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TAXONOMICAL NOTES ON MACROFUNGI IN ROADSIDE VERGES PLANTED WITH TREES IN DRENTHE (THE NETHERLANDS) – II

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In the second part of this study special attention is paid to the genera *Hebeloma, Psathyrel la* and *Russula. Psathyrella rhombispora* is described as a new species. *Russula cicatricata* Romagn., *R. elaeodes* (Bres.) Romagn. and *R. purpurata* Crawsh. are reduced to formae of *R. graveolens* Romell. in Britz.

This paper is a continuation of an earlier paper (Keizer & Arnolds, 1994). It presents descriptions, drawings and observations of rare, critical or less well-known macromycetes that were encountered during mycocoenological investigations carried out in road-side verges planted with *Quercus robur* (53 plots) or *Fagus sylvatica* (23 plots). For further details on the scope of this study, the reader is referred to the first part of this paper (Keizer & Arnolds, l.c.).

MATERIAL AND METHODS

The fungi dealt with in this study comprise the Macrofungi. Groups with relatively small or hidden fruit-bodies (e.g. the majority of the Helotiales, resupinate Aphyllophorales) have been omitted because a complete inventory would require a much more time consuming search strategy. The following groups have been included: Basidiomycetes: Agaricales; Gasteromycetes; non-resupinate Aphyllophorales and Heterobasidiomycetes. Ascomycetes: Clavicipitales: *Cordyceps*; Elaphomycetales: *Elaphomyces*; Helotiales: *Geoglossum, Leotia*; Pezizales: *Helvellaceae, Pezizaceae, Tuberaceae*; Deuteromycetes: *Paecilomyces*.

The nomenclature of the Basidiomycetes is mainly after Kreisel (1987) or Arnolds (1984) if species are not mentioned in the former work. The nomenclature of the smooth spored species of the genus *Inocybe* is after Kuyper (1986) and of the genus *Psathyrella* after Kits van Waveren (1985). Ascomycetes are after Cannon et al. (1985) and Deuteromycetes after Arnolds (l.c.).

Full understanding of mycocoenological studies is often hampered by the absence or incompleteness of descriptions of critical taxa. Therefore, descriptions and/or critical notes are given in this paper of rare and critical taxa and of collections, which disagreed with descriptions in literature. This criterion has been taken in a rather broad sense. The

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Table I. List of plots.

Survey of the plots where the described species originate. All plots are situated in the province Drenthe, the Netherlands, except the plots F15 and Q5, which lie in the province Friesland.
F = roadside verge planted with Beech; Q = roadside verge planted with Common Oaks; Age = age of trees (in 1988); Exp. means exposition of the plot: + = in open landscape, ± = half shady, – = shady; Pav. refers to the pavement of the roads: A = asphalt, B = bricks, N = no pavement.

Plot	Municipality	Near village	Coordinates on the topographic map	Local name	Age of trees	Exp.	Pav.	Description of the vegetation
F11	Peize	Altena	227,3–571,6	Lieverseweg	58	+	B	poor grassland
F12	Rolde	Deurze	237,5–556,7	Rolder Hoofdweg	78	+	A	mod. poor grassl.
F13	Beilen	Wijster	232,2–537,1	Bruntingerweg	37	+	A	mod. poor grassl.
F14	Beilen	Bruntinge	234,7–536,5	Hamweg	37	+	A	poor grassland
F15	Ooststellingwerf	Wateren	219,7–548,2	Bosweg	51	+	A	poor grassland
F16	Diever	Wateren	217,4–546,3	Oude Willem	51	+	A	mod. poor grassl.
F17	Anloo	Annen	244,7–563,7	Anlooerweg	54	+	A	poor grassland
F21	Vries	Rhee	234,4–561,4	N 870	66	+	A	mod. rich grassl.
F22	Sleen	't Haantje	252,6–537,5	Slenerweg	63	+	A	mod. rich grassl.
F23	Anloo	Annen	244,8–563,7	Eexterweg	61	+	A	rich grassland
F24	Peize	Peize	229,5–573,5	Zuurse weg	57	+	B	mod. rich grassl.
F25	Odoorn	Klijndijk	253,1–539,1	Odoornerzijtak	41	+	A	rich grassland
F31	Havelte	Havelte	211,7–531,2	Linthorst-Homanlaan	140	–	B	poor woodland
F32	Diever	Diever	217,9–542,1	Bosweg	55	–	B	poor woodland
F33	Gasselte	Gieten	246,3–555,5	Houtvester Jansenweg	66	–	A	± absent
F34	Anloo	Eext	245,6–561,6	Annerweg	81	–	A	poor woodland
F35	Eelde	Eelde	235,7–572,5	Hooghullen	70	–	A	rich woodland
F36	Odoorn	Klijndijk	253,4–539,3	Odoornerzijtak	41	–	A	rich woodland
F40	Ruinen	Hoogeveen	228,6–529,7	Spaarbankbos	44	–	N	poor woodland
F41	Gasselte	Gieten	245,3–557,6	Gieterveld	69	–	N	poor woodland
F42	Havelte	Havelte	211,7–531,2		72	–	N	± absent
F43	Eelde	Eelde	245,2–557,4	Hooghullen	82	–	N	mod. rich woodl.
F44	Roden	Roden	225,1–571,1	Mensingebosch	81	–	N	± absent
Q1	Sleen	Schoonoord	247,8–541,2	Oranjekanaal Z.Z.	100	+	A	poor grassland
Q2	Westerbork	Zwiggelte	235,5–545,0	Oranjekanaal N.Z.	100	+	A	poor grassland
Q3	Westerbork	Zwiggelte	236,2–545,0	Oranjekanaal Z.Z.	100	+	A	poor grassland
Q4	Anloo	Gieten	243,5–557,2	Gieterstraat	110	+	A	poor grassland
Q5	Ooststellingwerf	Wateren	219,7–548,0	Oude Willem	55	+	A	poor grassland
Q6	Vledder	Frederiksoord	209,0–540,1	Vledderweg	91	+	A	poor grassland
Q11	Assen	Deurze	236,9–556,6	Rolder Hoofdweg	113	+	A	poor grassland
Q12	Diever	Wateren	215,4–547,2	Waterenweg	130	+	B	mod. poor grassl.
Q13	Roden	Foxwolde	226,3–574,7	Roderwolderweg	114	+	B	mod. poor grassl.
Q14	Vledder	Vledder	209,9–541,1	Vledderweg	91	+	A	poor grassland

Plot	Municipality	Near village	Coordinates on the topographic map	Local name	Age of trees	Exp.	Pav.	Description of the vegetation
Q21	Assen	Deurze	236,6–556,6	Rolder Hoofdweg	113	+	A	rich grassland
Q22	Westerbork	Westerbork	236,5–541,5	Zwiggelterstraat	98	+	A	mod. rich grassl.
Q23	Ruinen	Pesse	225,3–532,2	Eursinge	112	+	A	rich grassland
Q24	Ruinen	Kraloo	225,5–533,8	Kralooerweg	70	+	A	rich grassland
Q26	Sleen	't Haantje	252,5–537,5	Oranjekanaal Z.Z.	116	+	A	rich grassland
Q31	Beilen	Ter Horst	230,9–540,1	Ter Horst	41	+	B	poor grassland
Q32	Odoorn	Odoornerveen	251,9–538,5	Odoornerzijtak	68	+	A	poor grassland
Q33	Beilen	Drijber	234,0–534,5	De Hullen	25	+	A	mod. poor grassl.
Q34	Odoorn	't Haantje	252,6–537,5	Oranjekanaal N.Z.	26	+	N	mod. poor grassl.
Q35	Peize	Altena	227,8–572,6	Hooghaar	47	+	B	poor grassland
Q36	Beilen	Klatering	232,9–543,5	Klatering	15	+	A	mod. poor grassl.
Q37	Beilen	Klatering	233,0–543,5	Klatering	15	+	A	mod. poor grassl.
Q38	Diever	Dieverbrug	218,6–540,6	Dieverbrug	10	+	A	poor grassland
Q39	Beilen	Beilen	234,6–544,0	Eursing	12	+	A	mod. rich grassl.
Q41	Beilen	Wijster	231,6–538,8	Beilerweg	48	+	A	mod. poor grassl.
Q42	Odoorn	Odoornerveen	248,8–540,8	Oranjekanaal N.Z.	32	+	A	mod. poor grassl.
Q43	Beilen	Wijster	230,5–537,6	Looveen	32	+	N	poor grassland
Q44	Beilen	Hooghalen	232,6–548,2	Stationsstraat	34	+	A	mod. poor grassl.
Q45	Beilen	Wijster	231,3–537,1	Boerkoelweg	35	+	B	mod. rich grassl.
Q46	Beilen	Wijster	231,8–536,9	Marsweg	35	+	B	mod. rich grassl.
Q51	Zweeloo	Witteveen	241,5–536,0	Bosweg	48	+	B	mod. poor grassl.
Q52	Odoorn	Odoornerveen	251,5–538,9	Torenweg	23	+	A	rich grassland
Q53	Sleen	Noordsleen	249,9–534,8	Middelesweg	28	+	A	rich grassland
Q54	Dwingeloo	Dwingeloo	222,3–538,1	Lheeweg	15	+	A	rich grassland
Q61	Zweeloo	Schoonoord	246,3–540,2	Oranjekanaal Z.Z.	116	–	B	rich grassland
Q62	Dwingeloo	Lheebroek	226,5–539,8	Lheebroek	76	–	B	mod. poor grassl.
Q63	Havelte	Havelte	210,9–531,3	Busselterweg	146	–	B	rich grassland
Q64	Havelte	Havelte	212,1–531,6	Overcingelaan	85	–	B	rich grassland
Q65	Anloo	Gieten	243,9–557,4	Gieterstraat	110	–	A	mod. poor grassl.
Q71	Zweeloo	Schoonoord	245,9–540,0	Oranjekanaal N.Z.	116	–	A	rich grassland
Q72	Westerbork	Zwiggelte	236,8–545,0	Oranjekanaal N.Z.	100	–	A	mod. poor grassl.
Q73	Havelte	Havelte	210,6–531,3	Busselterweg	125	–	B	mod. rich grassl.
Q74	Roden	Alteveer	225,3–570,3	Melkweg	106	–	A	mod. poor grassl.
Q81	Ruinen	Pesse	224,9–532,1	Leeuwte	110	–	A	ruderal
Q82	Assen	Assen	235,4–556,9	Steendijk	110	–	B	mod. rich grassl.
Q83	Roden	Roden	225,6–571,6	Mensingeweg	97	–	A	mod. rich woodl.
Q84	Anloo	Gieten	243,6–557,3	Gieterstraat	100	–	A	poor woodland
Q85	Havelte	Havelte	212,1–531,3	Van Helomaweg	140	–	A	rich grassland
Q87	Havelte	Havelte	212,1–530,8	Boskampsbrugweg	143	–	B	mod. rich woodl.
Q88	Ruinen	Rheebruggen	216,9–553,2	Rheebruggen	114	–	B	mod. poor woodl.
Q92	Havelte	Havelte	211,6–530,0		144	–	N	poor woodland
Q93	Ruinen	Hoogeveen	228,6–529,9	Spaarbankbos	105	–	N	poor woodland
Q94	Roden	Roden	225,4–571,5	Mensingebosch	102	–	N	poor woodland

reason for this is in the first place to provide a reference for some names used in the myco-coenological work and secondly to present the rate of disagreement with the current literature of some names that were accepted.

In the descriptions the following abbreviations of colour-codes have been used: Expo for Cailleux & Taylor (1958), K&W for Kornerup & Wanscher (1978) and Mu for Munsell Color Company (1954).

In the microscopic descriptions Q indicates the length/width ratio of the spores and av. Q the average of Q usually based on 10 spores per collection. In the figures the habit sketches are 0.8 × the natural size; in the microscopic drawings the bar always represents 10 µm. All collections mentioned below are made in the selected plots and deposited in the herbarium of the Biological Station in Wijster (WBS), part of the Agricultural University Wageningen. For each collection the plot number is given, where it originates. This refers to Table I, where the exact place and some brief ecological notes of the plots are listed.

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I. AGARICALES (continued)

Hebeloma (Fr.) Kumm.

"Il n'est pas de genre où la taxonomie des espèces soit plus embrouillée. C'est un véritable chaos." (Favre, 1960). It seems that little has changed since, despite recent revisions of the genus (Bruchet, 1970; Boekhout, 1982). The taxa that could be distinguished in the present material agreed rather well with the concepts of Boekhout (l.c.), which, for the time being, have been adopted. Particularly the taxa which belong to the species complex *H. crustuliniforme* sensu lato are difficult to separate (see there). The extremes in this complex are widely different, but most of the differentiating characters are not correlating in many less typical collections.

Hebeloma anthracophilum Maire — Fig. 1

Pileus 6–25 mm, convex to plano-convex, sometimes umbonate, when young with involute margin, pale pinkish brown (Expo C56), paler towards the margin. Lamellae 1–1.5 mm broad, moderately crowded, ventricose, narrowly adnate, purplish grey-brown, with white-floccose edge. Stipe 20–35 × 1.5–3.0 mm, cylindrical, at base slightly rooting, narrowly fistulose, apex cream-coloured, downwards brownish, at base dark brown, at apex white-floccose, downwards glabrous. Context in pileus and apex of stipe white, downwards in stipe darker brown. Smell faint to absent, taste unknown.

Spores (9.3–)9.5–10.3(–11.2) × (4.7–)4.9–5.9(–6.1) µm, Q = 1.7–2.0(–2.1), av. Q = 1.72–2.00, ellipsoid-subamygdaliform with loose exosporium, enveloping the complete spore, except for the hilar appendage; inner sporewall (epispore) thick-walled, with coarse

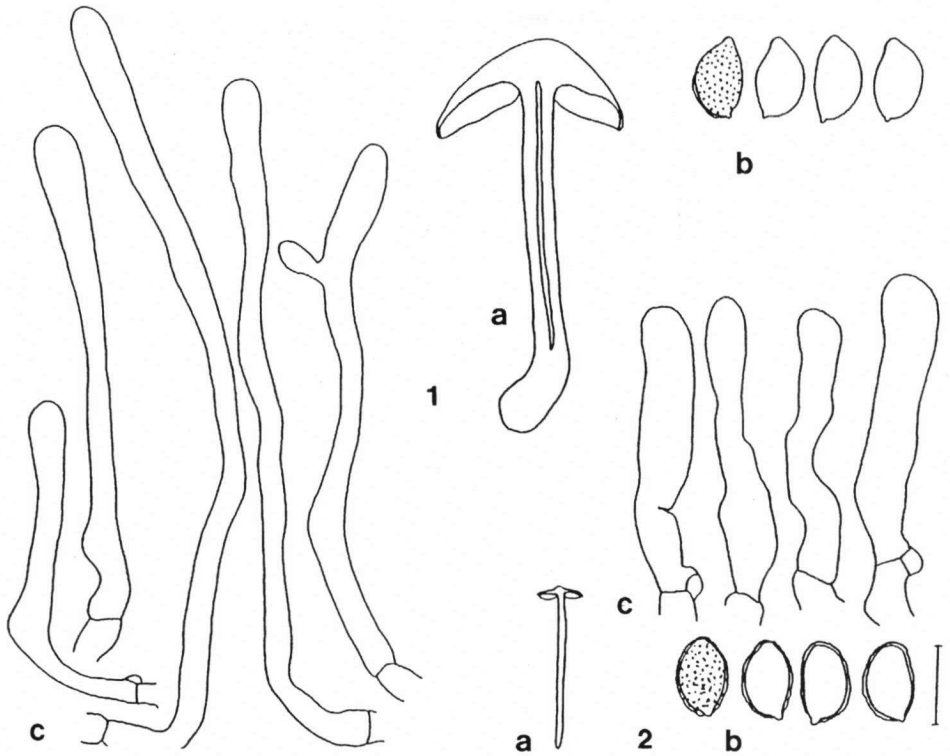

Fig. 1. *Hebeloma anthracophilum*. a. Habit; b. spores; c. cheilocystidia (*88268*). — Fig. 2. *Hebeloma crustuliniforme*. a. Habit; b. spores; c. cheilocystidia (*88201*).

roundish or irregularly shaped warts, rather dark brown under the microscope. Cheilocystidia 30–40 × 4–6 µm, more or less cylindrical, not or hardly enlarged at base or apex, thin-walled.

Habitat – Terrestrial in roadside verges planted with *Quercus* on nutrient-poor sandy soil.

Collections examined. Plot Q93, 30 Oct. 1987, *Keizer 87268*; Odoorn, Odoornerveen, 13 Oct. 1987, *Keizer 87338*; 31 Oct. 1989, *Keizer 89100*.

Hebeloma anthracophilum shows much resemblance with *H. spoliatum* in the microscopical characters. Macroscopically, the distinctly rooting stipe and more uniformly red-brown pileus of the latter are characteristic. We agree with Boekhout (1982) in considering *H. calyptrosporum* Bruchet synonymous with *H. anthracophilum*. The only differences mentioned by Bruchet (1970) are the habitat (growing on burnt places or not) and the stipe turning brownish with age or not. Differences in habitat alone cannot serve as distinguishing characters and a discolouring of the stipe with age is so common in the genus *Hebeloma* that it is certainly not sufficient to distinguish taxa on the level of species, if it is of any use at all.

Hebeloma crustuliniforme *sensu lato*

It appeared to be difficult to identify *Hebeloma* species of the group of *H. crustuliniforme* (± section *Denudata* (Fr.) Sacc.). This group as a whole is characterized by carpophores without veil, with long (± 50–100 µm), narrowly clavate to capitate cheilocystidia and amygdaliform spores with at most partially loosening perispore.

In order to separate taxa in a more or less objective way, groups have been distinguished in the 30 available collections, following the method described by Arnolds (1974): the groups were distinguished on the basis of characters that will be mentioned below, independent from previous species concepts in the literature. Subsequently, these groups were compared with taxa (species) described in literature. The advantage of this method is that individual collections are not 'forced' to match the description of a certain taxon. The following characters have been used: 1) habit, i.e. size and shape of the fruit-body; 2) colour of the pileus; 3) stipe hollow or not; 4) lamellae weeping at the edge or not, droplets watery or milk-white; 5) size and shape of the cheilocystidia; 6) size and shape of the spores; type of ornamentation; loosening of the perispore or not; reaction with Melzer's reagent; 7) smell.

The characters 3 and 4 appeared to be too variable, even within collections, to be useful, although they are considered by some authors as rather important (e.g. Bruchet, 1970; Moser, 1978, 1992; Vesterholt, 1992). In general, the stipe tends to become hollow as the sporocarp ages. Moreover, slender carpophores tend to have less often hollow stipes. Also the formation of droplets at the edge of the lamellae appears to be age-dependent (old specimens cease guttation) and varies with weather conditions. Dry weather hampers the excretion of liquid. This liquid can turn milky white after some time, which again makes the character dependent of the moment of collecting of the fruit-body. Vesterholt (1992) considers the degree of browning in the course of sporocarp development of taxonomic importance. In our opinion its use offers difficulties in practice as sporocarps of the same age must be compared, which are often not available.

Because mycocoenologists, unlike taxonomists, are often forced to study fruit-bodies in far from optimal conditions, most value has been assigned in this study to microscopic characters, assuming that they are less influenced by external factors than macromorphological characters. In our opinion, the characters of weeping lamellae and the presence of a cavity in the stipe as well as the density of the white floccose squamules covering the stipe, discussed in Boekhout (1982), together with so-called ecological characters, have been overestimated in literature, thus contributing to the confusion in this group.

On the basis of the shape and size of the cheilocystidia three groups could be distinguished with a) cheilocystidia rather short, e.g. 40–60 µm, the majority slenderly clavate with somewhat ventricose base, frequently with (sub)capitate apex; b) cheilocystidia 40–80 µm long, except for the very short ones (< 40 µm, always present together with the longer cystidia) usually not ventricose but with more or less parallel walls near the basis, very gradually broadening towards the apex; apex frequently furcate or more or less irregularly shaped; c) cheilocystidia up to 100 µm long, not ventricose near the base, hardly broader towards the apex to slenderly clavate, or a minority of the cystidia irregularly capitate. These groups were identified as *H. helodes*, *H. longicaudum* and *H. crustuliniforme* ss. str. respectively.

Some of the above-mentioned characters correlated rather well with the different form and size of the cheilocystidia.

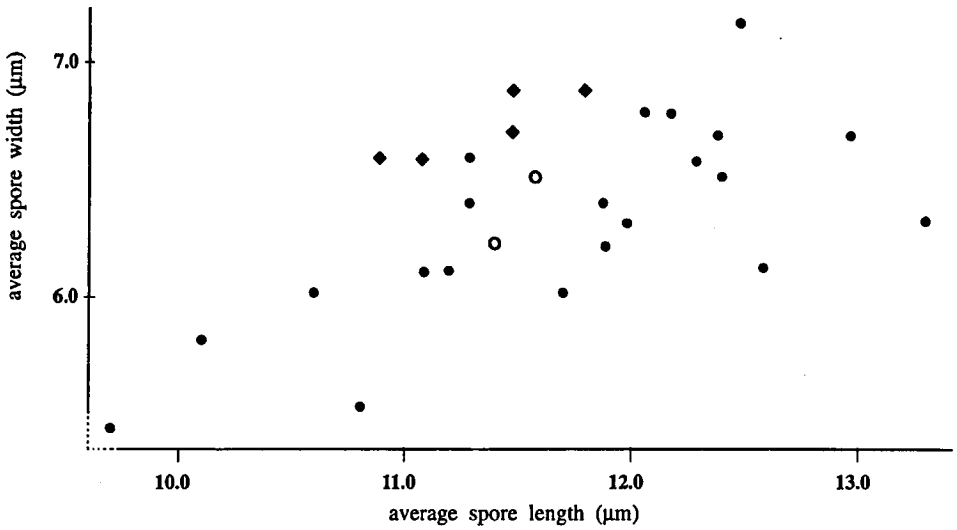

Fig. 3. Scatterdiagram of spore-sizes in *Hebeloma* species. Length (horizontal) and width (vertical) of spores of *H. helodes* (●), *H. longicaudum* (◆), and *H. crustuliniforme* s.str. (o). Each symbol represents the average values of 10 spores of one collection.

1) Habit of the fruit-body: *Hebeloma crustuliniforme* ss.str. has large and relatively thick-set carpophores, with context in the pileus relatively thick (up to more than 10 mm in centre) and with thick stipe (over 6 mm, near base over 10 mm thick). *Hebeloma helodes* and *H. longicaudum* generally have smaller pilei and more slender stipes.

2) Colour of the pileus: *H. crustuliniforme* has a ± uniform pale brown or alutaceous pileus; the other two species usually have a darker reddish brown centre contrasting with a pale margin.

6) Size and shape of the spores: *H. longicaudum* has relatively broad spores with av. Q = 1.56–1.71, whereas *H. crustuliniforme* and *H. helodes* have more slender spores with av. Q = (1.69–)1.72–1.92(–2.14) respectively (Fig. 3).

Differences in consistence of the stipe (3), weeping of lamellae (4) and smell (7) did not correlate with the size and shape of the cheilocystidia; all specimens had a raphanoid smell. The differences in characters of the spores (6) other than size and shape, such as type of ornamentation, colour (under the microscope), loosening of the outer spore-wall and differences in dextrinoid reaction with Melzer's reagent, described by Boekhout (l.c.), Bruchet (l.c.) and Vesterholt (l.c.), could not be confirmed by the study of the present material.

Hebeloma crustuliniforme comes closest to *H. helodes*. Robust carpophores of the latter with long cystidia can only be separated from the former by the darker and contrasting centre of the pileus, and this hardly warrants a distinction on specific level. It seems, however, that this problem occurs in only a minority of the collections. For further details, see descriptions of the individual species.

Hebeloma crustuliniforme (Bull.) Quél. sensu Boekhout — Fig. 2

Pileus 38–80 mm, convex, then expanding, at centre pale beige yellowish (Expo A62), towards the margin gradually paler (A61), viscid when moist, with age turning dirty ochre yellowish. Lamellae ± 6 mm broad, moderately distant, narrowly adnate, pale brown to pale purplish brown, with white-floccose edge, without droplets. Stipe 70 × 6 mm, cylindrical but at the base enlarged up to 10 mm broad, whitish with white floccose squamules, mainly in the apical part, narrowly fistulose. Context whitish. Smell raphanoid.

Spores (9.5–)9.7–10.5(–10.6) × 5.5–5.9(–6.0) µm, Q = 1.6–1.8, av. Q = 1.75, often with loosening perispore (not at apex), therefore seemingly thick-walled, rather coarsely verrucose; pale yellowish brown under microscope, not discolouring in Melzer's reagent. Cheilocystidia 50–100 × 2.5–3 µm, long, slender, more or less cylindrical, slightly enlarged in the apical part, up to 6 µm broad, the short ones somewhat ventricose near the base, the long ones with parallel walls throughout.

Habitat – Terrestrial in a roadside verge planted with *Fagus* on nutrient-poor sandy soil.

Collection examined. Plot F41, 28 Oct. 1988, *Keizer 88201*.

This collection has been named *Hebeloma crustuliniforme* on account of the long (up to 100 µm) cheilocystidia, the more or less uniformly coloured, pale pileus and the rather robust habit of the carpophores. The species is accepted here in the sense of Boekhout (1982) and not in the sense of Bruchet (1970). Their interpretations of *H. crustuliniforme* differ in the range of the length of the cystidia: 40–60(–70) × 4(–5) µm according to Bruchet (l.c.) and 35–95 × 2–9 µm according to Boekhout (l.c.). *Hebeloma crustuliniforme* ss. Bruchet (l.c.) possibly represents *H. longicaudum*.

Hebeloma helodes J. Favre — Figs. 4–6

Synonym: *Hebeloma fragilipes* Romagn., *H. oculatum* Bruchet, *H. velutipes* Bruchet, *H. helodes* var. *capitatum* prov. Boekhout.

Pileus 20–100 mm, convex, soon expanding, finally sometimes somewhat depressed, with centre orange to brown-yellow or reddish ochre-brown (Expo B56, C64, E52, D58, E32, E54, C-B56, C46), paler towards the margin, pinkish beige (B52, A21-22, C63), viscid when moist. Lamellae up to 7 mm broad, moderately to slightly crowded, sometimes ventricose, narrowly adnate or emarginate, rather pale brownish, 'caramel'-coloured, pale 'café-au-lait' (B32, C64), with white-floccose edge, sometimes guttating hyaline droplets or with brown spots (aggregations of spores where drops have evaporated), but frequently no trace of guttation visible. Stipe 40–100 × 3–12 mm, cylindrical or with somewhat broader base, mostly fistulose with a narrow or wide cavity, in the latter case with a hanging strand in the cavity, sometimes stuffed, whitish or cream-coloured, on handling dirty pale brown, white-floccose, mainly at the apex. Context in the pileus with a grey watery zone above the gills, in the stipe white. The smell is weakly or distinctly raphanoid.

Spores (9.0–)10.5–13.3(–14.8) × (5.0–)5.6–7.0(–7.7) µm, narrowly amygdaliform, Q = (1.5–)1.7–2.1(–2.4), av. Q = (1.69–)1.72–1.92(–2.14), perispore (in ammonia

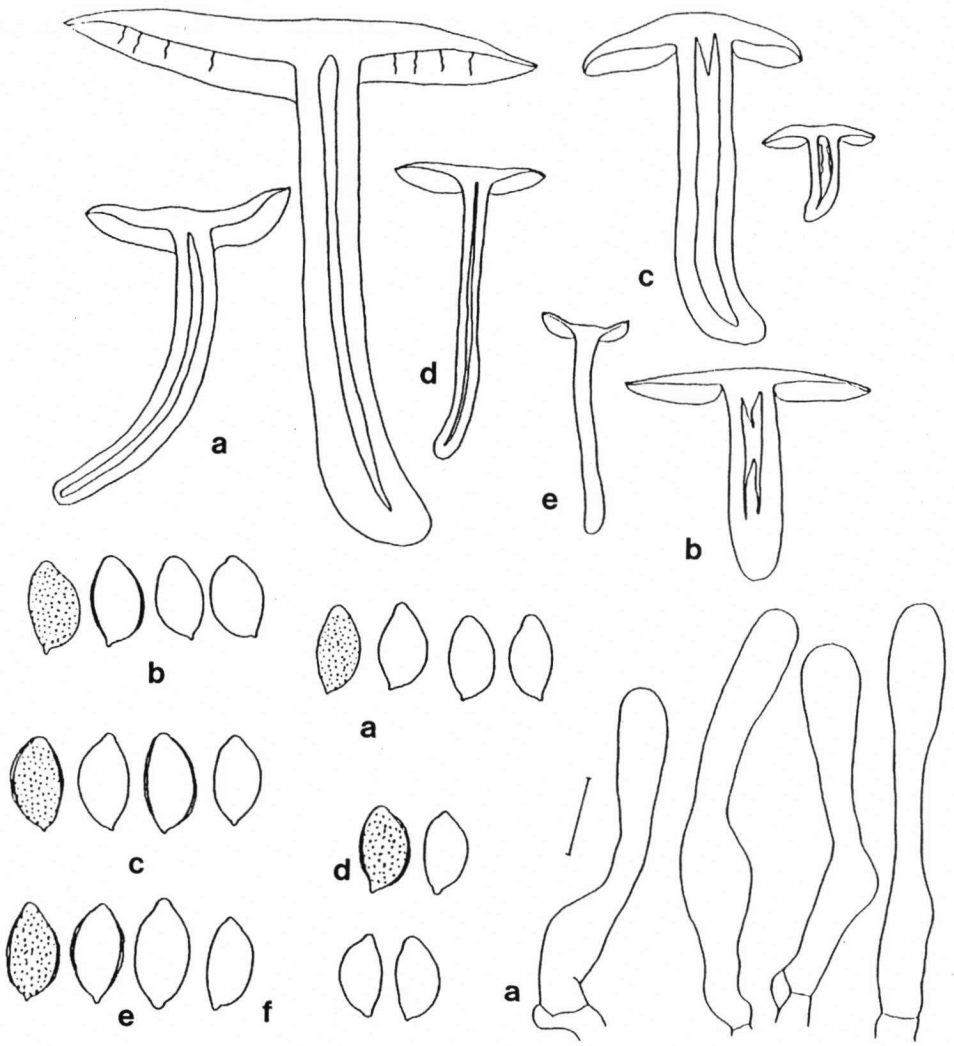

Fig. 4. *Hebeloma helodes*. Habit, spores, and cheilocystidia (a: *87313*; b: *87126*; c: *88120*; d: *87255*; e: *86173*; f: *86276*).

10%) often loosening in part of the spores, not so at the apex, sometimes with some hyaline blisters, usually with fine warts, the biggest spores often with only weak ornamentation, no dextrinoid rection in Melzer's reagent. Cheilocystidia 30–70(–90) × (2–)3–8(–16) µm, ventricose at the base, apical part clavate to (frequently) capitate, usually thin-walled.

Habitat – Terrestrial in roadside verges planted with *Fagus* or *Quercus* on nutrient-poor or enriched sandy soil, often very near the paved road surface.

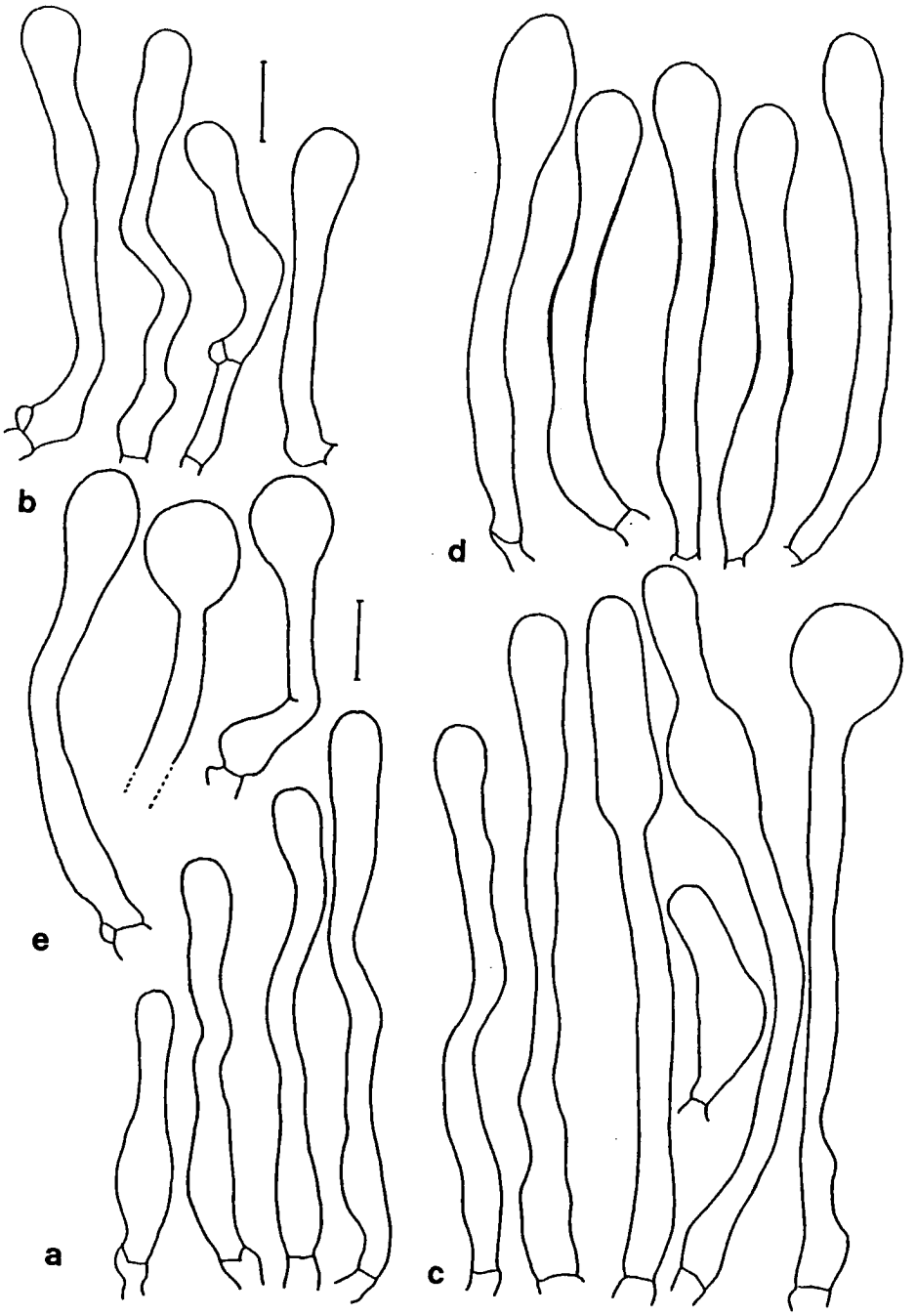

Fig. 5. *Hebeloma helodes*. Cheilocystidia (a: *86276*; b: *87126*; c: *88120*; d: *87255*; e: *86173*.).

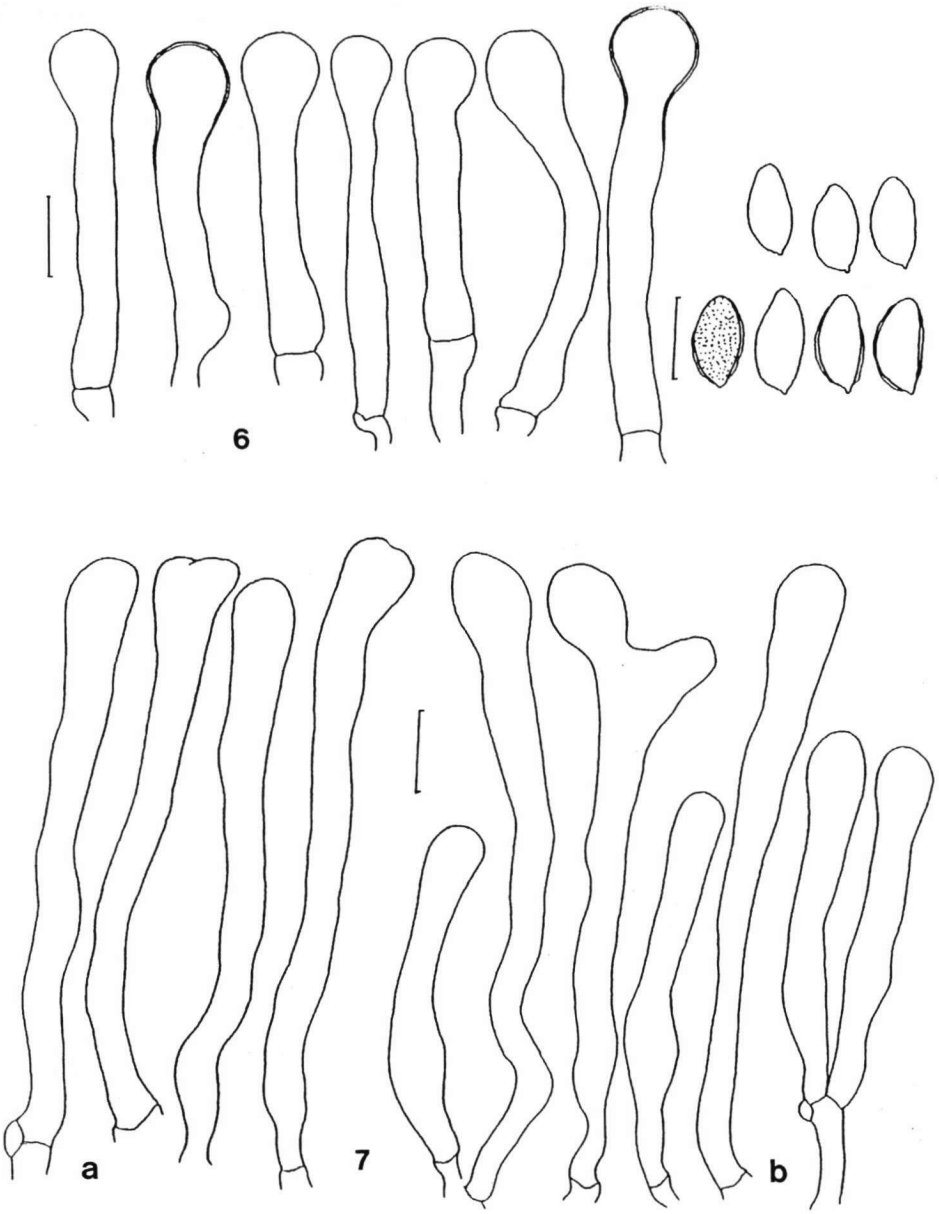

Fig. 6. *Hebeloma helodes*. Cheilocystidia and spores (*J. Favre, GK 7721*, 29 Sept. 1940, Haut Marais des Pleiades, Switzerland, G). — Fig. 7. *Hebeloma longicaudum*. Cheilocystidia (a: *88123*; b: *86172*).

Collections examined. Plot F14, 30 Oct. 1987, *Keizer 87313*; Plot F15, 26 Aug. 1987, *Keizer 87126*; Plot F16, 13 Nov. 1986, *Keizer 86232*; Plot F21, 30 Oct. 1986, *Keizer 86192*; 19 Nov. 1986, *Keizer 86260*; 24 Sept. 1988, *Keizer 88120*; Plot F24, 22 Sept. 1987, *Keizer 87181*; 3 Nov. 1987, *Keizer 87255*; Plot F41, 4 Sept. 1987, *Keizer 87123*; Plot Q2, 13 Oct. 1988, *Keizer 88223*; Plot Q11, 19 Nov. 1986, *Keizer 86259*; *Keizer 86273*; Plot Q26, 18 Sept. 1986, *Keizer 86155*; Plot Q33, 20 Oct. 1986, *Keizer 86173*; 22 Oct. 1988, *Keizer 88308*; Plot Q35, 10 Sept. 1986, *Keizer 86141*; 24 Oct. 1986, *Keizer 86189*; 10 Nov. 1986, *Keizer 86231*; 7 Oct. 1988, *Keizer 88157*; Plot Q43, 29 Sept. 1986, *Keizer 86112*; Plot Q83, 8 Sept. 1988, *Keizer 88175*; Odoorn, Odoornerveen, 1 Nov. 1988, *Keizer 88257*.

For an evaluation of the differences of this species with *Hebeloma longicaudum* and *H. crustuliniforme*, see the discussion under the *H. crustuliniforme* group.

Typically, the cheilocystidia of *H. helodes* are rather short and slender. Other types of cheilocystidia have been encountered in several collections: 1) Cystidia up to 60 µm long, clavate and frequently with thickened walls in the middle part. This variant is identical with *H. fragilipes* Romagn., which was regarded by Boekhout (1982) as a variety of *H. helodes* (Fig. 4d). 2) Cystidia long and slender (up to 90–100 µm), only slightly clavate. This variant is identical with *H. oculatum* Bruchet and was regarded by Boekhout (l.c.) as a form of *H. helodes*. 3) Cystidia in addition to the typical ones broadly clavate to capitate, with heads up to 12(–16) µm broad; distinguished by Boekhout (l.c.) as *H. helodes* var. *capitatum* prov. Until the study of extensive material shows the contrary, we consider these as taxonomically insignificant variants.

Bruchet (1970) used the name *H. velutipes* for the present species. He apparently did not know *H. helodes* J. Favre because he did not mention it explicitly. Two collections of *H. helodes* J. Favre, one of them being the lectotype (collection *G.K. 9139,* 30 Aug. 1939, Tourbière du sentier, Herb. G.), the other collected and identified by the author (collection *G.K. 7721,* 29 Sept. 1941, Haut Marais des Pleiades, Herb. G.), have been studied here in order to compare some of the microscopic characters (Fig. 5). The spores differed somewhat between the two collections, and were (9.3–)9.6–10.0(–10.7) × (4.9–)5–5.5(–5.7) µm, Q = 1.7–1.9, av. Q = 1.8 and (10.4–)10.5–11.7(–12.5) × (5.3–)5.4–5.9(–6.0) µm, Q = 1.9–2.1, av. Q = 2.0 respectively, narrowly amygdaloid, perispore loosening in part of the spores, ornamentation consisting of fine warts, pale brown in ammonia 10%. Cheilocystidia 35–65 × 4–5 µm, in majority cylindrical with more or less capitate apex, 7–11 µm wide, sometimes slightly ventricose at the base, some slightly thick-walled. These collections show in our opinion sufficient similarities with the collections described here to justify the name *H. helodes*. Consequently we consider *H. velutipes* Bruchet as a later synonym of *H. helodes*.

Probably, this common species has been included by most authors in *H. crustuliniforme* (sensu lato) until recently. It seems likely that still an older name exists somewhere in the literature because it is remarkable that such a common and wide-spread species is 'discovered' as late as 1948 in montane peat-bogs.

Hebeloma longicaudum (Pers.: Fr.) Kumm. — Figs. 7, 8

Pileus 28–35 mm, convex, then plano-convex, often with broad and low umbo, with margin at first involute, pale orange-pinkish brown (Expo D54, E54 or paler: C64) with paler margin (D52 or much paler), or ± uniformly pale beige (A61) with somewhat paler margin, viscid when moist. Lamellae 3–5 mm broad, moderately crowded, narrowly ad-

nate or emarginate, pale beige-brown, with age purplish brown, with white-floccose edge, sometimes slightly serrulate, sometimes weeping. Stipe 35–60 × 6–10 mm, usually cylindrical but base often bulbous, up to 15 mm wide, fistulose or stuffed, cream-coloured, downwards pale brownish, entirely white-pruinose or floccose, but less distinctly so to the base. Context in the pileus and stipe very pale beige to white. Smell raphanoid.

Spores (10.0–)10.5–12.2(–12.6) × (5.9–)6.3–7.3(–7.5) µm. Q = 1.5–1.8, av. Q = 1.56–1.71, usually rounded, sometimes tapering or papilla-like, perispore sometimes somewhat loosening (in ammonia 10%), with ornamentation consisting of fine, punctiform warts, pale brown under the microscope, not dextrinoid. Cheilocystidia 40–80 × 8–11 µm, usually slenderly clavate, gradually broadening towards the apex, apex frequently lobed or bifurcate, usually not ventricose at the base, sometimes slightly ventricose towards the base of short cystidia, sometimes a few slightly thick-walled.

Habitat – Terrestrial in roadside verges planted with *Quercus* on nutrient-poor or enriched sandy soil.

Collections examined. Plot Q1, 6 Oct. 1986, *Keizer 86172*; Plot Q2, 22 Sept. 1986, *Keizer 86156*; Plot Q43, 6 Oct. 1987, *Keizer 87215*; 12 Oct. 1988, *Keizer 88089*.

The combination of the non-ventricose and frequently lobed or furcate cystidia and the relatively broad spores is characteristic for this species. For a more detailed comparison of this species with *Hebeloma helodes* and *H. crustuliniforme*, see the observations under the *H. crustuliniforme* group.

The name *Hebeloma longicaudum* was rejected by Boekhout (1982: 97), but on the basis of an incorrect interpretation of the rules of nomenclature. He compared his description with Fries' description in Epicrisis (1838: 181), but that is not relevant from a nomenclatural point of view. Fries sanctioned *Agaricus longicaudus* in 1821 (: 248) on the basis of Persoon's diagnosis from 1801 (: 332), which consequently should be regarded as the basis for (neo)typification. Both descriptions differ considerably from the concept in the Epicrisis. *Agaricus longicaudus* Pers. fits the present fungus well (although the description is very short and therefore an irrefutable interpretation cannot be given). The combination of a pale leather-coloured pileus, a white, cylindrical stipe and punctate lamellae (due to dried excreted droplets!) suggests a *Hebeloma* near *H. crustuliniforme*. The small pileus and slender stipe exclude *H. crustuliniforme* sensu stricto. It should be noted that Persoon's description concerns a slender variant (pileus ± 40 mm, stipe ± 100 × 4–6 mm), as depicted by Lange (1938: 119E). However, more thick-set variants are equally wide spread and represent in our opinion the same taxon. This interpretation of *Agaricus longicaudus* is in agreement with widely accepted interpretations by Konrad & Maublanc (1924–1937: pl. 79), J. Lange (l.c.) and Bruchet (1970: 77).

Hebeloma spoliatum (Fr.) Gillet — Fig. 9

Pileus 7–35 mm, convex to plano-convex, warm red-brown (Expo F48, F-H36, E26), on drying more yellowish red-brown (E56), towards the margin paler, pinkish beige (C63), viscid. Lamellae up to 5 mm broad, crowded, emarginate to narrowly adnate, not or slightly ventricose, pale purplish brown, with white-floccose edge, not weeping. Stipe 22–35 × 1–5 mm (exclusive of the rooting part), cylindrical with rooting base, upper half pale beige to whitish, downwards greyish brown (± E68), solid, floccose. Flesh in pileus

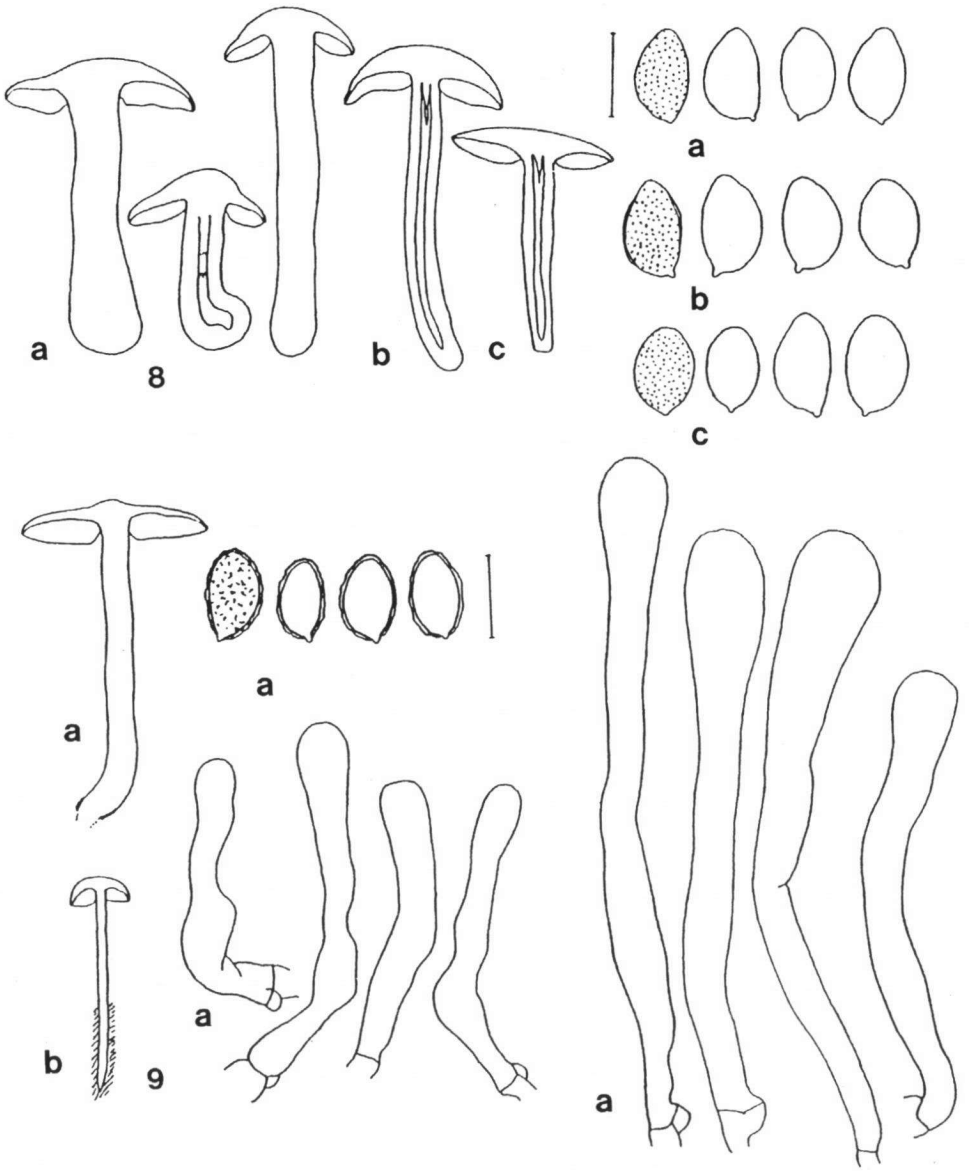

Fig. 8. *Hebeloma longicaudum*. Habit, spores, and cheilocystidia (a: *87215*; b: *88123*; c: *86172*). — Fig. 9. *Hebeloma spoliatum*. Habit, spores, and cheilocystidia (a: *88128*; b: *86233*).

white, above the lamellae greyish, in stipe cream-coloured in upper part, becoming brownish more downwards. Smell faintly raphanoid; taste bitter.

Spores (8.6–)9.4–10.6(–10.7) × (5.0–)5.2–5.9(–6.1) µm, Q = 1.7–2.0(–2.1), av. Q = 1.75–1.85, ellipsoid with loosening perispore which envelopes the complete spore, except for the hilar appendix, episporethick-walled with coarse, rounded or elongate warts,

rather dark brown under the microscope. Cheilocystidia 25–50 µm long, more or less cylindrical or apex slightly enlarged, base sometimes slightly ventricose, sometimes with slightly thickened walls.

Habitat – Terrestrial in a shady roadside verge planted with *Fagus* on nutrient-poor sandy soil.

Collections examined. Plot F32, 22 Oct. 1986, *Keizer 86190*; 13 Nov. 1986, *Keizer 86233*; Plot Q2, 13 Oct. 1988, *Keizer 88128*.

This rare species, well characterised by the rooting stipe, shows microscopically much similarity with *Hebeloma anthracophilum*, which has no rooting base of the stipe. The interpretation of Boekhout (1982), which has been followed, deviates from Bruchet (1970); the latter author mentions that the perispore is not loosening.

Gröger (1987) distinguished two taxa within *Hebeloma spoliatum* on the basis of habitat preference: 1) *H. spoliatum* Fr. in the original sense of Fries (1838) i.e. occurring in mountainous pine forests and 2) *H. danicum* Gröger (= *H. spoliatum* as interpreted by various modern authors e.g. Bruchet (1970), Romagnesi (1983), Weholt (1983)), which occurs in beech forests. We do not support this view because ecological differences alone do not warrant a distinction on specific level.

Hebeloma truncatum (Schaeff.: Fr.) Kumm. — Fig. 10

Pileus 28–80 mm, hemispherical, then plano-convex, with broad umbo or not umbonate, rather irregularly shaped, red-brown, then more yellowish brown (Expo E58,

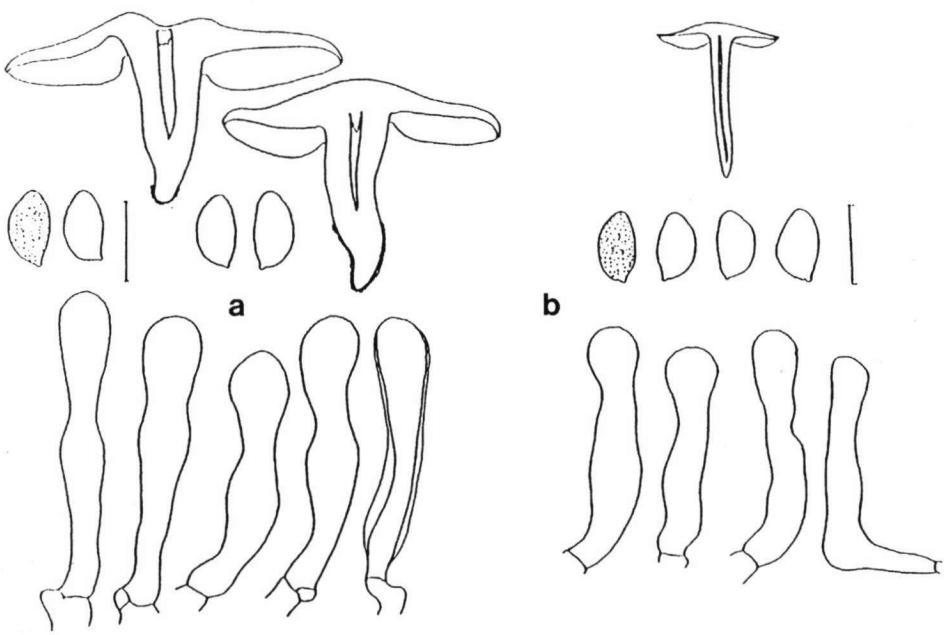

Fig. 10. *Hebeloma truncatum*. Habit, spores, and cheilocystidia (a: *88085*; b: *87028*).

D56) towards the margin slightly paler, smooth, dry. Lamellae up to 8 mm broad, moderately crowded, ventricose, emarginate-adnate, at first pale cream-coloured, then with colour of milk-chocolate, with white-floccose and sometimes serrulate edge, without droplets. Stipe 30–55 × 4–22 mm, mostly tapering to the base, sometimes with tendency of rooting, fistulose, apex whitish to beige, densely white-floccose, downwards brown to dark brown, slightly flocculose. Context pale cork-coloured in cap, darker brown in stipe. Smell raphanoid. Taste unknown.

Spores (8.0–)8.5–10.2(–10.4) × (4.1–)4.5–5.0(–5.2) µm, Q = 1.7–2.1 and av. Q = 1.79–2.01, oblong to amygdaloid, finely punctate without loosening perispore, not dextrinoid. Cheilocystidia 25–45 mm long, sometimes more or less cylindrical, more often with both apex and base ventricose, frequently some cystidia with thickened walls.

Habitat – Terrestrial in roadside verges planted with old *Quercus* trees on nutrient-poor sandy soil.

Collections examined. Plot Q2, 28 Oct. 1986, *Keizer 86193*; 15 Sept. 1988, *Keizer 88085*; 14 Oct. 1988, *Keizer 88235*; Plot Q32, 18 Aug. 1987, *Keizer 87028.*

According to Bruchet (1970), the cheilocystidia of *Hebeloma truncatum* are more cylindrical and longer than observed in the present material. However, the spores and the colour and habit of the carpophores point to *H. truncatum.*

Inocybe albomarginata Velen. (variant with slender spores) — Fig. 11

Pileus 24–48 mm, plano-convex, then expanding with faint umbo, dark reddish brown sometimes with greyish tinge (Expo J22, J42), paler towards the margin (D44-E58), with appressed squamules, at margin not rimulose, no velipellis observed. Lamellae up to 5 mm broad, thin, crowded, pale (yellow-)brown, soon darker, narrowly adnexed, with white-flocculose edge. Stipe 46–52 × 5–9 mm, cylindrical but towards the base sometimes enlarged up to 11 mm, subbulbous, pale beige-isabella, pinkish orange or pale brown (A22-C56), longitudinally striate, pruinose to about 2/3 radius. Context whitish in the pileus, more reddish in the stipe, especially near the cortex. Smell and taste unknown.

Spores (8.0–)8.3–10.0(–10.3) × (4.0–)4.1–4.8(–5.0) µm, oblong, Q = (1.8–)1.9–2.3, av. Q = 2.04–2.13, smooth, ± regular but sometimes with a faint depression, brown. Basidia 4-spored. Pleurocystidia 50–68 × 12–17 µm, lageniform, with 1–2 µm thick, pale, faintly yellowish walls, crystalliferous at apex, cheilocystidia as pleurocystidia, roundish cells abundant between the cheilocystidia.

Collections examined: Plot Q83, 3 Nov. 1987, *Keizer 87349*; 23 July 1988, *Keizer 88356.*

Macroscopically this collection fits well in *I. albomarginata* and shows some resemblance with *I. grammopodia* Malenç. The former has smaller spores ((6.0–)6.5–8.0 (–8.5) × 4.0–5.0 µm, Q = 1.4–1.7, av. Q = 1.5–1.7 (Kuyper, 1986)) and the latter has larger spores with a conical apex and more (sub)cylindrical pleurocystidia. Since this taxon grows in the same place where typical *I. albomarginata* is present and intermediate variants may occur, no final decision on its taxonomy could be taken; it is considered as a long-spored variant of *I. albomarginata*

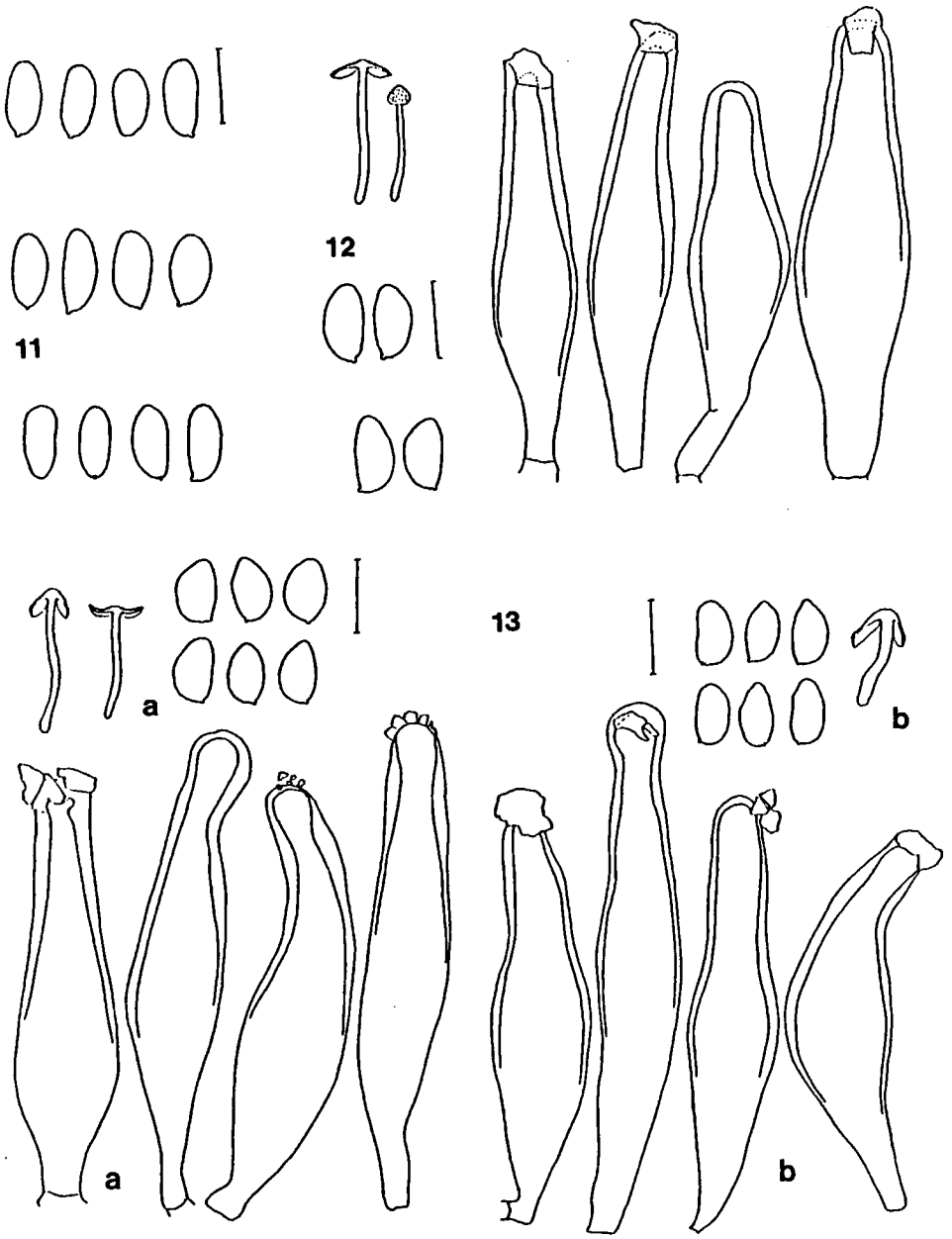

Fig. 11. *Inocybe albomarginata* (long-spored variant). Spores (*88356*). — Fig. 12. *Inocybe amethystina*. Habit, spores, pleurocystidia (*88296*). — Fig. 13. *Inocybe huijsmanii*. Habit, spores, and pleurocystidia (a: *88272*; b: *88304*).

Inocybe amethystina Kuyp. — Fig. 12

Pileus 6–13 mm, broadly campanulate, soon plano-convex with indistinct umbo, brown, then pale grey-brown (Expo F62 to C62), woolly fibrillose, near centre with scales darker than the surface of the pileus, with some remains of veil. Lamellae up to 2 mm broad, moderately crowded, narrowly adnate, rather dark brown, with white-floccose edge. Stipe up to 28 × 2 mm, cylindrical, hardly broader at the base, upper half pinkish-violet, downwards pale beige, in older carpophores violet colour only visible at the apex, only apex (± 1/10) pruinose, downwards brown-fibrillose. Smell indistinct.

Spores 9.3–10.3 × 4.5–5.2 µm, Q = 1.9–2.2, av. Q = 1.99, oblong-amygdaliform, with the abaxial side more rounded than the adaxial side. Pleurocystida 40–50 × 11–15 µm, narrowly lageniform, with 1.5–2.0 µm thick, yellow walls and some crystals at apex, cheilocystidis similar.

Habitat – Terrestrial in a roadside verge planted with *Fagus* on moderately nutrient-rich sandy soil.

Collection examined. Plot F24, 7 Oct. 1988, *Keizer 88296.*

The identification of our collections was confirmed by Kuyper. It differs in several respects from Kuyper's description (1986: 136), viz. in very small carpophores, narrower spores and smaller pleurocystidia.

Inocybe huijsmanii Kuyp. — Fig. 13

Pileus 8–15 mm, convex or campanulate without prominent umbo, ochraceous grey-brown, orange-brown to pale ochraceous isabella (Expo D63, E54, Mu 2.5 YR 7/4–6/4), radially fibrillose, fibrils not diverging, with some indistinct patches of veil around centre, at margin with remains of cortina. Lamellae 1.5–2 mm broad, slightly to moderately crowded, not or slightly ventricose, narrowly adnate, pale brown with pink-lilac hue, with white-floccose edge. Stipe 20–31 × 1.5–2.5 mm, cylindrical with slightly enlarged base, pale beige or isabella ochraceous, entirely or only at apex with a lilac hue (Mu 2.5 YR 7/3–7/4), covered with white fibrils. Context in pileus and apex of stipe pinkish-lilac, in the other parts white. Smell spermatic.

Spores 8.0–9.0(–9.4) × 4.2–5.0(–5.7) µm, Q = 1.5–2.1, av. Q = 1.7–2.0, ellipsoid or somewhat amygdaliform, in *collection 88304* often with a depression at the adaxial side. Pleurocystidia narrowly lageniform or narrowly fusiform, with walls 1.0(–1.5) µm thick and usually crystals at apex, cheilocystidia similar.

Habitat – Terrestrial in roadside verges planted with *Fagus* on nutrient-poor sandy soil.

Collections examined. Plot F21, 24 Sept. 1988, *Keizer 88272*; Plot F24, 7 Oct. 1988, *Keizer 88304*; Plot F43, 6 Oct. 1988, *Keizer 88357.*

Collection *88304* unites some characters of both *Inocybe huijsmanii* and *I. griseolilacina* J. Lange: it shows a more or less smooth pileus surface with yellowish brown colours and lacks a *Pelargonium* smell (*I. huijsmanii*), but it shows violaceous colours and some subcapitate pleurocystidia (*I. griseolilacina*; cf. Kuyper, 1986: 133–134). The spores deviate from other collections in the relatively narrow ellipsoid-subamygdaliform

shape with frequently a depression in the adaxial wall. For the time being, this collection has been called *I.* cf. *huijsmanii*. Spores of all collections were smaller than those reported for *I. huijsmanii* by Kuyper (1986: 135). The species was not recorded before from the Netherlands (Arnolds, 1984; Arnolds et al., 1989; Kuyper, l.c.).

Laccaria Berk. & Br.

Although representatives of this genus are extremely common, taxonomic problems still exist. The following notes illustrate how the species were distinguished.

Laccaria bicolor (R. Maire) P.D. Orton — Figs. 14, 15

Habitat – Terrestrial in roadside verges planted with *Quercus* or *Fagus*.

Collections examined. Plot Q62, 4 Oct. 1987, *Keizer 87210*; Plot Q38, 18 Sept. 1988, *Keizer 88053*; Plot F21, 28 Oct. 1988, *Keizer 88305*.

In typical cases, *Laccaria bicolor* has violaceous tinges in the lamellae and the basal mycelium. However, the intensity of the violaceous colour is variable and specimens are met without this colour at the basal tomentum and with only a lilac-pink hue in the lamellae, which come very close to typical *L. proxima* (see also observations under *L. purpureobadia)*. Spores subglobose to broadly ellipsoid with small spines.

Laccaria laccata (Scopoli: Fr.) Cooke — Fig. 18

Habitat – Terrestrial in roadside verges planted with *Quercus* or *Fagus* on nutrient-poor or enriched soil, often near the paved road surface or on otherwise disturbed places.

Collections examined. Plot Q93, 8 Sept. 1986, *Keizer 86134*; Plot Q33, 31 Aug. 1987, *Keizer 87036*.

Laccaria laccata is readily distinguished from *L. proxima* by the smoother (less squamulose) pileus, less striate stipe and especially by the globose spores with long spines (> 1 µm). According to Mueller (1991) the correct name for this taxon is *Laccaria laccata* var. *pallidifolia* (Peck) Peck. The typical variety, however, seems hardly distinct from *L. proxima*.

Laccaria proxima (Boud.) Pat. — Fig. 16

Habitat – Terrestrial in roadside verges planted with *Quercus* or *Fagus* on nutrient-poor soil, often near young trees.

Collections examined. Plot Q33, 3 Dec. 1986, *Keizer 86275*; Plot Q37, 7 Oct. 1987, *Keizer 87288*; Plot Q93, 8 Sept. 1986, *Keizer 86135*.

Three taxa around *L. proxima* can be distinguished in the field, which all are characterized by small scales on the cap, striate stipe and, microscopically, broadly ellipsoid to subglobose spores with small spines (< 1 µm), viz. *L. bicolor*, *L. proxima* and *L. purpureobadia* (see observations under *L. purpureobadia)*.

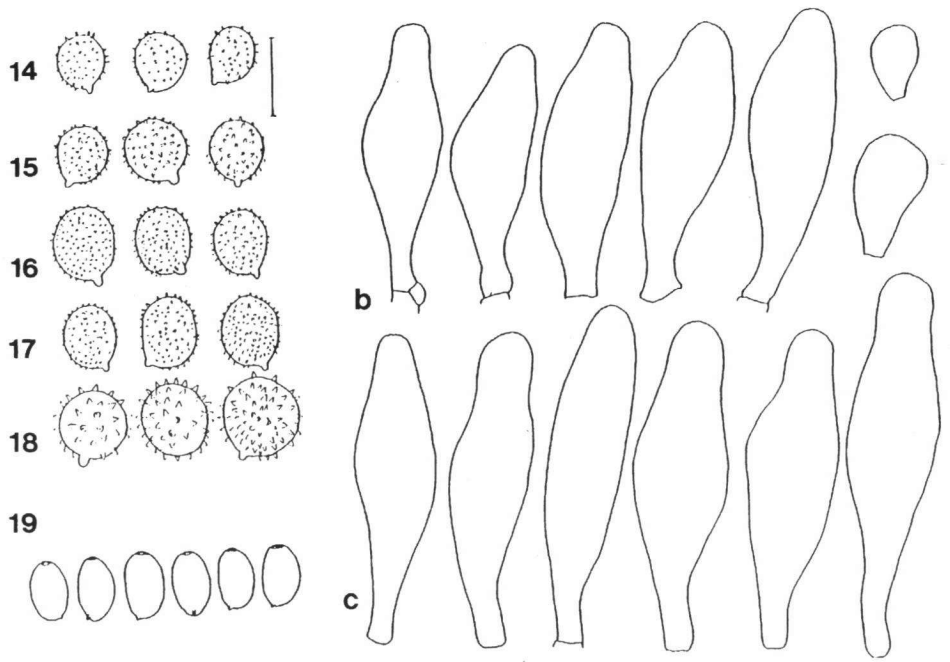

Fig. 14. *Laccaria bicolor*. Spores (*87210*). — Fig. 15. *Laccaria bicolor*. Spores (*A.E.Jansen 1264*). — Fig. 16. *Laccaria proxima*. Spores (*87288*). — Fig. 17. *Laccaria purpureobadia*. Spores (*87266*). — Fig. 18. *Laccaria laccata*. Spores (*87036*). — Fig. 19. *Psathyrella fulvescens* var. *brevicystis*. Spores, cheilocystidia (b), pleurocystidia (c) (*86140*).

Laccaria purpureobadia Reid — Fig. 17

Habitat – Terrestrial in roadside verges planted with old *Quercus* on nutrient-poor soil.

Collections examined. Odoorn, Odoornerveen, 6 Oct. 1986, *Keizer 86169*; Plot Q31, 28 Oct. 1987, *Keizer 87266*.

Laccaria purpureobadia, which is characterized by the dark purplish brown colours of pileus and stipe, was found twice, and in one case it grew mixed in a large group of typical *L. proxima*. The fruit-bodies of both 'species' were identical except for the dark colours in *L. purpureobadia* (like the water painting in Reid, 1966: pl. 5 and the photograph in Phillips, 1981: 53).

In Figs. 14–17 it is shown that the spores of *L. proxima*, *L. bicolor* and *L. purpureobadia* are largely similar. Consequently, if these taxa are only characterized by (rather variable) colours, it becomes questionable whether a distinction on specific level is desirable in this case. It would seem that the rank of variety is more appropriate. However, mating experiments have shown the interindependency of these species (Fries & Mueller, 1984), except for *L. purpureobadia*, which was not tested. In conclusion, although it seems that the species differ in only one character (colour of carpophore and mycelium) which would point

to a distinction on the level of variety, the specific status is maintained here because of the proven intersterility of most of the collections belonging to the taxa distinguished on the basis of their morphology.

Leccinum oxydabile (Sing.) Sing.

Pileus 30–42 mm, convex to hemispherical, hazel-brown (Expo E-F62), at margin and in young specimens slightly paler, slightly tomentose, near centre with very fine hairy scales. Tubes up to 7 mm long, at first white, soon greyish-brown, often ochraceous yellow-brown. Stipe 95 × 12 mm, slightly tapering upwards, cream-coloured, covered with warts which are white and small near apex, coarser downwards and with purplish brown tips near base spotted greenish blue. Context white, after a few minutes becoming pink, in extreme base of stipe dirty yellow. Smell absent, taste not tested.

Spores 17.0–19.5 × 6.0–6.5 µm, fusiform.

Habitat – Terrestrial in a roadside verge planted with old *Quercus* on nutrient-poor sandy soil, also small, mown *Betula* present.

Collection examined. Plot Q2, 15 Sept. 1988, *Keizer 88137.*

The pinkish discoloration of the context, rather pale pileus and the broad spores are distinctive for *Leccinum oxydabile.* This collection fits well with the description by Watling (1970: 53). The sporocarps grew between small, yearly mown birches. Most records of *L. oxydabile* from the Netherlands concern *L. variicolor* Watling (= *L. oxydabile* ss. Sing. 1967) or *L. roseofractum. Leccinum oxydabile* was not reported with certainty before in the Netherlands.

Mycena aetites (Fr.) Quél.

Collections examined. Plot Q53, 5 Nov. 1986, *Keizer 86214*; Odoorn, Odoornerveen, 2 Nov. 1989, *Keizer 89071*; 11 Nov. 1983, *Keizer 89090.*

For descriptions of *Mycena aetites* the reader is referred to Kühner (1938) and Maas Geesteranus (1988). With help of the keys by Maas Geesteranus (l.c.) it is rather simple to identify this species. In the field, however, it may show much resemblance with variants of the very common *M. leptocephala* (Pers.) Gill. which sometimes has a hardly perceptible chlorine-like smell, especially during cold and wet weather. Moreover, inodorous variants of both species seem to exist (Maas Geesteranus, l.c.). Field characters to separate *M. aetites* from *M. leptocephala* are among other things: 1) the stouter habit, 2) the more rigid consistency, and 3) the more broadly adnate lamellae that are usually paler grey in *M. aetites.* In mycocoenological work, one is forced to identify large numbers of carpophores so that it is impossible to check every carpophore under the microscope. In this study, small specimens of *M. aetites* might have been mistaken for *M. leptocephala* in some cases.

Mycena filopes (Bull.: Fr.) Kumm.

Collection examined. Plot Q2, 17 Nov. 1988, *Keizer 88325.*

Typical *Mycena filopes* with grey-brown pileus with a pale margin is common and well-known. Another taxon exists which is more or less similar (Arnolds, 1982: 409 f.f.) except for the pink pileus. It is called *Mycena filopes* var. *metata* (Fr.) ss. Oort (Arnolds, 1982) or *M. metata* (Fr.) Kumm. ss. Oort.

Although all intermediates exist between a grey-brown, pinkish grey-brown, greyish pink and pink pileus, the extremes seem to be rather different in several aspects. How subtle the difference in colour can be, is illustrated when fig. 7a (third fruit-body) and fig. 7b (first fruit-body) by Arnolds (1982) are compared. Minor differences between these two taxa, apart of those given by Arnolds (l.c.), are: 1) the greyish taxon has a more (narrowly) parabolical pileus, the pinkish taxon has a slightly more campanulate-expanded pileus; 2) in the greyish taxon the dark colours in the centre of the pileus are more contrasting to the pale whitish colour of the margin; 3) the greyish taxon tends to grow solitary while the pinkish form usually occurs in groups of for instance 5–10 carpophores in an area of 1 dm^2. These characters are correlated, but in each character intergradations seem possible. The possibility to distinguish the taxa by using differences in the shape of the cheilocystidia, as proposed by Maas Geesteranus (1980), was rejected by Arnolds (l.c.). We support this last view and therefore recognize them as varieties, named var. *filopes* and var. *metata*, respectively.

Maas Geesteranus (1984) proposed another distinction of the species of this group, mainly on the basis of differences in the cheilocystidia and of the excrescences on top of them. Maas Geesteranus (l.c.) suggested that *Mycena sepia* consists of two different taxa: *M. sepia* J. Lange (considered as synonymous with *M. filopes*) and *M. sepia* ss. Lundell, named *M. septentrionalis* Maas G. The differences between *M. metata* and *M. filopes* were extensively elaborated, but many of the characters mentioned seem variable.

In this study, where large numbers of carpophores had to be identified, preferably for the greater part in the field, the distinction of the species as proposed by Arnolds (1982), largely based on habit and colour characters, was preferred. See also *M. vitrea*.

Mycena vitrea (Fr.) Quél.

Synonym: *M. sepia* J. Lange.

Collections examined. Plot Q34, 5 Nov. 1986, *Keizer 86125*; Odoorn, Odoornerveen, 13 Oct. 1987, *Keizer 87235*; 1 Nov. 1989, *Keizer 89088*.

Mycena vitrea has been distinguished in this study from *M. filopes* on account of two macroscopic characters, viz. the dark pileus with only slightly paler, not contrasting margin and the somewhat stouter habit. Using the key presented by Maas Geesteranus (1980), the problem arose that the cheilocystidia did not agree entirely with one of the described and depicted types, owing to their great variation even within one lamella. This renders cheilocystidia morphology a character of limited value. Therefore we refrained from the use of cystidial characters and we agree with Arnolds (1982) who came to the same conclusion. Arnolds (l.c.) noted that in his collections of *M. filopes* 18% had a majority of 4-spored basidia whereas in *M. sepia* 82% of the collections was 4-spored. Consequently, this feature cannot be used as a distinctive character, at most as an additional character in case of doubt.

Collection *89088* had 4-spored basidia and collection *87235* had 4- and 2-spored basidia with a majority of 4-spored ones.

See also observations under *M. filopes*.

Pluteus pallescens P.D. Orton — Fig. 20

Pileus 27 mm, plano-convex, without umbo, hygrophanous, when moist rather dark (greyish) brown (Expo F63), margin strongly striate, on drying paler grey-brown (E63), dull. Lamellae 4 mm broad, somewhat ventricose, free from stipe, salmon-coloured pink with white-floccose edge. Stipe 65 × 4 mm, cylindrical, creamy white, striate lengthwise, fistulose.

Spores (5.8–)6.3–7.2(–7.8) × (5.0–)5.7–6.2(–6.5) µm, Q = 1.0–1.2, av. Q = 1.13, (sub)globose, thick-walled with ± 0.4 µm thick walls. Pleurocystidia 30–70 × 15–39 µm, broadly utriform to ± vesiculose, thin-walled, rather sparse. Cheilocystidia 30–50 × 15–25 µm, more or less similar to pleurocystidia but smaller and often broader clavate. Pileipellis consisting of sphaeropedunculate and broadly clavate cells.

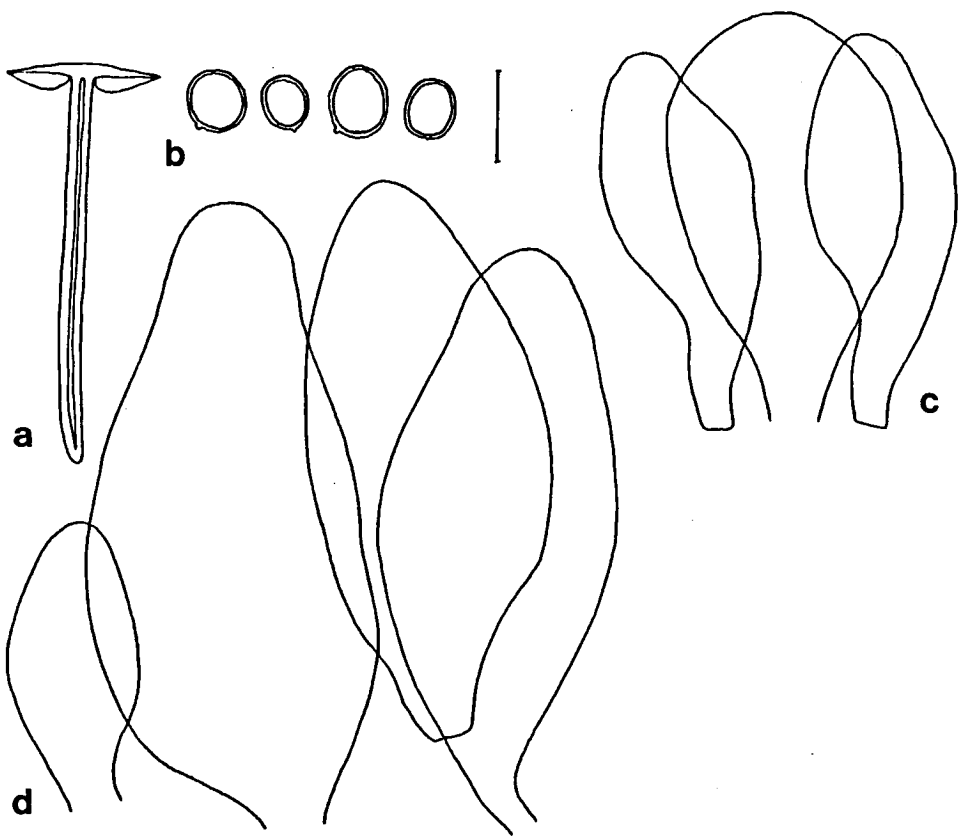

Fig. 20. *Pluteus pallescens*. Habit (a), spores (b), cheilocystidia (c), and pleurocystidia (d) (*87136*).

Habitat – Terrestrial in a roadside verge planted with *Quercus* on nutrient-poor sandy soil.

Collection examined. Plot Q22, 15 Sept. 1987, *Keizer 87136.*

This collection fits well with the description by Huijsman (1955) of *Pluteus umbrinellus* (misapplied name according to Orton (1960) and Vellinga & Schreurs (1985) and the plate by Bresadola (1927-1933: 544-2)). The specimen found here was not as dark brown as mentioned by Moser (1978) and Vellinga (1990). On account of the lack of olivaceous colours and the broad pleurocystidia it is called *P. pallescens*, which is a rare species in the Netherlands.

Psathyrella fulvescens (Romagn.) A.H. Smith var. **brevicystis** Kits van Wav. — Fig. 19

Collections examined. Plot Q24, 8 Sept. 1986, *Keizer 86140*; Plot Q72, 26 Sept. 1988, *Keizer 88142*; Plot Q88, 25 Sept. 1986, *Keizer 86160.*

It seems that still some confusion exists about this extremely common taxon. It is difficult to identify with the aid of the *Psathyrella*-monograph by Kits van Waveren (1985), owing to differences between his descriptions and drawings of the pleurocystidia and the pleurocystidioid cheilocystidia ('lageniform or fusoid') and the usual shape of these cells. The cystidia are usually more or less ventricose with a rounded cylindrical apical part, as figured by Arnolds (1982: 438, sub nomine *P. trivialis*) and in Fig. 19 of the present study. They may be called (narrowly) utriform or obtusely fusiform. Consequently, this species may therefore also be placed in sect. *Spadiceogriseae*, subsect. *Lutenses*. The macroscopic characters and other microscopic characters of the material found during this study agree with the descriptions by Arnolds (l.c.) and Kits van Waveren (l.c.).

Among the large numbers of carpophores of this species, growing on pieces of wood, often some specimens with an irregular and strongly wrinkled pileus were present. They could key out as *P. reticulata* (Romagn.) Sing., but all other characters agreed with *P. fulvescens* var. *brevicystis*. Therefore, *P. reticulata* may very well be only a variant of the latter taxon.

Psathyrella rhombispora Keizer & Arnolds, *spec. nov.* — Fig. 21

Pileus 15 mm latus, late campanulatus, obtuse umbonatus, hygrophanus, quando uvidus cinereo-brunneus, quando vero desiccat colore stramineo. Lamellae purpureo-fuscae, acie albo-flocculosa, subconfertae. Stipes 20 × 1.5–2.0 mm, cylindraceus, albidus, fistulosus. Sporae (8.2–)8.3–9.8(–10.0) × (4.2–)4.3–5.0 µm, Q = 1.7–2.0, medius Q = 1.90, ellipsoideae vel rhomboideae, saepe cum apiculo satis magno, poro nullo. Basidia 16–23 × 7–8 µm, (1–)2–3(–4)-sporigera, fibulata. Pleurocystidia 35–50 × 9–13 µm, plerumque utriformia, cheilocystidia utriformia 35–55 × 12–17 µm, modice numerosa, cheilocystidia sphaeropedunculata 15–25 × 10 µm, rara. Habitat: terrestris in solo arenoso.

Holotypus: The Netherlands, prov. Drenthe, Anloo, Plot Q65, 10 Nov. 1987, *Keizer 87234* (WBS).

Pileus 15 mm, expanded, broadly campanulate with broad umbo, hygrophanous, when moist grey-brown (Expo F64), at centre more reddish brown, on drying straw-coloured (C63), at centre more ochre-coloured, no velar remains observed. Lamellae moderately crowded, ventricose, narrowly adnate, purplish brown, with white-floccose edge. Stipe

20 × 1.5–2.0 mm, cylindrical, slightly broader downwards, shiny, whitish, near the base pale beige, with some white-floccose velar remains, fistulose. Smell insignificant.

Spores (8.2–)8.3–9.8(–10.0) × (4.2–)4.3–5.0 µm, Q = 1.7–2.0, av. Q = 1.90, ellipsoid to rhomboid, frequently with a fairly large hilar appendix, without germ-pore, rather light red-brown in H_2O, somewhat darker in NH_4OH 10%, rather variable in shape and size. Basidia 16–23 × 7–8 µm, (1–)2–3(–4)-spored, spheropedunculate, with basal

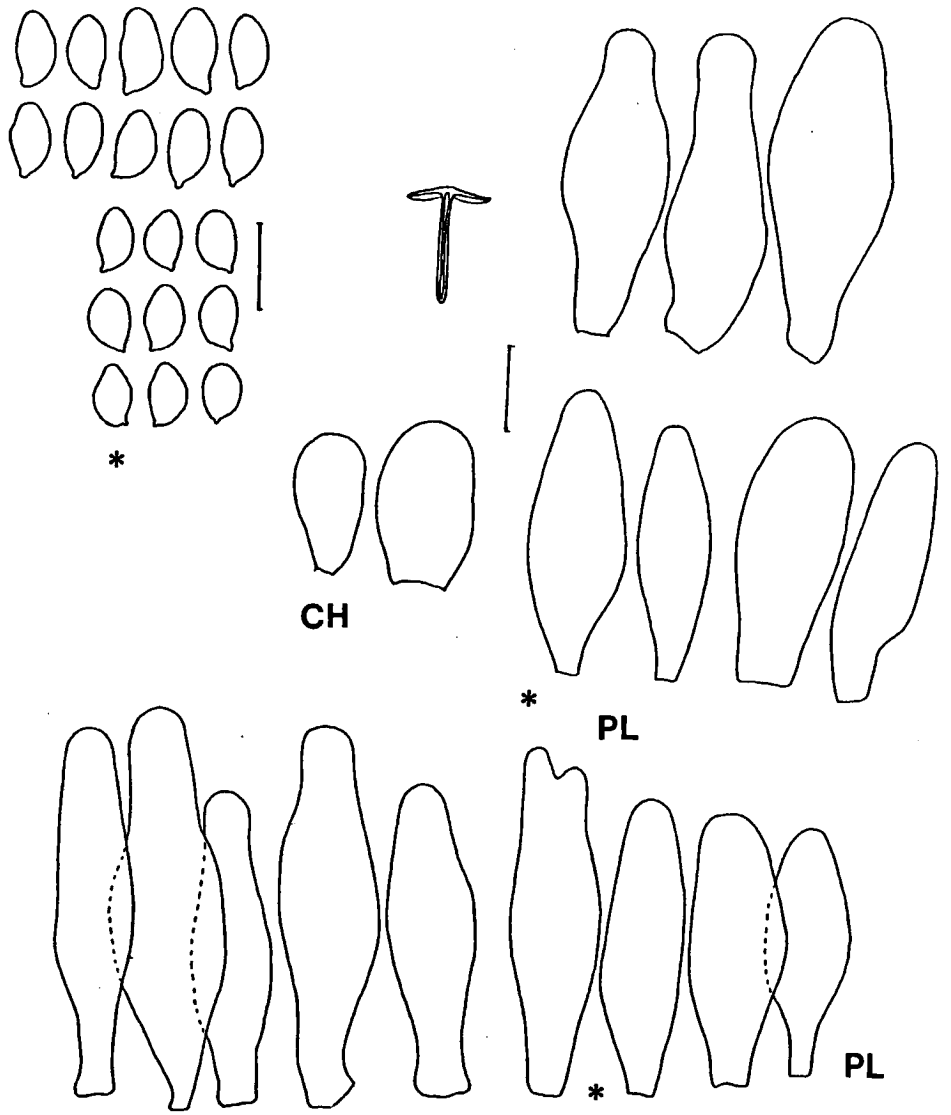

Fig. 21. *Psathyrella rhombispora*. Habit, spores, cheilocystidia, and pleurocystidia (spores marked with * from *88314*, all other figs. from *87324*; cystidia with * del. E. Kits van Waveren).

clamp. Pleurocystidia 35–50 × 9–13 µm, (narrowly) utriform to obtusely fusiform, pleurocystidioid cheilocystidia (narrowly) utriform to obtusely fusiform, occasionally apically bifurcate, 35–55 × 12–17 µm, frequently slightly thick-walled with pale brown walls (in NH_4OH), rather scarce, spheropedunculate cheilocystidia scarce. Hymenophoral trama pale yellow-brown at the base of the lamella, gradually less pigmented towards the edge.

Habitat – Terrestrial in a roadside verge planted with *Quercus* on moderately nutrient-poor sandy soil.

Collection examined. Plot Q65, 10 Nov. 1987, *Keizer 87234*.

Psathyrella rhombispora agrees in macroscopical appearance and pleurocystidia with the descriptions of *P. fulvescens* var. *brevicystis* in Kits van Waveren (l.c.) and Arnolds (l.c.), among other things because of the reddish brown centre of the pileus. However, the spores differ markedly in shape, a large proportion of the spores being rhomboid and tapering in a fairly large hilar appendix and in the absence of a germ-pore.

The present species belongs to sect. *Spadiceogriseae* subsect. *Spadiceogriseae* on account of the in majority (narrowly) utriform pleurocystidia and the rather scarce pleurocystidioid cheilocystidia. *Psathyrella clivensis* (Berk. & Br.) P.D. Orton (as described by Orton (1960), Kits van Waveren (l.c.), not by Smith, 1972) is one of the few *Psathyrella*-species which (almost) lacks a germ-pore. It differs in 1) the shape of the spores: ellipsoid to subphaseoliform in *P. clivensis* and ellipsoid to rhomboid in *P. rhombispora*; 2) the spores of *P. clivensis* are 5.5–6.0 µm broad, the spores of *P. rhombispora* are more slender, 4.3–5.0 µm broad; 3) the bases of the spores of *P. clivensis* are rounded with a small hilar appendix; in *P. rhombispora* they are often tapering in a large hilar appendix; 4) the basidia are 4-spored in *P. clivensis* but in majority 2–3-spored in *P. rhombispora*. In addition, the habitat of *P. clivensis* is chalk grassland; the present species was found on nutrient-poor sandy soil.

It is after some hesitation that this species was described as new, because the collection consists of only one specimen. It is obvious that there exists not yet a clear view of the possible variation of the studied characters. However, the noted differences with other (similar) species, especially in the morphology of the spores, warrant in our view a distinction on specific level. In the current literature no description could be found that sufficiently fits this material. We thank Dr. E. Kits van Waveren, who kindly studied the present material and gave valuable suggestions and opinions on this species.

Psathyrella seymourensis A.H. Smith — Fig. 22

Pileus 6–17 mm, hemispherical or paraboloid, hygrophanous, when moist dark brown (Expo ± J42), translucently striate up to 1/3 of the radius, on drying pale grey-brown (C63) with slightly darker centre (E68), some remnants of the veil present near the margin. Lamellae up to 2 mm broad, subdistant, narrowly to rather broadly adnate, pale (brownish) grey (J78), edge white. Stipe 15–23 × 1–2 mm, cylindrical, apical part white, downwards pale brown (E42-52), sometimes near base dark brown (J42), covered with small floccose veil remains.

Spores 8.0–9.1(–9.3) × 5.0–5.8(–6.0) µm, Q = 1.4–1.7(–1.9), av. Q = 1.55, slightly lentiform, in side-view ellipsoid-oblong, in face-view frequently subtriangular with largest width below middle, under the microscope dark chocolate brown. Pleurocystidia

30–45 × 9–14 µm, lageniform, thin-walled, hyaline. Cheilocystidia 35–40 × 9–11 µm more or less similar to the pleurocystidia, frequent, in addition sphaeropedunculate to clavate cells, 15–30 × 10–14 µm.

Habitat – Terrestrial in a roadside verge planted with *Fagus* on nutrient-poor sandy soil.

Collection examined. Plot F16, 13 Nov. 1986, *Keizer 86222.*

The carpophores and the spores of this collection are slightly larger than those described by Kits van Waveren (1985). *Psathyrella seymourensis* is a very rare species. The description by Kits van Waveren (1985: 266) was based on three collections only.

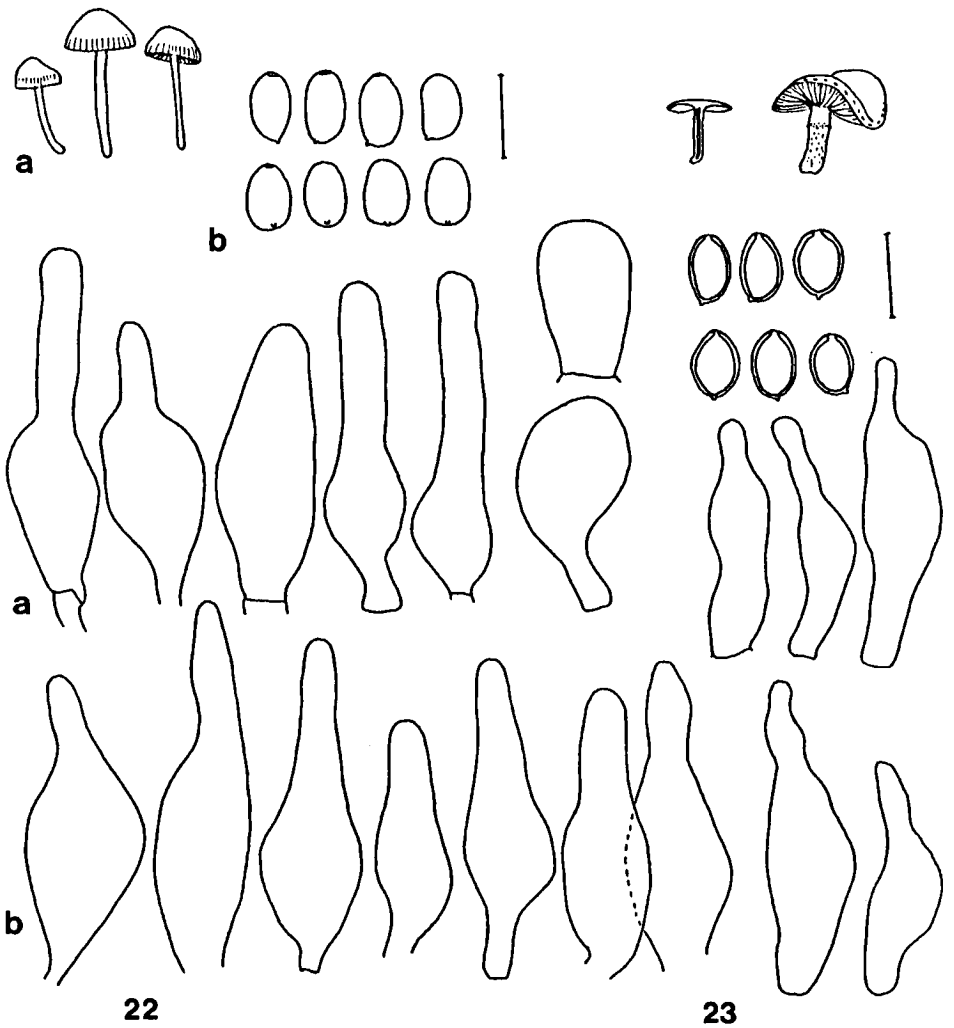

Fig. 22. *Psathyrella seymourensis.* Habit, spores, cheilocystidia (a), and pleurocystidia (b) (*86222*). — Fig. 23. *Psilocybe bullacea.* Habit, spores, and cheilocystidia (*88333*).

Psilocybe bullacea (Bull.: Fr.) Kumm. — Fig. 23

Pileus 7–24 mm, plano-convex or convex, soon becoming applanate, sometimes with slightly depressed centre, hygrophanous, when moist warm red-brown (Expo F44 (slightly more brown) or F54), with paler margin, translucently striate up to 1/3 of the radius, on drying ± orange-brown (D56-58), viscid and gelatinous pellicle slightly separable, near the margin with white, dentate veil remnants. Lamellae up to 2 mm broad, crowded, broadly to rather narrowly adnate, not ventricose, greyish pink-brown with paler edge. Stipe up to 10 × 1–2 mm, cylindrical or flattened and then up to 4 mm broad, concolorous with the pileus or slightly darker, white fibrillose, squamulose below an annular zone of veil. Smell indistinct.

Spores (7.4–)7.5–8.1(–8.5) × (4.7–)4.9–5.7(–6.0) µm, Q = 1.3–1.7, av. Q = 1.49, ellipsoid-oblong, slightly lenticular, differences beween side and face view about 0.5 µm, thick-walled with walls ± 0.6 µm thick, under the microscope (purplish) brown. Basidia 4-spored. Cheilocystidia 27–37 × 6–11 µm, irregularly lageniform, thin-walled, hyaline. Pleurocystidia not observed. Pileipellis an ixocutis of up to 300 µm thick, made up of hyphae of 2–4.5 µm wide, the thin hyphae hyaline, the thicker ones with brown encrusting pigment. Clamp-connections present in all tissues.

Habitat – Growing on dung of horse in a roadside verge planted with *Quercus* on nutrient-poor sandy soil.

Collections examined. Plot Q3, 14 Oct. 1988, *Keizer 88205*; 21 Dec. 1988, *Keizer 88333*.

These collections differ in several respects from previous descriptions. Ricken (1915), Orton (1969), Geesink (1972), Guzmán (1983), and Watling & Gregory (1987) described or illustrated this species with a more or less hemispherical or paraboloid pileus. Only Guzmán (l.c.) mentioned that older specimens become applanate or depressed. The specimens described here very soon become applanate. The lamellae in our collections are not exclusively broadly adnate but also sometimes narrowly adnate. The same is drawn by Geesink (l.c.). The habitat is described as manure or arable fields (Ricken (l.c.), Watling & Gregory (l.c.), Guzmán (l.c.)), bonfire places (Geesink, l.c.), other organic debris (Watling & Gregory (l.c.), Guzmán (l.c.)). Only the last author and Orton (l.c.) explicitly mentioned dung as habitat. The specimens described here grew on (old) horse dung. Arnolds (1982) regarded *P. bullacea* as a synonym of *P. montana*, in our opinion incorrectly so. Differences between these species are, besides the habitat: the generally stouter habit and the presence of whitish dentate veil remnants at the margin of the pileus of the former species.

Russula decipiens (Sing.) Svrcek — Fig. 24

Pileus 50–125 mm, convex, then expanding with slightly depressed centre and mostly somewhat involute margin, sometimes more funnel-shaped, colour rather variable, between cream-coloured beige and brick-red, often on a pale buff groundcolour, with a cloudy, often-concentric pattern of orange red to mostly brick-red (e.g. Expo D-E16), sometimes completely pale beige (A73, B72, C64) when older or only with a faint orange-pink colour at the margin, dull and white-pruinose when young, not viscid. Lamellae up to 10–12

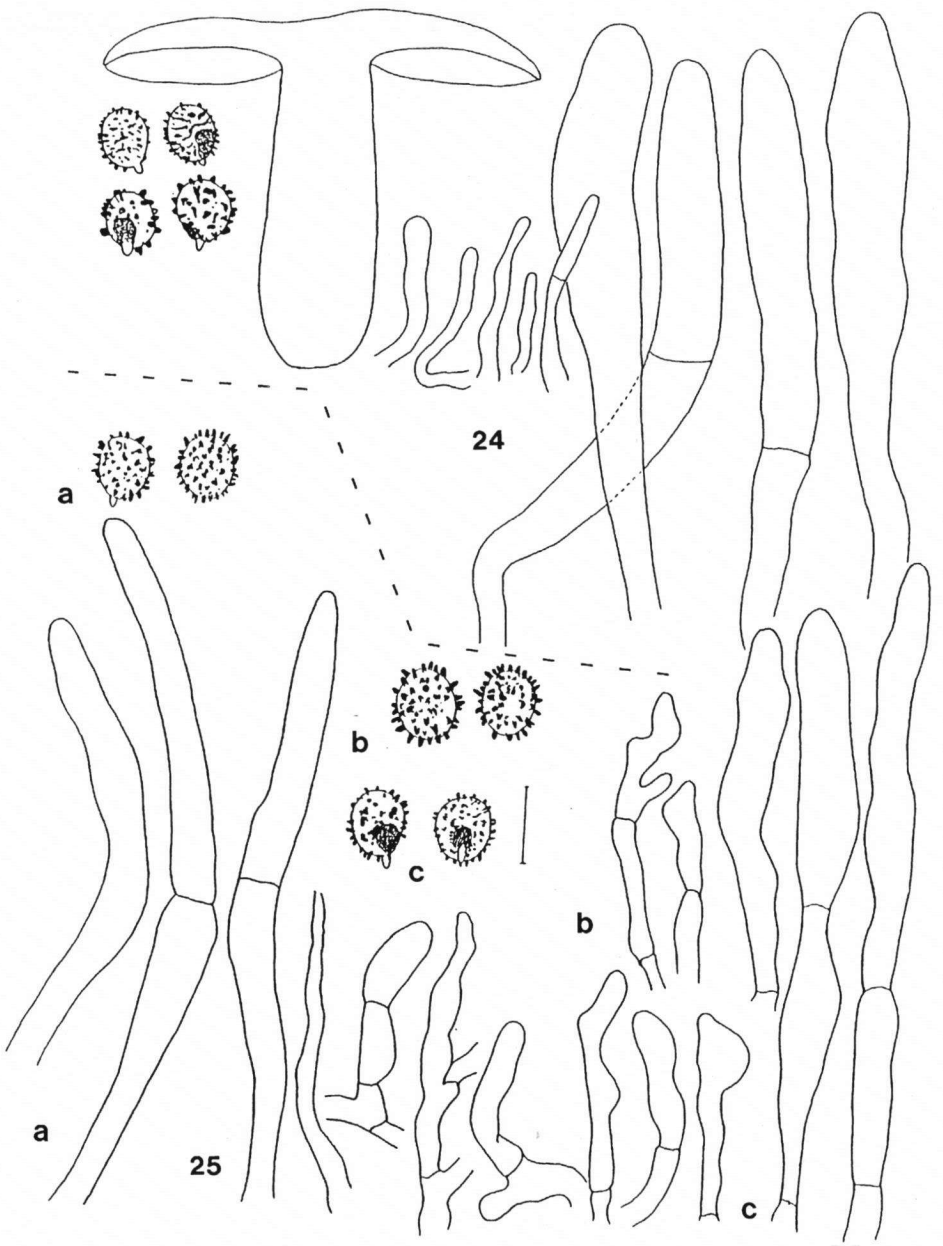

Fig. 24. *Russula decipiens*. Habit, spores, pileocystidia, and hyphae of pileipellis (*86130*). — Fig. 25. *Russula graveolens* f. *cicatricata*. Spores, pileocystidia, and hyphae of pileipellis (a: *87034*; b: *87219*; c: *88162*).

mm broad, subdistant, rather ventricose, narrowly adnate, near stipe frequently forked, in large specimens c. 7 per 10 mm at the margin of the pileus, at first pale yellow, then apricot-yellow, edge concolorous. Stipe up to 60 × 30 mm, cylindrical to (more often) club-shaped, white, with age and on handling yellowish grey-brown. Context in cap and stipe white, very firm, in stipe slowly turning brownish in age. Smell weak, fruit-like (± as *R. fellea*), taste sharp (but mild in collection *86199*). Reaction with $FeSO_4$ dirty orange. Spore print dark yellow (IVd-)IVe (according to Romagnesi, 1967).

Spores (7.2–)7.4–9.4(–10.1) × (6.0–)6.2–8.0 µm, Q = 1.2–1.3(–1.4), av. Q = 1.23, broadly ellipsoid, ornamentation variable, mostly with isolated warts or warts arranged in crests or connected with lines, rather blunt and c. 0.5 µm high, but a minority of the spores (sometimes a rather large proportion) with coarse, blunt, isolated warts, up to 1.0(–1.2) µm high. Pileocystidia numerous, rather variable, some up to 50 µm long, with suddenly enlarged apex, 7–9 µm broad, but in majority longer and gradually broader towards apex up to 10–12(–14) µm broad, frequently 1–2-septate, contents granular, dark in sulfovanillin. Hyphae of the cutis inconspicuous, cylindrical, 1.5–3.0 µm broad.

Habitat – Terrestrial in a roadside verge planted with *Quercus* on nutrient-poor sandy soil.

Collections examined. Plot Q13, 4 Aug. 1986, *Keizer 86125*; 10 Sept. 1986, *Keizer 86130*; 1 Oct. 1986, *Keizer 86167*; 24 Oct. 1986, *Keizer 86199*; 24 Aug. 1987, *Keizer 87112*; 23 July 1988, *Keizer 88031*; 29 Sept. 1988, *Keizer 88071*.

Since there exists some confusion with regard to the delimitation of *Russula decipiens*, *R. maculata* and, to a lesser extent, *R. veternosa*, a description is given of this species. The colours of the pileus of *R. maculata* and *R. decipiens* show large overlap, although the red colours tend to fade more often in the latter species. The greyish or brownish discoloration of the flesh is often difficult to assess with certainty. Both species seem to occur in the same habitats. The main difference is the presence of numerous large pileocystidia in *R. decipiens*, whereas these are smaller and less abundant in *R. maculata*.

Russula veternosa is macroscopically rather similar, but differs among other things in a paler spore print. Of these three species *R. decipiens* seems to be the most common in the Netherlands.

Russula graveolens Romell in Britz. — Figs. 25–29

Many problems arose with the identification of taxa within the *R. xerampelina* complex, which is well-characterized by the green reaction of the context with $FeSO_4$, the fishy smell and the brown discoloration of stipe and lamellae. Many characters show a large variation in this group. However, often the extremes of a certain character are connected by intermediates (although these intermediates seem to be less frequent than the 'extreme' variants) and none of the characters studied appear to be mutually correlated. Thus, following the criteria proposed by Kuyper (1988): at least two independent characters must be present to separate one species from another, it would be impossible to maintain a specific status for many of the variants observed during this study.

On the other hand, the intuitive feeling exists that it is hardly realistic to unite such different variants into one species. In modern literature (Moser, 1983; Romagnesi, 1967; Einhellinger, 1985; Marchand, 1977; Bon, 1988) this problem is reflected in the differ-

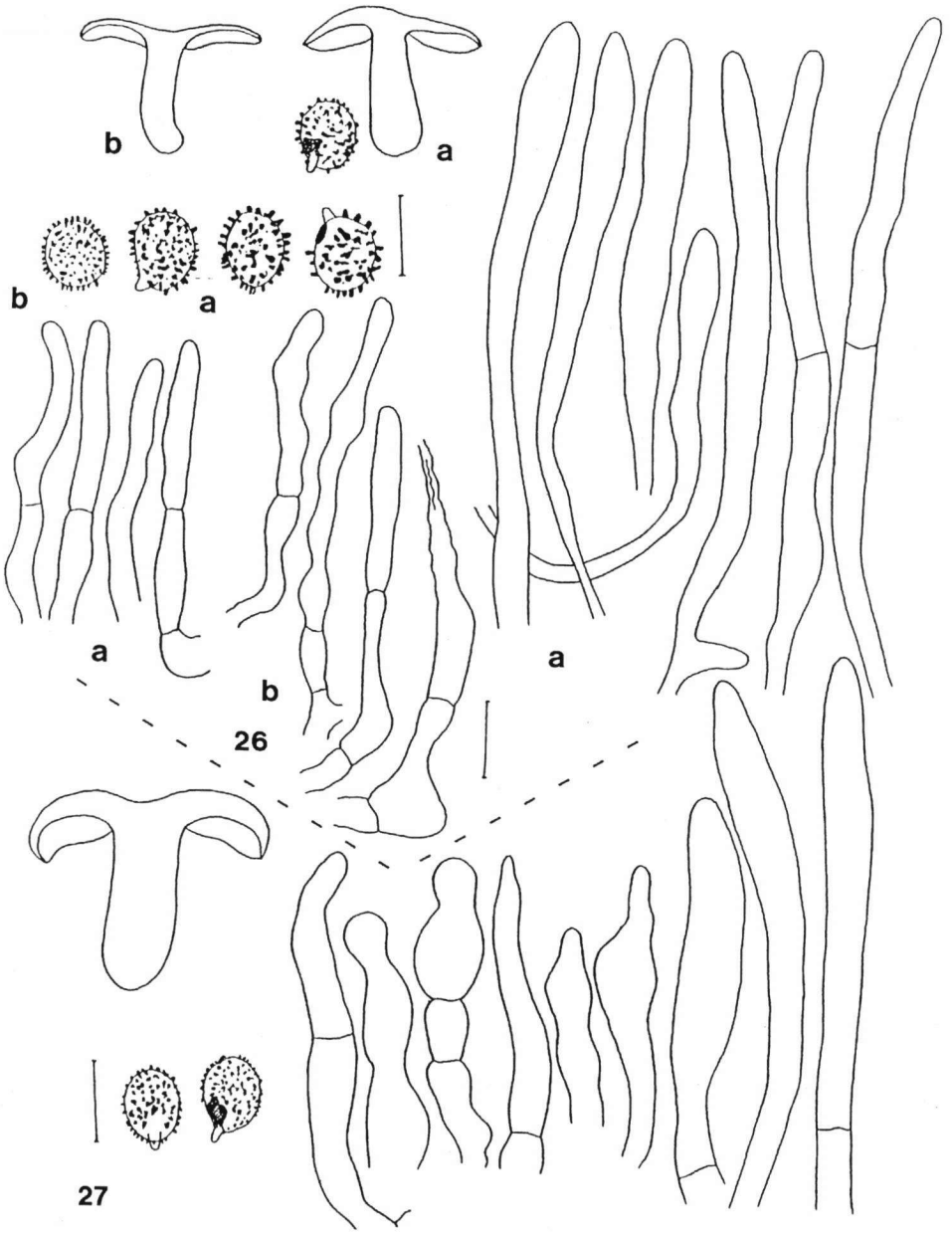

Fig. 26. *Russula graveolens* f. *elaeodes*. Habit, spores, pileocystida and elements of pileipellis (a: *88133*; b: *86166*). — Fig. 27. *Russula graveolens* f. *purpurata*. Habit, spores, and pileocystidia (Habit: *87186*, all other figs.: *87228*).

ences in species concepts in this group. Before Romagnesi's (1967) monograph the different variants were usually considered as varieties of one variable species (e.g. Schaeffer, 1952) which is in our opinion still the best taxonomic solution except for some characteristic and constant taxa like *R. xerampelina* (Schaeff.) Fr., *R. pascua* (Møller) J. Schaeff. and *R. faginea* Romagn., which deserve the rank of species. In order to give the possibility to compare the present data with other studies, some names proposed in the modern literature will be adopted here.

Romagnesi (1967) was the first one who tried to disentangle tentatively and eloquently the species of the *R. xerampelina* complex. Generally, he has been followed by the later authors except Moser (1983), who presented only a very brief key for the *Xerampelinae*.

On the other hand Bon (1988) presents a large number of taxa (39 species and varieties!) based on minute differences. The result of such extensive splitting must be that different names will be in vogue with different mycologists or groups of mycologists for the same taxon, each of them forced to find small differences in their own way. This procedure renders many mycological data, which are usually not provided with descriptions of the collections presented, of diminished value.

In this study the taxonomic classification by Einhellinger (1985) has been followed, which is based on Romagnesi (1967), but some doubtful 'species' were discarded. The taxa named here can be recognized only by macroscopical characters like the colour of the pileus, size and consistence of the fruit-body.

Other macroscopic characters like colour of the stipe (with/without red), discoloration of the flesh and stipe (always brownish), reaction with $FeSO_4$, smell, and separability of the cutis are more or less constant throughout the material or vary widely within collections and do not correlate with any other character.

The colour of the spore print generally is an important character in *Russula*. However, it appeared that within this group there was only little variation in the collections studied; sporeprints varied between IId–IIIa(–IIIc) according to the system of Romagnesi (l.c.). Unfortunately, spore prints were not produced by many young, old and damaged carpophores. Study of more material might show some value of this character.

Microscopic characters appear to be remarkably constant throughout the material. This is true for the spores (shape, size, properties of the ornamentation), the dermatocystidia (shape, size, number of septa) and hyphae in the epicutis. So it appears that these characters, which are normally so useful in the study of the genus *Russula*, fail largely in this particular group.

In view of the observed patterns of variation in the collections studied, it is in our opinion not possible to distinguish taxa in the rank of species, bearing in mind the criteria used by Kuyper (1988). In this context the taxa observed should be considered as formae: taxa where (single) character differences show limited intergradation.

Probably speciation within the *Xerampelina*-group is going on at present and has in most cases not yet resulted in morphologically well-defined species (with some exceptions, mentioned above). Therefore the taxa described here are distinguished as formae of *R. graveolens* Romell in Britzelmayer (1893), the oldest available species epithet in this group. There is no indication that the older name *R. barlae* Quél. belongs to the group of *R. xerampelina* and this name is rejected as a *nomen dubium*, in agreement with e.g. Krieglsteiner (1987: 24).

Key to the formae of *Russula graveolens* distinguished in the present study:

1a. Pileus predominantly green, olive-green, yellowish or brownish green 2
b. Pileus predominantly purplish red, red, brick-red or brownish violaceous..... 3
2a. Pileus small (c. 40–50 mm), firm, pileus rather dark brownish green to dark olive green or olive brown (sometimes with reddish or purplish hue) *R. graveolens* f. *elaeodes*
b. Pileus rather large (up to 75–100 mm), consistency not firm, pileus middle to pale olive green to yellow, sometimes a faint purplish hue present at the margin of the pileus, in centre often more brownish ..... *R. graveolens* f. *cicatricata*
3a. Pileus rather large (up to 80–100 mm or more), broadly expanded with age, dark purple-violaceous to (dark) reddish brown, sometimes mixed with olivaceous colours, in centre usually darker than margin; with viscid surface in wet weather, in dry situations dull, almost fine-granular; habit often much like *R. atropurpurea*, less often like *R. vesca* ..... *R. graveolens* f. *graveolens*
b. Pileus rather small (c. 35–45 mm), often less expanded with age, (brick-)red to purple, but large overlap with f. *graveolens*; often with remarkably dull-velvety granular surface ..... *R. graveolens* f. *purpurata*

Russula graveolens forma **cicatricata** (Romagn. ex) Keizer & Arnolds, *forma nova* — Fig. 25

A typo differt pileo olivaceo, luteo vel brunneo-virido pro parte maximo.
Holotypus: 'France, Coye-la-Forêt (Oise)', 13 Aug. 1960, *H. Romagnesi 60-69* (herb. Romagnesi; PC).

Pileus (40– when young) 75–100 mm or more, convex, then plano-convex with depressed centre, with different shades of olive-green or olive-brown to brown (Expo C78, D76, E76, D78, D88), towards the margin paler (e.g. B84, A84, A86, A76, D83 or K&W 4C5, 5E7, 5D8), sometimes with a concentric zone with purplish colours or this colour present in 'cloudy' patches (D64, D54, D52), surface dull to almost velvety, sometimes cracked in small patches towards the margin, in one case more or less concentrically arranged grooves present. Lamellae up to 8 mm broad, moderately distant, a few forked, not ventricose, narrowly adnate or slightly emarginate, cream-coloured, with concolorous edge. Stipe 32–60 × 12–25 mm, cylindrical or often broader towards the base, white, in one case with red colour at one side of the base of the stipe, discolouring brownish on handling and with age. Context spongy in the stipe, firmer in the pileus, white, turning brownish. Smell distinctive, fishy, like other members of the *Xerampelina*-complex. Chemical spot test: $FeSO_4$: blue-green. Spore print: IId–IIIa according to the system of Romagnesi (1967).

Spores 8.0–10.5 × 6.5–7.5(–8.0) µm, with Q = 1.1–1.3(–1.4), av. Q = 1.23, broadly ellipsoid, with ornamentation of coarse warts or spines, usually isolated but sometimes connected by a thin line, mostly acute, sometimes blunt, 1.0–1.3(–1.5) µm high, amyloid, supra-hilar spot obvious, amyloid. Dermatocystidia usually abundant, 80–100 × 3.5–7.0(–8.0) µm, frequently 1-septate, cylindrical or narrowly clavate, contents ± granular, with weak SV reaction. Hyphae of pileipellis 2.5–4.5 µm broad, usually cylindrical, sometimes inflated, up to 6(–13) µm.

Habitat – Terrestrial in roadside verges planted with *Quercus* on nutrient-poor sandy soil.

Collections examined. Plot Q11, 15 Sept. 1986, *Keizer 86127*; Plot Q32, 18 Aug. 1987, *Keizer 87034*; 3 Oct. 1988, *Keizer 88343*; Plot Q64, 19 Sept. 1988, *Keizer 88147*; Plot Q82, 4 Sept. 1987, *Keizer 87074*; 1 Oct. 1987, *Keizer 87219*; Plot Q83, 8 Sept. 1988, *Keizer 88162*.

Russula cicatricata was described by Romagnesi (1967: 694) as a species ad interim, without Latin diagnosis and therefore invalidly published. Romagnesi (l.c.) stated that the concentric furrows in combination with olive colours and a certain amount of ampulliform hyphae in the cutis are characteristic for *R. cicatricata*. This seems to be a solid base for a species, but according to our observations these characters are not reliable. The concentric furrows or cracks have been found only once (collection *87074*) and it seems to be a character which develops in dry weather conditions. Marchand (1977) also indicated that this character can be variable, even in specimens of one collection, and that the character may disappear after collecting.

The greenish colour is the most striking feature, but this colour can be mixed with a purple hue. It is clear that carpophores of this species can contain various quantities of purple pigment; the more purple pigment present, the more brownish the pileus. On the other hand, in forma *graveolens*, the pileus usually is purple red-brown, and can contain a variable proportion of olive or brownish colours. Such intermediates with colour of the pileus between greenish and purplish, are a minority among the studied collections. Occasionally, one can find purple and green carpophores so close together that one has to assume that they originate from the same mycelium. In the present material the hyphae of the cutis are usually cylindrical, but in two collections a small minority is inflated (collections *88162* and *88147*). This character occasionally also occurs in specimens which have been called f. *graveolens* and f. *purpurata* on account of the colour of the pileus.

In conclusion, none of the characters which are in use to determine f. *cicatricata* is reliable under all circumstances, and it is especially difficult to separate it from f. *graveolens*. A good plate is given by Marchand (1977: 480).

Russula graveolens forma **elaeodes** (Bres.) Arnolds & Keizer, *comb. nov.* — Fig. 26

Basionym: *Russula xerampelina* var. *elaeodes* Bres., Iconogr. mycol. 9 (1929) 420.

Pileus 30–40 mm, convex, then plano-convex to depressed, olive-green, olivaceous green-brown, or greyish (Expo E76, D74, E82), sometimes mixed with a faint purplish hue, short-sulcate at the margin (1–2 mm), surface moderately dull. Lamellae up to 4 mm broad, somewhat crowded, pale yellowish or cream-coloured with concolorous edge. Stipe 20–25 × 7–10 mm, more or less cylindrical or broader towards the base, whitish but strongly discoloring brownish on handling and with age. Context spongy in the stipe, firm in the pileus, white, turning brownish. Smell characteristic for the group, ± fish-like, not strong. Chemical spot test: $FeSO_4$: blue-green. Spore print: not obtained.

Spores 8.0–9.5(–10.2) × 6.2–8.3 µm, Q = (1.0–)1.1–1.3, av. Q = 1.20, broadly ellipsoid to subglobose, ornamentation 1.0–1.3 µm high, consisting of rather dense to scattered, usually isolated spines and warts, some may be connected by lines, amyloid,

suprahilar spot distinct, amyloid. Dermatocystidia 60–100 × 4–6 µm, more or less cylindrical or narrowly clavate, occasionally with a septum, contents granular or hyaline, with weak SV-reaction. Hyphae of pileipellis 2.0–4.5 µm broad, usually more or less cylindrical, sometimes inflated in places.

Habitat – Terrestrial in roadside verges planted with *Quercus* on nutrient-poor sandy soil.

Collections examined. Plot Q11, 24 Sept. 1988, *Keizer 88133*; Plot Q83, 1 Oct. 1986, *Keizer 86166*; Plot Q84, 29 July 1988, *Keizer 88011*.

The main differences between f. *elaeodes* and f. *cicatricata* are (1) the small, slender habit and (2) the less dull, almost grabrous surface of the pileus of the former. Possibly the pileus is darker than in f. *cicatricata*. This taxon is well-illustrated by Phillips (1981: 105, lower right).

Russula graveolens Romell in Britz. forma **graveolens** — Fig. 28

Pileus 45–83 mm, young convex, then plano-convex with depressed centre, in centre dark brown-purple, purplish red-brown, sometimes mixed with olivaceous colour (Expo H23), towards the margin paler, red purple-brownish (D23-24, E23-24, E34, D18), surface varying from smooth and viscid to dull and almost velvety, in part densely cracked. Lamellae up to 10 mm broad, distant, narrowly adnate, not ventricose, pale yellowish, cream-coloured, edge sometimes discoloring brownish with age. Stipe 40–80 × 13–25 mm, more or less cylindrical or broader towards the base to clavate, white, frequently with red colour at one side near the base, turning brown on handling and with age. Context firm in pileus and spongy in stipe, white, turning brownish. Smell characteristic for the group, fish-like, taste mild. Chemical spot test: $FeSO_4$: blue-green. Spore print IId–IIIb (mostly IId), in one case (IIIb–)IIIc.

Spores (8.1–)9.0–10.5 × 6.5–8.0(–8.2) µm, Q = 1.1–1.3(–1.4), av. Q = 1.26, broadly ellipsoid, ornamentation up to 1.0–1.3(–1.5) µm high, consisting of usually isolated spines, rarely connected, mostly acute, some broader and blunt, amyloid, supra-hilar spot distinct, amyloid. Pileocystidia abundant, 80–100 × (3.5–)4.5–7.0 µm, frequently with a septum, cylindrical or narrowly clavate, contents granular. Hyphae of cutis 2.5–5.0 (–7.0) µm broad, mostly ± cylindrical, rarely inflated up to 7.0 µm wide.

Habitat – Terrestrial in roadside verges planted with *Quercus* on nutrient-poor sandy soil.

Collections examined. Plot Q12, 18 Sept. 1988, *Keizer 88144, Keizer 88145*; Plot Q13, 23 July 1988, *Keizer 88019*; 7 Oct. 1988, *Keizer 88156*; Plot Q84, 1 Sept. 1986, *Keizer 86128*; 9 Oct. 1986, *Keizer 86164*.

For a discussion on the separating characters from f. *cicatricata* see under that taxon.

Russula megacantha Romagn. ad interim is, in agreement with Krieglsteiner (1987), considered a synonym, because the only reported difference, a slightly coarser and wider spore ornamentation, is not reliable since all kinds of transitions occur. Representative illustrations of f. *graveolens* were published by Marchand (1977: pl. 479), Einhellinger (1985: pl. 25) and Lange (1940: pl. 190A).

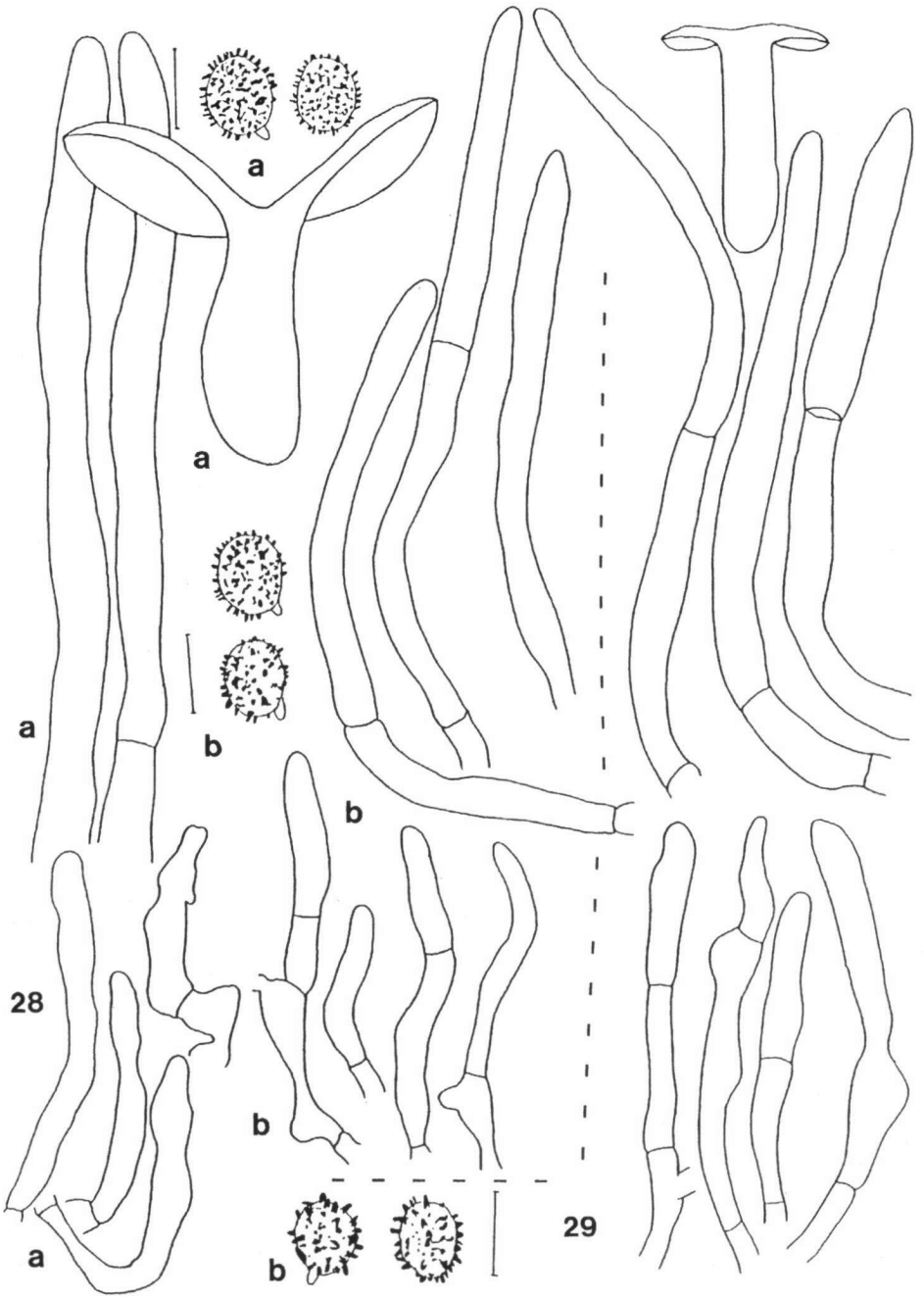

Fig. 28. *Russula graveolens* f. *graveolens*. Habit, spores, pileocystidia, and hyphae of pileipellis (a: *86164*; b: *88019*). — Fig. 29. *Russula graveolens* f. *purpurata*. Habit, pileocystidia, and hyphae of pileipellis (*87186*).

Russula graveolens forma **purpurata** (Crawshay) Keizer & Arnolds, *comb. nov.* — Figs. 27, 29

Basionym: *Russula purpurata* Crawshay, The spore ornamentation of *Russula* (1930) 103.

Pileus 33–45 mm, convex, then plano-convex, centre at most slightly depressed, deep purplish red or dark brownish purple (K. &W. 10F8 or Expo J62) with olive-brown tinge, towards the margin usually purplish red (K&W 10D8 or Expo E16), in one case more olive-brown (Expo J62), sometimes with yellowish spots, more or less viscid when moist, normally dull, almost velvety to minutely granular. Lamellae narrowly adnate, c. 2 mm broad, moderately crowded, not ventricose, occasionally forked, pale yellowish or cream-coloured. Stipe 23–40 × 9–13 mm, more or less cylindrical to clavate, white, base reddish at one side, on handling and with age brownish. Context white, remarkably firm, especially in stipe turning brownish. Smell rather weak, fish-like, as other members of the group. Chemical spot test: $FeSO_4$: blue-green. Colour of spore print unknown.

Spores 8.5–9.4 × 6.5–7.5 µm, Q = 1.1–1.4, av. Q = 1.25, broadly ellipsoid, with up to (0.7–)1.2–1.3(–1.5) µm high ornamentation of usually isolated warts or spines, sometimes connected by lines, amyloid, suprahilar spot distinct, amyloid. Dermatocystidia cylindrical to narrowly clavate, up to 80–100 × 4–6(–8) µm, frequently with 1–2 septa, with granular contents. Hyphae of cutis 3–5 µm wide, more or less cylindrical, with frequent inflations up to 7–10 µm wide.

Habitat – Terrestrial in roadside verges planted with *Quercus* on nutrient-poor sandy soil.

Collections examined. Plot Q4, 4 Oct. 1987, *Keizer 87228*; Plot Q13, 22 Sept. 1987, *Keizer 87186*; Plot Q82, 24 Sept. 1988, *Keizer 88344*; Plot Q84, 9 Oct. 1986, *Keizer 86165*.

The delimitation of *Russula graveolens* f. *purpurata* and *R. amoenoides* Romagn. seems to be very weak: the only separating character is the dull, more or less pruinose cap in *amoenoides* and a more glabrous cap in f. *purpurata*. Einhellinger (1985) described the surface of the pileus of f. *purpurata* as 'distinctly dull'. We regard *R. amoenoides* as a synonym. This forma was well depicted in Einhellinger (1985: pl. 25).

Russula parazurea J. Schaeff. ex J. Schaeff.

Habitat – Terrestrial in roadside verges planted with *Fagus* or *Quercus* on nutrient-poor to moderately nutrient-rich sandy soil.

Collections examined. Plot F21, 19 Nov. 1986, *Keizer 86270*; Plot F22, 25 Nov. 1986, *Keizer 86265*; Plot F33, 19 Nov. 1986, *Keizer 86269*; Plot F41, 19 Nov. 1986, *Keizer 86268*; Plot Q5, 2 Aug. 1988, *Keizer 88009*; Plot Q71, 25 Nov. 1986, *Keizer 86266*.

Russula parazurea proved to be very variable with respect to colour and surface of the pileus, more so than generally acknowledged in literature. Typically, the pileus is dark blue-greenish grey and pruinose. Frequently, specimens with violet or brick-red (e.g. Expo F44, C43; like the colour of *Russula vesca*) pileus can be found. In direct sunshine the original colour may fade to shiny yellowish, buff or straw-colour. Late in the season, from November onwards, the cutis becomes cracked, more or less like *R. virescens*, and then shows often brownish or violaceous colours.

The grey sporocarps preferably grow on or along footpaths in forests or on other shady places. The brick-red variants seem to prefer open habitats. The cracked cutis is only observed in places where other forms have been found before, and is consequently considered as a variant, induced by low temperatures.

All variants are considered as caused by environmental conditions and hence without taxonomic significance.

The species is relatively constant in microscopical characters with as most important feature the spore ornamentation which consists of warts in rows or crests, connected with lines, forming a more or less closed network. Among the related species in the subsection *Griseinae* this species has the most obviously reticulate spore ornamentation. In addition, the dermatocystidia often show a characteristic subapical constriction. In the field the lack of any pink colour in the stipe and the yellowish cream colour of the lamellae may help the identification.

Tricholoma scalpturatum (Fr.) Quél. var. **scalpturatum**

Habitat – Terrestrial in a roadside verge planted with *Quercus* on nutrient-poor sandy soil.

Collection examined. Plot Q14, 18 Sept. 1988, *Keizer 88148.*

We agree with Bon (1984) and Marchand (1986) to consider *Tricholoma scalpturatum* and *T. argyraceum* as different on the level of variety, the main separating character being the pale colour of the pileus in the latter. The microscopical features are more or less identical according to Bon (l.c.) and Marchand (l.c.). However, Moser (1978) gives different spore-sizes: 5–6(–7) × 3–4 µm and 7–9 × 4–5 µm respectively. The spores of this collection measure (4.1–)4.2–4.8(–5.4) × 2.8–3.2(–3.3) µm, and are somewhat smaller than the spore sizes cited above.

Tubaria furfuracea (Pers.: Fr.) Gillet incl. **T. hiemalis** Bon, **T. romagnesiana** Arnolds

Habitat – Terrestrial in roadside verges planted with *Fagus* or *Quercus* on nutrient-poor or enriched sandy soil; with a preference for *Fagus.*

Collections examined. Plot F22, 16 Nov. 1988, *Keizer 88320*; Plot F24, 10 Nov. 1986, *Keizer 86205*; Plot F43, 10 Nov. 1986, *Keizer 86204.*

Kühner & Romagnesi (1953: 243) distinguish three 'small' species within *Naucoria furfuracea* s.lat., viz.: *Naucoria segestria, N. furfuracea,* and *N. pellucida.* Arnolds (1982) followed this concept, although doubting whether the specific rank is deserved here. He changed the names in *Tubaria furfuracea* s.str., *T. hiemalis* and *T. romagnesiana.* After our experience the diagnostic characters (shape of cheilocystidia: capitate or not; very slight differences in spore-size; width of the hyphae in the trama of the lamellae) show large overlap. Even within one single fruit-body cheilocystidia may be found either of the '*hiemalis*'-type (capitate) or cylindrical-clavate or irregularly cylindrical. Therefore, we prefer to consider *Tubaria furfuracea* as one, rather variable, species.

II. APHYLLOPHORALES

Ramariopsis kunzei (Fr.) Corner

Synonym: *R. tenuiramosa* Corner.

Carpophores solitary or gregarious, up to 25 mm high, sparsely to strongly branched with 3 to 50 tips in one carpophore, branches c. 1 mm thick, with rounded axils, dirty white-yellowish to pale brownish beige (Expo B64, A62), on drying paler, stipe slightly darker, minutely velvety, base tomentose. Smell indistinct. Spores in mass white.

Spores (3.5–)3.6–4.7(–4.8) × 3.0–4.2(–4.4) µm, Q = 1.0–1.3, av. Q = 1.13, globose, subglobose or broadly ellipsoid, finely echinulate, with one oil-drop. Clamp-connections present.

Habitat – Terrestrial in roadside verges planted with *Quercus* on nutrient-poor sandy soil.

Collections examined. Plot Q2, 14 Oct. 1988, *Keizer 88234*; Plot Q38, 22 Oct. 1988, *Keizer 88244*.

The carpophores found here could not be unambiguously assigned to *Ramaria kunzei* or *R. tenuiramosa*. The drawings of the habit by Corner (1950) of these species look rather different, but our collections include intermediate carpophores. Besides, he stated under *R. kunzei* (p. 642) that it is an extremely variable species. Maas Geesteranus (1976) is inclined to consider *R. tenuiramosa* a modification of *R. kunzei*. The two collections differ in spore-size: collection *88324* has spores of 3.5–4.0 × 3.0–3.4 µm, collection *88244* of 3.5–4.7(–4.8) × (3.0–)3.5–4.2(–4.4) µm. These values fall within the range given by Corner (l.c.) for *R. kunzei*.

III. ASCOMYCETES

Helvella cf. **corium** (Weberb.) Massee

Ascocarp stalked-cupulate; excipulum 10 mm wide, grey to dark grey, villose-granulose, hymenium brown-black. Stipe 7 × 1.5 mm, cylindrical, somewhat paler than excipulum, grey, villose-granulose.

Spores 17.5–18.7 × 11.5–12.0 µm, ellipsoid, with one large oil-drop. Paraphyses 3.5–4.0 µm broad cylindrical, apical part enlarged, up to 7.0 µm, septate, apical cell 70–140 µm long, content diffuse greenish (in NH_4OH 10%).

Collection examined. Plot F43, 6 Oct. 1988, *Keizer 88230*.

The ascocarp of our collection is not as dark as on plate 239 in Boudier (1905: 10).

Helvella cupuliformis Dissing & Nannf.

Ascocarp 25 mm high, stalked-cupulate, excipulum 18 mm broad, roundish, with margin strongly incurved, grey (Expo D81, D61), rugose-tomentose, hymenium dark brown-grey (H-J32, central part F64). Stipe 15 × 2.5 mm, towards the base broad (up to 8 mm) and partially split, ivory-white or cream-coloured, at apex tomentose, at base finely tomentose. Smell none.

Spores 17.5–20.3 × 10.3–11.3 µm, elliptical with one large oil-drop. Paraphyses 3 µm broad, cylindrical but apical part irregularly enlarged, up to 5 µm, contents pale greyish, under the microscope in NH_4OH 10%. Hairs of excipulum multicellular, cells 14–22 × 14–17 µm, inflated.

Collection examined. Odoorn, Odoornerveen, 17 Sept. 1987, *Keizer 87167.*

This specimen has been named *H. cupuliformis* on account of the white stipe. The microscopic characters seem to be identical with *H. villosa.*

Otidea alutacea (Bres.) Massee

Apothecia 15–40 mm broad and up to 30 mm high, irregularly cup-shaped, often more or less stalked, split at one side; excipulum pale brownish beige, alutaceous (Expo D63, but more greyish and somewhat paler or K. &W. 5D4), finely granulose; hymenium concolorous or a little more reddish.

Spores (12.0–)12.3–15.0(–15.5) × (5.7–)6.0–6.5(–7.0) µm, ellipsoid, smooth, usually with two oil-drops, obliquely uniseriate. Asci 160–200 (or more) × 9.0–12.5 µm, cylindrical; paraphyses 2–3 µm thick, apical part slightly thicker, curved, sometimes slightly lobed.

Collections examined. Plot Q32, 3 Oct. 1988, *Keizer 88220*; Plot Q83, 8 Sept. 1988, *Keizer 88178.*

The specimens studied agree well with the plates in Boudier (1905–1910: pl. 327), Bresadola (1927–1933: pl. 1228-2), Breitenbach & Kränzlin (1981: pl. 60), Dennis (1978: pl. 8B), but not so well with the illustration in Phillips (1981: 270), which looks like *O. concinna* (Pers.) Sacc. on account of the yellow colour present in the excipulum. However, the spores are given as 12–15 × 6–7 µm, which is in agreement with the spore-size given above for *O. alutacea.* The spores of *O. concinna* as reported by Maas Geesteranus (1967) are smaller: 9.8–11.8 × 5.4–5.8 µm.

Otidea bufonia (Pers.) Boud.

Apothecia up to 40 mm broad and high, irregularly cup-shaped and deeply split at one side, indistinctly stalked; excipulum dark brown (Expo H32 - J21), finely velvety; hymenium darker than excipulum, blackish brown (J41 but darker).

Spores 13.4–15.6 × 5.8–7.2(–7.9) µm, ellipsoid, smooth, with two oil-drops, obliquely uniseriate; asci 150–200 (or more) × 9–12 µm, cylindrical; paraphyses 2–3 µm broad, apically enlarged up to 4 µm broad and slightly bent or straight, septate with cells of 15–40 µm long.

Collections examined. Plot F44, 8 Sept. 1988, *Keizer 88177*; Plot Q22, 13 Oct. 1988, *Keizer 88358*; Plot Q83, 10 Sept. 1986, *Keizer 86138.*

Among the large, dark brown species of *Otidea* described in literature, two species are found, one with large and one with smaller spores. Three names seem to be available for them: *Otidea bufonia, O. cochleata* and *O. umbrina.* The description of *Peziza umbrina* in Persoon (1801) is very short: "*magna cespitosa contorta umbrina*". Boudier (1905–1910) and Bresadola (1927–1933) used the name *O. umbrina* for the small-spored taxon (spores

15–16 × 7–8 µm and 14.7–17 × 6.5–8 µm respectively). However, Dennis (1978) and Maas Geesteranus (1967) mentioned *O. umbrina* as a (possible, Maas Geesteranus) synonym under the large-spored *O. cochleata* (spores 16–18 × 7–8 µm and 17.7–20.7 × 9.9–10.8 µm respectively). It is clear that Persoon's very briefly described *P. umbrina* variously has been interpreted and in the absence of authentic material better can be regarded as a *nomen dubium*. The material found during the present study fits well with the small-spored species and is therefore called *Otidea bufonia*.

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