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MARASMIUS KALLIONEUS, A NEW ARCTIC SPECIES.

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Summary: A new species of Marasmius is described, based on collections made from Greenland and Svalbard (Spitzbergen). It is characterized by having a pungent onion odour, pruinose stipe, distant and rather thick lamellae. Basidia are long and narrow, and always two-spored. Oleiferous hyphae are present throughout the fungus. Marasmius kallioneus sp. nov. belongs in the section Chordales Fr. Closely allied taxa showing onion odour are discussed.

Zusammenfassung: Aufgrund von Funden aus Grönland und Spitzbergen beschreibt der Autor eine neue Marasmiusart. Sie ist charakterisiert durch einen sehr scharfen Zwiebelgeruch, bereiften Stiel sowie durch entfernte und ziemlich dicke Lamellen. Die Basidien sind sehr lang und schmal und stets zweisporig. Oleiferen kommen in sämtlichen Teilen des Fruchtkörpers vor. Marasmius kallioneus sp. nov. gehört zur Sektion Chordales Fr. Die nächstverwandten Arten, die ebenfalls Zwiebelgeruch aufweisen, werden besprochen.

Résumé: Une nouvelle espèce de Marasmius est décrite sur la base des collections du Groënland et de Svalbard. Elle est caractérisée par une odeur d'oignon très âcre, un pied pruineux et des lamelles espacées et assez épaisses. Les basides sont longues et étroites et toujours bisporiques. Les hyphes oléifères sont présentes dans toutes les parties du champignon. Marasmius kallioneus sp. nov. appartient à la section Chordales Fr. Les taxons étroitement alliés, à odeur d'oignon, sont discutés.

In her study of Svalbard fungi, Ohenoja (1971) briefly mentioned a collection of *Marasmius* Fr. that produced a pungent onion odour. She apparently was the first to report this well defined taxon, which has since been mentioned on two further occasions (Petersen 1977:16 and Lamoure et al. 1982:89), but has remained unnamed. Many of the characters are striking and in clear contrast to existing species. Hence, this taxon merits specific rank and is herein dedicated to Professor Paaavo Kallio. His continuous efforts toward elucidating the numerous aspects of the North are unique.

MARASMIUS KALLIONEUS sp. nov.

Pileus usque ad 23 mm latus, 3-4 mm altus, initio convexus et margine involutus, obscure brunneus, non striatus, deinde convexo-planus vel raro depressus, brunneo colore, striae ad dimidium radii attigens. Odor alliaceus. Lamellae distantes, crassae, adnatae, pallide coloratae, minuter venoso-conjunctae. Stipes 20-40(-90) X 1.5-2.0 mm, aequalis, brunneus, apicali parte albopruinosus vel glaber, basali parte pubescens. Sporae hyalinae, laevae, amygdaliformes vel ellipsoideae, 10-13(-14) X 6.2-8.1 μ m, non amyloideae. Basidia bisporia, longa et angusta, 50-65 X 7.0-8.5 μ m, fibulata; sterigmata 9 μ m longa. Cystidia hymenii hyalina, cylindrata vel clavata vel rostrata. Trama lamellae regularis vel subregularis, fibulosa. Trama pilei non dextrinoidea, hyphas forsitan oleaceas habens. Cuticula pilei hymeniformis, e cellulis laevis, clavatis vel truncatis consistens, cellulis tenuiter tunicatis vel plus minusve crassotunicatis, fibulatis. Cortex stipitis typice ad apicem cystidiosus, cystidia tenuiter tunicata, clavata vel pyriformia, hyalina; cortex basalis pilos longos habens. Holotypus: Borgen 81.83 (C).

Pileus up to 23 mm in diameter when fresh, 3-4 mm high, at first convex with an inrolled margin, later plano-convex, more rarely somewhat depressed or papillate, hygrophanous, initially unicolorous and without striation, dark brown (Munsell 5YR4/3), later disk brown (Cailleux P67; 7.5YR5/4) and margin lighter (M69; 7.5YR7/4), crenulate, translucent striate to 1/2 or 3/4 of cap radius; either matt or with a slight sheen, smooth to naked eye. Context moderately thin, light grey brown, onion odour pungent, devoid of foetid components, taste similar, strong or weak.

Lamellae distant, thick, adnate to shortly decurrent, typically

horizontal, evenly spaced but of uneven length, 12-18 attached to the stipe, usually with 4-10 lamellulae, up to 3 mm broad, edges smooth to minutely uneven, whitish throughout or more rarely attaining pileal colour for ca 2 mm at the margin, basal parts greyish pink (M53; 7.5YR7/2); lamellae may have small ridges inbetween or running along their flanks.

Stipe 20-40(-90) X 1.5-2.0 mm, central, dark reddish brown (T29; 5YR3/3) to pink clay (ca 5YR6/4) or café-au-lait (7.5YR5/2 X 4/2), equal or base slightly wider, partly hollow, not shiny, totally white-pruinose or apically smooth, base pubescent.

Spores whitish in mass, typically ellipsoid to amygdaliform in side-view, ellipsoid in face-view, 10-12(-13) X 6.8-8.1 μm , L/W (1.4)1.5-1.6, average of 30 spores 10.9 X 7.4 μm (all from holotype), more elongate in other collections, measuring 10-13(-14) X 6.2-8.1 μm , L/W 1.5-1.7, average 11.8 X 7.2 μm , acyanophilous, inamyloid, indextrinoid, hyaline, smooth, often with conspicuous oily contents, apiculus prominent, ca 1 X 1 μm , spore base obtuse to acute. Basidia typically two-spored, more rarely one-spored, never seen to be three- or four-spored, long and narrow, 50-65 X 7.0-8.5 μm , including the ca 9 μm long sterigmata, basally clamped, with oily contents. Basidioles fusiform to cylindrical-clavate. Pleuro- and cheilocystidia scattered, cylindrical-clavate, 3-5 μm wide, or ventricose-rostrate, 4-6 μm wide below, 2-3 μm wide above, occasionally exceeding length of hymenial elements by up to 10 μm .

Hymenophoral trama regular-subregular, in dried material rather dark brown under dissecting microscope, hyphae with thickened walls, frequently reaching 0.5 μm in thickness, hyphae inamyloid, indextrinoid, clamped. Subhymenium not clearly delimited, made of interwoven, thin-walled hyphae. Pileal context of interwoven hyphae, these 4-8 μm wide, clamped, walls thickened (0.5 μm), neither amyloid nor dextrinoid (KOH pretreated), becoming subparallel towards the hymenium. Hyphae with dense and, in cotton blue, deeply colouring (oleiferous?) contents present in all parts of the fungus, in stipe irregular-lobate, in other parts more regular, rarely clamped.

Pileus cuticle smooth, a hymeniform layer of clavate cells, measuring 20-30 X 6-8 μm , thin-walled to quite thick-walled, rarely mixed with truncate (collapsed) cells and even more rarely with clearly lobate cells, in age the hymeniform structure may be lost, cuticle becoming deformed, all elements clamped, neither amyloid nor dextrinoid; pigment may be situated below the hymeniderm, where the basal cells with thick and deeply pigmented walls; when more evenly distributed,

colour present in lower parts of the hymeniderm elements, apices often subhyaline to hyaline; some pilei with numerous, 5-6 μm exceeding clavate elements of the hymeniderm.

Stipe cortex of septate, brown hyphae, 2-4 μm wide, in the upper portion typically densely covered with hyaline, thin-walled, clavate-pyriform cystidia, measuring ca 10-30 X 4-6 μm ; at the basal part with a pubescence caused from elongate, clamped, inamyloid, sparsely septate, thin to moderately thick-walled (0.5 μm) hyphae of variable length. Stipes rarely apically smooth under a hand-lens. Stipe context inamyloid.

Material studied: Greenland: Paamiut/Frederikshåb (62°00'N, 49°40'W) 25 m a.s.l., 24 Sept. 1983, leg T. Borgen 83.81 (Holotype, C); type locality, 2 Sept. 1984, Borgen 84.208 (C) and 12 Sept. 1984, Borgen 84.229 (C). -- Disko, Lyngmarken, 35 m a.s.l., 24 Aug. 1970, P.M. Petersen 70.209 (C); Disko, 1 Sept. 1971, P.M. Petersen 71.147 (C). -- Svalbard (Spitzbergen): Isfjorden, W side of Grønfjorden, Kongressdalen at 78°02'N, 14°07'E, 19 Aug. 1966, E. Kankainen (TUR). -- Longyearbyen, base of Blomsterdalen, 5 Aug. 1983, Huhtinen 83/267 (TUR); Longyearbyen, Blomsterdalen, 150 m a.s.l., 31 July 1983, Huhtinen 83/141 (TUR).

Additional material: Greenland: Paamiut/Frederikshåb, 1 Sept. 1978, Borgen 78.118 (C); 16 Sept. 1978, Borgen 79.154 (C); 24 Sept. 1983, Borgen 83.80 (C); 24 Sept. 1983, Borgen 83.81 (C). -- Gådthåb (Nuuk), 6 Sept. 1946, M. Lange 513 (C); Skarvefjeldfod near Gådthåb, 13 Aug. 1967, M. Lange 67-150 (C). -- Qinqva-valley (60°16'N, 44°33'W), Aug. 1983, Knudsen & Borgen & Petersen 512 (C).

In Greenland and Svalbard Marasmius kallioneus is found growing, mostly scattered, in dwarf scrub heathland. The type comes from a snow bed having Salix herbacea L., Cerastium L. and Empetrum L. Further collections in the area add Taraxacum Weber, Oxyria digyna Hill and Stellaria borealis Bigel. to the list. The collection cited by Petersen (1977) comes from a site dominated by Betula nana and having a thin layer of snow only during the winter. Other vascular species found near this agaric were: Silene acaulis L., Salix glauca L., Dryas integrifolia Vahl., Vaccinium uliginosum L., Empetrum hermaphroditum Hagerup, and Carex rupestris All. Svalbard collections were made on N-S facing slopes, one at the base of a peat hummock, the other amongst a dense stand of Peltigera Willd. The pH reaction for collection 83/141 was 4.9. The actual substratum for the fungus has been noted only twice: the collection cited above had one fruit body attached to the buried stem of Cassiope tetragona D. Don, and Mr. Borgen (pers. comm.)

noted specimens emerging straight from tufts of mosses, e.g. *Polytrichum* L. and *Drepanocladus* (C. Müll.) Roth.

Apparently *M. kallioneus* is not rare in snow bed communities around the type locality. Six mycelia were found inside an area of ca 1000 m² (Borgen, pers. comm.). In addition, well preserved fruit bodies have been noted by Mr. Borgen during a thaw period after two weeks of daytime frost.

DISCUSSION

Marasmius kallioneus is characterized macroscopically by having a strong onion odour when fresh but lost on drying, the pruinose stipe, the distant and thick lamellae. The long and narrow, constantly two-spored basidia also provide a means for quick identification. Though there is a slight difference in spore length between the material from type locality and rest of the collections both from Greenland and Svalbard, the conspecificity is strongly supported by all the other characters studied.

A number of species approximate with this fungus but are easily excluded. In the field it may first be confused with *M. scorodonius* (Fr.) Fr., but the pruinose stipe and microscopical features provide rapid means for identification. Lange (1936) illustrated *M. alliaceus* (Jacq. : Fr.) Fr. var. *subtilis* Lange, but no material remains in Copenhagen. A recent collection (Denmark, Sjælland, Ebberys Skov, 22 Aug. 1982, leg. & det. H. Knudsen, C), however, most likely represents this taxon. It constantly showed four-spored, shorter basidia with prominent (50-60 X 10-15 µm), ventricose cheilocystidia and smaller spores when compared to those of *M. kallioneus*. Lange's illustration also shows a truly fragile, long-stiped taxon. Recent treatments of the genus *Marasmius* in North America by Gilliam (1975, 1976) do not contain taxa matching the character combination of *M. kallioneus*.

In Singer's (1949) key two species in the section *Alliacei* Kühner (= *Chordales* Fr.) come seemingly close to present new species, but neither is conspecific (Singer, pers. comm.). *Marasmius subalpinus* Sing. has four-spored basidia and closer lamellae. *Marasmius alpinus* Sing. is different in being nearly odourless and by having very thick-walled caulocystidia. The description of *M. alpinus* (Singer 1937) is anteceded by that of *M. alpinus* Killermann (1933). Moreover, that fungus had rough spores, representing another genus.

Simultaneously with my studies a new species of *Marasmius* in the

section Chordales was being described by Dr. D.E. Desjardin (San Francisco, pers. comm.). *Marasmius applanatipes* Desjardin ined. has two- to four-spored basidia and spores only somewhat smaller than in *M. kallioneus*. The onion odour is again distinctive. On comparison the collections were found to represent different taxa. *Marasmius applanatipes* grows on needle litter in dense clusters, it has velutinous-pubescent stipe like that of *M. epidryas* Kühner, thick-walled caulocystidia and it lacks pleurocystidia.

There is still at least one more, undescribed taxon in the section Chordales. Professor Kühner has collections from the French Alps (on twigs of *Alnus viridis* DC.) and from the Pyrenees (on *Fagus* L. leaves) that macroscopically are a very close match with *M. kallioneus* (Kühner, pers. comm.). After studying a small fragment from the collection on *Fagus*, I can conclude that this taxon is not conspecific with the present new species, nor with *M. applanatipes*. From the former it differs by the constantly four-spored basidia, smaller spores, thick-walled caulocystidia and especially by the very abundant, clavate, lobed-tuberculate cheilocystidia. From the latter, Kühner's collection differs by the lack of a prominent pubescence on the stipe and by the smaller spores (spores from four-spored basidia compared).

Thus it seems that alliaceous taxa with more or less vested stipe require more extensive study. Describing this new species against the background treated above, it came evident that also the identity of *Marasmius porreus* sensu Fr. needs to be considered. Treating the species for the first time, Fries (1818) cited the plates by Schumacher (1801-1803) and Bulliard (1791). At least the latter, with its crowded lamellae, most likely represents the fungus now commonly known as *M. prasioemus*. The stated substrate for *M. porreus* was leaves of *Betula* L. and *Quercus* L. In his sanctioning work Fries (1821) referred again to a fungus on *Quercus* (and *Fagus*) leaves. He stated it to be common in oak woods of different areas. He also stated *Agaricus porreus* Pers.: Fr. as clearly different from *A. prasioemus* Fr., but judging from the substratum (see below) and the earlier illustrations he cited, this can be strongly suspected.

Subsequently, Fries (1849, 1863) changed his concept of *M. porreus* stating it to be rare, late and restricted to leaves of *Betula*. The kindness of Dr. Ryman (Uppsala) and Dr. Strid (Stockholm) made it possible for me to study copies of original plates of *M. porreus* and *M. prasioemus* (now in S). These plates were not made by Fries himself, but by others and were only approved by Fries. The plate of *M. porreus* has a citation to "Summa Vegetabilium Scandinaviae" (page 313) and

according to an original notebook by Fries, the illustrated specimens came from Femsjö (Strid, pers. comm.). Thus it evidently represents the fungus Fries knew only on *Betula* leaves. Since no material survived (Ryman, pers. comm.), this coloured plate is the main evidence on what Fries meant for *M. porreus*, apart from the inadequate descriptions. It apparently has little or nothing, however, to do with the first descriptions and is not the taxon of the sanctioning work (Fries 1821). Thus, the name is best considered as nomen dubium.

These two plates show that now, ca 30 years later, Fries was able to separate between *M. prasioemus* and "*M. porreus*". Apart from the somewhat different colours (compared by Dr. Strid from the originals), additional differences can be seen in the more spaced lamellae and less hairy stipe of the latter. Comparing *M. kallioneus* and "*M. porreus*" reveals one major difference: the former has even more distinctly spaced lamellae which may be only half of those in "*Marasmius porreus*". The overall colouring is quite similar (Strid, pers. comm.), as is the trend with these poorly known taxa with onion odour. Nevertheless, it is possible to state that *M. kallioneus* is not conspecific with "*M. porreus*" sensu Fries (1849, 1863). Since there is a coloured plate, a definite locality, a definite substratum, and a specific time of the season; in addition to the short description (Fries 1863), a search at Femsjö could be revealing.

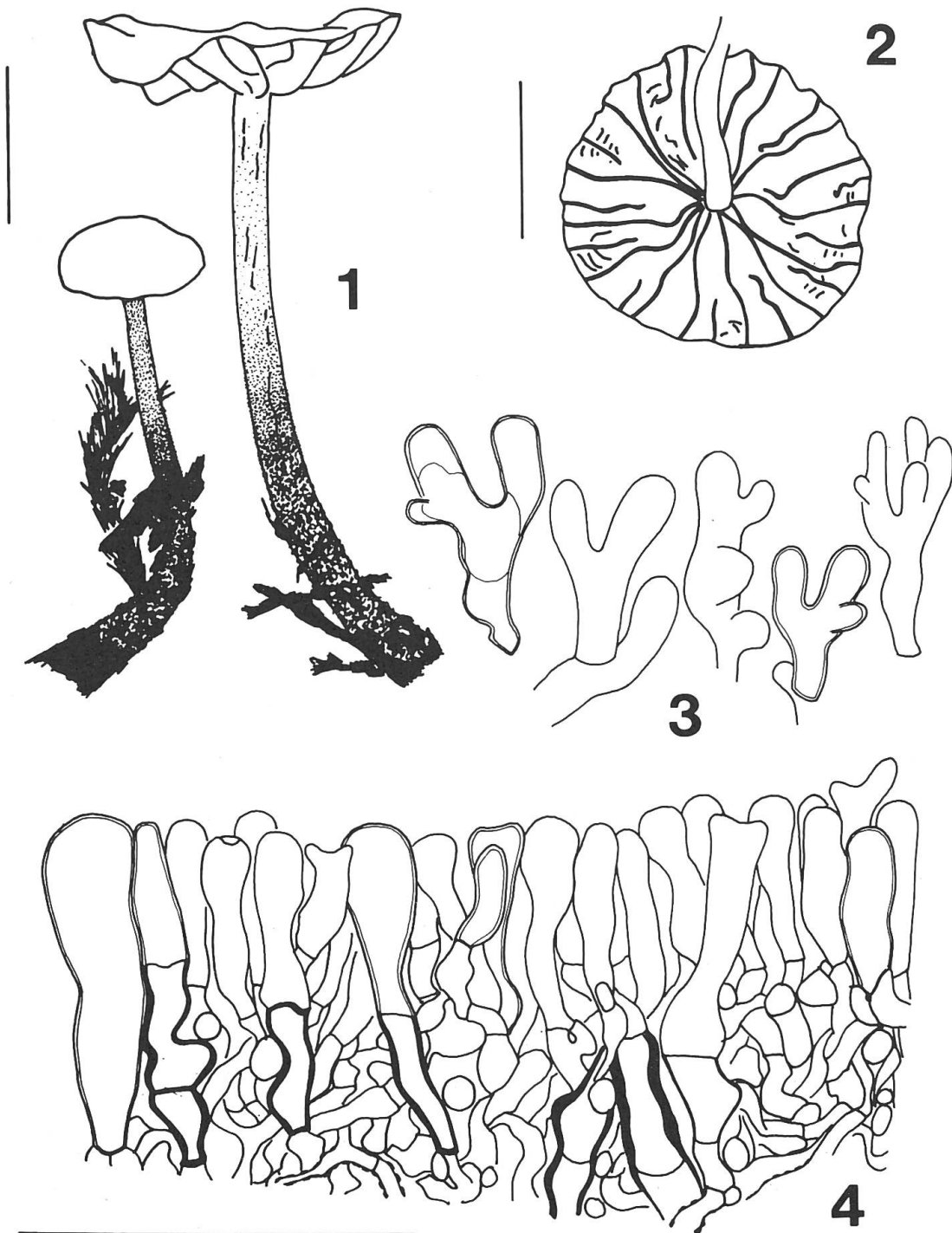
Owing to the hymeniform cuticle of smooth cells, basally pubescent stipe, inamyloid trama and context and a pungent onion odour, I consider the section *Chordales* Fr. as a logical taxonomic position for *Marasmius kallioneus* (cf. Gilliam 1975, Clémenton 1982).

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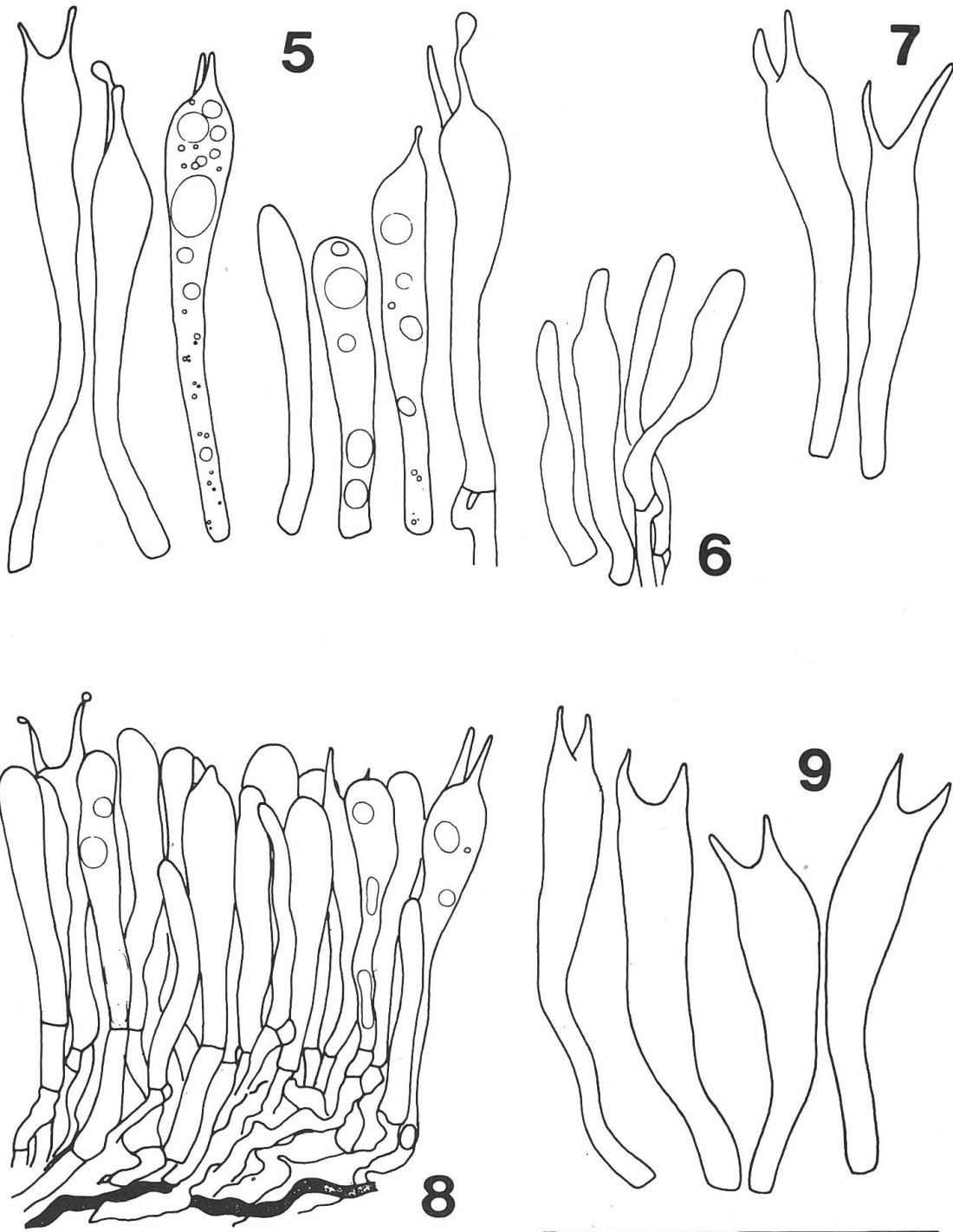
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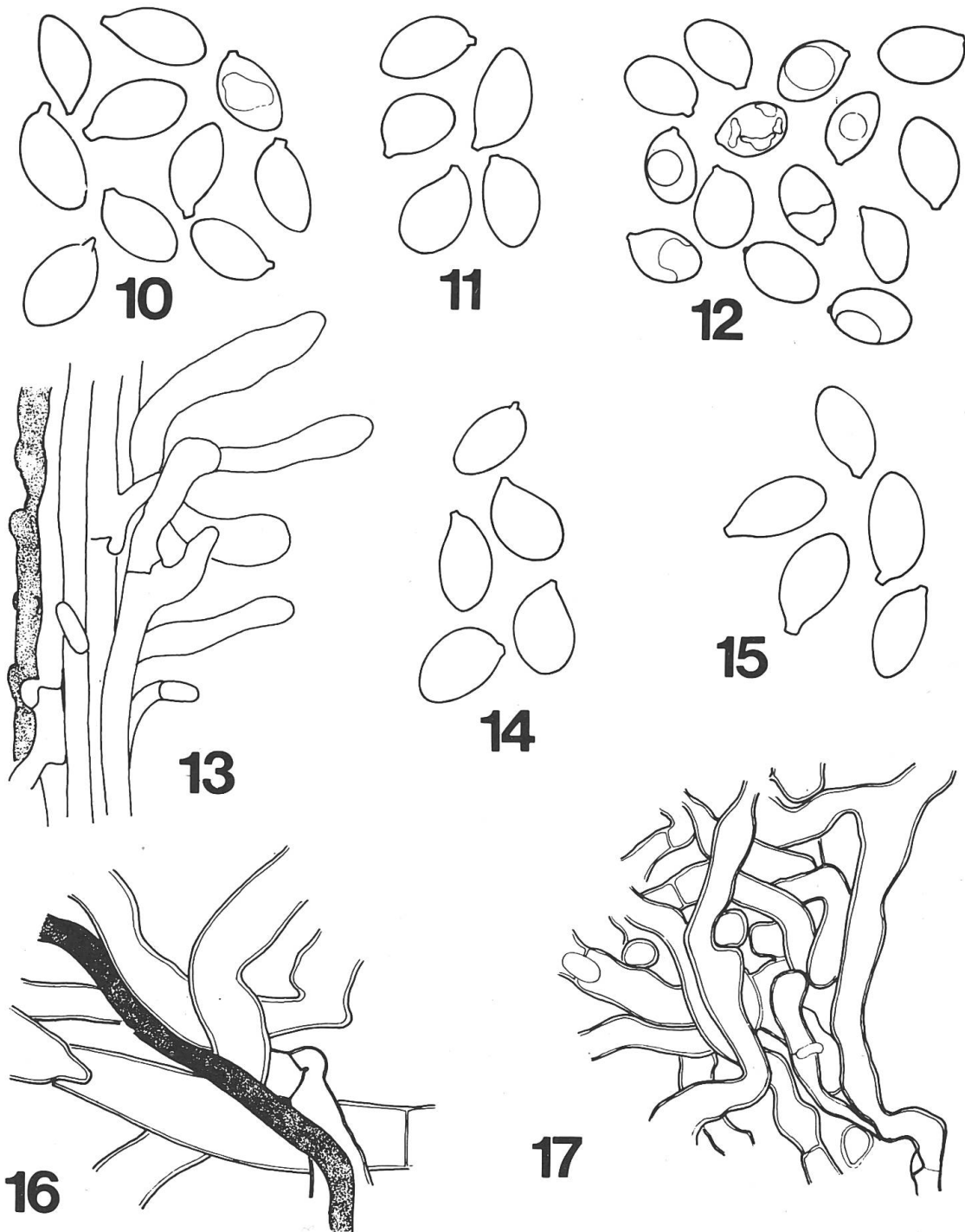
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Figs. 1-4. *Marasmius kallioneus* 1) dried fruitbodies (type) 2) dried hymenophore (type) 3) lobate cells of pileal cuticle (Huhtinen 83/267) 4) hymeniderm structure from juvenile pileus (type). Scales: 0.5 cm for fruitbodies, 50 μ m for microscopical features.



Figs. 5-9. *Marasmius kallioneus* 5) basidia and basidioles (Huhtinen 83/267) 6) hymenial cystidia (type) 7) basidia (Kankainen Aug. 1966) 8) detail from hymenium (Huhtinen 83/141) 9) basidia (type). Scale 50 μ m.



Figs. 10-17. *Marasmius kallioneus* 10) spores (Huhtinen 83/267) 11) spores (Petersen 71.147) 12) spores (type) 13) caulocystidia from stipe middle (type) 14) spores (Petersen 70.209) 15) spores (Kankainen Aug. 1966) 16) hyphae from pileus context (type) 17) hyphae from pileus context (Huhtinen 83/141). Scale 50 μ m.

