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

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

ELSE C. VELLINGA

Rijksherbarium, Leiden

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

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

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

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

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

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

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

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

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

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

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

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

The group of *F. limulatus* shows resemblances to the group of *Pholiota lucifera* as well as to the group of *Inocybe dulcamara*. It is not impossible that *F. limulatus* and *F. muricatus* contain styrylpyrones, as both species are vividly yellow-brown coloured,

as do several wood-inhabiting species of the genera *Pholiota* and *Gymnopilus*. In *Pholiota lucifera* the pileipellis is, in contrast with the pileipellis of *Flammulaster*-species, a slightly gelatinized cutis of cylindrical hyphae with incrusting pigment.

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

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

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

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

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

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

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

In this paper a key to the species of *Flammulaster* in north-western Europe is given, and the species are described and illustrated. Much attention is given to the species concept in two groups of taxa, viz. the group around *F. carpophilus* and the group of *F. limulatus*. As the species belonging to this genus are generally easily overlooked because

of the small size of the basidiocarps, it is not surprising that owing to the unknown variability of the taxa concerned too many have been distinguished.

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

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

Flammulaster Earle

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

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

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

KEY TO THE SPECIES

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

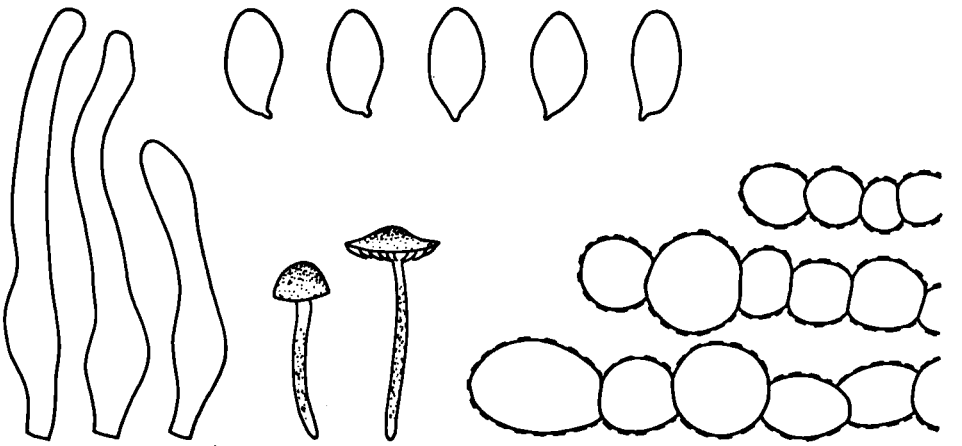

Fig. 1. *Flammulaster granulosus*. — Habit (× 1), spores, cheilocystidia and elements of pileipellis (from *Vellinga 697*).

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

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

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

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

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

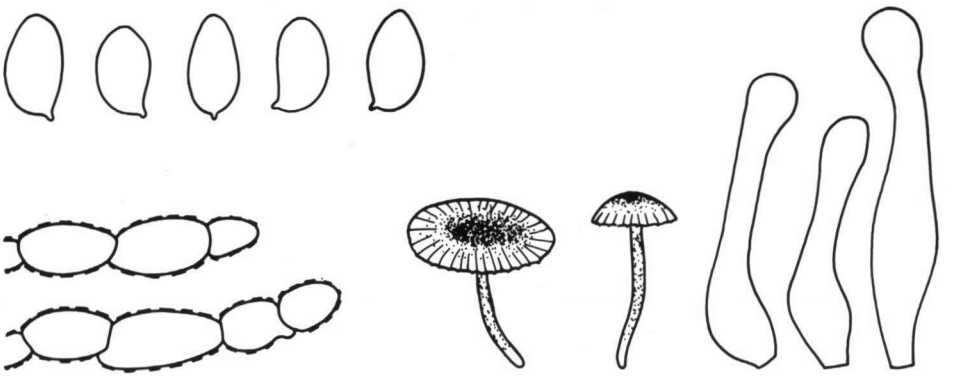

Fig. 2. *Flammulaster ferrugineus*. — Habit (= 1), spores, cheilocystidia and elements of pileipellis (from *Schreurs 763*).

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

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

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

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

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

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

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

Pileus 6–22 mm, at first hemispherical, convex or conico-convex, expanding to plano-convex or applanate with low broad umbo, hygrophanous, in moist condition dark rusty

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

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

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

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

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

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

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

rhombosporus (Atk.) Watl. in Notes R. bot. Gdn Edinb. 28: 67. 1967 (as *F. rhombospora*). — *Phaeomarasmius rhombosporus* (Atk.) Malloch & Redh. in Fungi canad. 142. 1979.

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

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

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

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

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

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

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

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

KEY TO THE INFRASPECIFIC TAXA OF F. CARPOPHILUS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

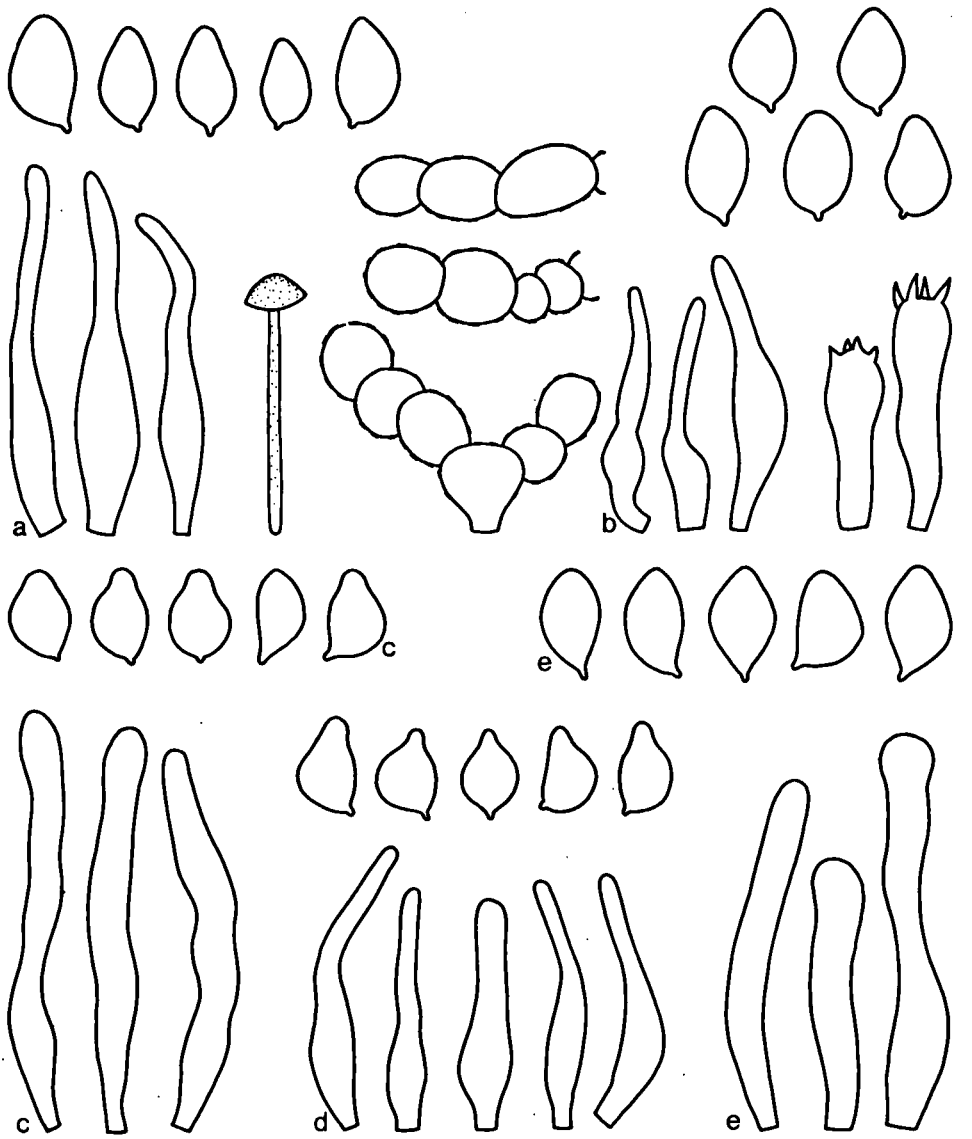

Fig. 3. *Flammulaster carpophilus*. — a, b. var. *carpophilus*, habit (× 1), spores, cheilocystidia, basidia, and elements of pileipellis. (a. from *Vellinga 733*, b. from *Bayer 558*.) — c. variant 2, spores, and cheilocystidia (from *Jansen 84–375*). — d. var. *rhombosporus*, spores and cheilocystidia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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The differential characters of the three taxa are the following:

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

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

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

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

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

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

KEY TO THE VARIETIES OF F. LIMULATUS

1. Spores in side view in majority distinctly phaseoliform, with germ pore . . . . . var. *limulatus*
1. Spores in side view in majority ellipsoid to oblong, or amygdaliform with acute apex, with or without distinct germ pore.
   2. Spores in side view amygdaliform or ellipsoid, with acute apex, with distinct germ pore var. *novasilvensis*
   2. Spores in side view amygdaliform, slightly phaseoliform or ellipsoid with rounded apex, without or with indistinct germ pore . . . . . var. *litus*

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

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

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

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

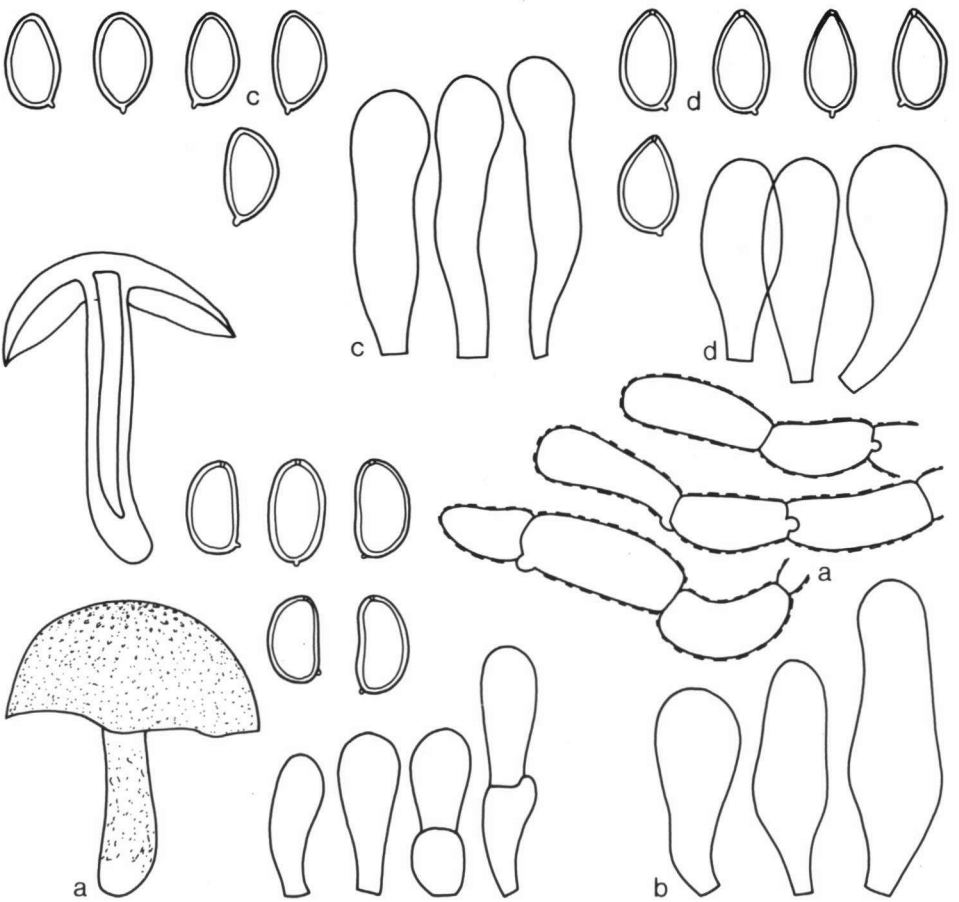

Fig. 5. *Flammulaster limulatus*. — a, b. var. *limulatus*, habit (× 1), spores, cheilocystidia and elements of pileipellis. (a. From *Vellinga 648*, b. from *Hechler 83/121*.) — c. var. *litus*, spores and cheilocystidia (from holotype). — d. var. *novasilvensis*, spores and cheilocystidia (from holotype).

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

Spores in side view 7.0–8.0(– 8.5) × 3.5–5.0 µm, Q = 1.55–2.05(–2.2), $\bar{Q}$ = 1.7–1.9, phaseoliform with rounded apex, a few ellipsoid or oblong, in frontal view (3.5–)4.0–5.0(–5.5) µm, Q = 1.45– 2.0(–2.1), $\bar{Q}$ = 1.65–1.85, ellipsoid to oblong, with distinct germ pore, brown and thickwalled. Basidia 20–27 × 5–8 µm, 4-spored, some, especially close to lamella edge, brown. Cheilocystidia crowded, often in small

clusters, 11–42 × 6–12 µm, cylindrical with rounded apex, narrowly clavate or subutriform, colourless to brown, sometimes slightly thick-walled. Pileipellis a cutis with ascending and reflexed bundles of hyphae, made up of slightly inflated elements, with terminal members 20–50 × 8–25(–45) µm, with coarsely brown incrusting pigment. Stipitipellis a cutis with loosely lying brown incrusted hyphae, with at apex some velar remnants, made up of colourless, often branched c. 4 µm wide, cylindrical hyphae.

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

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

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

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

Etymology: litus means 'covered, stained'.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

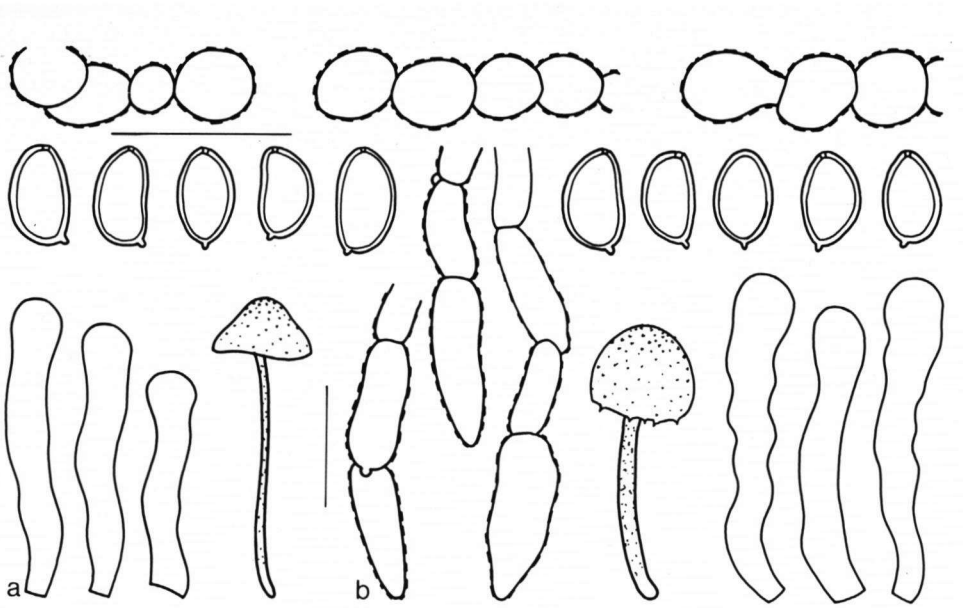

Fig. 6. *Flammulaster muricatus*. — Habit (× 1), spores, cheilocystidia, elements of pileipellis, and hairs of stipe. (a. From *Bas 5467*, b. from *Bayer & Wölfel, 7 July 1984.*)

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

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

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

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

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

Pileus 4–20 mm, hemispherical, broadly rounded conical to applanate, reddish-ochraceous brown (Munsell 7.5 YR 5/6) at centre to more yellowish golden-brown at margin (10 YR 7/8), covered with small ochraceous brown or reddish brown squamules, when young with fimbriate-dentate margin. Lamellae (L = 20–30, l = 1–3), moderately crowded to moderately distant, adnate, slightly emarginate, when young pale ochraceous

brown, later more rusty brown (10 YR 6/6–7.5 YR 5/6), with paler or white, flocculose edge. Stipe 13–35 × 0.8–2.5 mm, cylindrical, sometimes slightly bulbous at base, fistulose, more or less concolorous with pileus, slightly darker at base, covered with reddish brown or ochraceous brown granular floccules. Context in pileus brown to orange-brown, in stipe concolorous with surface. Smell absent or indistinct, rarely terroid-astringent. Taste not known.

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

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

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

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

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

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

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

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

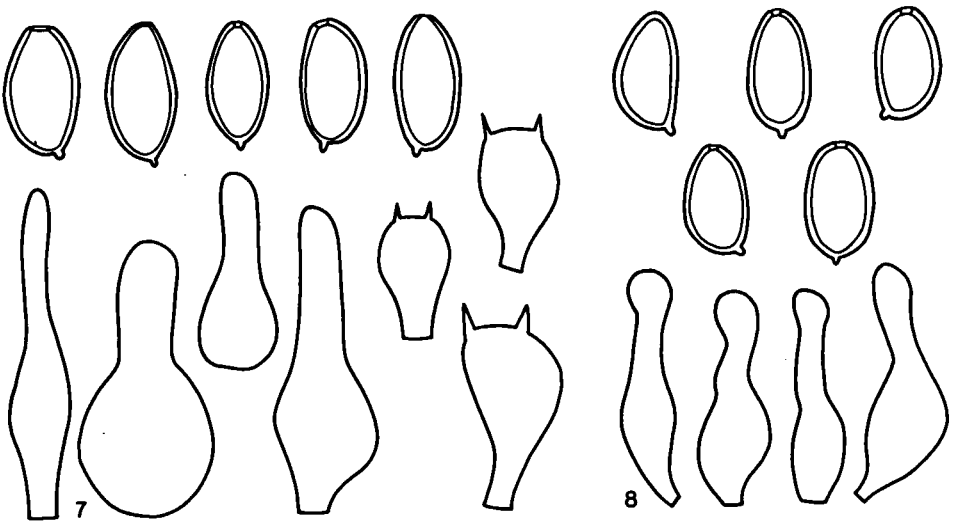

Fig. 7. *Flammulaster wieslandri*. — Spores, basidia and cheilocystidia. (All figs. from *Tjallingii & Tjallingii-Beukers, 15 Dec. 1984*.)
Fig. 8. *Flammulaster spec.* — Spores and cheilocystidia (from *Kits van Waveren, 28 Oct. 1962*).

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

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

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

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

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

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

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

8. Flammulaster spec. — Fig. 8

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

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

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

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

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

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

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

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

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

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

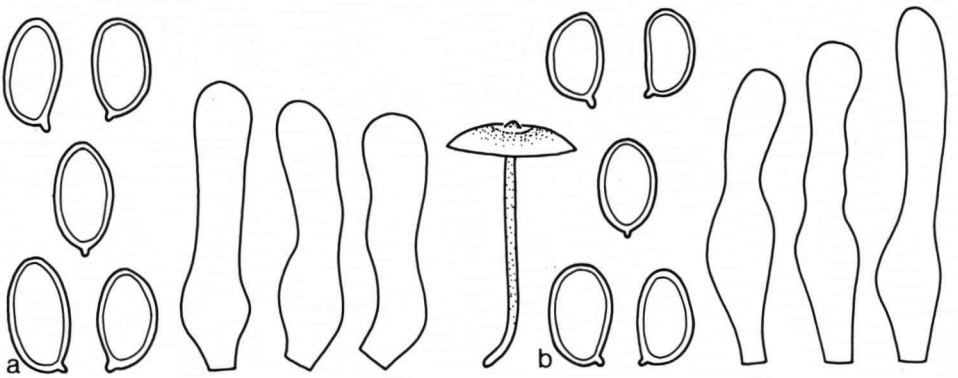

Fig. 9. *Flammulaster gracilis*. — Habit (× 2), spores and cheilocystidia. (a. From *Bas 7468*, b. from *De Meijer 389*.)

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

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

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

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

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

EXCLUDED TAXON

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

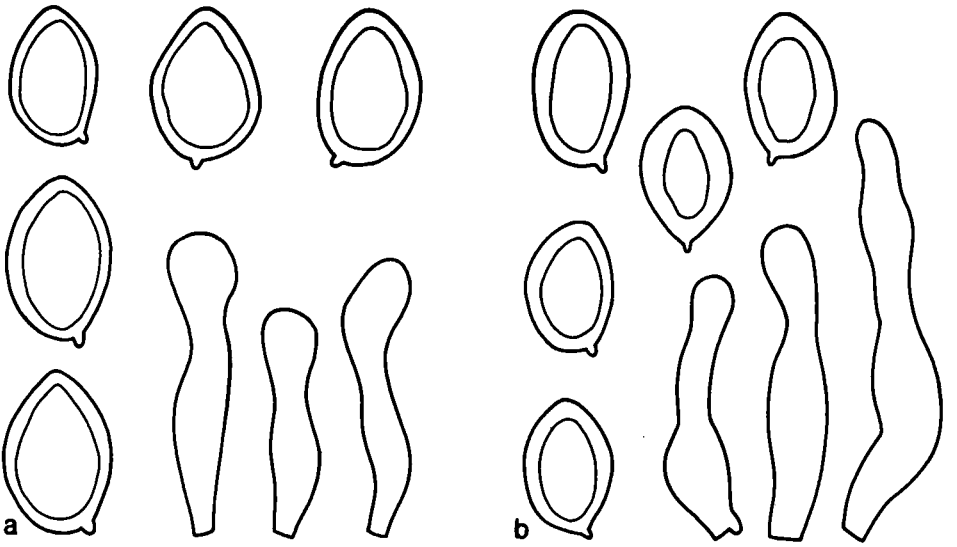

Fig. 10. *Galerina harrisonii*. — Spores and cheilocystidia. (a. From holotype, b. from holotype of *Galerina antheliae*.)

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

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

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

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

ACKNOWLEDGEMENTS

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

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

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

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

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

REFERENCES

BAS, C. (1986, in prep.). Order and family concepts in agarics and boleti. In Bas, C., Kuyper, Th. W., Noordeloos, M. E. & Vellinga, E. C. Flora agaricina neerlandica 1.

CETTO, B. (1983). I funghi dal vero 4. Trento.

EARLE, F. S. (1909). The genera of the North American gill fungi. In Bull. N.Y. bot. Gdn 5: 373–451.

FAVRE, J. (1948). Les associations fongiques des hauts-marais jurassiens. In Mat. Fl. crypt. Suisse X, 3: 5–227.

FRIES, E. M. (1818). Observationes mycologicae 2. Hafnieae.

—— (1877–1884). Icones selectae hymenomycetum nondum delineatorum. Stockholm.

HARMAJA, H. (1978). *Phaeomarasmius confragosus* – an agaric to be transferred to *Tubaria*. In Karstenia 18: 55–56.

HORAK, E. (('1979') 1980a). New species of *Simocybe* Karsten (Agaricales) from Papua New Guinea. In Sydowia 32: 123–130.

—— (('1979') 1980b). New and interesting species of *Phaeomarasmius* (Agaricales) from Papua New Guinea and adjacent regions. In Sydowia 32: 167–180.

—— (1980c). Fungi agaricini novazelandiae VIII. *Phaeomarasmius* Scherffel and *Flammulaster* Earle. In New Zeal. J. Bot. 18: 173–182.

—— (1980d). Fungi agaricini novazelandiae X. *Simocybe* Karsten. In New Zeal. J. Bot. 18: 189–196.

KÜHNER, R. (1969). Une Agaricale pue connue: *Tubaria confragosa* (Fr.) comb. nov. In Trav. Labor. La Jaysinia 3: 67–71.

—— (1980). Les hyménomycètes agaricoides. In Bull. Soc. linn. Lyon 49 (no. spéc.): 1–1027.

KÜHNER, R. & ROMAGNESI, H. (1953). Flore analytique des champignons supérieurs. Paris.

—— & —— (1957). Compléments à la Flore analytique VII. Espèces nouvelles, critiques ou rares de Naucoriacées, Coprinacées et Lépiotacées. In Bull. Soc. Nat. Oyonnax 10–11: 3–94.

KUYPER, Th. W. (1986, in press). A revision of the smooth-spored species of the genus *Inocybe* in north-western Europe with a reconnaissance of the remaining taxa in Europe. In Persoonia Suppl. 3.

MALENÇON, G. & BERTAULT, R. (1970). Flore des champignons supérieurs du Maroc 1. Rabat.

MALLOCH, D. W. & REDHEAD, S. A. (1979). *Phaeomarasmius rhombosporus*. In Fungi canad. 142.

ORTON, P. D. (1960). New checklist of British agarics and boleti. Part III. Notes on genera and species in the list. In Trans. Br. mycol. Soc. 43: 159–439.

—— (1984). Notes on British agarics VIII. In Notes R. bot. Gdn Edinb. 41: 565–624.

REIJNDERS, A. F. M (1963). Les problèmes du développement des carpophores des Agaricales et de quelques groupes voisins. Den Haag.

SINGER, R. (1975). The Agaricales in modern taxonomy. 3rd ed. Vaduz.

VOOUS, K. H. (1970). Wat is biosystematiek? In Biosystematiek. Wageningen.

VOSS, E.G. & al. (1983). International code of botanical nomenclature. In Regn. veget. 111: 1–472.

WATLING, R. (1967). The genus *Flammulaster*. In Notes R. bot. Gdn Edinb. 28: 65–72.

WEINMANN, C.A. (1836). Hymeno- et Gasteromycetes hucusque in Imperio rossico observatos. Petropoli.

WHARTON, H.T. (1884). On Fries' nomenclature of colours, an examination of the epithets used by him in describing the coloration of the Agaricini. In Grevillea 13: 25–31.