalazion was tentatively placed in the Thelebolaceae (Hawksworth et al., 1983; Eriksson & Hawksworth, 1998), but results of DNA-sequencing (Landvik et al., 1998b) indicate that *Chalazion* groups most closely with *Glaziella* Berk. and with *Pulvinula*, both belonging to the Pyronemataceae.

Boubovia vermiphila differs from *Boubovia luteola* in the smaller pulvinate apothecia, the larger and more abundantly ornamented ascospores with large polar caps. It may also be related to *Octospora spaniosa* K.B. Khare (Khare, 1975), but that has much smaller very finely reticulate ascospores.

The similarity to *Pulvinula*, as defined by Rifai (1968), Pfister (1976), Korf & Zhuang (1984, 1991), and Hohmeyer (1988), is in the eugymnohymenial development, pulvinate apothecia, yellow carotenoid pigment, identical textures of the cortex and the medulla, asci with a pleurorhynchous bifurcate base, and very thin, filiform paraphyses with strongly curved ends. It differs, however, in its clearly ornamented, ellipsoid ascospores.

Species with ellipsoid ascospores were accepted in *Pulvinula* by Pfister (1976) and by Korf & Zhuang (1984, 1991), but Yao & Spooner (1996a, 1996b) transferred such species to *Boubovia* Svrček. Besides the spore shape, they considered the presence of thick walls at a certain stage in young asci to be of sufficient importance for these transfers.

The value of the last mentioned character must be considered doubtful, since it concerns a cytological character based on post-mortem observations. It is well known that the inner layer of the ascus wall may swell strongly by imbibition when the ascus turgor disappears (Boedijn, 1933; van Brummelen, 1986, 1998; Baral, 1992), especially when placed in certain media for microscopic observation.

A reliable character of species of *Pulvinula* may be found in the development of the ascospores. Wu & Kimbrough (1993) demonstrated in ascospores of *Pulvinula convexella* (P. Karst.) Pfister a strongly zonated epispore and an outermost thin layer of the secondary spore wall which is finely echinulate or granular, which is not visible with light microscopy. In the view of these authors the outer layer of the episporium is directly deposited from the epiplasm, which would mean that the epispore becomes the outer spore layer. The early wall development in *Pulvinula* differs from that found in all other representatives of the large family of the Pyronemataceae, like *Aleuria*, *Octospora*, *Humaria*, *Trichophaea*, *Pseudombrophila*, and *Scutellinia*. Unpublished studies by the first author confirm this special mode of ascospore development in *Pulvinula convexella* and *P. ovalispora* Boud. In *Boubovia luteola* and *B. vermiphila*, with complex and extensive ascospore ornamentations,

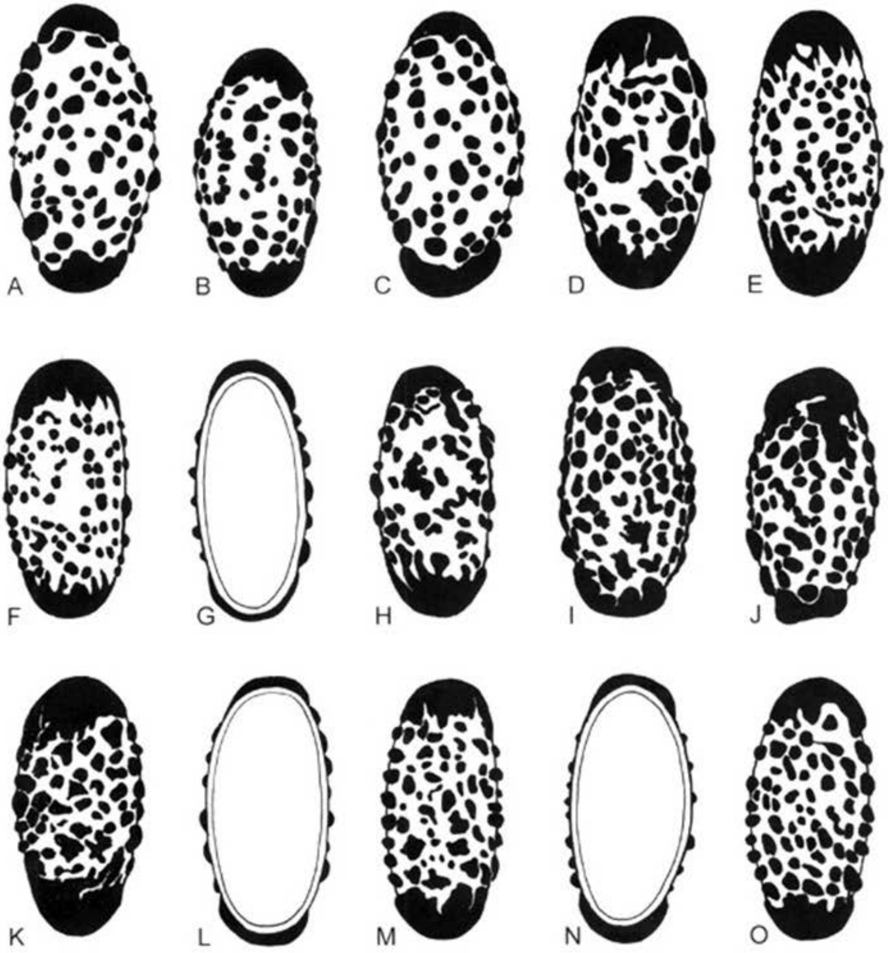

Fig. 2. *Boubovia vermiphila*. A–O. Ascospores, × 1600 (A–C from *RK 83.145*; D–H from *RK 89.18*, holotype; I–L from *RK 90.15*; M–O from *RK 98.30*).

the development of the secondary wall will be a more complex process, but ultrastructural confirmation will be needed. In *Pulvinula* the smooth ascospores are naked (i.e. devoid of a secondary wall). This would mean that *Pulvinula* should be restricted to species with smooth spores, whether globose or ellipsoid, while *Boubovia* should accommodate species with ornamented spores, so far all showing ellipsoid spores.

Air or gas inclusions are almost constantly reported as 'de Bary bubbles' for ascospores of *Pulvinula*, but in *Boubovia* these inclusions are produced only occasionally. This difference can be explained by the very dense, stratified, impermeable epispore in *Pulvinula* (Wu & Kimbrough, 1993) and a supposed more simple one in *Boubovia*.

The taxonomic position of *Boubovia* is within the Pyronemataceae, since the ascus apical apparatus is of the *Octospora* type (van Brummelen, 1978, 1986), also found in *Pulvinula convexella* and *P. ovalispora*. A subapical swelling in the shape of a ring can be observed at the inner side of the ascus wall at some distance behind the ascus tip, while the operculum and the ascostome are rather roughly delimited during ascus dehiscence (Fig. 1F). In all genera of the Pyronemataceae studied thus far this type of ascus apical apparatus could be established.

Preliminary results of DNA-sequencing by Dr. S. Landvik (pers. comm.) indicate that both *Boubovia luteola* and *B. vermiphila* are grouping close to *Pulvinula* and *Chalazion*, other representatives of the Pyronemataceae.

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REFERENCES

Baral, H.O. 1992. Vital versus herbarium taxonomy: morphological differences between living and dead cells of ascomycetes, and their taxonomic implications. Mycotaxon 44: 333–390.

Benkert, D. 1991. Zwei neue Arten der Gattung Lamprospora (Pezizales, Ascomycetes). Feddes Repert. 101: 631–637.

Benkert, D. 1998. Beiträge zur Kenntnis bryophiler Pezizales-Arten. 8. Viersporige Taxa der Gattung Octospora. Österr. Z. Pilzk. 7: 39–63.

Benkert, D. & R. Kristiansen. 1999. Moravecia hvaleri und Kotlabaea trondii – zwei neue Pezizales-Arten aus Norwegen. Z. Mykol. 65: 33–39.

Boedijn, K.B. 1933. The genera Phillipsia and Cookeina in Netherlands India. Bull. Jard. Bot. Buitenzorg III, 12: 57–76.

Brummelen, J. van. 1978. The operculate ascus and allied forms. Persoonia 10: 113–128.

Brummelen, J. van. 1986. Ultrastructure of the ascus top and the ascospore wall in Fimaria and Pseudombrophila (Pezizales, Ascomycotina). Persoonia 13: 213–230.

Brummelen, J. van. 1998. Reconsideration of relationships within the Thelebolaceae based on ascus ultrastructure. Persoonia 16: 425–469.

Brummelen, J. van & R. Kristiansen. 1998. Two rare coprophilous ascomycetes from Norway. Persoonia 17: 119–125.

Doveri, F., Y.-Z. Wang, G. Cacialli & V. Caroti. 1998. Una nuova specie di Chalazion dalla Toscana, Italia. Contributio allo studio dei funghi fimicoli – XXVIII. Riv. Micol. 41: 203–209.

Eriksson, O.E. & D.L. Hawksworth. 1998. Outline of the ascomycetes – 1998. Systema Ascomycetum 16: 83–296.

Hawksworth, D.L., B.C. Sutton & G.C. Ainsworth. 1983. Ainsworth & Bisby's dictionary of the fungi, Ed. 7. CAB, Kew.

Hohmeyer, H.H. 1988. Die Gattungen der Tribus Aleurieae Seav. emend. Korf (Pyronemataceae, Pezizales). Mitteilungsbl. Arbeitsgemeinschaft Pilzk. Niederrhein 6 (1): 11–31.

Khare, K.B. 1975. Four new Octospora species from India. Norw. J. Bot. 22: 259–268.

Korf, R.P. & W.-Y. Zhuang. 1984. The ellipsoid-spored species of Pulvinula (Pezizales). Mycotaxon 20: 607–616.

Korf, R.P. & W.-Y. Zhuang. 1991. A preliminary discomycete flora of Macaronesia: Part 16, Otideaceae, Scutellinioideae. Mycotaxon 40: 79–106.

Kristiansen, R. 1985. Sjeldne og interessante discomyceter (Pezizales) fra Syd-Norge. Agarica 6 (12): 387–453.

Kristiansen, R. 1990. New records of species of the genus Chalazion (Pezizales) in Norway. With emphasis on their ecology. Agarica 10/11: 83–97.

Kristiansen, R. 1994. Ascodesmis (Pezizales) i Norge, en sjelden koprofil slekt eller bare oversett? Agarica 13 (22): 87–100.

Kristiansen, R. & T. Schumacher. 1993. Nye operkulate begersopper i Norges flora. Blyttia 51: 131–140.

Landvik, S., R. Kristiansen & T. Schumacher. 1998a. Phylogenetic and structural studies in the Thelebolaceae (Ascomycota). Mycoscience 39: 49–56.

Landvik, S., K. Winka & T. Schumacher. 1998b. Long-time storage of fresh fungal tissue in DNA preparation buffer. Proc. Asia-Pacific mycol. Conf. Biodivers. Biotechnol. (Thailand): 177–181.

Moravec, J. 1987. A taxonomic revision of the genus Marcelleina. Mycotaxon 30: 473–499.

Pfister, D.H. 1976. A synopsis of the genus Pulvinula. A new combination in the genus Gymnomyces. Occ. Pap. Farlow Herb. 9: 1–19.

Rifai, M.A. 1968. The Australasian Pezizales in the herbarium of the Royal Botanic Garden Kew. Verh. K. Ned. Akad. Wet. (Natuurk.) 57 (3).

Schumacher, T. 1990. The genus Scutellinia (Pyronemataceae). Opera Bot. 101: 1–107.

Svrček, M. 1977. New combinations and new taxa in operculate discomycetes (Pezizales). Česká Mykol. 31: 69–71.

Svrček, M. 1978. A taxonomic revision of Velenovský's types of operculate discomycetes (Pezizales) preserved in National Museum, Prague. Sb. nar. Mus. Praze XXXII B, No. 2–4: 115–195.

Velenovský, J. 1934. Monographia discomycetum Bohemiae. Pars 1, 2. Pragae.

Wu, C.-G. & J.W. Kimbrough. 1993. Ultrastructure of ascospore ontogeny in Aleuria, Octospora, and Pulvinula (Otideaceae, Pezizales). Int. J. Plant Sci. 154: 334–349.

Yao, Y.-J. & B.M. Spooner. 1996a. Delimitation of Boubovia and Pulvinula. Mycol. Res. 100: 193–194.

Yao, Y.-J. & B.M. Spooner. 1996b. Notes on British species of Pulvinula, with two newly recorded species. Mycol. Res. 100: 883–884.

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CONTRIBUTIONS TOWARDS A MONOGRAPH OF PHOMA (COELOMYCETES) III – SUPPLEMENT

Additional species of section Plenodomus

G.H. BOEREMA[1] & J. DE GRUYTER[2]

This supplement deals with the diagnostic characteristics and literature data of three species of *Phoma* sect. *Plenodomus*: *Phoma korfii* spec. nov. (synanamorph *Sclerotium orobanches* Schwein.: Fr.), *Phoma pimpinellae* spec. nov. (teleomorph *Leptosphaeria pimpinellae* Lowen & Sivan.) and *Phoma etheridgei* L.J. Hutchison & Y. Hirats. (only known from isolates). They are filed into the key of section *Plenodomus* and the indices of the section are supplemented.

The species placed in *Phoma* sect. *Plenodomus* (Preuss) Boerema et al. (1981) are characterised by their ability to produce scleroplectenchyma in the peridium of the pycnidia. Those occurring on herbaceous plants are often anamorphs of species of the Ascomycete genus *Leptosphaeria* Ces. & De Not. with a scleroplectenchymatous ascocarp wall.

The Contribution III (Boerema et al., 1994) dealt with 26 species of *Phoma* sect. *Plenodomus*, associated with 12 species of *Leptosphaeria*.

In this Supplement three recently studied *Plenodomus*-like *Phoma* anamorphs are discussed. This refers to:

1. A rare sclerotia producing fungus on Orobanchaceae, achlorophyllous plants, parasitic on roots. The isolates studied were made in the USA (Yáñez-Morales et al., 1998) from *Epifagus virginianus*, parasitic on the roots of *Fagus grandifolia*.
2. An ascomycetous fungus found on blackened stems of *Pimpinella anisum* (Umbelliferae) in Israel, and in 1989 described as *Leptosphaeria pimpinellae* Lowen & Sivan. The isolate studied was from a single ascospore.
3. A fungus isolated from the bark of black galls and related cankerlike structures on American trembling aspen, *Populus tremuloides*, in Canada (Hutchison et al., 1994).

The morphology of the pycnidial anamorphs in vivo and in vitro is discussed and the cultural characteristics are described in the usual way. The paper starts with supplements of the key and the indices of *Phoma* sect. *Plenodomus*.

SUPPLEMENT TO THE KEY OF PHOMA SECTION PLENODOMUS
(characteristics *in vivo*)

Insert α and β after 'la. Scleroplectenchymatous pycnidia (II) on dead stems (occasionally on roots) of herbaceous plants':

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[1] Karel Doormanstraat 4^5, NL-2041 HD Zandvoort, The Netherlands.

[2] Plant Protection Service, P.O. Box 9102, NL-6700 HC Wageningen, The Netherlands.

α. Pycnidia developing directly from the host tissue 2
[Immersed, subepidermal or superficial.]

β. Pycnidia arising from sclerotia on the host, with their outer surface a clear continuation of the sclerotia, globose to subglobose with a papillate pore, variable in size; conidia 2–4 × 1–1.5 µm; dead stems, flowers and roots of Orobanchaceae in North America (*Epifagus virginianus*) and Europe (*Orobanche major*)
i Phoma korfii, synanamorph *Sclerotium orobanches*
[In vitro usually only pycnidia II develop, but under certain conditions also only sclerotia or sclerotia and pycnidia, with pycnidia either separate from or developing on sclerotia; occasionally also pycnosclerotia (III) and thin-walled pycnidia I.]

Insert γ and δ between '13a' and '13b':

13a. Neck up to 500 µm long, ... etc.

γ. Neck shorter and distinctly papillate .... δ + 13b

δ. Neck usually no longer than 60 µm, i.e. short papillate; conidia 4–4.5 × 1.5 µm, biguttulate; on dead stems of *Pimpinella anisum* (Umbelliferae), necrophyte (so far only known from Israel)
ii Phoma pimpinellae, teleomorph *Leptosphaeria pimpinellae*
[In vitro pycnidia I → II, often globose with a long neck up to 500 µm, but also very irregular without clear pore.]

13b. Neck up to 200 µm long, ... etc.

Add a Note to 27a:

*) The pycnidia and conidia of *P. enteroleuca* s.l. in vivo show much resemblance with those produced in cultures of .... ***iii Phoma etheridgei***
[Characteristics in vivo unknown; described from isolates obtained from the bark of black galls and cankers of *Populus tremuloides* in Canada. Culture morphology, conidial length to width ratio, and colony colour reaction to NaOH showed differences between isolates of *P. etheridgei* and *P. enteroleuca*.]

ADDITIONS TO THE INDICES

HOST–FUNGUS INDEX

A. on herbaceous plants

Orobanchaceae	
Epifagus virginianus and *Orobanche major*	***i Phoma korfii*** (synanam. *Sclerotium orobanches*) [only a few records from North America (USA and Canada on *E. virginianus*) and Europe (Sweden and Germany on *O. major*)]
Umbelliferae	
Pimpinella anisum	***ii Phoma pimpinellae*** (teleom. *Leptosphaeria pimpinellae*) [so far only known from Israel]

B. on deciduous trees and shrubs

Salicaceae *Populus tremuloides*	***iii*** *Phoma etheridgei* [in North America (Canada) isolated from the bark of black galls and cankers; pycnidia I → II so far only known from cultures]

FUNGUS–HOST INDEX

A. on herbaceous plants

Phoma korfii (***i***) (synanam. *Sclerotium orobanches*)	*Epifagus virginianus* and *Orobanche major* (Orobanchaceae)
Phoma pimpinellae (***ii***) (teleom. *Leptosphaeria pimpinellae*)	*Pimpinella anisum* (Umbelliferae)

B. on deciduous trees and shrubs

Phoma etheridgei (***iii***)	*Populus tremuloides* (Salicaceae)

DESCRIPTIVE PART

i. **Phoma korfii** Boerema & de Gruyter, *spec. nov.*[3] — Fig. 1A

Synanamorph: *Sclerotium orobanches* Schwein.: Fr.

Pycnidia tantum in vivo in sclerotiis synanamorphes observata, globosa vel subglobosa, poro papillato aperientia, 130–370 × 110–333 µm; paries e cortice sclerotii extensus, deorsum haud distinctus a sclerotio.

Conidia ellipsoidea vel oblonga, 2–4 × 1–1.5 µm.

Holotypus: CUP 63537 ad caules Epifagi virginiani, Ringwood Swamp, Lloyd-Cornell. Preserve, in oriente ab Ithaca, NY, in Statis Unitis, 13 Sept. 1995.

Selected literature. Yáñez-Morales, Korf & Babcock (1998).

Description in vivo (on *Epifagus virginianus*)

Pycnidia II [arising directly from the sclerotia of the synanamorph (see below), with their outer surface a clear continuation of the sclerotial rind] 130–370 × 110–333 µm, globose to subglobose, with a papillate pore. Outer wall like the sclerotial rind consisting of polygonal scleroplectenchyma cells of variable dimensions and a dark cortex; cells at base not differentiated into a separate wall layer. Exudate not observed. Conidia ellipsoidal to oblong, 2–4 × 1–1.5 µm, sometimes guttulate.

Sclerotia (synanamorph *Sclerotium orobanches*; immersed in or erumpent from or superficial on dead stems, flowers and roots of the host plant, separate or in small clusters) rounded to elongate, often lobulate or twisted to vermiform, smooth or with 1–8 pycnidia (0.6–) 1–1.5 × 2–9 mm.

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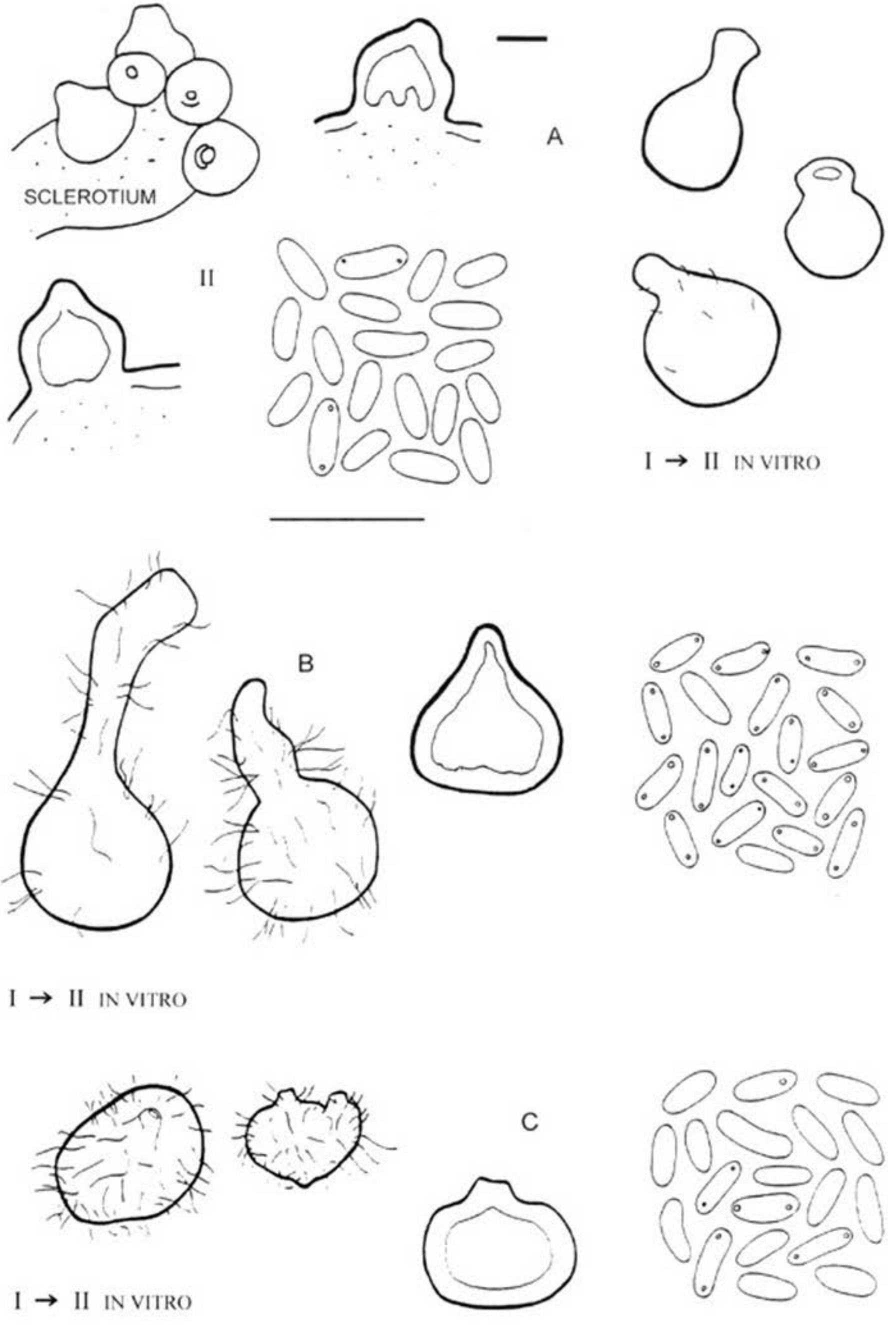
3) Named after Dr. R.P. Korf, who first discovered this pycnidial anamorph. It should be noted that *Phoma orobanches* C. Massal. (Massalongo, 1888, 1889) refers to a different species.


SCLEROTIUM
A
II
I → II IN VITRO
B
I → II IN VITRO
C
I → II IN VITRO

Description in vitro

OA: growth-rate 45 mm after 7 days, regular, with finely floccose, white aerial mycelium; colony colourless; reverse colourless to weak primrose near margin.

MA: growth-rate 37–48 mm after 7 days, regular, with compact finely floccose to woolly, white to pale olivaceous grey aerial mycelium; colony similar due to aerial mycelium; reverse olivaceous black, with straw near margin.

CA: growth-rate 52–53 mm after 7 days, (regular), with floccose, white aerial mycelium, colony colourless, partly salmon; reverse colourless to partly salmon/saffron. Under the standard method employed in our culture studies (de Gruyter & Noordeloos, 1992) only pycnidia I → II developed, 110–320 µm diam., subglobose to irregular, papillated, developing an elongated neck in a later stage, usually solitary, glabrous or with short mycelial outgrowths, with 1(–3) ostioles, honey to olivaceous, later olivaceous black; thick-walled, 4 or more layers of cells, outer layers pigmented; with white to buff / rosy buff or pale luteous exuded conidial masses; scattered, mostly on and in the agar. Micropycnidia present, up to 50 µm. Conidiogenous cells 4–7 × 3–6 µm, globose to bottle-shaped. Conidia somewhat larger than those observed in vivo, (2–)3–5.5 × (1–)1.5–2 µm, av. 4.2 × 1.6 µm, Q = 1.9–3.3, av. Q = 2.6, oblong to ellipsoidal, without guttules.

NaOH spot test: a weak discolouring occurs on OA and MA to salmon and greenish, respectively, not specific.

Crystals absent.

[Yáñez-Morales et al. (1998) obtained on other media at different light/dark and temperature regimes also cultures with only sclerotia, or sclerotia and pycnidia, with pycnidia either separate from or developing on sclerotia: "Sclerotia superficial, variously shaped, abundant and dispersed on some media, rare to fairly common at the periphery of plates on other media, produced in 4 weeks, developing their final shape and dark pigmentation during the 5th to seventh week." On potato dextrose agar, PDA 0.3–1 × 0.4–0.7 mm, on malt extract glucose agar, MGA 0.4–2 × 0.2–1 mm. Pycnidia II borne on the sclerotia were similar to those in vivo. On PDA they also observed relatively large papillate pycnidia, 360–600 × 280–550 µm, cream-salmon in colour and with a thin wall (type I). On MGA under some cultural conditions also "very hard, small, beaked structures, (50–)86(–130) × (60–)96 (–160) µm, resembling pycnidia but without spores, thus apparently pycnosclerotia" (III), developed.]

Ecology and distribution. The sclerotial anamorph of this fungus was already described by von Schweinitz in 1822 from roots and stems of *Orobanche virginiana* = *Epifagus virgini-*

Fig. 1. A. *Phoma korfii*. Pycnidia–II in vivo always arising from sclerotia (synanam. *Sclerotium orobanches*), globose to subglobose with papillate pore. Pycnidia in vitro I → II more irregular, often developing an elongated neck in a later stage. Conidia ellipsoidal to oblong. — B. *Phoma pimpinellae*. Pycnidia–II in vivo regular subglobose with a distinct papillate neck found together with, and very similar to the ascomata of the teleomorph *Leptosphaeria pimpinellae*. Pycnidia in vitro I → II, at first irregular, but later becoming more regular. Conidia oblong to ellipsoidal. — C. *Phoma etheridgei*. Pycnidia I → II only known from isolates, subglobose-papillate with hyphal outgrowths in varying degrees, and sometimes with a pointed base. Conidia ellipsoidal to ovoid to oblong, often acute at one end.

anus, in North America a not uncommon achlorophyllous plant (Orobanchaceae), parasitic on the roots of *Fagus grandifolia*, see Yánez-Morales et al. (1998). Fries (1998) recorded *Sclerotium orobanches* from Sweden and Germany on *Orobanches major*, parasitic on the roots of leguminous shrubs. The fungus may be an endophyte. The pycnidia of *Phoma korfii*, in nature only developing on the sclerotia, without doubt contribute to the dispersal of the fungus.

Representative culture. CBS 101638 (PD 97/12070) ex *Orobanche virginiana* (Orobanchaceae), USA.

ii. **Phoma pimpinellae** Boerema & de Gruyter, *spec. nov.* — Fig. 1B

Teleomorph: *Leptosphaeria pimpinellae* Lowen & Sivan.

Isolatus ex ascosporis, colonia in agaro farina avenae decocto: pycnidia fusca, crassitunicata, superficialia vel submersa vel in mycelio aerio, 125–300 µm diam., irregularia vel subglobosa, collulo elongato aperientia. Paries ad 12 cellulas crassus, extus pigmentatus. Cellulae conidiogenae globosae vel lageniformes in collum longum extensae, 4–6(–8) × 1.5 (sursum ad) –5 µm. Conidia oblonga vel ellipsoidea, 3.5–4.5 × 1–1.5(–2) µm.

Typus L 992.163-138, cultura sicca CBS 101637, ex ascospora singula ad caulem Pimpinellae anisi a Lowen & Sivanesan (1989) isolatus, Mt Carmel, Beit Oren Forest, Wadi near Kibbutz Oren, in Israel.

Selected literature. Lowen & Sivanesan (1989).

Description in vivo (on *Pimpinella anisum*)

Pycnidia II (immersed becoming superficial) up to 300 µm diam., globose with a thickened flattened base and a distinct papillate neck up to 60 µm high. Wall scleroplectenchymatous, especially conspicuous at the 'shoulder' near the neck. Exudate rosy vinaceous. Conidia short cylindrical (oblong), 4–5.5 × 1.2–1.8 µm, biguttulate. Conidiogenous cells 6–12 × 3 (at the base)–1 (at the phialidic apex) µm, i.e. bottle-shaped with a long neck[4] (data derived from Lowen & Sivanesan, 1989).

Description in vitro

OA: growth-rate 47 mm after 7 days, regular, with (finely) floccose, white to pale olivaceous grey, partly citrine green aerial mycelium; colony pale luteous to citrine, due to the release of a diffusable pigment, with olivaceous grey at centre; reverse pale luteous to amber, with olivaceous grey at centre.

MA: growth-rate 22–25 mm after 7 days (14 days: 45–48 mm), irregular, with finely floccose to coarsely floccose, white to citrine green aerial mycelium; colony citrine green to amber, due to the release of a diffusable pigment, white near margin, with olivaceous grey at centre; reverse citrine green/greenish olivaceous to amber, with olivaceous black to leaden grey at centre.

CA: growth-rate 44–45 mm after 7 days, regular, with finely floccose, white to greenish olivaceous aerial mycelium; colony citrine amber, due to the release of a diffusable pigment, with cinnamon to olivaceous patches; reverse similar, with leaden grey to olivaceous black at centre.

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4) Probably sometimes also globose-papillate as observed in vitro. The occurrence of 'conidiophores' as well as hardly differentiated conidiogenous cells is well known of another member of sect. *Plenodomus*, viz. *Phoma sclerotiodes* Preuss ex Sacc. (see Notolitzky & Colotelo, 1965 sub syn. *Plenodomus meliloti*).

Pycnidia I → II, 125–300 µm diam., developed in one week at sides of mycelial aggregation, irregular to subglobose with a long elongated neck, solitary or aggregated, with mycelial outgrowths, with usually 1 ostiole, olivaceous black; thick-walled, up to 12 layers of cells, outer layers pigmented; with rosy vinaceous exuded conidial masses; scattered, on and in the agar and in the aerial mycelium as well. Conidiogenous cells 4–6(–8) × 1.5 (at the apex) –5 µm, globose-papillate to bottle-shaped with a long neck. Conidia continuous, 3.5–4.5 × 1–1.5(–2) µm, av. 4.0 × 1.5 µm, Q = 2.4–3.3, av. Q = 2.7, oblong to ellipsoidal, with 2 small, polar guttules.

Chlamydospores absent.

NaOH spot test positive, a brick discolouring of the diffusable pigment on OA and MA.

Crystals absent.

Ecology and distribution. In Israel found on dead blackened stems of *Pimpinella anisum* (Umbelliferae). On the type substratum of the holomorph the pycnidia occur together with pseudothecia of *Leptosphaeria pimpinellae*, but it is plausible that both morphs play a different role in the life cycle of this fungus.

Representative culture. CBS 101637 (PD 92/41) ex *Pimpinella anisum* (Umbelliferae), Israel.

iii. **Phoma etheridgei** L.J. Hutchison & Y. Hirats. — Fig. 1C

Phoma etheridgei L.J. Hutchison & Y. Hirats. apud Hutchison, Chakravarty, Kawchuk & Hiratsuka, Can. J. Bot. 72 (1994) 1425.

Selected literature. Hutchison et al. (1994).

Appearance in vivo (Populus tremuloides)

This pycnidial fungus is only known from isolates obtained from the bark of galls and cankers of American trembling aspen in Canada.

Description in vitro

OA: growth-rate 23 mm after 7 days (14 days: 47–48 mm), regular, with floccose, white aerial mycelium; colony colourless to greenish olivaceous, with pale grey olivaceous at centre; reverse similar.

MA: growth-rate 23 mm after 7 days (14 days: 43–44 mm), regular, with compact, floccose, white to citrine green aerial mycelium; colony citrine green, due to aerial mycelium; reverse apricot, due to the release of a diffusable pigment, luteous near margin, olivaceous black at centre.

CA: growth-rate 23–24 mm after 7 days (14 days: 45–46 mm), regular, with floccose, white to grey olivaceous/olivaceous grey aerial mycelium; colony colourless to grey olivaceous/dull green; reverse similar, with salmon near margin.

Pycnidia (partly adopted from Hutchison et al., 1994) I → II, 95–270 µm diam., globose/subglobose to irregular, solitary or confluent, with mycelial outgrowths, sometimes setae-like, with 1 papillated ostiole, honey/olivaceous, later olivaceous black; thick-walled, up to 15 layers of cells, outer layer(s) pigmented; with flesh/salmon to pale vinaceous exuded conidial masses; scattered, both on and in the agar as well as in aerial mycelium. Conidiogenous cells 4–7 × 4–7 µm, globose to bottle-shaped. Conidia aseptate, 3–4.5(–5) × 1–2 µm, av. 4.4 × 1.4 µm, Q = 2.3–4.2, av. Q = 3.1, ellipsoidal, to oblong/ovoid or allantoid.

Chlamydospores absent.

NaOH spot test: on MA a greenish to orange discolouring occurs.

Crystals usually absent; however, in fresh isolates pale yellow crystals may be produced at margin of colony.

Ecology and distribution. This fungus seems to be specific to the bark of black galls ('burls') and related cankerlike structures on American trembling aspen (*Populus tremuloides*). Trees with these stem deformities are occasionally found in Western Canada and the Rocky Mountain States of the USA. Such trees showed a significant decrease or absence of infestation by the aspen decay pathogen *Phellinus tremulae* (Bond.) Bond. & Borissov. This phenomenon may be due to the presence of *Phoma etheridgei*, which proved to be strongly antagonistic in vitro against *Phellinus tremulae*.

Representative culture. DAOM 216539 (PD 95/1483) ex *Populus tremuloides* (Salicaceae), Canada.

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REFERENCES

Boerema, G.H., H.A. van Kesteren & W.M. Loerakker. 1981. Notes on Phoma. Trans. Br. Mycol. Soc. 77: 61–74.

Boerema, G.H., J. de Gruyter & H.A. van Kesteren. 1994. Contributions towards a monograph of Phoma (Coelomycetes), III – 1. Section Plenodomus: Taxa often with a Leptosphaeria teleomorph. Persoonia 15 (4): 431–487.

Fries, E.M. 1828. Elenchus Fungorum 2. Gryphiswaldiae.

Gruyter, J. de & M.E. Noordeloos. 1992. Contributions towards a monograph of Phoma (Coelomycetes), I – 1. Section Phoma: Taxa with very small conidia in vitro. Persoonia 15 (1): 71–92.

Hutchison, L.J., P. Chakravarty, L.M. Kawchuk & Y. Hiratsuka. 1994. Phoma etheridgei spec. nov. from galls and cankers of trembling aspen (Populus tremuloides) and its potential role as a bioprotectant against the aspen decay pathogen Phellinus tremulae. Can. J. Bot. 72: 1424–1431.

Lowen, R. & A. Sivanesan. 1989. Leptosphaeria pimpinellae and its Phoma anamorph. Mycotaxon 35 (2): 205–210.

Massalongo, C. 1888. Sulla germogliazione delle nelle Sphaeropsideae. Nuovo G. Bot. ital. 20: 437–439.

Massalongo, C. 1889. Nuovi miceti dell'agro Veronese. Nuovo G. Bot. ital. 21: 161–170.

Netolitzky, H. & N. Colotelo. 1965. Conidiophores of Plenodomus meliloti. Can. J. Bot. 43: 615–616.

Schweinitz, L.D. von. 1822. Synopsis fungorum Carolinae superioris. Schriften Naturf. Ges. Leipzig 1 (1): 1–105.

Yáñez-Morales, M. de J., R.P. Korf & J.F. Babcock. 1998. Fungi on Epifagus (Orobanchaceae) – I. On Sclerotium orobanches and its Phoma synanamorph. Mycotaxon 67: 275–286.

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CONTRIBUTIONS TOWARDS A MONOGRAPH OF PHOMA (COELOMYCETES) IV – SUPPLEMENT

An addition to section Heterospora: Phoma schneiderae spec. nov., synanamorph Stagonosporopsis lupini (Boerema & R. Schneid.) comb. nov.

G.H. BOEREMA[1], J. DE GRUYTER[2] & P. VAN DE GRAAF[3]

Study in vivo and in vitro of the '*Ascochyta*'-pathogen of lupin, indigenous to America, showed its conidial dimorphism. The phomoid phenotype developing in vitro and sometimes also in vivo is described as a new species of *Phoma* sect. *Heterospora*. The ascochytoid-stagonosporoid phenotype commonly occurring in association with disease symptoms is transferred to *Stagonosporopsis*.

In Contribution IV (Boerema et al., 1997) the section *Heterospora* was introduced for *Phoma* species producing apart from mainly aseptate, phomoid conidia also distinctly larger conidia, which may become one or more septate, 'ascochytoid or stagonosporoid'. Most of these fungi are pathogens specific to particular hosts. The two types of conidia apparently play different roles in the life cycle. The large, septate conidial phenotypes may be dominant in association with disease symptoms and are referred to *Stagonosporopsis* Died. The phomoid, aseptate conidia are sometimes only produced on dead host material. Humidity and temperature are apparently important co-factors which determine the conidial type. Both types may occur successively in the same pycnidium.

In vitro on standard agar media, the conidia are generally mainly aseptate-phomoid, but occasionally in vitro, several large, septate conidia develop as well; this possibly occurs when growth conditions are fluctuating.

So far, eleven species of *Phoma* studied in culture have been classified in section *Heterospora*. They have been connected with nine *Stagonosporopsis* synanamorphs in vivo, mostly originally described as *Ascochyta* species.

The American, seed-borne pathogen of lupins treated in this supplement to section *Heterospora* was formerly also classified in *Ascochyta* (Boerema, 1984), as *A. lupini* Boerema & R. Schneid. The original drawings of the conidia made by Dr. Roswitha Schneider (BBA, Berlin-Dahlem)[4] show large, septate conidia in vitro, which argues for the classification in *Ascochyta*. However, this has appeared to be exceptional: a fresh isolate (1998) as well as the preserved isolates made by Dr. Schneider produce mainly relatively small, aseptate conidia in vitro. In addition, in a letter dated 1-11-1978, Dr. Schneider had already noted the

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[4] Roswitha Schneider was born on May 19, 1917, and worked at the 'Institut für Mikrobiologie', BBA from 1948 until 1979. Among her many publications we would especially refer to her monograph 'Die Gattung *Pyrenochaeta* De Notaris' (Schneider, 1979).

occurrence of only small, aseptate conidia in pure culture on lupin stems! Therefore we have named the phomoid anamorph of the lupin pathogen after Dr. R. Schneider. The ascochytoid-stagonosporoid synanamorph has been placed in *Stagonosporopsis* and the cultural characteristics of the fungus are described in the usual way. The key and indices of *Phoma* sect. *Heterospora* are supplemented.

SUPPLEMENT TO THE KEY OF PHOMA SECT. HETEROSPORA (characteristics in vitro)

Replace in 11b. 'also 1-septate up to 16 × 6 µm' with 'elongated and 1-septate [they may reach double the length of aseptate conidia, but not three times the length as with the ascochytoid-stagonosporoid conidia in vivo].'

Insert 15c.:

15c. Colony with relatively scarce aerial mycelium on OA, pycnidia non-papillate or papillate, conidia mainly aseptate, 5.5–13.5 × 2.5–3.5 µm, 1-septate conidia 9.5–15(–21) × 2.5–4 µm; pathogen of *Lupinus* spp. [in vivo conidia sometimes all relatively small, 0–1-septate, but usually very large conidia predominate, 1–3-septate, mostly 15–30 × 5–9 µm, synanam. *Stagonosporopsis lupini*] . . . . . *P. schneiderae*

ADDITIONS TO THE INDICES

HOST–FUNGUS INDEX

Leguminosae	
Lupinus spp. (esp. American species) (Disease: Leaf Spot and Blight)	*Phoma schneiderae*: o + θ + (O+) Θ + Θ- (synanam. *Stagonosporopsis lupini*) [seed-borne pathogen known from North and South America; occasionally also recorded in the UK]

FUNGUS–HOST INDEX

Phoma schneiderae (synanam. *Stagonosporopsis lupini*)	*Lupinus* spp., esp. the American species *L. mutabilis*, *L. perennis* and *L. polyphylla*, are well-known hosts but Eurasian species, such as *L. albus* are also susceptible

DESCRIPTIVE PART

Phoma schneiderae Boerema, de Gruyter & van de Graaf, *spec. nov.* — Figs 1, 2

Conidial dimorph large, 1(oc. 2)-septate. Ascochytoid-stagonosporoid: *Stagonosporopsis lupini*, see below.

Pycnidia in vitro 80–320 µm diam., globosa vel subglobosa, solitaria vel confluentia, glabra, 1(–3) ostiolis papillatis vel non-papillatis praedita. Cellulae conidiogenae 5–16 × 5–13 µm, globosae vel lageniformes. Conidia plerumque unicellularia, 5.5–13.5 × 2.5–3.5 µm, eguttulata vel nonnullas guttulas sparsas continentia; conidia uniseptata 9.5–21 × 2.5–4 µm. (In vitro etiam chlamydosporae, 7–18 µm diam., globosae vel oblongae, breviter catenatae vel acervatae, intercalares vel terminales, olivaceae, guttulas viridulas continentes.)

Holotypus: HLB 998.099-105, cultura sicca CBS 101.494 (ADAS AR98/11 = PD 98/5247), isolatus e foliorum maculis in Lupino albo, Mepal-Ely, Cambridgeshire in Britannia, Apr. 1998.

Synanamorph: ***Stagonosporopsis lupini*** (Boerema & R. Schneid.), *comb. nov.*

Ascochyta lupini Boerema & R. Schneid., Versl. Meded. plziektenk. Dienst Wageningen 162 (Jaarb. 1983) (1984) 28 [basionym; holotype PAD No. '3476' as '*Ascochyta pisi* Lib. fm *lupini*'].

Ascochyta pisi var. *lupini* Sacc., Fungi Columb. (E. Bartholomew) (1915) No. 4506 [nomen nudum].

Ascochyta caulicola var. *lupini* Grove, Br. Coelomycetes (1935) 303 [not valid, no Latin description].

Selected literature. Boerema (1984: 28–31).

Description in vitro

OA: growth-rate 54–64 mm, regular to slightly irregular, with scarce, felty, olivaceous grey aerial mycelium; colony colourless to grey olivaceous/olivaceous grey or greenish grey/greenish black; reverse similar.

MA: growth rate 52–60 mm, slightly irregular, with felty, white to olivaceous grey aerial mycelium; colony citrine green/greenish olivaceous to dull green, with greenish black/iron grey at centre, reverse similar or with fawn patches.

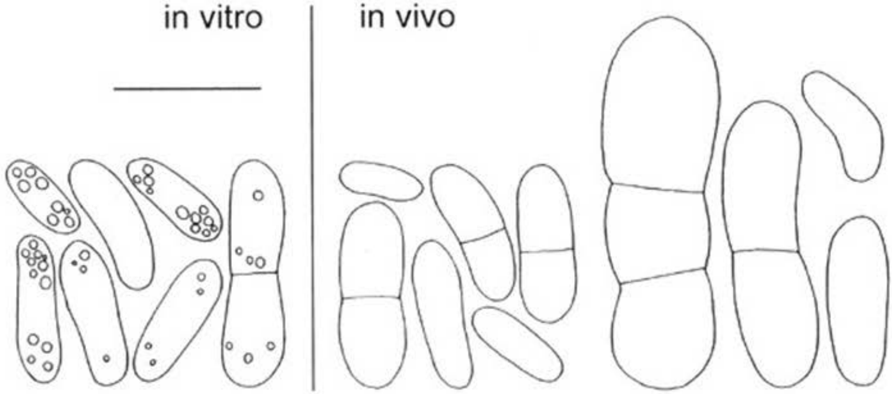

Fig. 1. *Phoma schneiderae*. Conidia in vitro mainly aseptate and variable in shape and size, but always including 1-septate conidia. Pycnidia in vivo may contain rather similar conidia, aseptate and septate, but mostly much larger conidia, usually 1(–2)-septate, synanamorph *Stagonosporopsis lupini*. — Bar = 10 µm. (Drawing conidia in vivo partly after Dr. R. Schneider.)

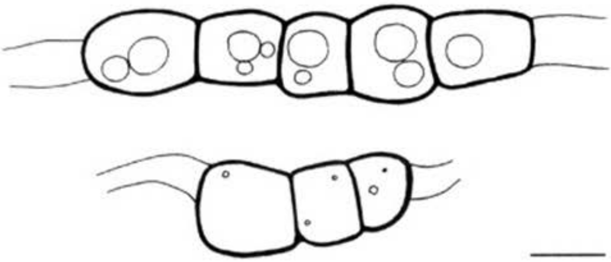

Fig. 2. *Phoma schneiderae*. Chlamydospores in vitro. — Bar = 10 µm.

CA: growth rate 50–62 mm, slightly irregular, with felty to finely woolly, white to olivaceous grey aerial mycelium; colony colourless with greenish olivaceous/dull green to olivaceous/iron grey patches, reverse similar with partly fawn.

Pycnidia 80–320 µm diam., globose to subglobose, solitary or confluent, glabrous, with 1(–3) non-papillate or papillate ostioles, citrine/honey, later olivaceous to olivaceous black; walls made up of 4–8 layers of cells, outer layer(s) pigmented; with white to buff exuded conidial masses; abundant, more or less concentrically arranged, both on and in the agar, and in the aerial mycelium. Conidiogenous cells 5–16 × 5–13 µm, globose to bottle-shaped. Conidia mainly aseptate, (5.5–)7–10(–13.5) × 2.5–3.5 µm, av. 8.1 × 2.8 µm, Q = 1.8–4.2, av. Q = 3.0, ellipsoidal to more or less obclavate, eguttulate or with several small, scattered guttules. Septate conidia (9.5–)11–15(–21) × 2.5–4 µm, av. 13.0 × 3.4 µm, Q = 3.0–5.2, av. Q = 3.9.

Chlamydospores 7–18 µm diam., globose to oblong, in short chains or clustered, intercalary or terminal, olivaceous with greenish guttules.

NaOH spot test: negative.

Crystals absent.

Description in vivo (on *Lupinus albus*)

Pycnidia (subepidermal in concentric rings on reddish-brown leaf spots with dark edges, or scattered on brown lesions on stems or pods), honey to light brown, later dark brown, variable in diameter 100–300 µm, but mostly 200–250 µm, globose to subglobose with one distinct, non-papillate ostiole. Usually, very large conidia predominate, which are 1–3-septate, ascochytoid-stagonosporoid and typical of the synanamorph *Stagonosporopsis lupini*: cylindrical with obtuse ends, mostly 15–30 × 5–9 µm. Some smaller, aseptate, phomoid conidia, 8–14 × 3–5 µm, are normally present as well. Sometimes, only 0–1-septate conidia are formed, which resemble those of *Phoma schneiderae* in vitro. Brown, unicellular chlamydospores can be present as well.

Ecology and distribution. This fungus is a specific, seed-borne pathogen of lupins, causing spots on leaves, stems and pods, and also occurring on roots. In South America, it is a serious problem in the cultivation of *L. mutabilis* (Frey & Yabar, 1983), while in North America it has been regularly found on perennial *Lupinus* spp. (e.g. Jones, 1942, Gordon, 1944 & Savile, 1947). In Europe, this fungus used to be known only from occasional findings on *L. arboreus* in England, but it has recently been isolated from the economically more important *L. albus* as well. The fungus occurred in January 1998 on autumn-sown white lupins cv. 'Lucyane' in Cambridgeshire, associated initially with leaf spots on cotyledons and progressing to cause leaf dieback and a stem base rot. The disease caused death of groups of plants within the crop. In view of this, the fungus should be regarded as a potentially dangerous organism to the cultivation of *L. albus* in continental Europe.

Representative culture. CBS 101494 (ADAS AR98/11, PD 98/5247) ex *Lupinus albus* (Leguminosae), United Kingdom.

Note. So far this pathogen has not been connected with a teleomorph. In the USA, a *Phoma*-anamorph has recently been found on overwintered lupin stems in close association with *Didymella lupini* (Cooke & Harkn.) Berl. & Voglino (Kaiser & Crous, 1998). The conidia of this anamorph show some resemblance with the aseptate conidia normally present together with the ascochytoid-stagonosporoid conidia of *Stagonosporopsis lupini*. However, cultural studies of *D. lupini* and its possible *Phoma*-anamorph have not been made by Kaiser & Crous.

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Special thanks are due to Dr. T.M. O'Neill (ADAS Arthur Rickwood) for initial recognition of the disease symptoms and revision of the English text, and to Mr. J. Carpanini for collecting plant material in the field. Dr. W. Gams kindly provided the Latin translations of descriptions.

REFERENCES

Boerema, G.H. 1984. Mycologisch-taxonomisch onderzoek. Versl. Meded. plziektenk. Dienst Wageningen 162 (Jaarb. 1983): 23–34.

Boerema, G.H., J. de Gruyter & M.E. Noordeloos. 1997. Contributions towards a monograph of Phoma (Coelomycetes) – IV. Section Heterospora: Taxa with large sized conidial dimorphs, in vivo sometimes as Stagonosporopsis synanamorphs. Persoonia 16: 335–371.

Frey, F. & E. Yabar. 1983. Enfermades y plagas de lupinos en el Peru. GTZ 142, Eschborn.

Gordon, W.L. 1944. Lupinus (–Lupine). Leaf Spot (Ascochyta ? Pisi Lib. var. Lupini Sacc.). A. Rep. Pl. Dis. Survey: 112 [Heavy on some leaves of L. sp.; first record in Man].

Jones, W. 1942. Lupinus. Leaf Spot and Blight (Ascochyta sp.). A. Rep. Pl. Dis. Survey: 102 [General along roadsides, also in spots, BC. Considerable foliage damage].

Kaiser, W.J. & P.W. Crous. 1998. Mycosphaerella lupini sp. nov., a serious leaf spot disease of perennial lupin in southcentral Idaho, USA. Mycologia 90: 726–731.

Savile, D.B.O. 1947. Lupinus (–Lupine). Leaf Spot (Ascochyta Pisi var. Lupini). A. Rep. Pl. Dis. Survey: 112 [General on lower leaves of L. polyphylla; first record from Que].

Schneider, R. 1979. Die Gattung Pyrenochaeta De Notaris. Mitt. biol. Bund Anst. Ld- u. Forstw. 189: 1–73.

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AMANITA DRYOPHILA (AMANITACEAE) SPEC. NOV. AND THE SPECIES OF THE SECTION VAGINATAE WITH A SEMIFRIABLE UNIVERSAL VEIL AND ELLIPSOID SPORES

GIOVANNI CONSIGLIO[1] & MARCO CONTU[2]

Amanita dryophila spec. nov. is described. The differential features of the new species with respect to *A. beckeri* as well as its delimitation from the other species of the section *Vaginatae* with a semifriable universal veil and ellipsoid spores are discussed.

INTRODUCTION

In forests of broad-leaved trees of the Italian territory, on calcareous soil, an *Amanita* belonging to the subgenus *Amanita* section *Vaginatae*, with rather unusual characters, has been observed several times.

The habit of the specimens and the macro- and micromorphological features of the universal veil strongly remind of *A. beckeri* Huijsman, but the ellipsoid spores show that a different entity is concerned.

Since none of the taxa described until now possesses the same characters as our collections, we think it necessary to describe a new species here, *Amanita dryophila* Consiglio & Contu.

Amanita dryophila Consiglio & Contu, *spec. nov.* — Fig. 1, Plate 15, 16

Pileus (5–)8.5–15(–20) cm latus, carnosus, convexus dein explanatus, plerumque haud umbonatus, typice malleatus, subavellaneus vel pallide castaneo-avellaneus vel aurantio-avellaneus, saepe verrucis albidis vel albo-ochraceis ornatus, margine striata. Lamellae confertae, albae, liberae, acie saepe brunnea. Stipes (6–)10–15(–20) × 1.5–3(–4) cm, cylindraceus, albus, aurantio vel avellaneo colore variegatus, exannulatus. Volva albida, vel ochraceotincta, fragilis, friabilis. Caro firma sed facile corrupta, alba, immutabilis; odor atque sapor debiles. Sporarum pulvis albidus.

Sporae 10.6–11.9 × 8.9–10.2 µm, Q = 1.12–1.24, hyalinae, inamyloideae, late ellipsoideae, monoguttulatae. Basidia 40–60 × 12–15 µm, tetraspora; subhymenium ex cellulis elongatioribus constitutum. Cellulae marginales 25–60 × 12–30 µm, piriformes vel clavatae vel sphaeropedunculatae. Suprapellis ex hyphis gelatinis tenuissimis, cylindraceis constituta; subpellis ex hyphis cylindraceis laxe intertextis, 3–8 µm latis, constituta, pigmento praecipue vacuolari. Textura velaris subcellularis, ex hyphis cylindraceis intermixtis plurimis cellulis globosis, hyalinis vel pallide ochraceis constituta.

Hyphae vasculares praesentes. Fibulae absunt.

Habitatio in nemoribus frondosis cum *Quercubus* (*Q. ilex, Q. suber, Q. robur*, etc.), in humo basica. Autumno.

Typus: Italia, Emilia Romagna, prov. Bologna, Monterenzio, loc. Ronchi, 30.6.1994, leg. G. Consiglio (97020), in herbario MCVE sub n. 736 conservatur.

Cap (50–)85–150(–200) mm broad, rather fleshy, convex to plano-convex, hardly ever completely expanded, with a striate margin, typically marked by some dimples and hollows, suggesting a semi-hypogeous development of the fruit-bodies, lubricous when wet, smooth,

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1) Via C. Ronzani 61, I-40033 Casalecchio di Reno, Italy.
2) Via Valsesia 7, I-07029 Tempio Pausania, Italy.

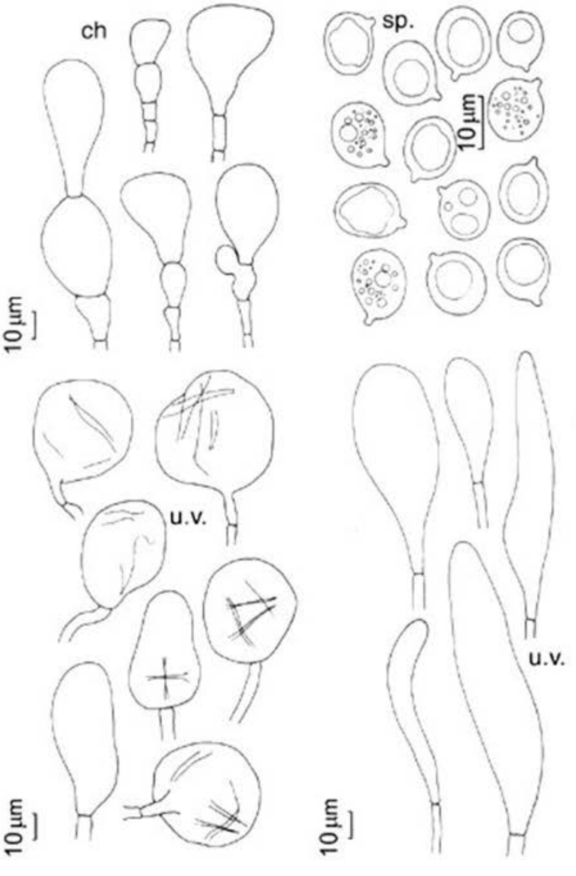

Fig. 1. *Amanita dryophila*. Marginal cells (ch); spores (sp.); universal veil (elongate cells) (u.v.); universal veil (inflated cells) (u.v.). Bar = 10 µm.

more or less saturated hazel-brown, sometimes with orange shades, never with grey tinges, often with detersile, white to slightly ochraceous small crumb-like volval remnants or glabrous. Gills rather broad and thick, ventricose, free, white with edge concolorous to pale hazel-orange, finely eroded. Stem (60–)100–150(–200) × 15–30(–40) mm, stuffed, rather strong, slender, cylindrical, progressively enlarged toward base, but never bulbous, dry, white, flecked with pale hazel or hazel-orange zigzag bands. Partial veil strongly reduced, not forming an annulus. Universal veil brittle, friable, almost never integral but tending to remain in the ground, sometimes forming a sort of volval belt on lower half of stem, white or whitish, often shaded with ochre, not turning grey. Flesh firm, solid but strongly perishable, white, unchanging. Smell and taste indistinct. Spore print whitish.

Spores 10.6–11.9 × 8.9–10.2 µm (average 11.3 × 9.6 µm), Q = 1.12–1.24 (average 1.18), hyaline, non-amyloid, broadly ellipsoid, rarely ellipsoid or subglobose, sometimes lacrymoid, with a large guttula inside, with a marked apiculus. Basidia 40–60 × 12–15 µm, 4-spored, rarely 2-spored, clavate, without clamps; subhymenium composed of branching hyphae with elongate cells. Trama of gills bilateral. Marginal cells 25–60 × 12–30 µm, pyriform, clavate or sphaeropedunculate, thin-walled. Pileipellis with an upper gelatinized region with cylindrical, very frail and irregularly arranged hyphae and with a lower region with cylindrical, 3–8 µm wide, somewhat interwoven hyphae; pileus context with some vascular hyphae. Remnants of the universal veil with a subcellular texture consisting of cylindrical, 2–6 µm wide hyphae, and several inflated, 20–60 µm wide, hyaline to slightly ochraceous cells. Vascular hyphae numerous. Clamps absent.

Habitat — Terrestrial, gregarious in open, sunny forests of broad-leaved trees, mainly *Quercus* spp., on calcareous soil, often bursting out of the soil. Autumn. Not rare in Italy.

Collections examined. ITALY: Brescia, Bovegno, 1.X.1984, *G. Guarinoni, A. Picena & G. Bontempi* (sub '*Amanita beckeri* Huijsman'); Lazio, prov. Roma, Villa Pamphili, 10.V.1986, *V. Migliozzi*, fragment in CAG 2/1.30; Sardegna, prov. Nuoro, Laconi, loc. S. Sofia, 8.XI.1987, *D. Farci & Z. Rubiu, M. Contu 87081101*; Emilia Romagna, prov. Reggio Emilia, Parco di Roncolo, 21.VI.1997, *G. Simonini*; ditto, prov. Reggio Emilia, Pulpiano, Viano, 22.VI.1997, *G. Simonini*; prov. Bologna, Monterenzio, Ronchi, 30.VI.1994, *Consiglio 97020* (holotypus); ibid., 5.VII.1997, *G. Consiglio 94025*; prov. Modena, Montese, Selva di Castelluccio, leg. *G. Consiglio & E. Franceschini 94033*.

DISCUSSION

Amanita dryophila belongs to the section *Vaginatae* (Fr.) Quél. and, within this section, can be included in the complex of species with broadly ellipsoid to elongate spores. It shows a very close resemblance to *A. beckeri* Huijsman (1959, sub '*A. strangulata*', 1961, 1962) with which it is often confused on the field. *Amanita dryophila* is remarkably different from this taxon, the most typical species of subsection *Inauratae* (M. Bon) Šebek with a white (not grey) universal veil, because of its broadly ellipsoid (not spherical) larger spores.

Among the similar European species with a semifriable universal veil and broadly ellipsoid to ellipsoid spores, *A. dryophila* has to be compared with *A. oblongispora* Tulloss & Contu in Tulloss (1994) and with *A. malleata* (M. Bon) Contu (see Piane, 1972; Bon, 1983; Migliozzi & Lavorato, 1987; Tulloss, 1994), the only species which, growing in similar habitats, could be confused with *A. dryophila* in the field.

However, *A. oblongispora* is very different from *A. dryophila*, as it has clamped basidia as well as markedly more elongate spores (Q = 1.2–1.5) and a cap with grey or ochraceous grey, sometimes buff or fawn, tints, but with hazel-brown or orange shades completely lacking. Moreover, the ecology of *A. oblongispora* is less restricted than that of *A. dryophila* as the former also grows well on acid soils where the latter has never been found.

Also *A. malleata* has grey to whitish grey colours. Moreover, the lectotype designated by Tulloss has gills with a pink tint and a subhymenium not composed of branching hyphae as in *A. dryophila* (cf. Tulloss, 1994: 352).

Amanita dryophila is very different from *A. biovigera* Sing., sometimes considered conspecific with *A. mairei* Foley (cf. Fraiture, 1993: 91), which has a cap with much deeper brown bistre to olivaceous bistre colours and a stem flecked with brown bistre, zigzag zones (for the micromorphology, see Tulloss, 1994: 352–353) and from *A. lividopallescens* var. *malleata* (Piane ex) Romagn. with grey ochre to pearl-grey tints and a universal veil with a filamentous texture (Romagnesi, 1982).

Among the extra-European species we have not found anything similar to *A. dryophila*. *Amanita antillana* Dennis, reported from Trinidad, has an olivaceous brown cap and an ochraceous brown veil (Dennis, 1952; Tulloss, 1994).

The species belonging to the complex under discussion can be separated by means of the following key:

1a. Basidia clamped; cap with grey to ochraceous grey, sometimes fawn tints; mediterranean species . . . . *A. oblongispora* Tuloss & Contu
b. Basidia not clamped 2
2a. Cap hazel-brown flushed with orange; white stem flecked with bands or little scales concolorous with pileus; subhymenium consisting of branching hyphae; in forests of broad-leaved trees on calcareous soil . . . . *A. dryophila*
b. Cap differently coloured 3
3a. Universal veil whitish; cap with whitish cream to ash grey or smoky grey tints; stem white or flecked with bands concolorous with the pileus, subhymenium subcellular to cellular . . . . *A. malleata* (M. Bon) Contu
b. Universal veil greyish, cap with brown bistre to olivaceous bistre tints, stem flecked with concolorous bands . . . . *A. biovigera* Sing.

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We thank Cornelis Bas (Leiden), Guy Redeuilh (Paris) and Giampaolo Simonini (Reggio Emilia) for their comments and criticisms. We also thank Giovanni Robich (Mestre, Venezia) for his collaboration.

REFERENCES

Bon, M. 1983. Typification de Amanitopsis malleata (Piane) comb. nov. Doc. Mycol. 48: 33–36.
Dennis, R.W.G. 1952. Lepiota and allied genera in Trinidad, British West Indies. Kew Bull. 4: 459–499.
Fraiture, A. 1993. Les Amanitopsis d'Europe. Op. Bot. Belg. 5: 1–127.
Huijsman, H.S.C. 1959. Deux Amanites méconnues. Bull. trimest. Soc. Mycol. Fr. 75: 14–32.
Huijsman, H.S.C. 1961. Amanita beckeri nov. sp. Bull. trimest. Soc. Mycol. Fr. 77: 349–350.
Huijsman, H.S.C. 1962. Amanita beckeri nov. sp. Bull. trimest. Soc. Mycol. Fr. 78: 271.
Migliozzi, V. & C. Lavorato. 1987. Note tassonomiche su Amanita malleata. Micol. e Veget. Mediterr. 11: 37–43.
Piane, V. 1972. Amanita (Amanitopsis) malleata. Bull. Soc. Nat. Oyonnax 19/21: 51–58.
Piane, V. 1975. Amanita (Amanitopsis) malleata. Bull. Féd. Mycol. Dauph.-Savoie 57: 17–19.
Romagnesi, H. 1982. Quelques espèces rares ou nouvelles des champignons. IX. Bull. trimest. Soc. Mycol. Fr. 98: 165–173.
Tulloss, R. 1994. Type studies in Amanita section Vaginatae 1: some taxa described in this century (studies 1–23) with notes on description of spores and refractive hyphae in Amanita. Mycotaxon 52: 305–396.

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NOTULAE AD FLORAM AGARICINAM NEERLANDICAM – XXXV
On the typification of Lactarius necator

MACHIEL E. NOORDELOOS[1] & THOMAS W. KUYPER[2]

Lactarius necator is neotypified with a collection from Sweden that fits well with the sanctioning description. The plate of Bulliard representing the original concept of *Agaricus necator*, is excluded from the type diagnosis. It is demonstrated that *A. plumbeus* is not conspecific with *A. necator*, and the alternative use of the name *Lactarius plumbeus* (Bull.: Fr.) Gray, as recently proposed by Heilmann-Clausen et al. (1998) is rejected.

Recently, the first author started revising the genus *Lactarius* for one of the forthcoming volumes of the Flora agaricina neerlandica. During this study also some nomenclatural problems were encountered, one of them being the application of the epithet *necator* for the well-known and widespread species with olivaceous-brown colours, associated mainly with *Betula*. In the current literature, this species has been called either *L. necator* or *L. turpis*, and occasionally, mainly in the French tradition, also *L. plumbeus*. Heilmann-Clausen et al. (1998), being aware of the problems connected with the typification of *Lactarius necator* also decided to use the name *Lactarius plumbeus* in their monograph of Nordic Lactarii. The present paper makes clear that the name *L. necator* can be maintained and points out that the name *L. plumbeus* should not be used for that taxon.

Fries (1821: 64) sanctioned *Agaricus necator* Bull. with the following diagnosis:

> "*A. necator*, pileo glabro zonato olivaceo-umbrino, margine villoso, stipite farcto. *Krapf* t. *V. f.* 1–4. A. nec. *Bull. t.* 14. *Pers. Syn. p.* 435. *Fries Obs.* 1, *p.* 59. Lact. *Pers. Obs.* 2. *p.* 42. Am. venenat. *Lam. l.c.* A. plumbeus. *Schum. p.* 345.
> Certe ab A. torminoso distinctus. Stipes brevis, attenuatus, pileo dilutior, intus albus. Pileus regularis, saepe plano-disciformis, viscosus, firmus, margine demum evoluto. Lamellae albidae, variant lutescentes et incarnatae. *In silvis & nemoribus, passim. Aug.– Oct.* (v.v.)"

Although Fries had seen the fungus in living condition – as indicated by 'v.v.' in his description, he largely based this diagnosis on earlier descriptions (Fries, 1815: 59–69; Persoon, 1799: 42; Persoon, 1801: 435).

It is clear from these descriptions that Fries and Persoon described a *Lactarius* species, nowadays commonly known as *L. necator* (Bull.: Fr.) Pers. However, it is remarkable that Fries and Persoon chose the epithet *necator* Bull. for this species. Bulliard published two plates as *Agaricus necator*. The first one, pl. 14, depicts (in the Leiden copy) a pinkish-reddish brown *Lactarius* species with zonate pileus and hairy pileal margin, obviously representing what we now are used to call *Lactarius torminosus*. Heilmann-Clausen et al. (1998:

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43) who consulted another copy of Bulliard, mention a plate depicting a blackish fungus with a hairy pileal margin. With Bulliard's second plate (l.c., pl. 529, fig. 2) a fungus is depicted which represents beyond any doubt *L. torminosus*. Fries (1821: 63) was aware of the identity of the fungus illustrated again as *Agaricus necator*, as he listed that plate under *Agaricus torminosus*.

Fries (1832) realised that Persoon's and his own earlier interpretation of the first plate of *A. necator* (Bull., pl. 14) might well have been wrong. He concluded that both Bulliard plates referred to *A. torminosus* and he changed author attribution of the name *A. necator*, listing it as *A. necator* Fr.! One might be tempted to conclude that Art. 48 is operative here and that a new taxon, *A. necator* Fr.: Fr. was created, which was an illegitimate name, even though sanctioned (Rauschert, 1989), but in view of Art. 7.8 and the taxonomic continuity of *A. necator* between (1815) 1821 and 1832, such a conclusion would not be imperative. Fries (1838), however, listed the same species as *L. turpis* (Weinm.) Fr. It is not clear why he changed the name, but it might seem that it was a consequence of his earlier realisation of the problems surrounding the application of the epithet *necator*. It is clear from Fries (1874) that he did so for a very different reason: the species under discussion is considered edible and even a delicacy, so that the epithet *necator* was clearly inept.

Many later authors adopted *L. turpis* in that concept, to replace *Agaricus necator* (Ricken, 1910; Cooke, 1888; Lange, 1940; Neuhoff, 1956). In this century, however, also many authors (Bon, 1980; Hesler & Smith, 1979; Imazeki & Hongo, 1988; Korhonen, 1984; Lundell & Nannfeldt, 1935; Marchand, 1980; Moser, 1983; Rauschert, 1989; Ryman & Holmåsen, 1992) retained the use of *Lactarius necator* in the concept of Fries (1815, 1821).

Fries (1821) sanctioned *Agaricus plumbeus* Bull. His description fits well with the original description and plate of Bulliard (pl. 282, 559 fig. 2 and Hist. Champ. 2: 489–491). *Agaricus plumbeus* Bull.: Fr. stands for a species with a uniformly coloured, not or hardly zoned, dark grey to grey-brown, smooth, more or less viscid pileus with naked margin, lamellae that turn ochre-yellow, and a stipe concolorous or slightly paler than the pileus. As such it does not remind of *L. necator* in its current concept, but more likely it is a species close to either *L. pyrogalus* or one of the group of *L. fuliginosus*. Fries adds in his description that the stipe may have an olivaceous-reticulate surface, which may have misled later authors to interpret it as a form of *L. necator*. It is not clear what *Agaricus plumbeus* sensu Fries 1821 stands for, but it certainly does not represent the current concept of *L. necator*. This is also indicated by Dennis et al. (1960: 95). Fries (1838) placed *Agaricus plumbeus* in sect. *Piperati* with about the same concept as in 1821.

Quélet (1872) described *Lactarius turpis* in a concept similar to that of Fries (l.c.), and also used the name *L. plumbeus* Bull. for a species close to *L. pyrogalus*, differing from that species mainly by the red-brown tot blackish brown pileus and white then yellow lamellae. Later, Quélet (1886), however, abandoned this concept of *L. plumbeus*, and gave a new description, which fits well with *Agaricus turpis* Weinm., which is mentioned in the synonymy. It becomes not clear, however, why Quélet changed his mind about the interpretation of *Agaricus plumbeus*. Quélet was followed by several French authors, e.g. Konrad & Maublanc (1937) and Blum (1976). Recently, Heilmann-Clausen et al. (1998) also became aware of the discrepancy between the sanctioning description of *Agaricus necator* and the original plate of Bulliard. They considered the original plate more important than the sanctioning description of *L. necator*, and therefore proposed the use of the name *Lactarius plumbeus*.

From the above discussion it will be clear that there are three good reasons to disagree with the reintroduction of the name *Lactarius plumbeus* to replace *L. necator*, viz. the identity of *A. plumbeus* Bull., the identity of *A. plumbeus* Bull.: Fr., and the identity of *L. plumbeus* (Bull.: Fr.) Quél.

Another question is whether *Lactarius necator* is in need of replacement because of the questionable identity of plate 14 of Bulliard (the identity of the other plate is irrelevant). The present code (Greuter et al., 1994), explicitly allows us to choose from the sanctioning description those elements that fit with the current concept of a species. In the case of *Agaricus necator* this can be done by accepting the diagnosis of Fries (1821), taxonomically excluding the cited plate 14 of Bulliard. The current use of the name *Lactarius necator* can be fixed with a neotype.

There might seem to be one problem with this procedure, viz. the apparent contradiction between Art. 48 (explicit exclusion of types) and Art. 7.8 (typification criteria for sanctioned names). If the latter article (and hence nomenclatural stability) is to function well, it should take precedence over Art. 48. For that reason the name should be cited as follows:

Lactarius necator (Bull.: Fr.) Pers., Observ. Mycol. 2 (1800) 42.

Agaricus necator Bull., Hist. Champ. (1792) pl. 14; *Agaricus necator* Bull.: Fr., Syst. mycol. 1 (1821) 64. — *Agaricus turpis* Weinm., Syll. Pl. Nov. 2 (1828) 85; *Lactarius turpis* (Weinm.) Fr., Epicr. (1838) 335.

Misapplied name. *Lactarius plumbeus* (Bull.: Fr.) Gray sensu Quélet, 1888; Konrad & Maubl., 1937; Blum, 1976; Heilmann-Clausen et al., 1998 non sensu Bulliard, nec sensu Fries, nec sensu Quélet, 1872.

Selected icons. Blum, Lactaires (1976) pl. 6, upper fig. (as *L. plumbeus*); Bres., Iconogr. mycol. 8 (1929) pl. 358 (as *L. turpis*); Cetto, Funghi Vero 1, ed. 1 (1975) pl. 357 (as *L. turpis*); Cooke, Ill. Brit. Fungi (1887) pl. 987 (as *L. turpis*); Courtec. & Duhem, Champ. France Eur. (1994) pl. 1540; Dähncke, 1200 Pilze (1993) 941; Hagara, Atlas Húb (1987) pl. 233 (as *L. turpis*); Heilmann-Clausen et al., Lactarius (1998) 43 (as *L. plumbeus*); Konr. & Maubl., Ic. sel. Fung. 10 (1937) pl. 318 (as *L. plumbeus*); Korhonen, Suomen Rouskut (1984) 136; J. Lange, Fl. agar. dan. 5 (1940) pl. 169D (as *L. turpis*); Marchand, Champ. Nord Midi 6 (1980) pl. 538; Neuh., Milchlinge (1956) pl. 8, fig. 30 (as *L. turpis*); R. Phillips, Mushr. other Fungi (1981) 83 (as *L. turpis*); Rick., Blätterpilze (1910) pl. 9, fig. 4 (as. *L. turpis*); Ryman & Holmåsen, Pilze (1992) 560.

Selected descriptions & figures. Bataille, Fl. monogr. Astérosporés (1908) 27 (as *L. turpis*); Blum, Lactaires (1976) 185–186 (as. *L. plumbeus*); Bon, Doc. mycol. 10 (40) (1980) 43; Heilmann-Clausen et al., Lactarius (1998) 42–43 (as *L. plumbeus*); Hesl. & Smith, Lactarius (1979) 549; Konr. & Favre in Rev. Mycol. 51 (1935) 131–132 (as *L. plumbeus*); Rauschert in Česka Mykol. 43 (1989) 205; Smith & Hesler, Lactarius (1979) 549–550; Vesterholt in Svampe 28 (1993) 5.

Neotypus: Sweden: Uppland, G:la Upsala parish, the plantation between the railway and Tunaberg (near Uppsala), 9.X.1935, D. Lihnell & Seth Lundell [Fungi Exsiccati Suecici, presertim Upsalienses no 228 (UPS)].

As a consequence of fixing *Lactarius necator* with a neotype, even though taxonomically excluding Bulliard's plate, the re-introduction of *L. turpis* is avoided. As shown above, there is no basis for the application of *L. plumbeus*.

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REFERENCES

Blum, M. 1976. Les Lactaires. Paris.

Bon, M. 1980. Doc. mycol. 10 (40): 1–85.

Cooke, M.E. 1888. Illustrations of British fungi.

Dennis, R.W.G., P.D. Orton & F.B. Hora. 1960. New Check List of British Agarics and Boleti. Trans. Br. Mycol. Soc. 43. Supplement.

Fries, E. 1815. Observationes mycologicae I.

Fries, E. 1821. Systema mycologicum 1. Lund.

Fries, E. 1832. Systema mycologicum III (index). Lund.

Fries, E. 1838. Epicrisis systematis mycologici, seu synopsis hymenomycetum.

Fries, E. 1874. Hymenomycetes Europaei sive Epicreseos Systematis Mycologici editio altera. Uppsala.

Greuter, W., F.R. Barrie, H.M. Burdet, W.G. Chaloner, V. Demoulin, D.L. Hawksworth, P.M. Jørgensen, D.H. Nicolson, P.C. Silva, P. Trehane (eds.). 1994. International Code of Botanical Nomenclature (Tokyo Code).

Heilmann-Clausen, J., J. Vesterholt & M. Verbeken. 1998. Lactarius. In Fungi of Northern Europe. Vol. 2.

Hesler, L.R. & A.H. Smith. 1979. North American species of Lactarius. Ann Arbor.

Imazeki, R. & T. Hongo. 1988. Fungi of Japan. Tokyo.

Konrad, P. & A. Maublanc. 1937. Icones selectae Fungorum 10.

Korhonen, M. 1984. Suomen Rouskut. Helsinki.

Lange, J. 1940. Flora agaricina danica. Vol. 5. Copenhagen.

Lundell, S. & J.A. Nannfeldt. 1935. Fungi Exsiccati Suecici praesertim Upsaliensis, Fasc. V–VI. Uppsala.

Marchand, A. 1980. Champ. Nord Midi 6. Perpignan.

Moser, M. 1983. Röhrlinge und Blätterpilze (Agaricales). In: Gams, Kl. Kryptog. Fl. 2b/2.

Neuhoff, W. 1956. Die Milchlinge. Die Pilze Mitteleuropas bd. IIb. Bad Heilbronn.

Persoon, C.H. 1799. Observationes mycologicae II.

Persoon, C.H. 1801. Synopsis methodica fungorum.

Quélet, L. 1872. Les Champignons du Jura et des Vosges 1. Mém. Soc. Emul. Montbéliard, sér. II, 5: 43–332.

Quélet, L. 1886. Enchiridion fungorum.

Rauschert, W. 1989. Nomenklatorische Studien bei Höheren Pilzen I. Russulales (Täublinge und Milchlinge). Ceská Mykol. 43: 193–209.

Ricken, A. 1910. Die Blätterpilze (Agaricaceae) Deutschlands und der angrenzenden Länder, besonders Oesterreich und der Schweiz.

Ryman, S. & I. Holmåsen. 1992. Svampar.

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NOTULAE AD FLORAM AGARICINAM NEERLANDICAM – XXXVI
Tricholoma

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The genus *Tricholoma* contains several taxonomically difficult groups. During the revision of the genus *Tricholoma* for the Flora agaricina neerlandica, vol. 4 (Bas et al., in press) some of these groups have been tackled. Detailed studies are presented of sect. *Lasciva* and sect. *Atrosquamosa* subsect. *Terrea* with keys, descriptions, and comments. Where possible neotypes or epitypes have been designated. In addition two new varieties are described in other sections, viz. *Tricholoma psammopus* var. *macrosporum* and *T. equestre* var. *populinum*. Notes are given on some nomenclatural problems within the genus *Tricholoma*.

Like in several other genera of Agaricales the application of species-names in *Tricholoma* is often based on old and usually short diagnoses. Types are often missing and current usage of names is often primarily based on mycological tradition and personal observations by the various authors. Confusion and misunderstanding of the original diagnosis and plates have often led to different concepts in different books and/or different parts of Europe. In an attempt to solve some of these problems lectotypes, neotypes and epitypes are designated for some species where no proper type material exists or is represented only with an icon.

MATERIAL AND METHODS

The descriptions given in this paper and in the Flora agaricina neerlandica (Noordeloos & Christensen, 1999) are based on personal observations of newly collected material and on studies of herbarium specimens. Field observations on *Tricholoma* species were made in Denmark and The Netherlands as well as during field trips in Norway, Sweden, Great Britain, France, Germany, Austria and Italy. Herbarium specimens were studied primarily from the Rijkherbarium in Leiden (L), but also from the Botanical Museum in Copenhagen (C), University of Oulu (OULU) and Natural Museum in Lugano (LUG), focussing on microscopical structures such as size and shape of spores and pileipellis structures. The average spore size presented in the diagrams (Figs. 1, 2) are based on at least 10 representative spores from each collection measured in 35% KOH. Drawings of microscopical structures have been made with a drawing-tube on a Leica microscope. The terminology and abbreviations in this paper follow Bas et al. (1988).

TAXONOMIC PART

Tricholoma section **Lasciva** M. Bon

The species in this section are characterised by a matt, glabrous pileus without obvious radial structure, a rather strong to very strong, unpleasant chemical smell reminiscent of

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radish, strong perfume or strongly scented flowers, and the frequent occurrence of clamp-connections in the pileipellis and pileitrama. Although the members of this section are relatively easy to recognize as a whole, species concept and delimitation appears to be rather difficult. In this paper the authors have tried to present well-delimited species, focussing on characters like spore size and -shape, frequency of clamp-connections, colour and discolouration of fruiting bodies, and smell. Concepts have also been fixed with lectotypes or neotypes. Confusion may also occur with other white or pale *Tricholoma* species from other sections, viz. *Tricholoma inamoenum* (Fr.: Fr.) Gillet (sect. *Inamoena*) which has very distant lamellae and very large spores (9.0–12.0 × 6.0–7.5 μm). Confusion may also occur with pale forms of *Tricholoma saponaceum* (sect. *Saponacea*), but the smell of that species is normally different and rather weak, reminiscent of cheap nonperfumed soap, and the context stains often slightly reddish. *Tricholoma columbetta* (sect. *Albata*) is a pure white species which can be distinguished by the radially fibrillose structure of the pileus, mild taste and often by the blue or reddish spots in older basidiocarps. *Tricholoma albidum* (sect. *Albida*) has a similar radially fibrillose pileus but is smaller than *T. columbetta*, and stains yellow. Even *Tricholoma acerbum* (sect. *Imbricata*) may be confused with members of sect. *Lasciva*, but the more brownish colour, the very crowded lamellae, the lack of smell and the very small spores distinguish it easily.

KEY TO THE EUROPEAN SPECIES OF SECT. LASCIVA

1a. Spores 6.0–8.0(–9.5) μm long, ellipsoid to oblong, av. Q > 1.6; pileus with pale greyish tinge when old; lamellae in exsiccates dark greyish brown . . . . *T. lascivum*

b. Spores 5.0–7.0 μm long, subglobose to broadly ellipsoid or ellipsoid, av. Q < 1.5; pileus without grey tinges when old; lamellae in exsiccates ochraceous 2

2a. Surface of pileus and stipe, lamellae, and context strongly discolouring yellow when bruised; spores subglobose to broadly ellipsoid, av. Q = 1.1–1.3; taste somewhat acrid, and only slightly bitter; smell relatively weak, aromatic mixed with gascomponent *T. sulphurescens*

b. Basidiocarps not discolouring strongly yellow when bruised, but sometimes pileus and stipe turning ochre-brownish with age or stipe with yellow spots; context not yellowing; spores broadly ellipsoid to ellipsoid, av. Q = 1.3–1.5; taste acrid and bitter; smell strong, unpleasant gaslike, raphanoid or aromatical or a mixture of those smells 3

3a. Pileus usually fairly small to medium-sized, less than 70 mm diam., regularly shaped when old, margin not costate; lamellae rather distant, often thickish, lamellae and lamellulae irregular, of unequal width; smell aromatic mixed with gascomponent; clamps usually absent or scarce in pileipellis . . . . *T. album*

b. Pileus usually large when old, up to 100 mm or more, irregularly shaped with undulating, often costate margin; lamellae moderately crowded to crowded, of normal thickness, of equal width; smell aromatic, rarely a bit chemical; clamps usually present on many septa in pileipellis . . . . *T. stiparophyllum*

DESCRIPTIONS OF THE SPECIES

Tricholoma album (Schaeff.: Fr.) Kumm.— Fig. 1a, Plate 1

Tricholoma album (Schaeff.: Fr.) Kumm., Führ. Pilzk. (1871) 131.

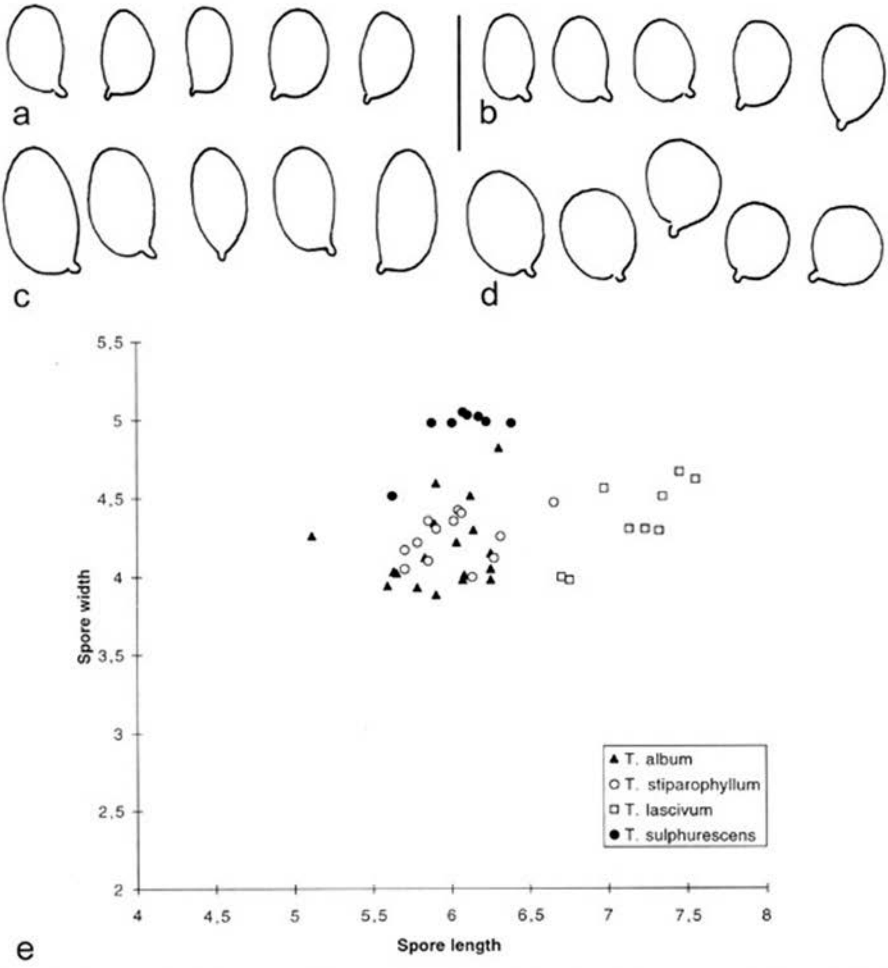

Fig. 1. Spores of sect. *Lasciva*. a. *T. album*; b. *T. stiparophyllum*; c. *T. lascivum*; d. *T. sulphurescens*; e. average spore sizes in sect. *Lasciva*. Bar = 10 µm.

Agaricus albus Schaeff., Fung. Bavariae 3 (1771) pl. 256; *Agaricus albus* Schaeff.: Fr., Syst. mycol. 1 (1821) 53; *Gyrophila alba* (Schaeff.: Fr.) Quél., Fl. mycol. France (1888) 270. — *Tricholoma album* f. *gracilis* Bres., Iconogr. mycol. 3 (1928) pl. 108. — *Tricholoma thalliophilum* R. Henry, Bull. Soc. mycol. Vesoul (1956) 153; *Tricholoma album* var. *thalliophilum* (R. Henry) M. Bon, Bull. trimest. Soc. mycol. Fr. 85 (1970) 487.

Misapplied. Tricholoma resplendens sensu Marchand, Champ. Nord Midi 9 (1986) pl. 840.

Excluded. Tricholoma album sensu Fr., Ic. sel. Hymenomyc. 1 (1874) pl. 43 (= *T. stiparophyllum*); J. Lange, Fl. agar. dan. 1 (1935) pl. 27D (= *T. stiparophyllum*).

Selected icons. Bres., Iconogr. mycol. 3 (1928) pl. 108 (f. *gracilis*); Konr. & M., Ic. sel. Fung. 8 (1934) pl. 266; Marchand, Champ. Nord Midi 9 (1986) pl. 840 (as *T. resplendens*); 842 and 843 (var. *thalliophilum*).

Selected descriptions and figures. M. Bon, Tricholomes Fr. Eur. occ. (1984) 90–91, fig. 11B; M. Bon, Fl. mycol. Eur. 2, Tricholomes (1991) 47; Marchand, Champ. Nord Midi 9 (1986) 88, 90, 92.

Lectotype (Iconotype): *Agaricus albus* Schaeff., Fung. Bavariae (1762) pl. 37.

Epitype (design. here): France, Territoire de Belfort, Le Salbert, NW of Belfort, 7 Oct. 1998, M. Christensen (MC 98094) (L, isoepitype in C).

Pileus 30–60(–75) mm, conico-campanulate with subinvolute margin, expanding to convex or plano-convex with small umbo, with deflexed then straight margin, white to pale yellow tinge, often with ochre-yellow centre when mature (Mu. 10 YR 8 / 2, 8–7/6–8, 2.5 Y 8/4–2, 7/6), smooth, glabrous, dry and dull, without radial structure. Lamellae, L = 50–60, l = (1–)3–5(–7), rather distant, thickish, irregularly segmentiform to ventricose, 4–11 mm broad, entire lamellae and short lamellulae of unequal width, white to pale yellowish (K. & W. 4A2) with serrate edge. Stipe 30–60(–85) × 8–15 mm, cylindrical, broadened or tapering towards base, white to pale brownish yellow (2.5 Y 8/4), then with yellowish spots, becoming brownish when handled, glabrous to minutely granular-flocculose at apex, felted-subfibrillose to fibrillose in lower part, at base sometimes with white mycelial strands. Context white. Smell strong, a mixture of aromatical-sweet (cheap soap, honey) and an unpleasant component (radish), sometimes more farinaceous when cut. Taste very unpleasant, subfarinaceous at first, soon acrid mixed with bitter.

Spores (5.0–)5.5–6.5(–7.0) × 3.5–4.5(–5.0) µm, Q = 1.2–1.8, av. Q = 1.3–1.5, broadly ellipsoid to oblong with pronounced hilar appendage. Basidia 25–34 × 5.0–6.0 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of cylindrical, 2.5–6.0 µm wide hyphae with scattered subclavate terminal elements, 20–50 × 3.0–9.0 µm; subpellis not differentiated from pileitrama, made up of cylindrical to inflated elements, 19–50(–70) × 3.0–12 µm. Pigment absent or very pale, intracellular. Clamp-connections very rare, practically absent on most septa in covering layers and hymenium.

Habitat & distribution — Ectomycorrhizal, mainly with *Quercus* on sandy and loamy soils. Widespread in Europe.

Collections examined. THE NETHERLANDS: prov. Gelderland, Estate 't Joppe, 16 Oct. 1983, *G. & H. Piepenbroek* (L); prov. Utrecht, Vijverbos near Harmelen, 3 Oct. 1994, *M.E. Noordeloos* (MEN 94111) (L); Nijenrode, 22 Sept. 1998, *M.E. Noordeloos* (MEN 98100) (L); prov. Noord-Holland, Bergen, 19 Oct. 1984, *P. IJpelaar* (*Bas 8330*) (L) (var. *thalliophilum*); Vogelenzang, 18 Oct. 1982, *C. Bas* (*Bas 8031*) (L); prov. Noord-Brabant, Ulvenhoutse bos, 19 Oct. 1952, *R.A. Maas Geesteranus* (MG 9222) (L); Dorst, 29 Oct. 1975, *P.B. Jansen* (PBJ 75394) (L). — DENMARK: NE Jylland, Skivum Krat near Vegger, 28 Sept. 1995, *R. Ernæs* (MC 95159) (C); Lovns Egekrat, 2 Oct. 1995, *L. Samsøe* (MC 95169) (C); NW Jylland: Kaas Egekrat, 15 Sept. 1998, *R. Ejnæs* (MC 98039) (C). — FRANCE: Territoire de Belfort, Bois Lachat, 7 Oct. 1998, *M. Christensen* (MC 98094) (C); Le Salbert, 7 Oct. 1998, *M. Christensen* (MC 98094) (epitype, L, C); Val de Masevaux, 8 Oct. 1998, *M. Christensen* (MC 98099) (C). — SWITZERLAND: Ticino, Stabio, 12 Sept. 1979, *G. Lucchini* (LUG); Aargau, Mellingen, 8 Oct. 1981, *A. Riva* (Riva 23.01) (LUG). — ITALY: Lombardia, Varese, 31 Oct. 1983, *A. Riva* (LUG).

Tricholoma album is generally smaller and more regularly shaped than *T. stiparophyllum*, and has distant, rather thick and irregular lamellae. The lamellae and lamellulae are of unequal width. It occurs mainly under *Quercus*. *Tricholoma album* var. *thalliophilum* differs by staining blue-green with thalliumoxide and sulfoformol (Bon, 1970). Since there are hardly any other morphological differences between var. *thalliophilum* and the typical variety, we do not attach much taxonomic value to it. *Tricholoma lascivum* differs by the more elongate spores and more frequent clamp-connections in pilei-, stipitipellis, and hymenium. *Tricholoma resplendens* (Fr.) P. Karst. sensu P. Karst. (1879) is likely misapplied for *T. album*, but the original description by Fries (1857) may refer to any species in section *Lasciva* or even to *T. columbetta* (Fr.) Kumm. It is consequently considered a nomen dubium.

Tricholoma stiparophyllum (Lund in Fr.) P. Karst. — Fig. 1b, Plate 2

Tricholoma stiparophyllum (Lund in Fr.) P. Karst., Ryssl. Finl. Skand. Halföns Hattsvamp. (1879) 42.

Agaricus stiparophyllus Lund in Fr., Monogr. Hymenom. Sueciae (1857) 29.

Tricholoma pseudoalbum M. Bon, Bull. trimest. Soc. mycol. Fr. 85 (1969) 486.

Misapplied. Tricholoma album sensu Fr., Ic. sel. Hymenomyc. 1 (1874) pl. 43; sensu J. Lange, Fl. agar. dan. 1 (1935) pl. 27D.

Selected icons. Breitenb. & Kränzl., Pilze Schweiz 3 (1991) 339, pl. 435; J. Lange., Fl. agar. dan. 1 (1935) pl. 27D (as *T. album*); Marchand, Champ. Nord. Midi 9 (1986) pl. 842 (as *T. pseudoalbum*); Riva, Tricholoma (1988) pl. 9 (as *T. pseudoalbum*).

Selected descriptions and figures. Breitenb. & Kränzl., Pilze Schweiz 3 (1991) 338.

Neotype (design. here): Sweden, Medelpad, Getberget near Borgsjö, 12 Sept. 1995, *M. Christensen* (MC 95114) (herb. L, isoneotypes in C, UPS).

Pileus 40–100 mm, conical, hemispherical or convex with involute to deflexed margin at first, expanding to plano-convex or applanate with low umbo or with depressed centre, with undulating marginal zone and deflexed to reflexed margin, almost white when young, soon with yellow-ochre or yellow-brown tinges (Mu. 10 Y 6/8, 10 YR 7–8/4–8), particularly at centre, often with brownish or ochre spots all over when old, rather smooth, glabrous or silky, margin usually distinctly costate, particularly in large mature specimens. Lamellae, L = 60–120, l = 39, moderately crowded to crowded, broadly adnate-emarginate or with small decurrent tooth, normally thick, regular, segmentiform to subventricose, white to cream-coloured or with pinkish tinge (10 YR 8–7/2), with brownish spots and marks when old or bruised, with coarsely eroded, concolorous edge. Stipe 70–100 × 5–15(–30) mm, cylindrical, often with broadened base, sometimes tapering towards base, white or with yellow-ochre tinges like pileus, pruinose to subfurfuraceous at apex, innately fibrillose to fibrillose-tomentose below with concolorous fibrils. Context firm, white, sometimes with a yellow tinge (5 Y 8/8). Smell strong, perfumed like cheap soap or flowers, a bit chemical. Taste very nasty acrid sometimes mixed with bitter and farinaceous.

Spores 5.0–7.0 × 3.4–4.5 µm, Q = 1.2–1.8, av. Q = 1.4–1.5, broadly ellipsoid to oblong with rather large hilar appendage. Basidia 26–32 × 5.0–7.0 µm, 4-spored. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of 2.5–7.0 µm wide cylindrical hyphae with cylindrical to subclavate terminal elements, 20–45 × 3.5–9.0 µm; subpellis not differentiated from pileitrama, made up of inflated elements, 18–45 × 3.0–11 µm. Pigment pallid, intracellular in pileipellis. Stipitipellis a cutis of narrow, cylindrical hyphae, 2.5–6.0 µm wide. Caulocystidia scattered, simple, cylindrical or irregularly shaped, 15–35 × 3.0–5.0 µm with hyaline, colourless walls. Clamp-connections infrequent but present on many septa in pilei ad stipitipellis.

Habitat & distribution — Ectomycorrhizal, usually associated with *Betula*, but also with *Picea, Populus, Fagus* and *Quercus*, in mixed deciduous and coniferous forests on mesic, sandy soils, sometimes on calcareous soil. Widespread and locally common in Europe, from the subarctic to the mediterranean.

Collections examined. THE NETHERLANDS: prov. Friesland, Schiermonnikoog, 19 Oct. 1970, *G. Stobbe* (L); prov. Zuid-Holland, Wassenaar, 9 Oct. 1993, *M.E. Noordeloos* (MEN 93238) (L); same loc. 25 Oct. 1996, *M. Nauta* (L); Rockanje, 20 Oct. 1963, *C. Bas* (*Bas 4004*) (L); Prov. Overijssel, Delden, 3 Oct. 1977, *Kits van Waveren* (L). — GERMANY: Bayern, Hilpoltstein near Roth, 20 Sept. 1995, *M.E. Noordeloos* (MEN 95203) (L). — DENMARK: NE Jylland, Skindbjerglund, 30 Sept. 1995, *T. Laessøe* (MC 95161) (C); Lovns, 2 Oct. 1995, *M. Christensen* (MC 95170) (C); E Jylland, Ørnjerg Mølle, 20 Oct. 1994, *C. Brandt* (MC 94054) (C); Troldbakke near Langesø, 19 Oct. 1996, *C. Brandt, L. Skipper & M. Christensen* (MC 96217) (C); Djurslund Plantage, 19 Oct. 1996, *C. Brandt, L. Skipper & M. Christensen* (MC 96222) (C); Fyn, Snarup Mose, 26 Sept. 1992, *M. Christensen* (MC 92120) (C); NE Sjælland, Tokkekøb Hegn, 3 Oct. 1984, *J. Vesterholt* (JV 841436) (C); NW Sjælland, Jyderup Skovene, 19 Oct. 1994, *M. Christensen* (MC 94079) (C); Bredevang S of Jyderup, 19 Oct. 1994, *C. Brandt* (MC 94080) (C). — SWEDEN: Medelpad, Getberget near Borgsjö, 12 Sept. 1995, *M. Christensen* (neotype, MC 95114) (L); Borgsjö Church, 12 Sept. 1995, *M. Christensen* (MC 95117) (C); Jämtland, Bräcke, 1 Sept. 1997, *M. Candusso* (MC 97039) (C); Lockna W of Änge, 4 Sept. 1997, *M. Christensen* (MC 97114, MC 97119) (C); E of Brukvallernäs, 9 Sept. 1997, *M. Christensen* (MC 97166) (C). — NORWAY: Buskerud, Ringerike, 6 Oct. 1968, *G. Gulden* (L). — FINLAND: Oulun-Pohjanmaa, Ylikylä near Kiiminki, 12 Sept. 1970, (OULU); Inari Lapland, Kevo, 15 Aug. 1995, *M.E. Noordeloos* (MEN 95068) (L); 17 Aug. 1995, *M.E. Noordeloos* (MEN 95085) (L).

Tricholoma stiparophyllum is distinguished from *T. album* by the larger fruit-bodies, the irregular pileus often with costate margin, the more regularly shaped, crowded lamellae, and its occurrence with *Betula*. *Tricholoma lascivum* has a more greyish-yellowish tinge in the pileus, distinctly larger spores, and occurs mainly with *Fagus* on rich soil. *Agaricus stiparophyllus* clearly refers to a large species with whitish-yellowish pileus, resembling *T. acerbum*, with strong smell and acrid taste. It is originally described from the Stockholm region. Karsten (1879) adopted it in the same concept as *Tricholoma stiparophyllum* (Fr.) P. Karst. From the original diagnosis there is no doubt that this is the same fungus described by Bon (1970) as *T. pseudoalbum* and as *Tricholoma album* by Lange (1935). Judging from the original diagnosis, *Tricholoma raphanicum* P. Karst. may also be synonymous.

Tricholoma lascivum (Fr.) Gillet — Fig. 1c, Plate 5

Tricholoma lascivum (Fr.) Gillet, Hyménomycètes (1878) 111.

Agaricus lascivus Fr., Syst. mycol. 1 (1821) 110; *Gyrophila lasciva* (Fr.) Quél., Fl. mycol. France (1888) 279.

Selected icons. Breitenb. & Kränzl., Pilze Schweiz 3 (1991) 331, pl. 423; Bres., Icongr. mycol. 1 (1928) pl. 94; J. Lange, Fl. agar. dan. 1 (1935) pl. 27C; Konr. & M., Ic. sel. Fung. 4 (1928) pl. 265; R. Phillips, Mushr. other Fungi (1981) 40; Riva, Tricholoma (1988) pl. 7.

Selected descriptions and figures. M. Bon, Tricholomes Fr. Eur. occ. (1984) 88; Breitenb. & Kränzl., Pilze Schweiz 3 (1991) 330.

Neotype (design. here): Denmark, E Jylland, Borum, 10 Oct. 1995, *M. Christensen* (MC 95184) (L).

Pileus 40–100 mm, broadly campanulate to hemispherical or convex with involute margin when young, expanding to applanate with low umbo or with shallowly depressed centre, with straight margin, very pale greyish-yellow, especially when old (Mu. 10 YR–2.5 Y 8–7/2), sometimes with yellow spots (7.5 YR 7(–6)/2), smooth, glabrous or subfelted, dry. Lamellae, L = 60–80, l = 39, rather distant, thickish, irregularly segmentiform, of unequal width, white, with yellow-ochre or reddish spots when bruised, with coarsely serrate, concolorous edge. Stipe 40–80 × 6.0–15 mm, cylindrical, tapering downwards, or broadened at base, often rather irregularly shaped, white to pale pinkish cream-coloured, with yellow-ochre spots when bruised, innately fibrillose, glabrous, base with white tomentum. Context white. Smell strong, a mixture of aromatical fruity and nauseating chemical, sometimes more farinaceous when cut. Taste very strongly acrid and bitter, mixed with farinaceous.

Spores 6.0–8.0(–9.5) × 3.5–5.0 µm, Q = 1.3–2.0, av. Q = 1.6–1.7, ellipsoid-oblong with pronounced hilar appendage. Basidia 22–40 × 6.0–7.0 µm, 4-spored. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of cylindrical, 3.0–5.0(–6.5) µm wide hyphae; subpellis not differentiated, made up of cylindrical to inflated elements, 15–45(–60) × 4.0–

15 µm. Pigment pallid, intracellular in pileipellis. Stipitipellis a cutis of cylindrical hyphae, 3.5–5.0(–6.0) µm wide. Caulocystidia scattered at apex, simple, cylindrical, 5.0–35 × 3.5–6.0 µm. Clamp-connections rather numerous and very large, in pileipellis, stipitipellis and also in hymenium.

Habitat & distribution — Ectomycorrhizal, associated with *Fagus* on rich loamy, preferably calcareous soil, more rarely associated with *Quercus* on similar soils. Widespread in Europe, but real distribution poorly known because of the taxonomic confusion with similar species.

Collections examined. GERMANY: Bayern, Weissehofener Espaan near Roth, 25 Sept. 1995, *M.E. Noordeloos* (MEN 95181) (L); Teutenburger Wald, 25 Sept. 1964, *C. Bas* (*Bas 4571*) (L). — UNITED KINGDOM: Kings Langley, 26 Nov. 1953, *D.A. Reid* (L). — DENMARK: NE Jylland: Buderupholm Skov, 30 Sept. 1995, *M. Christensen* (MC 95163) (C); E Jylland: Trelde Skov, 24 Sept. 1994, *C. Brandt & C. Lange* (MC 94042) (C); Marselisborg Sko, 27 Sept. 1995, *J. Vesterholt* (MC 95157) (C); Borum, 10 Oct. 1995, *M. Christensen* (MC 95184, MC 95186) (C); 10 Oct. 1996, *M. Christensen & C. Brandt* (MC 96168) (neotype, L, C); Marielund, 14 Oct. 1997, *M. Christensen & J.H. Petersen* (MC 97232) (C); W Sjælland: Kattrup Skov S of Jyderup, 19 Oct. 1994, *C. Brandt* (MC 94081) (C). — ITALY: Toscana, Monte Soldano, 8 Nov. 1996, *M. Christensen* (MC 96342) (C).

Tricholoma lascivum is very similar to *T. album* in many respects, particularly in the general habit with rather thick, irregular, distant lamellae. The colour of the pileus, however, has a distinct pale greyish component, and the spores are definitely longer and more elongate. In exsiccata the lamellae have a rather dark greyish-brownish tinge, whereas those of *Tricholoma album* are normally paler in exsiccata. It is assumed that some records from the Netherlands of *T. inamoenum* from deciduous woodland actually represent *T. lascivum*, but this could not be confirmed because well-annotated collections were not available.

Tricholoma sulphurescens Bres. — Fig. 1d, Plate 3, 4

Tricholoma sulphurescens Bres., Annls. mycol. 3 (1905) 159.

Misapplied. Gyrophila resplendens (Fr.) Quél., Fl. Myc. (1888) 287.

Selected icons. M. Bon, Tricholomes Fr., Eur. occ. (1984) pl. 2A; Bres., Iconogr. mycol. 3 (1928) pl.; Cetto, Funghi Vero 3, ed. 1 (1983) pl. 589; Courtec. & Duhem, Champ. Fr. Eur. (1994) 366; Mal. & Bert., Fl. champ. sup. Maroc 2 (1975) pl. 5; Mos. & Jül., Farbatl. Basidiomyc. III (1987) Tricholoma 9; Riva, Tricholoma (1988) pl. 6.

Selected descriptions and figures. M. Bon, Fl. mycol. Eur. 2, Tricholomes (1991) 47; Christensen et al., Boll. Gruppo micol. G. Bres. 40 (1997) 151; Daun et al., Windahlia 15 (1985) 19; Mal. & Bert., Fl. champ. sup. Maroc 2 (1975) 113; Riva, Tricholoma (1988) 170.

Pileus 50–100(–120) mm, campanulate to convex with involute to deflexed margin, expanding to irregular applanate, with low umbo, with undulating marginal zone, with deflexed margin, white when young then strongly yellowing, particularly when bruised, finally yellow with brown-yellow centre (2.5 Y 8/6–8), dry, silky-fibrillose at first, when old tomentose or breaking up in small, irregular, appressed squamules. Lamellae, L = 100, l = 37, moderately distant, adnate-emarginate, white, yellowing with age (2.5 Y 8/4) with subentire, concolorous, finally often staining yellow edge, particularly near pileus margin. Stipe 50–100(–120) × 10–20 mm, cylindrical or broadened towards base, white then pale yellow at apex and turning deep-yellow to ochre-brown in basal part, (10 YR 7–6/8), particularly when bruised, upper part finely floccose to squamulose with slightly darker squamules, lower part velutinous, finely squamulose with brown fibrillose scales. Context white, staining lemon-yellow to sulphur-yellow or ochre, particularly when bruised. Smell strong, aromatical fruity with nauseating component reminiscent of that of *T. sulphureum*. Taste somewhat acrid.

Spores (5.0–)5.5–6.5(–7.0) × (4.0–)4.5–5.0(–5.5) μm, Q = 1.1–1.4, av. Q = 1.2–1.3, subisodiametrical to broadly ellipsoid with large hilar appendage. Basidia 30–40 × 6.0–8.0 μm, 4-spored, clamped. Lamella edge fertile. Cheilocystidia absent. Pileipellis a cutis of narrow, cylindrical, 5.0–10.0 μm wide hyphae with scattered ascending bundles of hyphae. Pigment pallid, intracellular in pileipellis. Stipitipellis a cutis with transitions to a trichoderm, made up of long, septate hyphae, 2.5–7.0 μm wide. Clamp-connections scarcely present in pileipellis and stipitipellis.

Habitat & distribution — Ectomycorrhizal, associated with *Betula*, *Fagus*, *Quercus*, and *Castanea*. Widespread all over Europe, from the subarctic to the Mediterranean, but rare in most areas. *Tricholoma sulphurescens* has a wide ecological and geographical range (Christensen et al., 1998), but occurs most frequently on calcareous soil under deciduous trees like *Fagus*, *Quercus* or *Betula*.

Collections examined. THE NETHERLANDS: prov. Gelderland, Apeldoorn, 21 Oct. 1966, *E. Kits van Waveren* (L). — Germany: Bayern, Weisenhofener Espaan near Roth, 25 Sept. 1995, *M.E. Noordeloos* (MEN 95182) (L). — AUSTRIA: Kärnten, St. Margareten im Rosental, 9 Sept. 1998, *M.E. Noordeloos* (MEN 9881) (L). — ITALY: Toscana, Cipresseta di S. Agnese E of Poggibonzi, 5 Nov. 1996, *M. Christensen* (MC 97296) (C); Ulignano SE of Volterra, 5 Nov. 1996, *M. Christensen* (MC 97294) (C). — SWEDEN: Öland, Ismantorp. 31 Aug. 1996, *P. Ålind & T. Knutsson* (herb. T. Knutsson); Medelpad, Stöde, 22 Aug. 1995, *J.H. Petersen & S.A. Elborne* (SAE 95.7S) (C). — FINLAND: Kainuu, Yli-Näljänkä, 1 Sept. 1991, *M. Ohenoja* (OULU); 8 Sept. 1991, *M. Ohenoja* (OULU); Mieslahti near Paltamo, 12 Aug. 1987, *M. Ketonen & S. Leinonen* (OULU); Pohjois-Pohjanmaa, Muhos, 5 Sept. 1965, *S. Eurola* (OULU); Oulun-Pohjanmaa, Kiiminki, 9 Sept. 1972, *M. Ohenoja* (OULU); Inarin Lappi, Kevo, 4 Sept. 1970, *Tauno Ulvinen* (OULU); same loc. 17 Aug. 1995, *M.E. Noordeloos* (MEN 95086) (L).

Tricholoma sulphurescens is well-characterized by the quick yellow staining of the basidiocarps when touched, the yellow context, the initially smooth pileus, the rather crowded lamellae and the floccose to squamulose stipe, in combination with subglobose to broadly ellipsoid spores. *Tricholoma sulphureum* has overall yellow colours, more distant lamellae and much larger, oblong spores and a very characteristic nauseous smell. The name *Gyrophila resplendens* has been used for *T. sulphurescens* (Quélet, 1888), but the original description of *Agaricus resplendens* (Fries, 1857) does not mention the strong yellow staining which is the most obvious macroscopical character (see comments under *T. album*). It is likely that the name *Tricholoma impolitum* (Lasch) Gillet also has been used for *T. sulphurescens*. According to the original description, however, *Tricholoma impolitum* does not belong to sect. *Lasciva*, but probably refers to a species close to, or even synonymous with *T. acerbum*. Also the name *Tricholoma saponaceum* var. *cnista* Lange has been misused for *T. sulphurescens*, but that taxon is characterised by a slight reddish and not yellow staining of the basidiocarp.

Tricholoma section **Atrosquamosa subsect. Terrea** (Konr. & M.) M. Bon

Subsection *Terrea* is distinguished from the other *Tricholoma* species with grey colours in the pileus, by its relatively small basidiocarps with a fibrillose-tomentose to squamulose pileus, and a mild, never bitter taste. Furthermore many species in stirps *Scalpturatum* have very small spores and frequently a strong yellow staining of old and / or bruised basidiocarps.

The species of subsect. *Atrosquamosa* occurring in the Netherlands (*T. atrosquamosum* and *T. orirubens*) have somewhat larger basidiocarps and a fairly strong, peppery smell. Both species often stain reddish when bruised or old. Subsection *Virgata* (including *T. virgatum*, *T. bresadolanum*, and *T. sciodes*) is characterized by more robust basidiocarps with a bitter, acrid taste and an often radially fibrillose, shiny pileus.

Several authors have discussed the species in subsect. *Terrea* (Bon, 1976; Clemençon, 1983; Huijsman, 1968; Marriotto & Turetta, 1996; Basso & Candusso, 1997; Riva, 1998). After revising the material for the Flora agaricina neerlandica the need was felt, however, to present our own concept on this difficult group.

KEY TO THE STIRPS AND SPECIES OF SUBSECT. TERREA IN NORTHWESTERN EUROPE

1a. Pileipellis with well-differentiated subpellis of subisodiametrical to broadly ellipsoid elements; spores relatively large, 5.5–9.0 × 4.0–5.0 µm; surface and context never staining strongly yellow when bruised or with age; smell generally absent or weak stirps *Terreum*, 2
 b. Pileipellis poorly differentiated, subpellis made up of cylindrical hyphae hardly differentiated from pileitrama; spores relatively small, 4.5–6.0 × 2.5–4.5 µm; surface and context often staining strongly yellow when bruised or with age; smell more or less farinaceous . . . . stirps *Scalpturatum*, 3
2a. Stipe fibrillose, not squamulose; spores 5.5–7.0(–7.5) × 4.0–5.0(–5.5) µm, Q = 1.3–1.7, av. Q = 1.4–1.5, broadly ellipsoid to oblong . . . . *T. terreum*
 b. Stipe with minute darker dots and/or squamules; spores 7.0–9.0 × 4.0–5.0 µm, Q = 1.6–2.2, av. Q = 1.7–1.9, oblong to ellipsoid . . . . *T. triste*
3a. Stipe with a woolly annulus . . . . *T. cingulatum* (not included in this paper)
 b. Stipe without a woolly annulus, but often with a fibrillose cortina 4
4a. Pileus rather pale, often almost white, tinged grey at centre only, often with an acute umbo, even when expanded; spores narrow, 4.5–6.0(–6.5) × 2.5–3.5 µm, Q = 1.4–2.1, av. Q = 1.5–1.9 ellipsoid to oblong . . . . *T. argyraceum*
 b. Pileus moderately dark to very dark grey to grey-brown; convex with broad umbo when expanded; spores (4.5–)5.0–6.0 × 3.0–4.0(–4.5) µm, Q = 1.2–1.7, av. Q = 1.3–1.5, broadly ellipsoid to oblong . . . . *T. scalpturatum*

DESCRIPTIONS OF THE SPECIES

Tricholoma terreum (Schaeff.: Fr.) Kumm. — Fig. 2a, Plate 7, 8

Tricholoma terreum (Schaeff.: Fr.) Kumm., Führ. Pilzk. (1871) 134.

Agaricus terreus Schaeff., Fung. Bavariae (1762) 28; *Agaricus terreus* Schaeff.: Fr., Syst. mycol. 3, index (1832) 44; *Gyrophila terrea* (Schaeff.: Fr.) Quél., Fl. mycol. France (1888) 285; *Agaricus myomyces* Pers., Syn. meth. Fung. (1797) 20; *Agaricus myomyces* Pers.: Fr., Syst. mycol. 1 (1821) 44; *Tricholoma myomyces* (Pers.: Fr.) J. Lange, Dansk bot. Ark. 8 (3) (1933) 21; *Tricholoma bisporigerum* J. Lange, Dansk bot. Ark. 8 (3) (1933) 20.

Selected icons. Breitenb. & Kränzl., Pilze Schweiz 3 (1991) 340; Bres., Iconogr. mycol. 2 (1927) pl. 75; Cetto, Funghi Vero 1, ed. 1 (1976) pl. 127; Courtec. & Duhem, Champ. Fr. Eur. (1994) 392 & 394 (as *T. myomyces*); J. Lange, Fl. agar. dan. 1 (1935) pl. 21A (as *T. myomyces*); Marchand, Champ. Nord Midi 1 (1973) pl. 43; Marchand, Champ. Nord Midi 9 (1984) pl. 849 (as *T. myomyces*); Riva, Tricholoma (1988) pl. 16 & pl. 18 (as *T. myomyces*); Rocabruna in Bolets Catalunya 1 (1982) pl. 49.

Selected descriptions and figures. M. Bon, Tricholomes Fr. Eur. occ. (1984) 141; M. Bon, Fl. mycol. Eur. 2, Tricholomes (1991) 60; Riva, Tricholoma (1988) 209.

Lectotype (Iconotype): *Agaricus terreus* Schaeff., Fung. Bavariae (1762) pl. 28.

Epitype (design. here): Bayern, Sperberslohe near Roth, 24 Sept. 1995, *M.E. Noordeloos* (MEN 95192) (L).

Pileus 30–90 mm, conical, campanulate or conico-convex, hemispherical to campanulate, often with conical umbo, expanding to conico-convex, convex or plano-convex with conical or rather flat umbo, with deflexed then straight margin, mouse-grey to very dark grey-brown (Mu. 10 YR 7/3–2, 10 YR 3–5/2; 3/1–2, 3/2, 4/2) rarely more reddish brown (7.5 YR 5/4–3/2–3), at margin sometimes more brown (10 YR 5/4; 7.5 YR 7/2), entirely radially fibrillose to tomentose, finally breaking up in small appressed or erect squamules, often in radial pattern showing paler flesh in between with age, dry. Veil usually present in primordia, and often clearly visible as a fibrillose-arachnoid layer on young pilei, but often absent in mature specimens, sometimes clearly visible as white fibrillose-arachnoid patches near and along margin of pileus and as a fibrillose zone on stipe. Lamellae, L = 60–90, l = 37, moderately distant, adnate-emarginate, segmentiform to subventricose, up to 9 mm broad, often more or less thick and brittle, white to grey (10 YR 6–8/2, 6/3; 5 YR 6/1) with irregular, concolorous or slightly paler edge or rarely blackish edge. Stipe 50–90 × 7–20 mm, cylindrical or fusiform, straight or flexuous, solid then narrowly fistulose, straight or flexuous, whitish, then with sordid greyish or ochre-yellow tinges in lower part, with or without remnants of veil otherwise glabrous or with a few loose fibrils. Context white, often greyish under pileipellis at centre of pileus, firm. Smell none, or weakly farinaceous when crushed. Taste mild.

Spores 5.5–7.0(–7.5) × 4.0–5.0(–5.5) µm, Q = 1.3–1.7, av. Q = 1.4–1.5, broadly ellipsoid to oblong with pronounced hilar appendage. Basidia 28–35 × 6.0–7.0 µm, 4-spored, clampless. Lamella edge fertile. Pileipellis a cutis, sometimes with transitions to a trichoderm, made up of long, septate hyphae with cylindrical to inflated elements, straight or constricted at septa, 15–70(–90) × 5.0–16 µm; subpellis usually well differentiated, composed of (2–) 3–5(–7) layers of strongly inflated, subisodiametrical or elongate elements, 10–35(–50) × 8.0–28 µm. Pigment brown, parietal and incrusting in pileipellis, sometimes in addition intra and intercellular brown pigment clots have been observed. Stipitipellis an undifferentiated cutis of 2.5–7.0 µm wide, cylindrical hyphae. Caulocystidia absent or scarce, single, 10–42 × 2.5–6.0 µm, cylindrical to subclavate or irregularly shaped, hyaline, thin-walled. Clamp-connections not observed.

Habitat & distribution — Ectomycorrhizal with *Pinus*, more rarely *Abies*, *Picea* or *Fagus* on more or less calcareous, sandy to loamy soils. Rather common to common in most parts of northern Europe.

Collections examined. FRANCE: ex Herb. Persoon collection of *Agaricus myomyces*, without date, locality (L). — THE NETHERLANDS: prov. Noord-Holland, Wassenaar, 31 Oct. 1954, *R.A. Maas Geesteranus* (MG 10217); Noordwijk, 20 nov. 1956, *R.A. Maas Geesteranus* (MG 11888) (L); Heemstede, Amsterdamse Waterleiding Duinen near Oase, 1 Oct. 1994, *M.E. Noordeloos* (MEN 94101) (L); Putten, 15 Nov. 1958, *E. Kits van Waveren* (L); Aerdenhout, 18 Oct. 1979, *E. Kits van Waveren* (L); prov. Zeeland, Haamstede on Westenschouwen, 7 Nov. 1998, *M. Christensen* (MC 98209) (C). — GERMANY: Bayern, Sperberslohe near Roth, 24 Sept. 1995, *M.E. Noordeloos* (epitype, MEN 95192) (L); Mauk near Roth, 26 Sept. 1995, *M.E. Noordeloos* (MEN 95207) (L). — ITALY: Trentino, Roncegno, Cinque Valli, Sept. 1996, *M.E. Noordeloos* (MEN 96137) (L). — AUSTRIA: Steiermark, Mariazell, Greith, Krönterin, 7 Sept. 1994, *M.E. Noordeloos* (MEN 9460) (L). — DENMARK: E Jylland, Brabrand near Aarhus, 25 Sept. 1995, *B. Vestergaard & K. Nielsen* (MC 95155) (C); Mols, 9 Oct. 1995, *C. Brandt* (MC 95176) (C);

Nordlandsvej, Risskov, 15 Oct. 1998, *M. Christensen* (MC 98118) (C). — SWEDEN: Jämtland: Fillstabäcken SW of Östersund, 2 Sept. 1997, *M.E. Noordeloos* (MEN 9739) (L); Ormskärret, 6 Sept. 1997, *M. Christensen* (MC 97133) (C).

Tricholoma terreum is a rather variable species. Several taxa have been recognized, mainly on account of the structure of the pileipellis, the shape and colour of the pileus and the presence or absence of veil, which prove to be similar. *Tricholoma myomyces* sensu Clémençon (1983) and Bon (1991) is characterized by only one or two layers of isodiametrical cells in the pileipellis in contrast to three or more in *T. terreum*. But according to our observations the number of layers in the pileipellis is very variable and also depends on the age of the basidiocarps and ecological and climatical conditions. The shape of the pileus in *Tricholoma myomyces* is described as more or less convex contrasting with a more or less conical pileus in *T. terreum*. The illustrations of *Tricholoma myomyces* (Lange, 1935; Marchand, 1986; Riva, 1988) do not support these differences and our observations from fresh collection frequently show a rather continuous range of pileal shapes from conical or campanulate to convex, in basidiocarps from one mycelium. The same applies to the colour of the pileus, ranging from rather pale grey to deep greyish-black, connected with the variation found in the microscopy of the pileipellis. Another character used in the literature to distinguish *Tricholoma myomyces* from *T. terreum* is the presence (*T. myomyces*) or absence (*T. terreum*) of a fibrillose cortinate veil as white, fibrillose, arachnoid patches along the margin of the pileus, and a fibrillose annuliform zone on the stipe. Our studies show a rather big variation in the occurrence of veil. In many collections veil was observed in very young basidiocarps or primordia, but it may disappear completely in the course of development. Presence of veil remnants in mature basidiocarps did not seem to be correlated with any of the other distinguishing characters mentioned for *Tricholoma myomyces* and *T. terreum*. Therefore, it was decided to consider *Tricholoma myomyces* as a synonym of *T. terreum*.

Tricholoma gausapatum (Fr.) Quél. as conceived by Huijsman (1968) and Bon (1976, 1991) differs from *T. terreum* by the woolly-plushy, not squamulose surface of the pileus, which may also have a more brown-grey tinge, the greyish-glaucous tinge of the lamellae, and the fugacious fibrillose annuliform zone on the stipe. According to Clémençon (1983) *Tricholoma gausapatum* is also characterized by clamps or pseudoclamps in the hymenium. So far we have not studied any material that matches this concept of *T. gausapatum*. It seems to be a very rare species, restricted to southern Europe.

Tricholoma bisporigerum Lange (1933) may represent a 2-spored form of *T. terreum*, but further studies are needed.

Tricholoma leucoterreum Mariotto & Turetta (1996), described from central Italy, resembles in all aspects *T. terreum*, but differs in the lack of any pigment. It probably is a pigmentless albino-form.

Tricholoma triste (Scop.: Fr.) Quél. — Fig. 2b, Plate 6

Tricholoma triste (Scop.: Fr.) Quél., Mém. Soc. Émul. Montbéliard, sér. 2, 5 (1872) 79 (Champ. Jura Vosges 1).

Agaricus tristis Scop., Fl. carn., ed. 2 (1772) 483; *Agaricus tristis* Scop.: Fr., Epicrisis (1836) 34; *Gyrophila triste* Quél., Fl. mycol. France (1888) 285.

Excluded. Tricholoma triste sensu Cetto, Funghi Vero 2, ed. 1 (1976) pl. 567 (= ? close to *T. terreum* or *T. atrosquamosum*); sensu Marchand, Champ. Nord Midi 9 (1986) pl. 850 (?); sensu M. Bon, Tricholomes Fr. Eur. occ. (1984) 146; Fl. mycol. Eur. 2, Tricholomes (1991) 59 (= *T. scalpturatum*?).

Neotype (design. here): Germany, Baden-Württemberg, Seedorfer Wald, Schwarzwald, 27 Sept. 1996, *M. Meusers* (E 3754) (L).

Pileus 10–50 mm, conical to conico-convex with deflexed margin, expanding to plano-convex with or without low umbo, with deflexed to straight margin, with undulating lobed marginal zone when old, uniformly very dark grey-brown to almost black or more brown-grey when old (Mu. 10 YR 2–3/2, 3/4, 4/3, 7.5 YR 3–4/2), very finely tomentose all over, then sometimes breaking up in very fine fibrillose squamules, with very conspicuous whitish, arachnoid veil along margin. Lamellae, L = 50–60, l = 1–7, moderately distant, adnate-emarginate, segmentiform to narrowly ventricose, grey (10 YR 7–6/2) with concolorous or in part blackish-dotted, subentire to eroded edge. Stipe 25–40 × 4–7 mm, cylindrical or slightly broadened towards base, straight or flexuous, pale grey, fibrillose-punctate with greyish fibrils all over, glabrescent, innately fibrillose with age. Context white to pale grey. Smell indistinct. Taste indistinct.

Spores 7.0–9.0 × 4.0–5.0 µm, Q = 1.6–2.2, av. Q = 1.7–1.9, oblong with pronounced hilar appendage. Basidia 29–38 × 6.0–7.5 µm, 4-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis with transitions to a trichoderm, made up of septate hyphae, with elements 15–60 × 3.5–7.0 µm, constricted at septa or not; subpellis well differentiated from pileitrama, made up of inflated elements, 14–50 × 4.0–15 µm. Pigment dark yellow-brown, incrusting in pileipellis. Stipitipellis a cutis of cylindrical hyphae, 3.0–7.0 µm wide, with yellow, finely incrusted walls. Caulocystidia in clusters, 14–40 × 3.5–5.0 µm, subcylindrical, with yellow-brown, incrusted walls. Clamp-connections not observed.

Habitat & distribution — Ectomycorrhizal, associated with coniferous and deciduous trees (*Picea*, *Pinus*, *Larix*, *Fagus*) in mountainous forest on more or less acid bedrock. Recorded from central Europe, but distribution poorly known.

Collections examined. GERMANY: Baden-Württemberg, Seedorfer Wald, Schwarzwald, 27 Sept. 1996, *M. Meusers* (neotype, E 3754) (L) — ITALY: Trento, Spera Val Campella, 8 Sept. 1996, *M.E. Noordeloos* (MEN 96112) (L).

Tricholoma triste – as presented here – agrees with the rather short original diagnosis of Scopoli (1772). As such, it also fits well within the concept of Bresadola (1927). It is distinguished from *Tricholoma terreum* mainly by the large and slender spores, the smaller size of the basidiocarps and the blackish squarrulose stipe. *Tricholoma triste* sensu M. Bon (1984, 1991) has smaller spores, a fibrillose, not squamulose stipe and a less differentiated pileipellis. This taxon seems to be a transition between stirps *Terreum* and stirps *Scalpturatum*, and may even be a variant of *Tricholoma scalpturatum*. Bon (1995) states that *Tricholoma scalpturatum* var. *atrocinctum* Romagn. (1974) represents a kind of intermediate form between *T. scalpturatum* and *T. triste*, but according to our species concept this variety seems to be more related to *T. argyraceum* (see below).

Tricholoma argyraceum (Bull.) Gillet — Fig. 2c, Plate 9

Tricholoma argyraceum (Bull.) Gillet, Hyménomycètes (1878) 103.

Agaricus argyraceus Bull., Herb. France (1779) pl. 423, fig. 1; *Gyrophila argyracea* (Bull.) Quél., Enchir. Fung. (1886) 12; *Tricholoma scalpturatum* var. *argyraceum* (Bull.) Kühn. & Romagn., Fl. anal. Champ. sup. (1953) 154.

Selected icons. Alessio & Rebaudengo, Micol. ital. 7 (1) (1978) pl. 19; Dähncke & Dähncke, 700 Pilze (1979) pl. 182; J. Lange, Fl. agar. dan. 1 (1935) pl. 23B; R. Phillips, Mushr. other Fungi (1981) 37 (as *T. inocybeoides*); Riva, Tricholoma (1988) 27.

Selected descriptions and figures. M. Bon, Tricholomes France, Europe occ. (1984) 153 (as *T. scalpturatum* var. *argyraceum*); M. Bon, Fl. mycol. Eur. 2, Tricholomes (1991) 61; Riva, *Tricholoma* (1988) 248.

Iconotype: *Agaricus argyraceus* Bulliard, Herb. Fr. (1789) pl. 423.

Epitype (design. here): The Netherlands, Prov. Groningen, Verhildersum near Leens, 21 Sept. 1994, *M.E. Noordeloos 9491* (L).

Pileus 15–60 mm, conico-convex to convex with pronounced conical umbo, with deflexed margin, expanding with age to convex or plano-convex, usually with acute umbo and deflexed to straight margin, marginal zone sometimes undulating and splitting with age, thin-fleshed, white or very pale cream-coloured (Mu. 10 YR 8/2, 2.5 Y 8/2), at centre sometimes with brown fibrillose covering (10 YR 5–4/2, 10 YR 5/3) that sometimes agglutinate in minute squamules, towards margin innately radially fibrillose, silvery shining, often distinctly staining yellow when old and bruised, particularly near the margin. Veil present in primordia, usually quickly disappearing, but sometimes visible in mature specimens as arachnoid fibrils at pileal margin. Lamellae, L = 60–80, l = 37, rather crowded, deeply emarginate, rarely broadly adnate, segmentiform to ventricose, then often extending under pileus, white or very pale grey, often staining yellow when old or bruised, with entire to eroded, concolorous edge. Stipe 20–50 × 3–8(–9) mm, cylindrical or tapering towards base, white, sometimes tinged pale grey in lower part, sometimes staining yellow when bruised, finely fibrillose-striate lengthwise, silky shining. Context thin, white. Smell farinaceous, sometimes weakly so, but then strongly farinaceous when cut. Taste farinaceous rancid.

Spores 4.5–6.0(–6.5) × 2.5–3.5 µm, Q = 1.4–2.1, av. Q = 1.5–1.9, narrowly oblong with pronounced hilar appendage. Basidia 21–30 × 5.0–7.0 µm, 4-spored, clampless. Lamella edge sterile or heterogeneous with few to abundant, sometimes clustered cheilocystidia, 16.5–25.5 × 2.0–6.0 µm, versiform, subcylindrical to clavate or lageniform, thin-walled. Pileipellis a poorly differentiated cutis, rarely with a slightly tendency towards a trichoderm, made of narrow, cylindrical hyphae; elements 15–55(–70) × 2.5–7.5(–9.0) µm; subpellis not differentiated from pileitrama, made up of cylindrical to slightly inflated elements, 30–95 × 5.0–13(–17) µm. Pigment absent or pale yellow, membranal or very minutely incrusting. Stipitipellis a cutis of cylindrical hyphae, 2.0–6.0 µm wide. Caulocystidia absent or sparsely present, 15–24 × 2.5–6.0 µm, cylindrical to subclavate or irregularly shaped. Clamp-connections absent.

Habitat & distribution — Ectomycorrhizal with deciduous trees (*Carpinus*, *Populus*, *Betula*, *Quercus*, *Tilia*) in parks and woods on nutrient rich, sandy or clayey soil. Widespread all over Europe, but apparently rare.

Collections examined. THE NETHERLANDS: prov. Groningen, Verhildersum near Leens, 21 Sept. 1994, *M.E. Noordeloos* (MEN 9491) (Epitype, L); prov. Flevoland, Noordoost Polder, Voorsterbos, 12 Oct. 1983, *C. Bas* (*Bas 8201*) (L); prov. Noord-Holland, Amsterdamse Waterleiding duinen, 30 Nov. 1958, Kits van Waveren (L); Vogelenzang near Bloemendaal, 11 May 1972, *C. Bas* (*Bas 5808*) (L); 7 Nov. 1970, *P.B. Jansen* (PBJ 70252) (L); Koningshof near Bloemendaal, 9 Sept. 1987, *A.G. Becker* (L); prov. Zuid-Holland, 's-Gravenhage, 18 Nov. 1973, *H. Kroes* (L); Meyendel near Wassenaar, 23 May 1983, *M.E. Noordeloos* (MEN 8303) (L); prov. Zeeland, Schouwen, 23 Oct. 1966, *C. Bas* (*Bas 4867*) (L); Haamstede, 7 Nov. 1998, *N. Dam* (MC 98210). — ITALY: Trentino, Valle di Sella, 16 Sept. 1995, *M.E. Noordeloos* (MEN 95144) (L). — DENMARK: E Jylland, Vestre Kirkegaard in Aarhus, 9 Oct. 1995, *M. Christensen* (MC 95171-173) (C); 11 Aug. 1998, *M. Christensen* (MC 98007) (C). — SWEDEN: Jämtland, Östersund, 2 Sept. 1997, *M. Christensen* (MC 97060) (C).

Tricholoma argyraceum is a pale coloured species, usually with prominent umbo, with rather small fruit-bodies with a short stipe in relation to the diameter of the pileus, and nar-

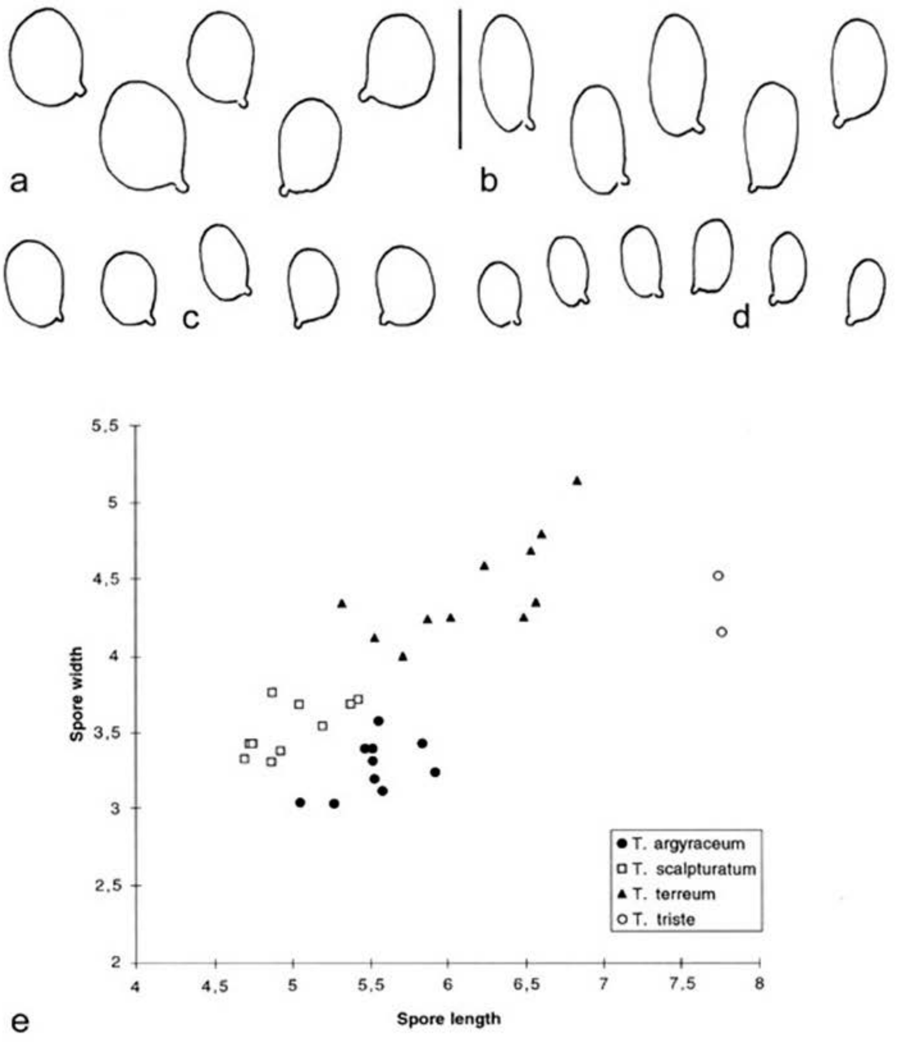

Fig. 2. Spores of subsect. *Terrea*. a. *T. terreum*; b. *T. triste*; c. *T. argyraceum*; d. *T. scalpturatu*;. e. average spore size for species in subsect. *Terrea*. Bar = 10 µm.

row spores. Within this concept is also included *Tricholoma inocybeoides* A. Pears., which is considered a form with a pileus with a prominent grey-fibrillose umbo (see below). *Tricholoma scalpturatum* differs mainly by the darker colours, slightly larger habit, and broader spores. *Tricholoma scalpturatum* var. *atrocinctum* Romagn. is considered a form of *T. argyraceum* with a distinct black line around the stipe. *Tricholoma scalpturatum* var. *argyraceum* as depicted in Riva (1998: photo p. 247) represents typical *T. argyraceum* in our concept, but unfortunately no microscopical details are given for the depicted collection. Also

T. inocyboides and *T. alboconicum* discussed and illustrated in the paper of Riva (1998) fit well in our concept of *T. argyraceum*.

Tricholoma albidum M. Bon has an innately silky fibrillose pileus without squamules. It is probably closely related to *Tricholoma columbetta*.

Tricholoma argyraceum forma **inocybeoides** (A. Pears.) M. Christensen & Noordel., *comb. nov.*

Basionym: *Tricholoma inocybeoides* A. Pears., Trans. Br. mycol. Soc. 22 (1938) 29.

Synonyms: *Tricholoma argyraceum* var. *inocybeoides* (A. Pears.) M. Bon, Bull. trimest. Soc. mycol. Fr. 85 (1970) 475–492; *Tricholoma alboconicum* (J. Lange) Clémençon, Mycol. helv. 1 (1983) 26; *Tricholoma myomyces* var. *alboconicum* J. Lange, Fl. agar. dan. 5 (1940) IX.

Neotype: (Basso & Candusso, 1997): Great Britain, Sussex, Richmond, Royal Botanic Garden, Kew, 15 Oct. 1966, D.A. Reid (herb. K; not studied).

Tricholoma bonii Basso & Candusso (1997), described from southern Europe, is very similar to *Tricholoma argyraceum* forma *inocybeoides* but differs by larger spores, (5.5–) 6.0–7.0 × 4.0–4.5(–5.0) µm, and a more differentiated pileipellis, characteristic for stirps *Terreum*.

Tricholoma scalpturatum (Fr.) Quél. — Fig. 2d

Tricholoma scalpturatum (Fr.) Quél., Mém. Soc. Émul. Montbéliard, sér. 2, 5 (1872) 232 (Champ. Jura Vosges 1).

Agaricus scalpturatus Fr., Epicrisis (1838) 31. — *Tricholoma scalpturatum* var. *atrocinctum* Romagn., Bull. trimest. Soc. mycol. Fr. 90 (1974) 166.

Misapplied. Tricholoma argyraceum sensu auct. non Bull.

Selected icon. Breitenb. & Kränzl., Pilze Schweiz 3 (1991) pl. 431; Courtec. & Duhem, Champ. Fr. Eur. (1994) 396; Marchand, Champ Nord Midi 9 (1987) pl. 852; R. Phillips, Mushr. other Fungi (1981) 37 (as *T. argyraceum*); Riva, *Tricholoma* (1988) pl. 24.

Selected descriptions and figures. M. Bon, Tricholomes France, Europe occ. (1984) 150; M. Bon, Fl. mycol. Eur. 2, Tricholomes (1991) 61; Breitenb. & Kränzl., Pilze Schweiz 3 (1991); Marchand, Champ. Nord Midi 9 (1984) 852; Riva, Tricholoma (1988) 238.

Neotype (design. here): Sweden, Jämtland, Sundnæs Sjö, 8 Sept. 1997, *M. Christensen* (MC 97165) (L).

Pileus 20–70 mm, conico-convex with subinvolute to deflexed margin when young, expanding to plano-convex or applanate with low umbo, with straight or reflexed, often undulating margin, uniformly dark grey-brown, entirely densely tomentose when young, when expanded breaking up in radially arranged, grey-brown small appressed or slightly uplifted, fibrillose squamules on paler background (Mu. 10 YR 4–5/2–3; 6/2–3), dry. Lamellae, L = 80–100, l = 15, moderately crowded, emarginate adnate, segmentiform to narrowly ventricose, white to pale cream-coloured (10 YR 8–7/2), staining yellow with age or not, with entire to eroded, concolorous edge. Stipe 20–40 × 5–10 mm, cylindrical, white, finally pale yellow, innately silvery fibrillose, sometimes with veil as a very faint fibrillose, white, rarely blackish annuliform zone. Context white. Smell strongly farinaceous. Taste farinaceous to rancid.

Spores (4.5–)5.0–6.0 × 3.0–4.0(–4.5) µm, Q = 1.2–1.7, av. Q = 1.3–1.5, broadly ellipsoid to oblong with pronounced hilar appendage. Basidia 19–28 × 4.5–7.0 µm, 4-spored, clampless. Lamella edge fertile, heterogeneous or rarely almost sterile, with single to clustered thin-walled, cylindrical to clavate cheilocystidia, 18–30 × 4.0–7.0 µm. Pileipellis a cutis with transitions to a trichoderm, made up of cylindrical elements, 15–45 × 2.5–7.5 µm, constricted at septa or not; subpellis not very much differentiated from pileitrama, made up of cylindrical to slightly inflated elements, 21–74 × 4.0–17 µm. Pigment brown, parietal and strongly incrusting in pileipellis, in addition sometimes intracellular. Stipitipellis a cutis of cylindrical hyphae, 2.5–7.5 µm wide. Caulocystidia scattered, single, 12–30 × 2.0–6.0 µm, cylindrical to versiform, thin-walled.

Habitat & distribution — Ectomycorrhizal, usually associated with deciduous trees (*Quercus*, *Fagus*, *Tilia*, *Populus*), rarely with coniferous trees (*Pinus*), on clay or on nutrient-rich sandy or sandy-peaty soils. Widespread all over Europe and fairly common.

Collections examined. THE NETHERLANDS: prov. Groningen: Gieten, Boekweitveentje, 11 Sept. 1994, *M.E. Noordeloos* (MEN 9468); prov. Friesland: Sneek, IJsbrechtum, 17 Oct. 1978, *J. Wisman* (L); dito, 17 Oct. 1978, *C. Bas* (Bas 60B, L); prov. Noord-Brabant, Valkenburg near Landgoes NW of Ginneken, 25 Oct. 1964, *P.B. Jansen* (PBJ 64245); prov. Utrecht, Vijverbos near Harmelen, 2 Oct. 1993, *M.E. Noordeloos* (MEN 93213); Koningsweg near Bunnik, 13 Oct. 1968, *E. Arnolds* (*Arnolds 337*) (L); Kasteel de Haar near Haarzuilens, 4 Sept. 1953, *C. Bas* (L); Eemsdijk near Baarn, 7 Nov. 1998, *H. van der Aa* (Aa 12493, Aa 12495, MC 98213) (C); prov. Zuid-Holland, Duinrell near Wassenaar, 31 Oct. 1954, *R.A. Maas Geesteranus* (MG 10217) (L); Katwijk, 5 Feb. 1989, *L. Jalink & M. Nauta* (J&N 6032) (L); Noord-Holland, Vogelenzang, 11 May 1972, *C. Bas* (*Bas 5808*); prov. Flevoland, Noordoost Polder, 3 Nov. 1977, *H. van der Aa* (*Aa 6118*) (L); 12 Oct. 1983, *C. Bas* (*Bas 8201*) (L). — SWEDEN: Jämtland, Sundnæs Sjö, 8 Sept. 1997, *M. Christensen* (neotype, MC 97165) (L). — FRANCE: Territoir Belfort, Bois Lachat SE of Belfort, 7 Oct. 1998, *M. Christensen* (MC 98091) (C).

Tricholoma scalpturatum is used here in a narrow sense. It remains a rather variable species, however, with the colour of the pileus ranging from grey-brown to blackish grey. The pileus is darker than in *T. argyraceum* and normally more convex and without an acute papilla which is characteristic for *T. argyraceum*. The most important distinguishing character, however, is found in the rather broad spores with an average Q less than 1.5. *Tricholoma cingulatum* is very similar, differs mainly by its well-developed, woolly fibrillose annulus on the stipe. *Tricholoma scalpturatum* var. *atrocinctum* Romagn. has a blackish fringed annuliform zone, which occasionally also has been observed in *T. cingulatum*.

NEW VARIETIES

Tricholoma psammopus var. **macrosporum** Noordel. & M. Christensen, *nov. var.* — Fig. 3

A varietate typica sporis grandis 7.0–8.5 × 5.5–7.0 µm differt.
Holotypus: The Netherlands: prov. Zuid-Holland, Noordwijk, 15 Nov. 1957, C. Bas 1381 (L).

Pileus 30–50 mm, convex to plano-convex with low, broad umbo and deflexed margin, pale yellow-brown to ochraceous with darker red-brown centre, dull to somewhat shining, smooth-rugulose at centre, towards margin more rugulose-fibrillose to subsquamulose. Lamellae, L = 40–70, l = 15, rather distant, adnate-emarginate, cream-coloured to pale yellowish-ivory, sometimes with rusty spots with age, with entire, concolorous edge. Stipe 30–50 × 48 mm, cylindrical often tapering towards base, white to pale cream at apex, often sharply delineated from rest of stipe, downwards concolorous with pileus, with reddish brown punctate to floccose covering, more reddish-tinged towards base. Context whitish in inner parts, reddish brown in base of stipe. Smell indistinct. Taste bitter-sweet.

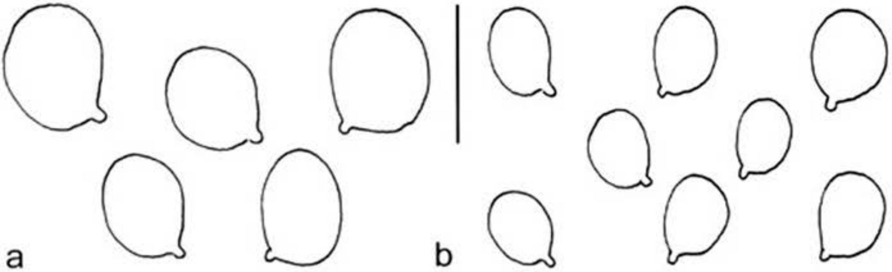

Fig. 3. Spores of *Tricholoma psammopus*. a. var. *macrosporum*; b. var. *psammopus*. Bar = 10 µm.

Spores 7.0–8.5 × 5.5–7.0 µm, Q = 1.1–1.5, av. Q = 1.2–1.3, subglobose, broadly ellipsoid to ellipsoid with pronounced hilar appendage. Basidia 24–40 × 6.0–8.0 µm, 4-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of cylindrical, 3.0–7.5 µm wide hyphae with trichodermal tufts of subclavate terminal elements, up to 12.0 µm wide. Pigment membranal and intracellular in pileipellis. Stipitipellis a cutis of 3.0–6.0 µm wide, cylindrical hyphae with membranal, sometimes finely incrusting pigment, with trichodermal tufts of cylindrical to clavate caulocystidia, 22–75 × 4.0–8.0(–9.0) µm with intracellular pigment. Clamp-connections absent.

Habitat & distribution — Ectomycorrhizal, associated with *Pinus* in plantations on calcareous, sandy soils and loamy-sandy soil. So far only known from The Netherlands.

Collections examined. THE NETHERLANDS: prov. Zuid-Hollland, Noordwijk, 15 Nov. 1957, *C. Bas* (holotype, *Bas 1381*) (L); prov. Overijssel, Delden 1974, *E. Kits van Waveren* (L).

Tricholoma psammopus is characterized by its moderately dark, reddish brown, very finely tomentose, granulose-punctuate to finely floccose pileus and stipe, and lack of smell. It occurs widespread in Europe in association with *Larix*, particularly in mountainous regions and on rich, often calcareous soil. However, it has also been found sometimes in association with *Pinus*. Bon (1984) reports also association with *Abies* and *Picea*. From the Netherlands only two collections are known, one from the coastal dune-area, collected under *Pinus* on calcareous sand, and one from an inland locality on loamy-sandy soil, without indication of accompanying trees. Both collections deviate from the current concept of *Tricholoma psammopus* (Bon, 1991; Riva, 1988) by having larger spores, that are born on 4-spored basidia. *Tricholoma psammopus* forma *bisporum* M. Bon has similar spores, born on 2-spored basidia, however, but grows also in association with *Pinus* (Bon, 1984). Considering the differences in basidia, it seems best, however, to keep forma *bisporum* separate from var. *macrosporum*.

Tricholoma equestre var. **populinum** M. Christensen & Noordel., *var. nov.* — Plate 10

A typo pileo haud viscoso sed appresso squamuloso, sporis tenuioribus 5.0–6.5 × 3.5–4.5 µm et sub Populo crescens differt.

Holotypus: Sweden, Medelpad, Borgsjö, 1 km W of the village, 16 Sept. 1995, M. Christensen (MC 95151) (L).

Tricholoma equestre var. *populinum* differs from var. *equestre* by the non viscid, entirely appressedly squamulose pileus, the more bright yellow colour of the lamellae and the smaller, subglobose to ellipsoid spores, 5.0–6.5 × 3.5–4.5 µm, Q = 1.2–1.8, av. Q = 1.4–1.6. The pileipellis is a cutis with transitions to a trichoderm, made up of 2.0–5.0 µm wide, cylindrical hyphae, with cylindrical to subclavate terminal elements, 18–35 × 2.0–7.0 µm and with poorly differentiated subpellis composed of inflated elements, 2.5–7.0 µm wide.

Habitat & distribution — Ectomycorrhizal with *Populus* and possibly also *Picea*; widespread in northern and western Europe, not yet recorded from the Netherlands.

The pileus of *Tricholoma equestre* var. *equestre* varies from rather smooth and viscid, particularly in young and fresh specimens, to rather dry and radially fibrillose to subsquamulose, but the spore size of the typical variety is larger (6.0–7.5 × 3.5–5.0 µm, Q = 1.2–1.9, av. Q = 1.5–1.7), and slightly more oblong than in var. *populinum*, and the lamellae are normally less yellow. Some authors (Bon, 1991) distinguish *T. auratum* (Paul.) Gillet as a separate species with viscid pileus. It is here considered a morphological variant of var. *equestre*.

NEW COMBINATIONS

Tricholoma section **Megatricholoma** (Kost) M. Christensen & Noordel., *comb. & stat. nov.*

Basionym: *Megatricholoma* Kost, Sydowia 37 (1984) 54.

Kost (Sydowia 37 (1984) 53–74) created the genus *Megatricholoma* to accommodate *Tricholoma colossus* (Fr.) Quél. The present authors, however, consider the differences not convincing enough to support a distinction on generic level and propose to accommodate *Tricholoma colossum* in a separate section of *Tricholoma*.

Tricholoma atrosquamosum var. **squarrulosum** (Bres.) Christensen & Noordel., *comb. nov.*

Basionym: *Tricholoma squarrulosum* Bres., Fungi trident. 2 (1892) 47, Plate 152.

NOMENCLATORAL NOTES

1. On the names Agaricus fulvus and A. ustale

The name *Agaricus fulvus* was used by Bulliard (1792a), first in connection with plate 555, fig. 2. Later Bulliard (1792b) published a second icon of the same species (pl. 574). From the descriptions with the plates in the later reissue of the plates (Bulliard 1809: 608) it becomes clear that pl. 555, fig. 2 stands for the *Tricholoma* species currently named *Tricholoma fulvum* or *T. flavobrunneum* with a distinct yellow tinge in the context of stipe and lamellae, growing with *Betula*. Plate 574 clearly depicts *T. ustale* (Fr.: Fr.) Kumm. in its current use, with whitish context, lamellae white then pale yellow, with brown spots, etc., associated with *Fagus*.

Fries (1821: 37) sanctioned the name *A. fulvus* Bull., referring to both plates of Bulliard. In his diagnosis, Fries stressed the yellowing of the context of the stipe as an important character to distinguish it from *A. albobrunneus* and *A. ustalis*. It is clear that in this concept, *A. fulvus* Bull.: Fr. is the same as the current use of *Tricholoma fulvum* or, as it is also generally called, *T. flavobrunneum* (Fr.) Kumm.

Fries (1821: 37) included *Agaricus flavobrunneus* Fr. (1818) in the synonymy of *Agaricus fulvus*. Judging from the diagnosis of *A. flavobrunneus*, Fries was completely right in accepting this synonymy. However, he did not cite Bulliards plate 555, fig. 2 for *A. flavobrunneus*, but Bulliard pl. 574, fig. 1! Since *Agaricus flavobrunneus* has not been sanctioned by Fries, it seems appropriate to accept it as a synonym of *A. fulvus*, excluding the cited plate of Bulliard. From the diagnosis it seems also very likely that *Agaricus nictitans* Fr.: Fr., (1821) is a synonym of *A. fulvus*.

Fries (1821) also describes *Agaricus ustalis* Fr.: Fr., characterized by a red-brown, viscid, glabrous pileus, white lamellae, and a stipe with glabrous apex, fibrillose-squamulose in lower part, growing under *Fagus* as well as *Betula*.

However, confusion starts when Fries (1838) completely reconsidered the taxonomy of this group of species. He abandoned *Agaricus fulvus*, obviously considering it a nomen confusum, connected with the name *Agaricus rufus* in various interpretations. A new species was described as *Agaricus fulvellus* Fr., referring to Bulliards plate 555, fig. 2. In his description, however, Fries does not mention any yellow tinges in the context of stipe, nor in the colour of the lamellae. It is said to grow under *Fagus* in S Sweden, and the description therefore most likely refers to the current concept of *Tricholoma ustale* (Fr.: Fr.) Kumm. The description of *Agaricus nictitans* Fr. was emended to include Bulliard's plate 574, fig. 1, and might therefore refer to *Agaricus ustalis*. Fries redescribed in this publication also *Agaricus flavobrunneus* Fr. (1818), as a common species from *Betula* forest with a red-brown, virgate-squamulose, viscid pileus, deeply emarginate, yellow lamellae that stain reddish with age, and a stipe which is slightly viscid when moist, with naked apex, and fibrillose lower part. Fries indicates that *Agaricus rufus* sensu Fr. (1821: 37) is a synonym of *A. flavobrunneus*.

Finally, Fries (1838) gives a new description of *Agaricus ustalis*, characterized by a red-brown, glabrous, viscid pileus, white lamellae which stain reddish when old, and a stipe with naked apex, reddish fibrillose below, growing in mountainous *Pinus* forest.

CONCLUSIONS

Tricholoma fulvum (Bull.: Fr.) Bigeard & Guill., Fl. Champ.: 89, 1913

Basionym: *Agaricus fulvus* Bull., Herb. France (1792) pl. 555, fig. 2; *Agaricus fulvus* Bull.: Fr., Syst. mycol. 1 (1821) 37.

Lectotype: Bull., Herb. France (1792) pl. 555, fig. 2.

Epitype: Denmark: N. Jylland, Livö, 29 Sept. 1995, J. Vesterholt & M. Christensen (MC 95-160) (L, C).

We exclude from the sanctioning description the second plate by Bulliard (1792, pl. 574, fig. 1).

SYNONYMS

Agaricus flavobrunneus Fr., Observ. mycol. 2 (1818) 119; *Tricholoma flavobrunneum* (Fr.) Kumm., Führ. Pilzk. (1871) 130.

Type-description: Fries, Observ. mycol. 2 (1818) 119, excl. the reference to Bulliard, pl. 574, fig. 1.
Agaricus fulvellus Fr., Epicr. (1838) 28.

Lectotype: Bull., Herb. France (1792) pl. 555, fig. 2.

The type-description is excluded because it is confusing, and probably refers to *Agaricus ustalis*.

Tricholoma ustale (Fr.: Fr.) Kumm., Führ. Pilzk. (1871) 130.

Basionym: *Agaricus ustalis* Fr., Obs. mycol. 2 (1818) 122; *Agaricus ustalis* Fr.: Fr., Syst. mycol. 1 (1821) 37.

Lectotype: Bull., Herb. France (1792) pl. 574, fig. 1.

Epitype: Denmark: N. Jylland, Rold Skov E of Store Øksø, 7 Oct. 1997, M. Christensen (MC 97-239) (L, C).

The original diagnosis and sanctioning description clearly refer to the current concept of *Tricholoma ustale* (Fr.: Fr.) Kumm. The fact that Fries in later works confused several species under that name, is irrelevant for the nomenclatural status. The current use is now fixed with the designation of an iconotype and epitype.

2. Tricholoma populinum versus T. suffocatum

Tricholoma populinum J. Lange, Dansk Bot. Arkiv 8 (3) (1933) 14 (as nom. nov. for *Tricholoma pessundatum* var. *stans* forma *campestris* Fr.).

Holotype not existing. Neotype (selected here): Denmark, E. Jylland, Edwin Rahrse Vej, Braband, W of Aarhus, 10 Oct. 1996, M. Christensen (MC 96-171) (C, L).

Tricholoma suffocatum Richon. & Roze (1888) 81, represents an older synonym of *T. populinum* J. Lange (1933) and should be used instead. In fact, Lange (1935) was aware of the possibility that his *T. populinum* was a synonym of *T. suffocatum*. However, the older name has never been used in modern literature. Most authors (Bon, 1984,1991; Breitenbach & Kränzlin, 1991; Courtecuisse & Duhem, 1994; Gulden, 1992; Marchand, 1986; Moser, 1983; Riva, 1988) use the name *Tricholoma populinum*. Therefore a formal proposal has been made to conserve the name *T. populinum* in favour of *T. suffocatum*. Awaiting the decision of the nomenclature committee of the International Botanic Congress, we continue the use of the name *T. populinum*.

3. Tricholoma albobrunneum versus T. striatum

The species around *Tricholoma albobrunneum* are all characterized by a more or less red-brown, viscid pileus, white lamellae, and a stipe which may have a distinctly delimited white apical zone or not. Several species have been distinguished in this group, but there is still confusion, in particular with regard to the interpretation of old names.

Agaricus striatus Schaeff. (1762, pl. 38) is depicted as a fungus which clearly belongs to this group. Persoon (1801: 293) describes *Agaricus albobrunneus* Pers. referring to *A. striatus* Schaeff., which he considers a synonym. Fries (1821: 37) sanctioned the name *Agaricus albobrunneus* Pers. and confirms the synonymy of *Agaricus striatus* Schaeff., but Fries specifically states that the plate of Schaeffer is not representative. Since the name *Agaricus albobrunneus* has been sanctioned, we use that name for our interpretation of Persoon's taxon. Furthermore, from a taxonomical point of view, the synonymy of *Agaricus striatus* Schaeff. is questionable, as it may represent another species in the same group, such as *Tricholoma batschii* Gulden.

4. Tricholoma equestre versus T. flavovirens

Agaricus equestre L. 1772: 12 is sanctioned by Fries (1821). Although Linnaeus described a rather unspecific taxon, the sanctioning description is rather unambiguous. Following the advise of the International Code of Botanical Nomenclature (Greuter et al., 1994) we use therefore the name *Tricholoma equestre* (L.: Fr.) Kumm. in favour of *T. flavovirens* Pers.: Fr., although the latter also has been sanctioned by Fries in 1821.

5. Agaricus luteovirens versus T. apium

Agaricus luteovirens A. & S. (1805: 168) has been interpreted as a species of *Floccularia* (Pouzar, 1957; Pilát, 1969; Bon, 1991). According to the original diagnosis this could well be true. Kreisel (1987), however, concluded from the original description that the name *Agaricus luteovirens* A. & S.: Fr. must be considered an older synonym of *Tricholoma apium* Schaeff. However, since Albertini & Schweinitz (1805), nor Fries (1821) in the sanctioning description refer to the very characteristic celery-like smell of *Tricholoma apium*, we do not follow Kreisel (1987), and continue the use of the name *Tricholoma apium* for the species in question.

6. Tricholoma batschii versus T. fracticum

Agaricus subannulatus Batsch is typified by a description and plate that can be identified without problems as the *Tricholoma* species currently known as *T. batschii* Gulden. Gulden (1969) created this new name for *T. subannulatus* (Batsch) Bres., because it is a later homonym of *T. subannulatus* (Peck) Zeller. Unfortunately, the new name was not valid according to the International Code of Botanical Nomenclature, because Gulden did not mention the basionym, nor presented a diagnosis.

Kreisel (1984) considered *Agaricus fracticus* Britzelmayr (1885: pl. 568) as conspecific with *T. batschii*, and recombined the epithet of Britzelmayr in *Tricholoma*. The present authors, however, disagree with the synonymy proposed by Kreisel (1984). Britzelmayr's plate does not show the sharply delimited white apical zone of the stipe, which is the main characteristic for *T. batschii*. It therefore likely represents another species in the group of *T. albobrunneum*. We therefore validate Guldens binomial.

Tricholoma batschii Gulden ex. M. Christensen & Noordel., *nom. nov.*

Basionym: *Agaricus subannulatus* Batsch, Elench. Fung. (1786) pl. 16.

Lectotype: Batsch, Elench. Fung. (1786) pl. 16, fig. 75ab.

Epitype (design. here): Germany, Gerolstein, Eifel, 23 Sept. 1980, H van der Aa (*Aa 7541*) (L).

Synonyms: *Tricholoma subannulatum* (Batsch) Bres., Icon. Myc. 2 (1927) pl. 63 non *T. subannulatum* (Peck) Zeller, Mycologia 14 (1922) 187. — *Tricholoma batschii* Gulden, Musseronflora (1969) 60 (invalid).

Misapplied. Tricholoma fracticum (Britz.) Kreisel sensu Kreisel, Feddes Rep. 95 (9, 10) (1984) 700 non Britz.

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REFERENCES

Albertini, J.B. & L.D. Schweinitz. 1805. Conspectus fungorum Lusatiae superioris agro Niskiensi crescentium. Leipzig.

Bas, C., Th.W. Kuyper, M.E. Noordeloos & E.C. Vellinga (eds.). 1988. Flora agaricina neerlandica I. Rotterdam.

Basso, M.T. & M. Candusso. 1997. Tricholoma bonii. Doc. Mycol. 107: 64–71.

Batsch, A.J.G. 1786. Elenchus fungorum. Halae.

Bon, M. 1970. Révision des Tricholomes. Bull. trimest. Soc. mycol. Fr. 85: 475–492.

Bon, M. 1976. Tricholomes de France et d'Europe occidentale (4ième Partie). Doc. mycol. 6 (22–23): 160–304.

Bon, M. 1984. Les Tricholomes de France et d'Europe occidentale. Encycl. Mycol. 36.

Bon, M. 1991. Flore Mycologique d'Europe 2, Les Tricholomes et ressemblants. St. Valery-sur-Somme.

Bon, M. 1995. Macromycetes rares ou interessants de la region Nord-Picardie. Doc. Myc. 24 (96): 13–39.

Breitenbach, J. & F. Kränzlin. 1991. Pilze der Schweiz 3. Verlag Mykologia. Luzern.

Bresadola, G. 1927. Iconographia Mycologica 2: pl. 51–100. Milano.

Britzelmayr, M. 1885. Die Hymenomyceten aus Südbayern 4. 28. Jahresbericht des Naturhistorie Vereins Augsburg: 119–160 & plates.

Bulliard, J.B.F. 1792. Herbier de la France ou Collection complète des Plantes indigènes de ce Royaume. Tome 12. Paris.

Bulliard, J.B.F. 1809. Histoire des Champignons de la France, ou traité élémentaire, renfermant dans un ordre methodique les descriptions et les Figures des Champignons qui croissent naturellement en France. 2ième ed. Paris.

Christensen, M., T. Knutsson & C. Lange. 1998. Ecology and distribution of Tricholoma sulphurescens Bres. and Tricholoma bresadolanum Clémenç. in the Nordic countries. Boll. Gruppo micol. G. Bres., Nuova Serie 40 (23): 151–158.

Clémençon, H. 1983. Die Erdritterlinge und ihre nächst verwandten Arten aus der Gattung Tricholoma, Sektion Tricholoma. Myc. helv. 1: 17–30.

Courtecuisse, R. & B. Duhem. 1994. Guide des Champignons de France et d'Europe. Paris.

Fries, E. 1818. Observationes Mycologicae praecipue ad illustrandam floram Suecicam, Pars II. Copenhagen.

Fries, E. 1821. Systema Mycologicum. Lund.

Fries, E. 1838. Epicrisis Systematis Mycologici seu Synopsis Hymenomycetum, Vol II. Lund.

Fries, E. 1857. Monographia Hymenomycetum Sueciae I. Uppsala.

Greuter, W., F.R. Barrie, H.M. Burdet, W.G. Chaloner, V. Demoulin, D.L. Hawksworth, P.M. Jørgensen, D.H. Nicolson, P.C. Silva, P. Trehane & J. McNeill. 1994. International Code of Botanical Nomenclature (Tokyo Code). Regnum vegetabile 131. Koeltz Scientific Books, Königstein.

Gulden, G. 1969. Musseronflora. Oslo.

Gulden, G. 1992. Tricholoma (Fr.) Staude. In: L. Hansen & H. Knudsen. Nordic Macromycetes 2. Copenhagen.

Huijsman, H.S. 1968. Observations sur les Tricholomataceae (1). Le groupe Tricholoma terreum sensu stricto. Schweiz. Z. Pilzk. 46: 143–153.

Karsten, P.A. 1879. Rysslands, Finlands och den Skandinaviska halföns Hattsvampar II. Helsinki.

Kost, G. 1985. '1984'. Megatricholoma nov. gen. Eine neue agaricoide Gattung mit verwandtschaftlichen Beziehungen zu Arten anderer Organisationsstufen der Homobasidiomyzeten. Sydowia 37: 53–74.

Kreisel, H. 1984. Beitrag zur Nomenklatur einiger Grosspilze II. Feddes repertorium 95 (9–10): 699–700.

Kreisel, H. (ed.) 1987. Pilzflora der Deutschen Demokratischen Republik. Jena.

Lange, J.E. 1933. Studies in the agarics of Denmark. Dansk Bot. Arkiv 8 (3): 1–47.

Lange, J.E. 1935. Flora Agaricina Danica 1. Copenhagen.

Marchand, A. 1986: Champignons du Nord et du Midi 9. Perpignan.

Mariotto, M. & I. Turetta. 1996. Una interessante nuova specie dei Colli Berici Tricholoma leucoterreum nov. sp. Revista di Micologia 39: 29–38.

Moser, M. 1983. Kleine Kryptogamenflora, Die Röhrlinge und Blätterpilze. Gustav Fischer Verlag. Stuttgart, New York.

Noordeloos, M.E. & M. Christensen. 1999. Tricholoma. In: C. Bas, Th.W. Kuyper, M.E. Noordeloos, & E.C. Vellinga (eds.) Flora agaricina neerlandica IV.

Persoon, C.H. 1801. Synopsis metodica fungorum, sistens enumerationem omnium hucusque detectarum specierum, cum brevibus descriptionibus nec non synonymis et observationibus selectis. Göttingen.

Pilát, A. 1969. Über Floccularia luteovirens (A. & S. ex Fr.) Pouz. f. alba (A.H. Smith) Pil. in Ungarn. Česka Mykol. 23: 13–14.

Pilát, A. & M. Svrček. 1946. Tricholoma heviodor, sp. n. Bohemica. Studia botanica Cechoslovaca 7: 28.

Pouzar, Z. 1957. Nova Genera Macromycetorum I. Ceska Mykol. 11: 48–50.

Richon, C. & E. Roze. 1888. Atlas des Champignons comestibles et vénéneux de la France et des pays circonvoisins. Paris.

Riva, A. 1988. Tricholoma (Fr.) Staude. Fungi Europaei 3. Saronno.

Riva, A. 1998. Il genere Tricholoma (Fr.) Staude. Revista di Micologia 41 (3): 243–266.

Romagnesi, H. 1974. Bull. trimest. Soc. mycol. Fr. 90: 166–168.

Schaeffer, J.C. 1762. Fungorum qui in Bavaria et Palatinatu circa Ratisbonam nascuntur Icones nativis coloribus expressae 1. Ratisbonae.

Scopoli, A. 1772. Flora carniolica.

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BOOKS RECEIVED BY THE RIJKSHERBARIUM LIBRARY

R. Agerer (ed.). *Colour atlas of ectomycorrhizae. Issue 2.* (Einhorn Verlag, Eduard Dietenberger GmBH, Schwäbisch Gmünd. 1997). ISSN: 1431-4819; ditto, *Issue 3.* (Einhorn Verlag, Eduard Dietenberger GmBH, Schwäbisch Gmünd. 1998). ISSN: 1431-4819. Price: unknown.

The second and third issue of this series give elaborate descriptions of the morphology, anatomy of the mantle, colour reactions with different reagents, auto-fluorescences, a list of reference specimens, discussions and references for 34 species of macrofungi, including *Tricholoma scalpturatum, Lyophyllum descastes,* Gasteromycetes *(Geastrum fimbriatum, Balsamia alba, Genea verrucosa, Hysterangium stologniferum, Leucangium carthusianum),* Aphyllophorales *(Gomphus clavatis; Bankera fuligineoalba),* and several unidentified mycorrhizae. This documentation is unique in its kind, and not only a very valuable tool for all those dealing with mycorrhizae, but it also presents new data on ecology of several mushrooms.

H.L. Barnett & B.B. Hunter. *Illustrated genera of Imperfect Fungi. Fourth edition.* (APS Press, The American Phytopathological Society, 3340 Pilot Knob Road, St. Paul, MN 55121-2097, USA. 1998.) Pp. i–xxii, 1–218, 24 black-and-white photographs, 69 illus. Price: US $ 43.

This is the fourth edition of a well-known illustrated key to the 'Fungi imperfecti', often used in elementary courses of mycology. The keys and classification used are still based on the fully artificial, but very practical and easy system proposed by Saccardo (1886, 1906) and Lindau (1900). The present authors do not believe the time has come to shift to a new system for the identification of 'form-genera' of these fungi by the student. An alternative set of keys, based on the Hughes-Tubaki-Barron system of classification, is added and uses characters primarily based on the development of the conidia. The convention by hyphomycete specialists (Kananaskis, 1969) to standardize the categories and terms to allow accurate description of the conidium ontogeny is not followed here. In this edition a new introduction is included, with several additions of new genera and 60 new references since the former edition (1972). The illustrations are about the same with some rearrangements and additions. Only the print is now much darker, leaving details in the dark parts unresolved.

T.E. Brandrud, H. Lindström, H. Marklund, J. Melot & S. Muskos. *Cortinarius Flora Photgraphica , Vol. 4.* (Cortinarius HB, Klöoverv. 13, c/o Muskos, SE-864 33 Matfors, Sweden, 1998). Price: Unknown.

This is the fourth volume of this *Cortinarius* Flora, which occurs in regular intervals (the last volume occurred in 1994). It is gratifying that this Flora still continues and can maintain its high standard. This volume presents another set of 60 colour plates, accompanied – as in former volumes – by a description of the morphology and microscopy, data on habitat, and general comments on the taxa. These new colour plates can be sorted in between the previously published plates, according to the systematic arrangement. The text contains an updated systematic arrangement of the plates, references to supplementary descriptions, addenda and corrigenda to previous volumes, nomenclatural discussions and typifications, Latin diagnoses and new combinations, a complete list of references for volume 1–4, and an updated alphabetical index of taxa. It is hoped that the series will continue this way.

R.T. Hanlin. *Illustrated genera of ascomycetes. Volume II.* (APS Press, The American Phytopathological Society, 3340 Pilot Knob Road, St. Paul, MN 55121-2097, USA. 1998.) Pp. i–viii, 1–258, 3 black-and-white photographs, 100 illus. Price: US $ 35.

This volume contains the compiled descriptions and illustrations of a series of 100 genera' of ascomycetes, additional to the 100 of the first volume, entitled 'Illustrated genera of ascomycetes', published in 1990 by the same author. The spiral-bound booklet consists for the main part of the generic descriptions and the accompanying illustrations. The genera treated are chosen rather arbitrarily from a very wide range of ascomycetes, such as yeasts, *Taphrinales*, unitunicate and bitunicate pyrenomycetes, operculate and inoperculate discomycetes, *Laboulbeniales*, and lichenized groups. Cleistohymenial plectomycetes and hemiascomycetes are not included. The arrangement is on the basis of the over a century old Saccardoan system of spore types (like hyalosporae, allantosporae, phaeosporae, hyalodidymae, phaeodidymae, etc.) and types of ascoma. This leads to a completely artificial arrangement, with e.g. a group of 'hyalosporae', including together genera like *Saccharomyces, Taphrina, Amauroascus, Bisporella, Cookeina, Cyttaria, Otidea, Cladonia, Colpoma,* etc. A dichotomous key using artificial characters is provided for the identification of the hundred genera of this second volume, without considering the genera included in the first volume. The work is meant for students with little knowledge of fungi and should provide means for easy identification. But the artificial keys and arrangement will not learn the student much about relationships and relevant structures of genera of ascomycetes. The main value of this book is in the rather consistent generic descriptions and the clear, somewhat stylized and diagrammatic illustrations. References are made mainly to handbooks and flora's, but modern monographs of the genera treated are rarely cited.

R.T. Hanlin. *Combined keys to illustrated genera of ascomycetes I & II.* (APS Press, The American Phytopathological Society, 3340 Pilot Knob Road, St. Paul, MN 55121-2097, USA. 1998.) Pp. i–v, 1–113, 3 text-figs. Price: US $ 20.

This key was necessary after the publication of 'Illustrated genera of ascomycetes' (1990) and 'Illustrated genera of ascomycetes. Volume II' (1998) by the same author; each containing descriptions and illustrations of 100 genera. Since the keys in each of the previous volumes were restricted to the hundred genera included, the author felt the need of a new key to the 200 genera of both volumes. An alternative key on more natural characters is missing. Following the key is a section containing corrections and additions to the first volume (1990). Especially nomenclatural changes and additional information is provided for the earlier descriptions. More recent references are listed. Special attention has been paid to the terminology, with three diagrams on types of spores and tissues, and a more general glossary of terms.

H.-J. Hardtke & P. Otto (Eds.). *Kommentierte Artenliste der Pilze des Freistates Sachsen. – A commented list of the fungi of Saxonia. (Myxomycota, Oomycota, Ascomycota und Basidiomycota, exclusive der lichenisierten Arten.)* (Sächsisches Landesamt für Umwelt und Geologie. Lößnitz-Druck Gmbh, Güterhofstraße 5, D-014445 Radebeul, Germany. 1998.) Pp. 1–217, 45 colour photographs. Price: DM 24.

The project for an extensive list of the fungi of Saxonia is of long standing. It started in 1916, but was interrupted several times. Most progress was made during the previous two decennia. The area covered is the German Province of Saxonia with its political boundaries of 1997. It has been subdivided in eight geographical regions. The groups of fungi included depend on the specialists available in the region. In total 3,833 species of 816 genera are listed. Especially Myxomycota (195 species), 'macromycetes' (c. 2,600 species), terrestrial Oomycota, phytopathogenic fungi (Peronosporales, Erysyphales, Uridinales, Ustilaginales), and many orders of Pyrenomycetes are included. 'Micromycetes', Fungi imperfecti, and lichens are omitted. The list is based on numerous field trips and publications on the local myco-flora. The mycological collections of the herbaria of Dresden, Görlitz, and Leipzig are screened. The historical herbarium collection of K.W. Krieger (1885–1919) 'Fungi Saxonici' is incorporated in the present work. Many mycologists collected extensively in Saxonia and published on its fungi, e.g. B. Auerswald, J.B. von Albertini & L.D. von Schweinitz, E.H. Benedix, D. Benkert, R. Buch, P. Dietel, W. Dietrich, H. Dörfelt, I. Dunger, P. Ebert, O. Frömelt, H.-J. Hardtke, K. Herschel, H. Kreisel, K.W. Krieger, P. Otto, E. Pieschel, L. Rabenhorst, R. Rauschert, and P. Sydow. For each species listed the following information is given: the correct name, important synonyms, frequency, habitat, geographical region(s) within Saxonia, localities with geometrical grid, and eventual literature references. Of taxa described as new from Saxonia reference is made to the type and the type locality. It is a thorough mycological inventory of an important part of central Europe. From the literature consulted and the names used it can be concluded that the main part was already finished about ten years before publication.

L. Krieglsteiner. *Pilze im Naturraum Mainfränkische Patten und ihre Einbindung in die Vegetation.* (Regensburger Mykologische Schriften 9 (1) and 9 (2), Regensburgische Botanische Gesellschaft, Regensburg. 1999.) Pp. 905, 40 coloured pls., 74 text-figs. Price: DM 92.

This voluminous publication is based on an inventory of 100 permanent plots in the nature area of the Main-frainconian plates in NW Bavaria. During this research project almost 2,500 species of Fungi and Myxomycetes were found and their ecology, in particular their relations to the 42 investigated plant associations, were studied.

About 100 pages of the first volume are filled with an enumeration of the plant communities studied and the Fungi and Myxomycetes found in them: the last two grouped according to the substrate. The main body (about 700 pages) of this work consists, however, of an annotated list of the Fungi and Myxomycetes found in the area with detailed notes on their localities and habitats. Another list is added of Fungi arranged according to host and special habitats. The coloured photographs depict mostly rare species.

This work offers a wealth of autecological and synecological information on the elements of a very rich mycoflora of an area in southern Germany.

M. Sarnari. *Monografia illustrata del genere Russula in Europa. Tomo primo.* (Associazione micologico Bresadola, Trento. 1998.) Pp. 800, appr. 200 coloured photographs. Price: LIT 100.000.

The first volume of this monograph is an impressive hard-cover book with a large number of very high quality, well-reproduced photographs. It is the first European monograph on the genus *Russula* since the magistral work of Romagnesi (1967). The book gives an extensive introduction on the characters of the genus, including 25 (!) pages on ecology, and a long discussion on the infrageneric taxonomy. The taxonomic part gives keys and descriptions of about 100 taxa, with discussions, coloured photographs and microscopical drawings of high quality. The nomenclature is brought up to date with the help of the French specialist G. Redeuilh. References are not given, and will be listed in the second and final part of the monograph. The keys are not always strictly dichotomic, and in quite a few cases the couplets are not clearly giving opposite character states, which makes identification sometimes difficult. However, the long and detailed descriptions and good illustrations facilitate identification. Species concepts seem to be rather large, in contrast to those of some contemporary French authors (Bon, Reumaux). The conclusion is that we have a very good modern European monograph with this work of Sarnari, that is highly recommended, although the Italian language may form a difficulty for many users. Fortunately the keys are also given in English. It is recommended that the author gives an extensive English summary in the second volume of this series, which will certainly increase the number of users. We look forward to volume 2.

Plate 1. *Tricholoma album* (epitype). Photograph by M. Christensen.

Plate 2. *Tricholoma stiparophyllum* (neotype). Photograph by M. Christensen.

Plate 3. *Tricholoma sulphurescens*. Coll. MEN 95086. Photograph by M.E. Noordeloos.

Plate 4. *Tricholoma sulphurescens*. Coll. MEN 95086. Photograph by M.E. Noordeloos.

Plate 5. *Tricholoma lascivum* (neotype). Photograph by M. Christensen.

Plate 6. *Tricholoma triste*. Coll. MEN 96113. Photograph by M.E. Noordeloos.

Plate 7. *Tricholoma terreum.* Coll. MC 95-119. Photograph by M. Christensen.

Plate 8. *Tricholoma terreum.* Coll. MC 96-223. Photograph by M. Christensen.

Plate 9. *Tricholoma argyraceum* var. *inocybeoides*. Coll. MC 95-171. Photograph by M. Christensen.

Plate 10. *Tricholoma equestre* var. *populinum* (holotype). Photograph by M. Christensen.

Plate 11. *Coprinus bicornis*. Coll. *Uljé 1232*.

Plate 12. *Coprinus bicornis*. Coll. *Uljé 1232*.

Plate 13. *Agaricus rufotegulis*. Fruit-bodies (holotype). Photograph by J. Wisman.

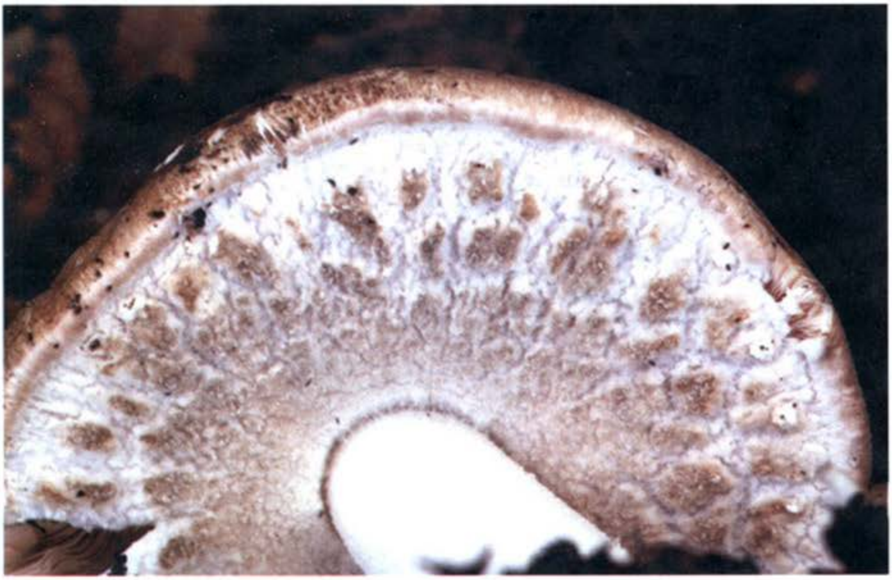

Plate 14. *Agaricus rufotegulis*. Detail of annulus (holotype). Photograph by J. Wisman.

Plate 15. *Amanita dryophila*. Coll. *Consiglio 97020*.

Plate 16. *Amanita dryophila*. Coll. *Consiglio 94025*.

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